ADI Journal on Recent Innovation (AJRI)
Vol. 5 No. 2 March 2024

p-ISSN : 2685-9106
e-ISSN : 2686-0384

Analysis of Factors Influencing Intention to Adopt Battery Electric Vehicle in Indonesia

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Author Notification
24 July 2023
Final Revised
05 September 2023
Published
05 September 2023

To cite this document:
Saputra, M. C., & Andajani, E. . (2023). Analysis of Factors Influencing Intention to Adopt Battery Electric Vehicle in Indonesia. ADI Journal on Recent Innovation, 5(2), 100–109.
DOI: https://doi.org/10.34306/ajri.v5i2.993

Abstract

The emergence of environmental pollution problems in recent years has compelled the transportation sector to embrace environmentally friendly electric vehicles. Indonesia, being a significant market for both two-wheeled and four-wheeled vehicles, nevertheless experiences relatively low adoption of electric vehicles (EVs). This study aims to analyze the influence of attitudes, subjective norms, perceptions of behavioral control, moral norms, environmental awareness, financial incentive policies, and risk perceptions on the intention to adopt battery electric vehicles (BEVs). This research falls under the category of basic research, specifically quantitative in nature, involving the analysis of numerical data using statistical methods. Data for the study were collected through an online questionnaire using a non-probability purposive sampling design. The collected data were processed using SPSS 25 software and subjected to a Partial Least Square Test. The data analysis for this study utilized SmartPLS software version 3.2.7. Results based on a sample of 224 respondents suggest that attitudes and subjective norms do not significantly influence BEV adoption intentions. However, while perceived behavioral controls, moral norms, environmental concerns, and financial incentives have a positive and significant impact on willingness to adopt battery electric vehicles (BEVs), the perceived risks , has a negative and significant impact on BEV adoption intentions.

Keywords: Battery Electric Vehicle, Environmental Concern, Financial Incentive Policy, Intention Adopt, Moral Norm, Perceived Behavioral Control, Perceived Risk, Subjective Norm

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1.Introduction

About 60 percent of air pollution contributors in Indonesia are caused by conventional motorized vehicles. Fuel vehicle exhaust contains the toxic gas's carbon monoxide, lead, nitrogen dioxide and carbon dioxide. Currently, the use of electric vehicles is believed to save up to 80 percent energy compared to conventional oil-fired cars. AbleIncomplete sentence to realize Indonesia's commitment to reduce greenhouse gas (carbon dioxide) emissions by 29 percent in 2030. The use of electrical energy as a substitute for fuel will reduce fuel consumption and the burden of subsidies that must be borne by the state, thereby increasing national energy security. In the 2014-2019 period, the amount of fuel subsidies reached IDR 700 trillion. In the 2021 State Budget, subsidies for certain types of fuel reach an IDR 16.6 trillion. TheIncomplete sentence development of electric Repeated Word vehicles (EV) while maximizing the potential of battery raw material resources for electric Repeated Word vehicles. Since 2018, Indonesia has been recognized as the king of world nickel, believed to control nearly 30 percent or around 21 billion tons of world nickel reserves and resources. Apart from nickel, Indonesia is also rich in important component materials for the battery industry, including 1.2 billion tons of aluminum, 51 billion tons of copper and 43 billion tons of manganese[25].

The development Repeated Stem of electricRepeated Word vehicles (EV) in Indonesia is currently being developed Repeated Stem and encouraged by the government. One of the reasons the government is pushing to accelerate the use of electric Repeated Word vehicles (EV) is because oil production continues to decrease, and consumption continues to increase every year and also Indonesia's commitment to reducing CO2 emissions in the world.

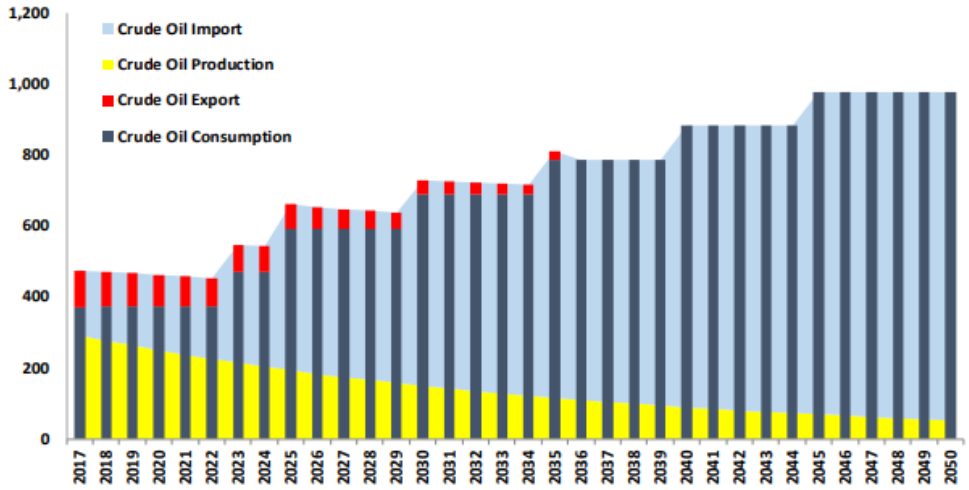

Figure 1. Indonesia's Oil Balance
Source: Indonesia Energy Outlook, 2019

One of the bolsters from the Government of Indonesia is the issuance of PERPRES Number 55 of 2019 concerning the Speeding up of the Battery Electric Vehicle Program for Street Transportation. In addition to the issuance of the Presidential Decree, the government also provided additional incentives for Electric Vehicle (EV) users, namely the provision of incentives for BEV PPnBM rates to 0% as stated in (PP) No. 73/2019 which started in October 2021. The government will also provide special rates for additional electricity of IDR 150,000 for 11 thousand Volt Ampere and IDR 450,000 for power up to 16.5 thousand Volt Ampere for BEV users. Together with this arrangement, in arrange to quicken the populace of utilizing electric vehicles in Indonesia, the government will stipulate controls with respect to street maps for acquiring electric vehicles in government organizations. The government is additionally committed to focusing on halting deals of ordinary vehicles in 2040 for two wheels and 2050 for four wheels.

p-ISSN : 2685-9106
e-ISSN : 2686-0384

The increase in the use of electric cars is expected to grow significantly in the next 10 years. Based on the projections of the State Electricity Company (PLN), electric cars paved in the country will reach more than 65 thousand units by 2030. PLN predicts that there will be a drastic increase, around 16 thousand units of electric cars in Indonesia by 2025. constant increase of 8-9 thousand units annually.

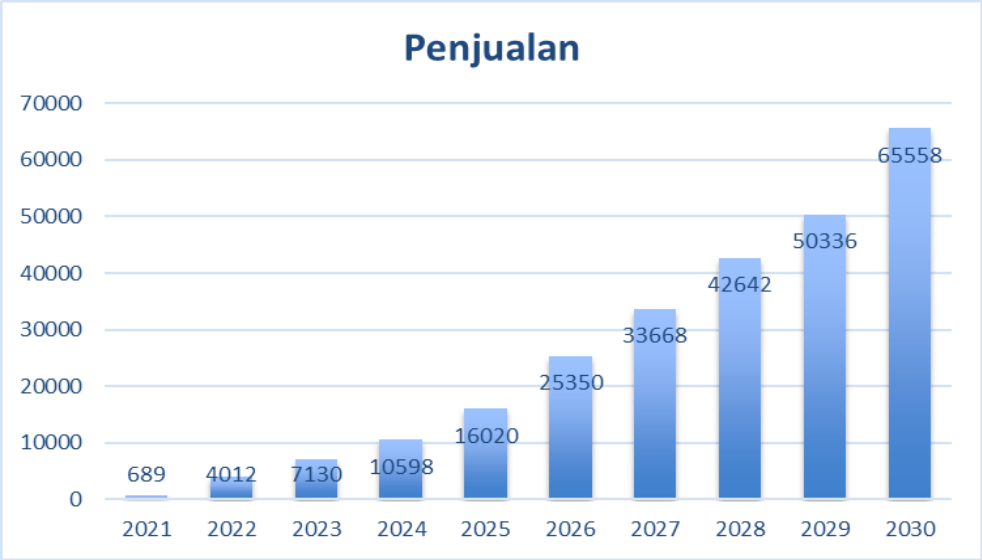

Figure 2. BEV Sales Projection in Indonesia
Source: State Electricity Company, 2019

This figure is not much different from the actual conditions. Based on data from the Association of Indonesian Automotive Industries (Gaikindo) as of September 2021, electric car sales have reached 420 units. This figure has increased significantly compared to 2020 which recorded sales of 127 BEV and PHEV units. The above data is a forecast for the growth rate of electric vehicles in Indonesia, although sales increased year-on-year, electric vehicle sales in Indonesia are still far from the target set by the government and can be said. , the Indonesian population's interest in using electric vehicles is still low [23].

Electric vehicles (EVs) are progressively seen as a solid elective to routine vehicles (CVs)[1], [2], [3]. Based on control source and drive instrument, electric vehicles can be classified into 3 primary categories:

(1) battery-only electric vehicle (BEV), (2) small-battery and ordinary motor-powered crossover electric vehicle (HEV) and (3) plug-in electric vehicle with huge battery and little engine (PHEV). Of these three, BEV may be a unadulterated shape of zero-emission electric vehicle, while plug-in electric vehicle is considered the foremost viable due to its capacity to consistently switch between gasoline motor and electric engine. 4], [1], [5], [6].

Open intrigued within the utilize of electric vehicles (EVs) is still moderately moo, the number of electric vehicle sales in Indonesia is additionally still low, far from the national target set out within the Ministry's control No. 27 2020 Industry. around 600,000 units. by 2030. The government moreover points to deliver 2 million electric cars by 2030 as well as 16 million electric motorbikes[24].

To support programs to accelerate the adoption of electric vehicles, it is very important to know and understand the factors that influence Indonesians' willingness to use battery electric vehicles (BEVs) in Indonesia. This study investigated several TPB factors: attitudes, subjective norms, perceived behavioral control, ethical standards, and environmental concerns [8]. The results of this study show that his five principles of TPB influence EV adoption intentions. Another study conducted by [9] explored his four components: attitudes (attitudes) toward green purchasing, subjective norms, perceived behavioral control, and environmental knowledge. The comes about of this ponder demonstrate that the factors Green Acquiring Demeanor (Demeanor) and Subjective Criteria have no positive and critical affect on deliberate to utilize

electric vehicles. whereas the factors Seen Behavioral Control and Natural Information have a positive and critical affect on purposeful to apply VE.

In another ponder by [10]–[12] inspected information of VE, seen hazard, seen convenience, and budgetary motivation arrangement. In his consider, the factors Information of VE, Seen Hazard and Seen Value had a positive and critical affect on deliberate to embrace VE. Whereas the budgetary motivation approach alter did not have a positive and noteworthy affect on the deliberate to utilize electric vehicles. Opposite to the comes about of the investigate conducted[13], the budgetary motivation arrangement alter incorporates a positive and noteworthy affect on the purposeful to embrace electric vehicles.

2. Research Method

This sort of inquire about is included within the category of fundamental investigate. This ponder utilized a quantitative strategy by dispersing online surveys in Indonesia. The populace of this ponder is Indonesian. Criteria for taking an interest within the ponder are individuals who live in Indonesia and utilize a customary 2- or 4-wheel vehicle, since the BEV itself has 2 sorts of 2-wheelers and 4-wheelers. Tests were taken employing a non-probability testing procedure with a deliberate examining arrange. The independent factors utilized within the consider incorporate demeanors, subjective standards, seen behavioral control, moral guidelines, natural concerns, monetary motivations, and seen dangers. whereas the dependent variable is the intention to apply portrayed within the markers and after that decreased to address things. in look help.

The information sort in this ponder employments variance-based basic condition modeling (SEM). Information were handled utilizing SPSS 25 computer program and halfway slightest squares test. This ponder employments information examination strategy utilizing SmartPLS4 software[14].

2.1 Analysis Method

Introductory information handling and testing comprised of testing the legitimacy and unwavering quality of a test of 30 questions utilizing the program SPSS25[15], which demonstrated that the legitimacy test was utilized. utilized to degree the legitimacy/validity of a survey. A survey can be considered substantial in the event that the questions within the survey can uncover something that will be measured by the survey, i.e. the esteem of r > table r or a critical relationship esteem. let's say alpha 0.7[16].

Halfway slightest squares test This think about employments information examination strategy utilizing Savvy PLS program adaptation 3.2.7. The PLS or Fractional Slightest Squares test may be a variation-based auxiliary condition approach (SEM). This approach is used to perform path analysis, which is widely used in behavioral research. PLS is therefore a statistical technique used in models with multiple dependent variables. and independent variables [12], [17]. PLS analysis is performed in three steps: external model analysis (measurement model), internal model analysis (structural model), and hypothesis testing.

2.2 Hypotheses

H1: It has a significant impact on positive attitudes and intentions to introduce battery electric vehicles (BEVs).
H2: Subjective norms have a positive and significant impact on battery electric vehicle (BEV) adoption intentions.
H3: A positive and significant impact of behavioral control on adoption intentions for battery electric vehicles (BEVs) was recognized.
H4: Ethics have a positive and significant impact on the intentions of deploying battery electric vehicles (BEVs).
H5: Environmental concerns have a positive and significant impact on the willingness to adopt battery electric vehicles (BEVs).
H6: Financial incentive policies have a positive and significant impact on willingness to adopt battery electric vehicles (BEVs).
H7: Perceived risks adversely affect intent to deploy battery electric vehicles (BEVs).

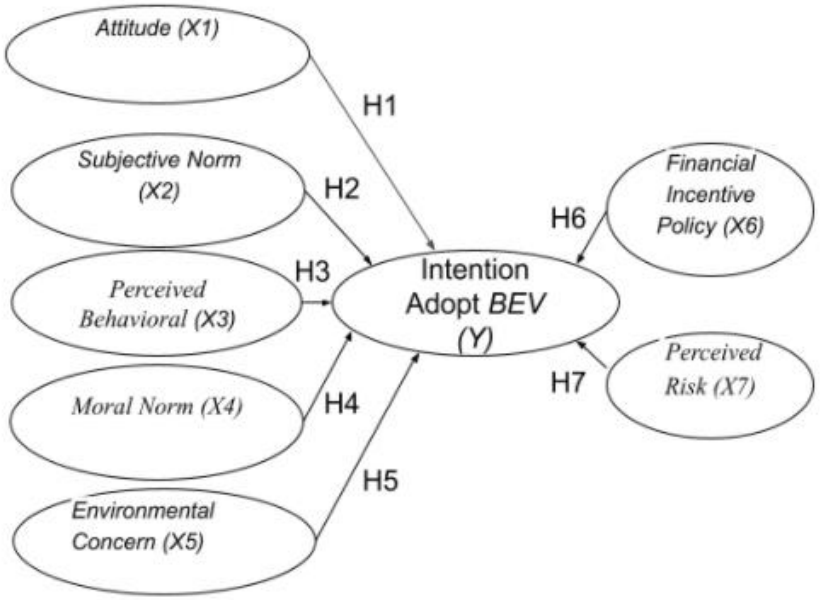

Figure 2. Research Model
Source: Shalender & Sharma (2021), Wang et al (2018)

3. Discussion

3.1 Research Implementation

Within the process of disseminating surveys to gather information from respondents, it is done by online surveys, to be specific conveyance of Google Shape joins to media clients through Facebook bunches and WA bunches. There are certain criteria and requirements when selecting respondents, that is, the ownership/use of a conventional 2- or 4-wheel vehicle. A total of 224 questionnaires were collected. However, 23 of them did not meet the criteria and requirements of the study participants. Thus, the number of votes that meet the criteria, the respondent's request to be processed is 201 votes. Out of 224 people surveyed, 96 people (42.9%) owned a personal motorbike, which is the largest number of respondents in this study.

Table 1. Outer Model Validity and Reliability

Variable	Indicator	Factor loading	Cronbatch Alpha	Composite reliability	AVE
Attitude	ATT 1	0.835	0.795	0.877	0.705
	ATT 2	0.854			
	ATT 3	0.840			
Subjective Norm	SN 3	0.753	0.719	0.842	0.640
	SN 2	0.844			
	SN 3	0.801			
Perceived Behavioral	PB 1	0.611	0.774	0.857	0.604
	PB 2	0.849			
	PB 3	0.847			
	PB 4	0.777			
Moral Norm	MN 1	0.623	0.670	0.798	0.500
	MN 2	0.773			
	MN 3	0.651			
	MN 4	0.768			
Environmental Concerns	EC 1	0.675	0.578	0.763	0.518
	EC 2	0.692			
	EC 3	0.787			

Financial Incentive Policy	FIP 1	0.855	0.783	0.874	0.698
	FIP 2	0.863			
	FIP 3	0.786			
Perceived Risk	PR 1	0.879	0.864	0.917	0.786
	PR 2	0.897			
	PR 3	0.884			
Intention Adopt	IA 1	0.859	0.837	0.902	0.754
	IA 2	0.874			
	IA 3	0.872			

Table 1 shows the values of factor loading, cronbach's alpha, composite reliability, and AVE. The factor loading value on the indicators for all indicators for each variable gets a value of > 0.7 except for the indicators PB 1, MN 1, MN 3, EC 1, EC 2 which get a value below 0.7, namely PB1 = 0.611, MN1 = 0.623, MN3=0.651, EC1=0.675, EC2=0.692. The factor loading value recommended by[18] is above 0.7. However, in other references, according to[19] states that a factor loading value of > 0.6 can be said to be valid and any indicator with a value below 0.4 must be removed/removed[18]. Thus, in this study the flags PB 1, MN 1, MN 3, EC 1, EC 2 can still be used and not cleared/deleted. In addition, the obtained Cronbach's alpha values for all indicators are > 0.6 and the obtained composite reliability values > 0.7. This can explain why the reliability of the model has a good level of consistency and reliability [20], [21]. The obtained AVE value is also greater than 0.5, showing that the model has a good level of validity [21], [22].

Tabel 2. Discriminant Validity

	ATT	EC	FIP	HE	M N	PB	home work	SN
ATT	**0.839**							
EC	0.471	**0.720**						
FIP	0.408	0.539	**0.83**6					
HE	0.402	0.540	0.606	**0.868**				
M N	0.450	0.647	0.486	0.573	**0.707**			
PB	0.356	0.485	0.498	0.516	0.578	**0.777**		
PR	0.021	0.197	0.331	0.445	0.219	0.282	**0.886**	
SN	0.473	0.476	0.476	0.534	0.467	0.475	0.244	**0.800**

Table 2 shows that the value of discriminant validity > average cross loading/coefficients correlation, this explains that the discriminant validity of the external model is very good.

Table 3. Inner Model Analysis Results.

Construct	R2	Q2	F2	Ket
Intention Adopt	**0.566**	**0.402**		
attitude			**0.006**	**small**
Subjective Norm			**0.035**	**small**
Perceived Behavioral			**0.006**	**small**
Moral Norm			**0.043**	**small**
Environmental Concerns			**0.010**	**small**
Financial Incentive Policy			**0.077**	**small**
Perceived Risk			**0.115**	**small**

Note(s) : f^2 : 0.02 = small ; 0.15 = average ; 0.35 = substantial

p-ISSN : 2685-9106
e-ISSN : 2686-0384

Table 3 shows that the value of the coefficient of determination (R^2) in the structure of Intention to accept is 0.566, that is, the built variables Attitude, Subjective Norms, Cognitive Behaviors, Moral Standards, Relationships Environmental concerns, Financial incentives, Perceived risk could explain the changes. in structure or interval values in terms of Intent to Pursue to Apply, i.e. 56.6%. The results of the coefficient of determination (R^2) in the endogenous variable construct have shown good results where the influencing variables can explain changes in the construct/variance value of at least that is > 0.4 or more than 40%. Furthermore, the predictive relevance value (Q^2) of each Intention Adopt construct is 0.402. This value explains that the predictive relevance value (Q^2) of the endogenous construct in the study shows a value greater than 0, so the construct model has predictive relevance. In addition, the relative effect size (F^2) explains that the Intention Adopt construct has a medium level where the constructs that influence it have a small level effect.

Table 4. Hypothesis Test Results

	Original Sample (O)	Sample (M)	Standard Deviation (STDEV)	T-Statistics (O/STDEV)	P Values	Information
ATT -> IA	0.065	0.068	0.056	1.158	**0.247**	**Not significant, Not Supported**
SN -> IA	0.159	0.163	0.073	2,170	***0.030**	**Significant, supported**
PB -> IA	0.067	0.065	0.070	0.958	**0.338**	**Not significant, Not Supported**
MN -> IA	0.199	0.205	0.082	2,445	***0.015**	**Significant, supported**
EC -> IA	0.094	0.090	0.064	1,469	**0.142**	**Not significant, Not Supported**
FIP -> IA	0.242	0.236	0.066	3,643	***0.000**	**Significant, supported**
PR -> IA	0.244	0.242	0.049	4,955	***0.000**	**Significant, supported**

Theory testing utilizing fractional slightest squares (PLS) was performed by testing t-statistics and p-values. In case the t-statistic is > 1.96 and the p-value is 0.05, there's no impact between the factors and this appears that the proposed speculation is rejected/unsupported.

Based on the results of the hypothesis test presented in the data processing results, the p-value and p-value relationship between attitudes and intentions to introduce BEV is 0.247 > 0.05, the t-statistic is 1.158, and the original value is I know there is. The sample value is positive. In that case, we can say that the first hypothesis (H1) is rejected. These results indicate that statistically attitude has no effect on the intention to adopt BEV. This means that the attitude of the Indonesian people in choosing a vehicle does not affect their behavioral intentions in buying this type of vehicle due to a lack of insight and education regarding vehicles in Indonesia at this time. And also the people of Indonesia still prioritize the function of the vehicle compared to the technology that is currently developing.

Based on the comes about of theory testing, it appears that the P esteem of the relationship between the subjective standard and the deliberate to apply BEV is 0.030 <0.05 and the t-statistic is 2.170 and the introductory test esteem is positive; at that point ready to say that the moment speculation (H2) is acknowledged. These come about show that the measurably, subjective standard has an impact on purposeful to apply.

Based on the comes about of the theory test, it appears that the P-value of the relationship between seen control and purposeful to receive is 0.338 > 0.05 and the measurable t-esteem is 0.958 and the first test esteem is positive; at that point, it can be said that the third speculation (H3) is rejected. These come about demonstrate that factually Seen Behavioral Control has no noteworthy and positive impact on Deliberate to Embrace BEV. This implies that Seen Behavioral Control does not influence the deliberate of Indonesian individuals towards

BEV appropriation due to the need of a campaign approximately BEV, this makes Indonesian individuals commonplace with BEV items so that both in terms of cost, details and models on the advertise nowadays, individuals don't think to look and discover out BEV items.

Based on the comes about of the theory test, it appears that the p-value of the relationship between Ethical Standard and Purposeful to Receive BEV is 0.015 <0.05 and the measurable t esteem is 2.445 and the initial test esteem is positive; at that point it can be said that the to-place theory (H4) is acknowledged. These comes about indicate that measurably Ethical Standard includes a positive and critical impact on Purposeful to Receive BEV.

Based on the comes about of theory testing, the relationship between natural concerns and purposeful to receive BEV includes a p-value of 0.142 > 0.05 and a t-statistic of 1.469, demonstrating that the first test esteem is positive. In that case, we are able say that the fifth speculation (H5) is rejected. These comes about recommend that natural concerns don't have a factually positive and noteworthy affect on BEV selection eagerly. This implies that the Indonesian individuals have low environmental mindfulness, don't consider the natural impact when choosing a car, and don't consider exchanging to eco-friendly cars.

Based on the speculation test comes about displayed, the p-value for the relationship between financial motivation arrangements and purposeful to receive BEV is 0.000<0.05, the measurable t-value is 3.643, and the initial test esteem is positive. It is appeared that there's ;In that case, able to say that the 6th speculation (H6) is acknowledged. These comes about recommend that monetary motivating force approaches have a measurably noteworthy positive affect on BEV selection eagerly.

Based on the speculation test comes about, the p-value relationship between seen hazard and deliberate to receive BEV is 0.000 < 0.05, the factual t-value is 4.955, and the first test esteem is positive. In that case, we will say that the seventh speculation (H7) is satisfactory. These comes about propose that factually seen dangers have a noteworthy affect on BEV appropriation eagerly.

4. Conclusion

This setting does not influence the expectation of BEV sending. Subjective standards have a huge positive affect on BEV selection eagerly. Discernment of behavioral control does not altogether impact the deliberate of BEV presentation. Morals have a critical positive affect on the aim of BEV execution. Natural concerns have no noteworthy affect on his BEV deliberate, money related motivating force arrangements have a positive and critical affect on his BEV deliberate, and seen dangers have a critical negative affect on his BEV deliberate. affect. Based on the discoveries conducted in this think about, commerce officials are likely to be more likely to be influenced by states of mind, subjective standards, seen behavioral control, ethical standards, natural concerns, money related motivation approaches, seen dangers, and selection. You can see that they pay particular attention to their intentions. The company's management strategy needs to be optimized in order to increase interest in BEV adoption in Indonesia. Increasing campaigns for environmentally friendly vehicles so that the Indonesian people are more familiar with environmentally friendly vehicles and begin to glance at them and have the intention to adopt them. Then the support of the Government of Indonesia is also very important in the growth of BEV users in Indonesia, by increasing incentives or significant tax reductions that can attract people's attention to switch to BEV. This research has several limitations, and these limitations can create opportunities for improvement for further research.This research can be carried out again with a larger number of samples and a wider range by taking into account the representativeness of the sample and further research is to analyze more deeply the relationship between Attitude, Subjective Norm, Perceived, Behavioral Control, Moral Norm, Environmental concern, Financial Incentive Policy, Perceived Risk, and Intention to Adopt can be done in more detail with a newer year.

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