

# Tacit Knowledge and Product Information about the Environmental Impact towards the Purchase Intention of Electric Motorcycles

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**Abstract:** In recent years, Indonesia has started to adopt electric motorcycles (EMCs), but until 2019 the market share of electric vehicles (EVs) was only around 0.05%. This figure is far from the target set by the Ministry of Industry of a 20% market share in 2025. This quantitative research was conducted to get a novel picture of what potential customers think about EMC products. The proposed model used structural equation modelling with SmartPLS-3 over 300 respondents. The research found that detailed product information positively and significantly influences consumer attitudes toward adopting EMCs. Tacit knowledge also positively and significantly influences consumer attitudes toward the environment. Furthermore, tacit knowledge directly affects the purchase intention of EMCs with a significant and positive value. As the mediating variable, consumer attitudes towards the environment have no mediation effect toward purchase intention. These findings are expected to increase the public's knowledge and awareness of the environmental impact in determining which EMC products are more environmentally friendly than others. Here, environmentally friendly means the absence of direct emissions on vehicle exhaust and the total direct and indirect emissions.

**Keywords:** Electric motorcycles (EMCs), electric vehicles (EVs), consumer behavior, tacit knowledge, attitude towards the environment, product information, purchase intention.

## Introduction

Indonesia has the most extensive motorcycle market among ASEAN countries. It has immense potential to develop electric motorcycles [1]. Many producers in various countries strive to obtain this market share through their marketing mix strategy. Besides price, place, and promotion, the technology utilized in the product is undoubtedly a differentiation. Consumers must know this technology to impact the environment from its lower total emissions produced. Various qualities of electric motorcycle products also have the opportunity to enter the market. Electrical motorcycle products with lower efficiency will impact the emergence of more significant environmental pollution. This condition will only shift the problem of pollution from cities to rural areas where power plants are located. The environmental impact is the pollution that is directly and indirectly emitted by electric motorcycles. Direct emissions come up through the exhaust from the burning process of fuel through the engine combustion process like what conventional engines do. An indirect emission is generated from power plants where the electricity is used to charge the electric motorcycle batteries [2].

The distinguishing characteristic of electric motorcycles that needs to be investigated is the highest-selling motorcycles in the Indonesian market. The scooter motorcycle is the most popular one in Indonesia, with a market share of almost 80% [1]. This product can potentially be disrupted by electric motorcycles (EMCs).

## Problem Statement

The adoption of electric motorcycles in Indonesia is different from that already done in developed countries. In developed countries, power plants used to charge electric vehicle batteries come from renewable energy and even nuclear energy. Therefore, there is reduced pollution from burning fuel oil in vehicles turned into environmentally friendly energy combustion from power plants for electric vehicles [3]. While in Indonesia, power plants still use fossil fuel energy such as coal and petroleum. Although the electric motorcycles to be sold have low efficiency with lower prices, they can cause more pollution than the present situation. As responsible consumers, this information needs to be considered in choosing an EMC product. By being aware and having good ethics, consumers will encourage a civilized society that measures developed countries.

Indonesian Presidential Regulation number 55 of 2019 initiated the Electric Vehicle Acceleration Program. From this new regulation, the prices of electric cars are expected to be more affordable. Thus, sales

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**Table 1.** Research comparison by scope, field of study and country

No	Author	Year	Country	Vehicle type		Adoption factors	Consumer behavior	Environment comparative study*	Purchase intention*
				Electric car or equiv.	Electric motorcycle*				
1	Lunn, Choidealbha, and	2020	Ireland	√	--	--	√	√	√
2	Athanasopouloua and Bikasa	2018	Greece	√	--	--	--	√	--
3	Baumann, Simon, Dura, and Weil	2012	Germany	√	--	--	--	√	--
4	Jayadi and Sudiarto	2019	Indonesia	--	--	--	--	√	--
5	Niikuni and Koshika	2013	Japan	√	--	√	--	√	--
6	Utami, Yuniaristanto, and Sutopo	2020	Indonesia	--	√	√	√	--	√
7	Li, Long and Chen	2017	China	√	--	√	--	--	√
8	Riyanto, Nuryakin and Riyadi	2020	Indonesia	√	--	√	√	--	√
9	Levay, Drossinos and Thiel	2017	Belgium	√	--	√	--	--	√
10	Prasetio, et al	2020	Indonesia	√	√	√	√	√	--
11	Chiu, Yi and Tzeng, Gwo	1999	Taiwan	--	√	√	√	√	√
12	Syamnur, FH, et al	2019	Indonesia	--	--	√	√	--	√
13	Prianjani, Sutopo and Hisjam	2019	Indonesia	--	√	√	√	√	--
14	Kaloko, Soebagio and Purnomo	2011	Indonesia	√	--	--	--	√	--
15	Setiawan, Indra C.	2020	Indonesia	√	√	√	--	--	--
16	Palmer, et al	2017	US, Japan	√	--	√	--	--	--
17	Dumortier, et al	2013	US	√	--	--	√	√	√
18	Sutopo, et al	2018	Indonesia	√	√	--	--	√	--
19	Sutopo, W and Kadir, Evizal	2017	Indonesia	√	√	√	--	--	--
20	Hernandez, Kockelman and Lentz	2019	US	--	√	√	--	√	--
N	Pramajaya, Agung E.	2021	Indonesia	--	√	--	√	√	√

will increase and therefore could make Indonesia greener. In opposite, according to data from the increase and therefore could make Indonesia greener. In opposite according to data from the Indonesian Automotive Industry Association (GAIKINDO), sales from dealers to consumers from January to November 2019 were only 940,010 units [4, 5]. The market share of total EVs was only around 0.05% in 2019, and two-wheeled electric vehicles only reached 0.14% of the government’s target for 2025 [6, 7].

**Research Gap**

Previously, many types of research had been conducted regarding the adoption factors of EMCs. Most of them claimed that high prices, the lack of available charging stations, and the short-range of capabilities hampered EMC adoption. Nevertheless, the differences in consumer behavior factors that could influence the purchase intention of EMCs in Indonesia compared to other countries have not been observed. In some research conducted in developed countries, consumers have very civilized behavior toward the environment. When selecting an electric vehicle, they ask for clear and objective product information. That information is about how efficient an EV is compared to a gasoline vehicle [2].

Research on factors that influence EV adoption has been widely carried out in Indonesia [6, 8, and 9]. However, this research does not explicitly address motorcycles with a considerable market. Another issue is that consumer awareness in developed countries is well established. They do assessments and are highly concerned about the environmental impacts when purchasing a vehicle product, such as the efficiency of vehicles with the lowest pollution.

Therefore, the question arises about whether such an attitude will appear for electric motorcycle products in Indonesia.

**Research Questions**

Shortly, conventional internal combustion engine (ICE) motorcycle products will potentially be disrupted by electric motorcycles. The fact is that in the past few years, the sales of electric motorcycles are still small. This study will examine whether there are other factors besides technological readiness and price issues that affect the purchase intention of prospective consumers. Other factors, namely the attitude of developing countries, tacit knowledge, and product information, are questions for research that may influence consumers’ purchase intention of EMCs.

**Methods**

**Adoption and Purchase Intention of Electric Vehicles**

Indonesia has just started a new phase to encourage the use of EV technology. However, the experience of other countries shows that the EV market share is still limited; for example, in Europe, the BEV market shares only ranged from 1.5% to 3% in 2017. Many factors play a role in consumers’ car purchase decisions. These include monetary factors (that are captured by the total cost of ownership – TCO concept) and non-monetary factors like driving range capability, brand, charging time, and charging station availability [10].

Since the past decade, there has been increasing research on electric vehicle adoption, conversion, and purchase intentions in developed countries (see [11,

12, 13, 14, 15, 16] among others). Likewise, many types of research have been carried out on the Indonesian market (see, [6, 17, 18, 19] among others) that revealed that the variables of price and travel distance are the leading causes of interest in purchasing electric vehicles (EVs).

According to Riyanto *et al.* [8], EV adoption depends on the total cost of the vehicle's ownership [8]. If it is cheaper than the conventional one, consumers will purchase an EV rather than a conventional vehicle. TCO also depends on how the supply side can afford the technology development cost, with the highest manufacturing cost. Consumers in Indonesia cannot afford the prices of EV vehicles unless the government provides subsidies in the form of vehicle tax exemptions and other incentives. Anfinen *et al.* [20] conducted a study in Norway, which found that EVs face difficulties penetrating the market and gaining consumers' acceptance.

Although electric vehicles are "green" and friendly to the environment and do not create noise pollution, using EVs has many difficulties. These difficulties include a lack of stations to recharge power, an extensive recharge process, time consumer recharge process, and a limited distance that EVs can operate with one recharge. Yousif and Alsamydai [21] carried out a study in Jordan that concluded that the most critical factor that affects the consumer buying behavior of electric vehicles is power availability. Another barrier that faces consumers is that they do not have enough detailed and integrated information about electric vehicles that may help to make a purchase decision. They also indicated from previous research that the most critical location for the plug-in electric vehicle (PEV) charging process is at the customer's house, office, and public facilities.

Indonesia has just started a new phase to encourage electric vehicle (EV) technology. In the following years, the consumer market still has a choice, whether they will spend their expenditure allowance to purchase a conventional engine vehicle or make an investment in an electric vehicle. At least up to 2030, the manufacturers still cannot set competitive prices for EVs [22, 23].

### The Theory of Reasoned Action (TRA)

The TRA theory from Fishbein and Ajzen [24] states that a person should consider the consequences of an attitude before deciding to take that attitude. Besides that, consumers take actions or behaviors to achieve the desired results. In the model, behaviors are determined by a person's intention to perform the behavior.

Afroz and Rahman [25] conducted a study in Kuala Lumpur, Malaysia, to prove the Theory of Reasoned Action in the purchase intention of electric vehicles (EVs), which is influenced by individual values and attitudes. The research results revealed that this theory might apply to Malaysian society as represented by the respondents, namely that individual motivation from cost factors and consumer convenience is negatively related to the purchase intention of electric vehicles (EVs). Also, environmental consequences are not a significant predictor of the purchase intention of EVs.

Consumer behavior research conducted by Ozaki and Sevastyanova [26] supported the proposition that some people buy EV products to get a specific image, express their identities, and have a desire to be seen as someone who cares about the environment. Motivation to purchase environmentally friendly hybrid products is determined by how much financial benefit is obtained. This motivation is also related to the transportation policy created. In addition, social norms and consumers' willingness to comply with group norms can influence purchasing decisions.

In developed countries, there is a government policy in the form of a tax charge levied for vehicles that are not environmentally friendly. Therefore, consumers there feel obliged to purchase electric vehicles [27]. Meanwhile, there are still no tax charges for high emission vehicles in developing countries like Indonesia. People tend to buy premium products because they follow somebody else or want to make themselves look different and be judged by others as consumers who care about the environment. This phenomenon is related to the issue that the purchase of goods is not completely useful, which has long been a topic of discussion in consumer behavior studies. Purchases that are based on wants and not needs arise as a result of insecurity and wanting to be seen by others to increase one's social strata or class [28].

### Tacit Knowledge of Electric Vehicles

Recently, consumers have had a positive attitude toward electric vehicles but an insufficient understanding of them [29]. The trend of purchasing electric vehicles is increasing, and consumer attitudes towards buying electric vehicle products are relatively positive. However, consumer perceptions of electric vehicles are still early and lagging with the renewal of electric vehicle models that have accelerated technological developments and manufacturers' expectations.

Further research in China conducted by Wang *et al.* [30] showed that there is a positive relationship between consumer knowledge about electric vehicles

and the intention to adopt EVs, which is also related to the attitudes and perceptions of usability. Moreover, the negative impact felt by consumers towards EV products also affects the intention to adopt an electric vehicle as well as the perceptions of usability and attitudes. Furthermore, other variables such as attitude and usability were also positively related to intention to adopt electric vehicles. Next, consumers' lack of knowledge about EVs can hinder their acceptance of EVs. Therefore, a government policy must be launched immediately to accelerate the adoption of electric vehicles, including carrying out promotions. Another finding is that offering incentives does not significantly affect the intention to adopt electric vehicles. These findings also reinforce the findings described earlier in this research.

Another research in Belgium conducted by Lebeau and Mierlo [31] conditioned respondents to watch a film for 10 minutes about electric vehicles, their environmental impact, characteristics, and available electric charging conditions. With this conditioning, it is expected that the respondents' knowledge will increase, but the results of this study indicate that the level of knowledge does not affect consumer perceptions about the advantages and disadvantages of electric vehicles.

### Attitude towards the Environment

Chen and Chai [32], through their research entitled "Consumers' Perspectives of Attitude towards the Environment and Green Products," quoted the definition of 'environmental attitudes' from Blackwell [33] that an attitude determines what consumers like or dislike. Meanwhile, Allport [34] defined a *person's attitude* as a mental state that influences a person's response to objects and situations related to that person.

Another theory from Schiffman and Kanuk [35] found that the amount of information received and the number of consumer experiences with a product shows the consumer's attitude towards that product, whether positive or negative.

Since electric vehicles are perceived as a sustainable alternative to combustion vehicles, consumers must correctly understand whether the EV products positively contribute to reducing environmental pollution through sufficient product information. Consequently, the environmental performance of electric vehicles is an essential factor in determining a consumer's attitude, which can help the adoption process of electric motorcycles in Indonesia.

Close to Indonesia, there are also exciting findings in Malaysia. Research conducted by Afroz and Rahman

[25] examined the effects of attitudes and individual values on purchase intention of an EV product in Malaysia. This research investigated how a value and responsibility for the environment can affect a person's attitude towards buying an electric vehicle. Respondents were surveyed on several variables, including their views on a set of values, attitudes, and purchase intentions of EVs. The findings of this study used the Structural Equation Modeling (SEM) technique and indicated a relationship between personal consequences related to cost and convenience and the intention to buy an EV, even though the relationship is negative. Meanwhile, environmental consequences are not significantly related to purchase intention and are not an influencing factor.

Afroz and Rahman [25] discovered a study limitation that this research only focused on consumers' attitudes who do not intend to buy EVs but do not have any reasons that influence their decisions. Future research will provide more valuable information on why some consumers do not consider buying an EV.

### Product Information of Electrical Vehicles

In general, consumers may hesitate to purchase durable modern commodities, including EVs, because they have no sufficient information and no previous experience with them [21]. However, many consumers are willing to experience new things, like electric vehicles. Also, manufacturers and marketers do not have enough information about consumer acceptance of their satisfaction with and reaction and attitude towards this type of vehicle.

Schuitema and Anable [36] inferred that the most critical thing in the minds of potential consumers of electric vehicles is the "green" image of EVs, because it is believed to be able to contribute to sustainable road transportation and encourage the conversion of more environmentally friendly power plants such as by using renewable energy. So, it is essential to provide a product image that matches consumers' image in order to be able to express their identity to others. As a result, providing information on a new EV product can affect the attitudes of others towards the product.

Prospective consumers who have an identity as opinion leaders influence other potential customers to have a higher interest than other potential customers because EV vehicles are considered vehicles that have new modern and sophisticated technology and represent the image of the future. They are looking for better value and better promotions instead of becoming followers like in Indonesia [37].

## Hypotheses Development

### *Tacit Knowledge and Attitude toward the Environment in Indonesia*

When combined with renewable energy sources, EVs can be seen as a promising "zero-emission" technology. The most reliable energy source is fossil fuels, like oil and coal, because they are easy to store and a relatively inexpensive investment in power generation. In contrast, energy from renewable sources experiences severe fluctuations depending on the state of the source (wind power, solar output, etc.), so it is difficult to match the supply and demand of electricity or the respective charging processes. This is an obstacle to developing power plants that use renewable energy. Afroz and Rahman [25] researched in Malaysia used the theory of reasoned action (TRA) to see the relationship between consumers' attitudes and individual values. It found that a respondent's attitude toward an environmental consequence positively relates to the conservation value but is less intense towards an individual consequence. In contrast, individual consequences and self-enhancement values are negatively related to purchase intention triggered by being environmentally responsible.

In Indonesia, it is necessary to prove whether the consumer perception of EMCs is already in the early stage and is still lagging behind the accelerated technological development and the expectations from the manufacturers. Therefore, purchase intention could be analyzed. Also, as what happens in developed countries that have had previous experience in adopting EMCs, it could pose similar challenges to global pollution and the demands of greener vehicle alternatives.

Based on the constructed theory above, the first and second hypotheses are as follows:

- H1: A consumer's tacit knowledge about electric vehicles has a positive and significant influence on attitude towards the environment to adopt an electric motorcycle.
- H2: A consumer's tacit knowledge about electric vehicles has a positive and significant influence on the purchase intention of an electric motorcycle.

### *Product Information and Attitude toward the Environment*

Online product information and attitude toward the environment in a different relationship has been an important research topic in many countries (see, [38, 39, 40, 41] among others), where recently consumers are more mindful of where they spend money in the digital world. They are looking for better value and

better promotions through online information. According to McKinsey and Company [37], consumer behavior in Indonesia has begun to change, where 92% of the respondents of the survey stated that they as consumers had tried new shopping habits during the COVID-19 pandemic in 2020, and 58% of them use a new digital shopping method and delivery apps. This phenomenon needs to be further investigated whether this influences the exposure of product information from an environmentally friendly product such as an EMC and thus leads to purchase intention.

The study of product information presented by a previous researcher [27] was tested in developed countries to determine the existence of several choices of information to consumers was modified. That research revealed that consumers would prefer products with better efficiency to benefit from the resulting efficiency for products with the exact cost. Thus, efficiency benefits are communicated to potential customers in cost per unit of use. In addition to efficiency, the benefits of products for the environment are also essential to convey to potential consumers whether they will get tax incentives because of this decision.

Sooner or later, many EMC products will enter Indonesia. The next step of this research is to evaluate whether the product information presented about electric vehicle brands can influence the consumer choice of electric motorcycles if the product information states that one brand has better CO<sub>2</sub> emission than another brand and the initial brand has a longer battery replacement time. This research tests whether Indonesian consumers already know the environment after experiencing the previous information given. This research also aims to evaluate the desired product information that should be presented about an electric motorcycle product that will be sold in Indonesia. The detailed product information that is presented to the target market will increase their awareness of the environment as the societies of developed countries have already experienced. Based on the findings above, the third hypothesis is as follows:

- H3: Detailed product information about perceived usefulness towards the environment has a positive and significant influence on a consumer's attitude toward the environment.

Research in Japan [12] revealed that a driving test with an electric vehicle test investigated energy efficiency variations and battery degradation. The timing and impact of the battery replacement on CO<sub>2</sub> emissions were not directly estimated by testing the Li-ion battery cells. These results found that the battery replacement has a more significant impact on indirect CO<sub>2</sub> emissions than the variation in energy

efficiency. Estimates can be obtained for indirect CO<sub>2</sub> emissions for a 100,000 km drive compared to emissions from internal combustion engine vehicles. Internal resistance can affect battery function.

The reduction in battery capacity can shorten the range of electric vehicles. From that result, it was revealed that CO<sub>2</sub> emissions increase when replacing damaged batteries with new batteries. In that study, when an electric vehicle has reached 100,000 km, the indirect emissions produced will exceed the indirect emissions from conventional ICE vehicles. They exceed the indirect emission because, at this point, the electric vehicle needs to have its battery replaced, and it is the battery production process that produces emissions. Therefore, the battery manufacturing technology here also determines the emergence of emissions; however, whether this information is already ingrained in Indonesian consumers' knowledge before making a purchase.

Based on those findings, the fourth hypothesis is as follows:

H4: Detailed product information about the perceived usefulness towards the environment.

### *Attitude toward the Environment and Purchase Intention of an EMC*

Finally, the potential EMC consumers in Indonesia were asked about their attitudes toward the environment after obtaining information on the environmental impact of EMC products. There is a positive side that is reducing pollution in cities and a negative side in terms of the total CO<sub>2</sub> emissions in Indonesia. Furthermore, an EMC's electricity source comes from a combination of power plants that still use coal as the primary resource and a battery lifetime that brings additional indirect pollution to the EMC products that are not "green" yet. Furthermore, the researchers hypothesize that after obtaining more comprehensive information about the positive and negative impacts of EMCs in Indonesia, consumers will have a change in attitude towards their purchase intention compared to the initial conditions when relying on their tacit knowledge.

Some previous research shows that the total direct and indirect CO<sub>2</sub> emissions from EMCs are not worse for ICE vehicles. However, with many EMC products that vary and use different technologies, from the lowest to the most efficient ones, consumers must properly look for whether a particular EMC product has a pollution-reducing impact on the environment. These consumers can be described as "green consumers." Thus, the last hypothesis concerning the consumer behavior in Indonesia above is as follows:

H5: A consumer's attitude toward the environment has a positive and significant influence on the purchase intention of an electric motorcycle.

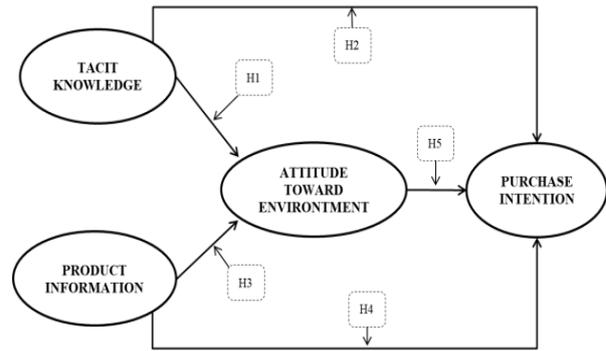


Figure 1. Research model with hypotheses paths

## Research Methods

### *Survey Design and Sampling Method*

The current research is a quantitative research design. First, data were collected by conducting a survey using a questionnaire that referred to indicators that previous researchers had carried out from other countries but different in the object of the product being studied. Then the questionnaire was given to respondents who had sufficient purchasing power based on the average income of Indonesians compared to statistical data in Indonesia [42]. At the time of conducting this study, the country was experiencing a coronavirus disease pandemic, so people as target respondents were more comfortable conducting online surveys. The survey document and the link to the online survey were sent deliberately to people through email and a social media group contact list. Questionnaires were distributed among 700 respondents of a social media group and as residents in big cities and rural areas of Indonesia within a two-month duration, starting from January to February 2021.

### *Measurements and Analysis Methods*

All the measurements for the current study were adopted from prior research on EV cars, but since the research object was not the same, it is necessary to test this study's validity and reliability. The responses were measured on a 7-point Likert scale that had a range from (1) "strongly disagree" to (7) "strongly agree" [43]. This research model was analyzed using the Partial Least Square (PLS) method and computed by SmartPLS-3 software. PLS is an alternative method of Structural Equation Modeling (SEM) that can solve problems in determining the relationships between variables.

### *Indicators and Variables Used*

This study consisted of four latent variables, which were tacit knowledge (TAC), attitude towards the environment (ATE), product information (PRD), and

purchase intention (PIN). Those indicators referred to prior similar studies which were already tested with high consistency to the objects of this research. A seven-item scale developed by Afroz and Rahman [25] was adopted for measuring tacit knowledge.

To measure the product information, reference items developed by previous researchers that indicated that the ease of use, battery life, emissions of CO<sub>2</sub>, and nitrogen oxide (NO<sub>x</sub>) emissions that have profound implications for the environment and public health were also adopted to expand the study [12, 13, 21, 27, 44]. The indicators for this variable were: (1) product information of an electric motorcycle should contain the total cost of ownership of the product; (2) product information of an electric motorcycle should contain the battery lifetime that reflects the indirect pollution caused by this battery replacement; and (3) product information of an electric motorcycle should contain the technology level adopted as indicated by the emissions produced of an EMC compared to a generic gasoline vehicle, which is expressed by gram-CO<sub>2</sub> emission/km.

The attitude toward the environment variable was measured by scale items developed by Bang *et al.* [23] and Ahmad *et al.* [43]. In addition, a seven-item scale developed by Afroz and Rahman [25] was also adopted to measure purchase intention. The indicators for the purchase intention variable were: (1) I would buy an electric motorcycle even if the performance towards the environment is worse than a conventional motorcycle; (2) I would buy an electric motorcycle even if the price is higher than a conventional motorcycle, including the high price of the battery replacement; (3) I would buy an electric motorcycle even if it has a less appealing design; and (4) I would buy an electric motorcycle even if it is less convenient in terms of charging the battery along the street. Therefore, if a respondent answers on a large scale, it can be said that the consumer has a powerful desire to buy the EMC product even if the information on the existing environmental conditions from the previous questions was stated.

## Results and Discussion

### Socio-economic Characteristics of the Respondents

The gender distribution of the sample was 59.7 percent male and 40.3 percent female. For the economic condition of the respondents, 14.3 percent had an income in the range of Rp12,000,001 to Rp 20,000,000 per month, while 31.7 percent of the sample had an income range of Rp5,000,000 and below. About 8.9 percent of the sample had an income of Rp20,000,001 to Rp30,000,000, and 12.6 percent of the sample had an income of more than Rp30,000,000 per month.

**Table 2.** Extracted hypotheses testing using SmartPLS-3

Hypothesis	Path	Path Coef	t-stat	p-values
H1	TAC->ATE	0.298	6.067	0
H2	TAC->PIN	0.343	7.278	0
H3	PRD->ATE	0.360	6.470	0
H4	PRD->PIN	-0.072	0.651	0.515
H5	ATE->PIN	0.092	1.798	0.073

According to the respondents surveyed in this study had an income level that was higher than the average income level of Indonesian people. With this condition, the respondents had good purchasing power and were a potential target market for electric motorcycle products.

### Model Fit

The SEM outputs shows the overall model fit indexes indicating that the CTA model is consistent with the data with all fit indexes equal to the recommended values (model fit 79.9%, SRMR=0.081, dULS=0.785, dG=0.26, Chi-Square=479.21, NFI=0.799). The value of RMSR is 0.081, which is less than 0.10 and is close to 0.08. Therefore, the research model is considered a good fit.

### Significance (t-statistic)

In the Partial Least Square (PLS) test, each relationship was examined using a simulation with the bootstrapping method of the sample [45]. From the relationship of PRD to ATE, the value of the t-statistic is 6.47, which means it is above 1.96, and the p-value is 0, which is <0.05 (5%). Thus, this relationship which refers to hypothesis 3 is significant and valid (accepted). Another relationship among the variables which refers to each hypothesis is summarized in Table 2, which infers that three of the five hypotheses are significant.

### Results

Hypothesis 1 confirms that tacit knowledge affects attitude toward the environment in a positive and significant way with a P-value of 0.000 < significant level (5%) and the t- statistical calculation is 6.067>t-table (1.96) and a resulting positive path coefficient of 0.298>0. From the respondents' questionnaire, it can be derived that the highest percentage of the respondents' education had a Bachelor's Degree (67.0 percent), 18.3 percent had a postgraduate degree, 8.7 percent had reached higher secondary levels, and 6.0 percent had reached a diploma degree. The data on the education level of the respondents as a whole is indeed higher than the Indonesian statistical data [42]. This indicates that consumers with higher levels of education have more positive tacit knowledge about EMCs. Potential EMC consumers in Indonesia are ready because they have good tacit knowledge and,

therefore, a positive attitude towards environmental impacts. Consumers already have an awareness that environmental awareness is important.

One of the essential parts of consumer behavior in this research is perception, partly obtained from a person's tacit knowledge. Since hypothesis 1 is accepted, it can be concluded that Indonesian citizens currently have sufficient tacit knowledge in realizing that an electric motorcycle is a fuel-efficient vehicle and it can reduce CO<sub>2</sub> emissions. However, developed countries previously adopted electric vehicles, as they can reduce pollution because they are combined with electricity sources produced from renewable energy and even nuclear energy [3].

In contrast, Indonesia still uses a lot of raw material sources of coal and petroleum in more than half of its power plants. As a result, converting from conventional vehicles to electric vehicles faces several constraints in reducing CO<sub>2</sub> emissions. However, the facts obtained from the respondents' data state Indonesian people perceive that EMCs are environmentally friendly products despite the information and the fact that the source of electricity generation in Indonesia is still not truly environmentally friendly. It can be interpreted that potential EMC consumers in Indonesia have high expectations that the presence of EMC products will contribute to the reduction of environmental pollution, including air, water, and soil pollution.

Hypothesis 1 is similar and strengthens the results of previous research conducted by Bang *et al.* [23] in the United States that found a positive relationship between beliefs about salient consequences and attitudes toward paying more for renewable energy as predicted by the theory of reasoned action. It is also similar to a study by Wang, Wang, and Li [30] in China, which stated that consumers' knowledge about EVs is positively and significantly related to the perceived usefulness, attitude, and intention to adopt EVs. Afroz and Rahman [25] in Malaysia also found that the conservation value was positively related to the attitude on environmental consequences towards EV purchase intention.

Further facts obtained from hypothesis 2 stated that the respondents expressed that EMC products must be efficient, positively contribute to reducing CO<sub>2</sub> emissions, and lessen other greenhouse gases. With that knowledge, prospective EMC customers already have the intention to buy an EMC product if it is marketed in Indonesia. This condition is quite interesting because even though the respondents' average education level is relatively high, they do not consider further environmental issues regarding EMC environmental obstacles. The condition of the

power plant source, which is still not environmentally friendly enough, battery waste management, the problem of high prices and subsidies, difficulties in charging along the streets, and travel distance limitations for one-time charging are not significant considerations in buying an EMC product, or because they are not well informed yet.

Therefore, this is an excellent start for EMC product marketers to start marketing their products by exploring the well-established tacit knowledge of consumers in Indonesia without neglecting ethics and carrying out a simple marketing strategy by providing sufficient product information on the environmental impacts of a better future.

Hypothesis 2 contradicts previous research by Lebeau and Mierlo [31] in Belgium, which claimed that knowledge has no impact on acceptance for the driving range. However, consumers with more knowledge want a car with a higher maximum speed and desire faster-charging durations (both slow and fast). This could happen as the level of understanding of the people in Belgium is much higher because the average level of education is above Indonesia. Therefore, their demands for the ability of electric vehicles are also getting higher. Additionally, the knowledge factor there does not affect the purchase or adoption of EMCs. However, hypothesis 2 is similar and strengthens the results of previous research conducted by Alzahrani *et al.* [46] in Saudi Arabia that found subjective norms and attitudes are significant in explaining Saudi consumers' intention on purchasing EVs. Yousif and Alsamydai [21] in Jordan also inferred that there is a strong relationship between the independent variables (perceived usefulness, attitude toward using an EV, perceived ease of EV use, perceived challenges of use) and the dependent variable (EV use). Therefore, it can be indicated that tacit knowledge positively affects the purchase intention of an electric vehicle in developing countries or those that have recently adopted EVs, such as Saudi Arabia, Jordan, and Indonesia. However, tacit knowledge does not affect the purchase intention in developed countries, as represented by Belgium in the study that had adopted EVs a few years earlier.

The test results for the product information variable are significant for the attitude toward the environment variable with a P-value of 0.000 < significant level (5%), the t-statistic is 6.47 > t-table (1.96), and also has a positive path coefficient of 0.36 > 0, indicating that the product information variable has a significant positive effect on the attitude toward the environment. Thus, hypothesis 3 in this study is accepted.

Details of the product information conveyed to the respondents stated that the product information of an EMC should contain the total cost of the ownership of the product, the battery lifetime that reflects the indirect pollution caused by the battery replacement, and the technology level adopted as indicated by the emissions produced of an EMC compared to a generic gasoline vehicle which is expressed by gram-CO<sub>2</sub> emission/km. Furthermore, several indicators of the attitude toward the environment variable include concern about the environment, unease about air pollution, worry about water pollution in the city, anxiety about soil contamination, and apprehension about the environment when making purchases.

Hypothesis 4 reveals that the product information does not affect purchase intention. The test results of hypothesis 4 are not significant. A number of the questions in the product information questionnaire demand that EMC products must have advantages such as competitive prices including taxes and maintenance costs, and also battery processing procedures. With some of these questions, it seems like a requirement that EMC products must have all these advantages. Therefore, the respondents ultimately gave a negative assessment when they were asked whether to buy EMC products.

From the questionnaire, it can be inferred that potential consumers of electric motorcycles in Indonesia want to purchase EMC products because the performance toward the environment should be better than a conventional motorcycle. Also, the price should not be higher than a conventional motorcycle, including an affordable battery replacement price. Besides that, EMC products must have an appealing design, be comfortable to use, and ease charging the battery along the street. Therefore, EMC manufacturers and marketers must strive to provide all the values above so that the sales of EMC products can penetrate a higher market share in Indonesia.

Related to the previous analysis, hypothesis 5, which states that "Consumers who have an attitude toward the environment that are more knowledgeable about the environmental impact in Indonesia tend to have a significant positive influence toward purchase intentions of electric motorcycles," proved that attitude toward the environment affects purchase intention in a positive but not significant relationship. The purchase intention of EMC products is more significantly influenced by tacit knowledge from prospective consumers than by attitude toward the environment.

Consumer habits when buying EMC products are no longer the same as when buying conventional motorcycles. The reasons for efficiency and environmental

friendliness will be the basis for consideration of the selection. By presenting detailed product information, prospective consumers will be aware that in adopting an EMC, they are not just buying a product, but they are also making a positive contribution to the improvement of the environment. Consumers' attitudes toward the environment will escalate, which is an excellent thing for Indonesia in the early stage of EMC adoption. Indonesian people already have a fairly good level of concern for the environment is a good stepping stone towards becoming a "green consumer."

Product information displayed both offline and online will provide fair comparisons between electric motorcycle products, in which one of those has good efficiency and has minor emissions. Consumers will feel proud when they are involved and part of the actual contribution to the environmental improvement when they decide to purchase the "greenest" products. Hence, it can increase public awareness of the importance of environmental conservation. In the future, with a high level of public awareness of environmental concerns when they buy EMC products, environmental sustainability will be obtained.

### **Recommendations for Electric Motorcycle Producers and Marketers**

From the hypotheses constructed, it can imply that potential EMC consumers in Indonesia have high expectations that the presence of EMC products will contribute to the reduction of environmental pollution, including air, water, and soil pollution. Prospective consumers represented by the respondents strongly agree that the product information of an EMC product should contain general vehicle performance information like conventional motorcycle products and further information regarding whether an EMC product has sufficient technology so that it can outperform conventional motorcycles in terms of performance. Furthermore, total exhaust emissions should be converted in the same unit, namely grams of CO<sub>2</sub> per km of use; therefore, it can distinguish the "greenest" product.

Certain technology should also be informed to consumers about how long the battery life is, including indirect pollution caused by purchasing a new battery. Prospective customers also want product information that contains the total cost of ownership of an EMC product. It can be concluded that the level of understanding of Indonesian people is good enough to understand that in addition to the initial purchase price, an EMC product must also be durable. Therefore, there are not many additional costs when they buy a conventional motorcycle, such as replacing a battery over the years, tax costs, and the cost of purchasing new EMC products.

This provision will require producers to have a certificate from a national standardization body that assesses all EMC products with the same standards and tests. It also encourages the consumer agency to issue standards for what information needs to be displayed on the sale of EMC products, which is essential for both producers and consumers.

### **Recommendations for Prospective Consumers of EMC Products.**

Based on data from the respondents, Indonesian people want comprehensive product information on electric motorcycle products. Even though so far, with conventional motorcycle products, we as consumers rarely or never even ask whether the motorcycle we are going to buy has a good enough value and has the best total cost ownership among other products. This new perception raised by potential EMC customers can be observed from this phenomenon. Therefore, it becomes interesting whether this EMC product will still be classified in the vehicle category or even be classified in another new product category such as a cellphone, laptop, or another electronic product category that usually has complete product information. Thus, purchase intention is obtained by comparing the specifications from its product information rather than the existing ICE marketing method.

As consumers, we must have enough knowledge, especially regarding the environmental effects generated from an EMC product. Consumers cannot just look at the product's appearance or low price, but they should also consider the environmental data. This EMC product aims to reduce environmental pollution; therefore, all products sold must have enough information on their environmental impacts. As consumers, we must be careful in choosing which products are the "greenest" to be purchased with a sense of responsibility.

### **Recommendations for the Indonesian Government**

The product information should be helpful for the government as a regulator to state some regulations that every EMC product marketed in Indonesia must have good efficiency and have transparent and responsible procedures for how to process used batteries so that they do not pollute the soil. A problem that potentially occurs in an EMC market is that the products are just good models, but the efficiency is poor, and there are also many problems in the next 4-5 years, such as replacing the battery, which breaks down too quickly and creates a new pollution problem in this country. The more product information described among the EMC products and their impacts

on the environment, the more valuable they are. Consequently, in the future, Indonesia will be able to adopt electric motorcycles without ethically neglecting the customer satisfaction factor.

In this case, the government can use the national standardization agency and the Ministry of Trade to issue standards and conduct proper testing for all electric motorcycle products to be sold in the market, as BPPT and other agencies currently do tests on conventional motorcycle products, but of course with different standards. The gradual setting of standards according to the technological capabilities of producers must find an equilibrium point at a price that the market can absorb. As a result, with this policy, the long-term plan for adopting EMCs in Indonesia can be successful.

The government should also encourage power plants in Indonesia to start using renewable energy to reduce air pollution caused by the increasing demand for electricity due to the increasing number of EMC products in the community that charge every day. This is in accordance with what is indicated by the respondents: according to their tacit knowledge, EMC products must positively impact the environment; otherwise, EMC products cannot meet the challenge of reducing pollution, and these products will become merchandise that has no added value.

### **Conclusion**

This research examined the readiness and knowledge level of potential Indonesian consumers toward adopting electric motorcycles from the consumer behavior point of view. First, we defined four variables to construct the research model. Those variables were tacit knowledge, product information, environmental attitude, and purchase intention (TAC, PRD, ATE, and PIN). The SEM simulation using SmartPLS-3 exhibited that the indicators are valid, and the construct validity of the scales is high. Furthermore, the overall model fit indexes indicated that the CTA model was consistent with the data, with all the fit indexes equal to the recommended values (model fit 79.9%; SRMR=0.081, dULS=0.785, dG=0.26, Chi-Square=479.21, NFI=0.799).

Consumers' tacit knowledge that is more knowledgeable about environmental usefulness has a positive influence on the purchase intention of electric motorcycles with a significant value. While detailed product information about the perceived usefulness towards the environment has a significant positive influence on consumers' attitude towards the environment. The purchase intention of EMC products in Indonesia is more significantly influenced by tacit knowledge from prospective consumers than

by attitude toward the environment (whose value is not significant for the respondents in Indonesia in 2021).

## References

1. Tonko, M., and Gidwani, M., Roland Berger Focus. *Motorcycle Growth Prospect in Southeast Asia: Rise of Business Use Two- Wheelers*, 2018, pp 2-7.
2. Baumann, M., Simon, B., Dura, H., and Weil, M. The Contribution of Electric Vehicles to the Changes of Airborneemissions, *2nd IEEE ENERGYCON Conference and Exhibition*, 2012.
3. Athanasopoulou, L., and Bikasa, H., Comparative Well-to-Wheel Emissions Assessment of Internal Combustion Engine and Battery Electric Vehicles. *Elsevier, 6th CIRP Global Web Conference*, 2018.
4. Kumara, K., Future Power Train Technology Scenario. *The 27th GAIKINDO Indonesia International Auto Show*, Jakarta: GAIKINDO, 2019, pp . 2-6.
5. Gaikindo, Retrieved from GAIKINDO: <https://www.gaikindo.or.id/gaikindo-penjualan-mobil-januari-sampai-november-2019-dekati-1-juta-unit>, 2019, December.
6. Utami, M. W., Yuniaristanto, and Sutopo, W, Adoption Intention Model of Electric Vehicle in Indonesia, *Jurnal Optimasi Sistem Industri*, 19(1), 2020, pp. 70-81.
7. Yuliani, W., Pendanaan Inovasi dalam Inovasi Teknologi Power Train Kendaraan Masa Depan untuk Pasar Indonesia. *GAIKINDO Future Power Train Scenario* Jakarta: RISTEKDIKTI, 2019, pp. 2-23.
8. Riyanto, Nuryakin, C., Riyadi, S. A., and Massie, N. W., Estimating the Total Cost of Ownership (TCO) of Electrified Vehicle in Indonesia. *LPEM-FEBUI*, 2020, pp. 2-15.
9. Prasetyo, E. A., F, B. P., and Anggarini, L., Acceptance of Electric Vehicle in Indonesia: Case Study in Bandung. *2019 6th International Conference on Electric Vehicular Technology (ICEVT)*, 2020.
10. Coffman, M., Bernstein, P., and Wee, S., Electric Vehicles Revisited: A Review of Factors that Affect Adoption. *Transport Reviews*, 2017, pp. 79-93.
11. Chiu, Y. C., and Tzeng, G. H., The Market Acceptance of Electric Motorcycles in Taiwan Experience through a Stated Preference Analysis. *Pergamon: Transportation Research Part D 4*, 1999, pp. 127-146.
12. Niikuni, T., and Koshika, K., Investigation of CO2 Emissions in Usage Phase Due to an Electric Vehicle - Study of Battery Degradation Impact on Emissions-*EV27 International Battery, Hybrid and Fuel Cell Electric Vehicle Symposium 1*, 2013.
13. Dumortier, J., and al, e., Effects of Providing Total Cost of Ownership Information on Consumers' Intent to Purchase a Hybrid or Plug-in Electric Vehicle, *Transportation Research Part A: Policy and Practice*, 72, 2015, pp. 71-86.
14. Levay, P. Z., Drossinos, Y., and Thiel, C., The Effect of Fiscal Incentives on Market Penetration of Electric Vehicles: A Pairwise Comparison of Total Cost of Ownership. *Elsevier: Energy Policy* 105, 2017, pp. 524–533
15. Palmer, K., Wadud, Z., Tate, J. E., and Nellthrop, J., Total Cost of Ownership and Market Share for Hybrid and Electric Vehicles in the UK, US and Japan. *Elsevier: Applied Energy*, 209, 2017, pp. 108-119.
16. Vilchez, J., Kelleher, L., and Thiel, C., Electric Car Purchase Price as a Factor Determining Consumers' Choice and their Views on Incentives in Europe. *Sustainability, MDPI*. 2019.
17. Syamnur, F. H., Pambudi, N. A., Biddinika, M. K., and Wardani, N. S., Barriers to the adoption, acceptance and public perceptions of Electric Vehicles (EV) in Indonesia: Case studies in the city of Surakarta. *Journal of Physics: Conference Series*. 2019.
18. Setiawan, I. C., Policy Simulation of Electricity-Based Vehicle Utilization in Indonesia (Electrified Vehicle - HEV, PHEV, BEV and FCEV). *Journal UNIMMA - Automotive Experiences*, 2(1), 2019, pp 1- 8.
19. Prianjani, D., Sutopo, W., Hisjam, M., and Pujiyanto, E., Sustainable Supply Chain Planning for Swap Battery System: Case Study Electric Motorcycle Applications in Indonesia. *IOP Conf. Series: Materials Science and Engineering*, 2019.
20. Anfinsen, M., Lagesen, V. A., and Ryghaug, M. Green and gendered? Cultural perspectives on the road towards electric vehicles in Norway. *Journal of Transportation Research Part D*, 2019, pp 37-46.
21. Yousif, R. O., and Alsamydai, M. J., Perspective of Technological Acceptance Model toward Electric Vehicle. *International Journal of Mechanical and Production Engineering Research and Development*, 9, 2019, pp. 873-884.
22. Chubachi, K., Alternative Power Train Technology in The World. *GAIKINDO Seminar of Future Power Train Technology*, Jakarta: Honda RandD Indonesia, 2019, p. 35.
23. Bang, H. K., Ellinger, A. E., Hadjimarco, J., and Traichal, P. A., Consumer Concern, Knowledge, Belief, and Attitude toward Renewable Energy: An Application of the Reasoned Action Theory. *Psychology and Marketing*, 17(6), 2000, pp 449-468.
24. Fishbein, M., and Ajzen, I., *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley, 1975.

25. Afroz, R., and Rahman, A., How Individual Values and Attitude Influence Consumers' Purchase Intention of Electric Vehicles—Some Insights from Kuala Lumpur, Malaysia. *Journal of Environment and Urbanization Asia*, 6(2), 2015. pp 1–18.
26. Ozaki, R., and Sevastyanova, K., Going Hybrid: An Analysis of Consumer Purchase Motivations. *Energy Policy*, 39(5), 2011, pp 2217-2227.
27. Lunn, P., Choisdealbha, A. N., and Timmons, S., Experimental Evidence for the Effect of Emission Charge and Efficiency Information on Consumer Car Choice, *Journal of Cleaner Production*, 254, 2020, pp. 120-140.
28. Haryanto, J. O., *Konsumerisme dan Pepesan Kosong*, (2020, November 30). Retrieved from Industry.co.id: <https://www.industry.co.id/read/77492/konsu-merisme-dan-pepesan-kosong>
29. Yang, S., and Zhang, D., Market Cultivation of Electric Vehicles in China: A Survey Based on Consumer Behavior. *Sustainability-MDPI*, 2018.
30. Wang, S., Wang, J., and Li, J., Policy Implications for Promoting the Adoption of Electric Vehicles: Do Consumer's Knowledge, Perceived Risk and Financial Incentive Policy Matter? *Transportation Research Part A: Policy and Practice*, 117, 2018, pp 58-69
31. Lebeau, K., and Mierlo, J. V., Consumer Attitudes towards Battery Electric Vehicles: A Large-scale Survey, *Journal of Electric and Hybrid Vehicles*, 5 (1), 2013, pp.28-41.
32. Chen, T. B., and Chai, L. T., |Attitude towards the Environment and Green Products: Consumers' Perspective, *Management Science and Engineering*, 4(2), 2010, pp. 27-39
33. Blackwell, R. D., Miniard P. W, and Engel, J.F., *Consumer Behavior* (10th ed.). South Western: Thomson Learning, 2006.
34. Allport, G. W., Attitudes. *In a Handbook of Social Psychology*. Worcester, MA: Clark University, 1935.
35. Schiffman, L. G., and Kanuk, L. L., *Consumer Behavior, 7th edition*. New Jersey USA: Prentice Hall, Inc. 2000.
36. Schuitema, G., and Anable, J., The Role of Instrumental, Hedonic and Symbolic Attributes in the Intention to Adopt Electric Vehicles. *Journal of Transportation Research Part A: Policy and Practice*, 48, 2013. pp 39-49.
37. McKinsey and Co, *Survey: Indonesian consumer sentiment during the coronavirus crisis*, 2020, July 09. Retrieved from McKinsey.com: <https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/survey-indonesian-consumer-sentiment-during-the-coronavirus-crisis>
38. Monsuwe, T. P., Dellaert, B. G., and Ruyter, K. D., What Drives Consumers to Shop Online? A Literature Review, *International Journal of Service Industry Management*, 15(1), 2004, pp 102-121.
39. Cho, Y. C., Exploring Factors that Affect Usefulness, Ease of Use, Trust, and Purchase Intention in the Online Environment, *International Journal of Management and Information Systems – First Quarter 2015*, pp 21-36.
40. Okada, T., Tamaki, T., and Managi, S., Effect of Environmental Awareness on Purchase Intention and Satisfaction Pertaining to Electric Vehicles in Japan, *Transportation Research Part D: Transport and Environment*, 67, February 2019, pp 503-513.
41. Reeves, M., Lang, N., and Carlsson, P., Lead Your Business through the Coronavirus Crisis, *Harvard Business Review*, 2020.
42. BPS-Statistic Indonesia. *Keadaan Pekerja di Indonesia Februari 2020*. Jakarta: Badan Pusat Statistic, 2020.
43. Ahmad, I., Syed, F., Naseer, S., and Rasool, G., Environmental Concern as an Underlying Mechanism between Environmental Beliefs and Green Purchase Intentions. *South Asian Journal o Management Sciences*, 12(1), 2018, pp 93-115/
44. Roger, B., and Rohini, V., Consumer Attitudes towards Electric Vehicles: Effects of Product User Stereotype and Self-image Congruence, *European Journal of Marketing*, 52(3/4), 2018, pp 499-527.
45. Garson, G David, Partial Least Square (PLS-SEM). *Partial Least Square: Regression and Structural Equation Models*, 2016, pp. 62-79.
46. Alzahrani, K., Phillips, A., and Zeng, A. Z., Applying the Theory of Reasoned Action to Understanding Consumers' Intention to Adopt Hybrid Electric Vehicles in Saudi Arabia, *Journal of Transportation*, 46, 2019, pp 199–215.