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The Contribution of Perceived Value to the Intention to Purchase Electric Motorcycles

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Abstract. *Gasoline-fueled motorcycles predominate as private vehicles worldwide. The high number of motorized vehicles running on fossil fuels contributes to air pollution and hence to the destruction of the environment and of human health. This has given rise to alternative vehicles such as electric cars and motorcycles—a market which Indonesia, with its high market share of motorcycles, ought to understand better. Consumer behavior related to electric motorcycles ought to be investigated to boost adherence to this type of vehicle. This study aims to evaluate the intention of residents of Surakarta, an Indonesian city with a dynamic market, to purchase electric motorcycles. The two independent variables implemented are perceived value and age, and respondents number 184, selected through cluster sampling to represent Surakarta's population. The study employs ordinal logistic regression, as the response variable at hand is ordinal. Results show that age and perceived value influenced the intention to purchase electric motorcycles in Surakarta. Especially based on our young and middle-aged respondents, we can conclude that as perceived value increased, so did the probability of the intention to buy an electric motorcycle.*

Keywords: *Electric motorcycle, electric vehicle, perceived value, intention to purchase, green transportation*

1. Introduction

Modern transportation contributes greatly to air pollution (Deluchi et al., 1989). About 14% of greenhouse gas emissions in 2010 came from the transportation sector (EPA, 2021), mainly from the use of gasoline- and diesel-based vehicles. This urgently calls for the promotion of alternatives such as hydrogen fuel cell and electric vehicles (Uyterlinde, 2009). Electric vehicles (EVs) have received much attention worldwide (Ajanovic & Haas, 2015), having been invented more than 150 years ago (Plötz et al., 2014), although they remain under development toward market penetration improvements.

The high amount of investment required (Ajanovic & Haas, 2015) and high battery costs (Ajanovic, 2014) have been among the barriers to EVs' market penetration. Hence, governments have been urged to provide incentives or subsidies to increase EVs' adoption. However, in China, incentives have largely failed to attract consumers to buying electric motorcycles (Wang et al., 2017).

Studies have mainly addressed EV adoption from two perspectives: attributes of electric vehicles and psychological factors among consumers (Han et al., 2017). Most research on the intention to buy EVs has limited its focus to elements such as how price, incentive and electric vehicle adoption relate to one another (Wang et al., 2017). Incentives are meant to reduce the price and costs associated with EVs to increase consumer adherence. As the high investments needed to develop EVs are viewed as a common barrier to their adoption, it is crucial to investigate the role price plays in this.

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Based on these underlying factors and the research gap, this study aims to investigate the relationship between age, perceived value, and intention to purchase an electric vehicle. Most EV studies have focused on electric cars; however, in Indonesia, motorcycles lead the vehicle population. Electric motorcycles are thus the object of the present study.

We conducted this study in Surakarta, a medium-sized city in Indonesia which could be a target market for electric motorcycles. As electric motorcycles produce less pollution, they should be widely adopted in Surakarta to counter the environmental harm from motor vehicles, and we found that people's use of the former could inspire others to do the same.

2. Literature Review

In marketing, price is closely related to perceived value. Prebensen et al. (2014) summarized the three components of perceived value as product, price, and experience. Zeithaml (1988) elaborated on definitions of value; for example, value might refer to low price, the benefit received from the product, a tradeoff between what consumers give (pay) and get (quality), and how much consumers get from buying the product. Most of those values are related to price.

Perceived value is an individual assessment of the utility of a product or service based on the perceptions they receive (Sumaedi et al., 2012; Yaacob & Baroto, 2019). It could be defined as the ratio of process quality and result delivered to customers (Tami, 2004). In other words, it could be viewed as the evaluation of benefits and cost of the product or service by customer perception (Alonso-Almeida, 2019).

Perceived value has been found to play a vital role in the decision to purchase or adopt a product, mediating between product quality and repurchase intention (Vafa-Arani et al., 2014). Sumaedi et al. (2012) and Cheng and Tseng (2016) demonstrated that perceived value determined the intention to use public transport, and Chen et al. (2012) investigated the intention to adopt hydrogen electric motorcycles as affected by perceived value. Moreover, Oviedo-García et al. (2016) argued that perceived value helped to determine ecotourism visits, while Karjaluoto et al. (2019) showed that perceived value influenced the adoption of mobile banking apps. The relationship between perceived value and green consumption was further evidenced in Muraguri et al. (2020); and, according to Wang et al. (2019), high perceived value has tended to drive consumers to use ride-sharing.

Regarding EVs, perceived value strengthened by financial incentive and environmental concerns could influence purchase intention toward electric motorcycles (Kim et al., 2018). At the same time, Vassileva and Campillo (2017) suggested that the costs for charging and maintenance determined consumers' decision on adopting EVs in Sweden.

Han et al. (2017) studied the contribution of functional and non-functional value to the intention to adopt EVs. Functional value relates to tangible needs, such as monetary, performance, and convenience values, and non-functional value to intangible needs, such as emotional, social, and epistemic values. Their research showed that while functional values contributed to the intention to adopt EVs, non-functional values did not significantly influence the intention to buy them. According to a study by Wang et al. (2018), perceived value did not influence EV adoption.

Besides value, age could shape the intention to adopt EVs (Qian & Yin, 2017). In Germany, middle-aged consumers have been the ones usually buying EVs (Plötz et al., 2014), which have been known to be expensive but could be more affordable to them than to consumers in other age groups.

Meanwhile, a study by Guerra (2019) on electric motorcycles in Surakarta, Indonesia, showed that younger consumers were more prone to adopting this type of vehicle than older consumers were. Since motorcycles are popular among young people in Indonesia, they tend to be more aware of the technology. This study is equivalent to research by Smith et al. (2017). Conversely, Wang et al. (2016) contended that age did not influence purchase intention toward EVs. Given most of the evidence available, however, we formulate the following hypothesis on this topic:

H_1: Age is associated with the intention to buy motorcycles.

A large body of research has investigated the relationship between perceived value and intention to purchase. Most of those studies showed that perceived value contributed to the intention to purchase EVs (see e.g., Chen et al., 2012; Vassileva & Campillo; 2017; Kim et al., 2018). Hence, our corresponding hypothesis is as follows:

H_2: Perceived value is associated with the intention to buy motorcycles.

The conceptual model of this study is presented in Figure 1.

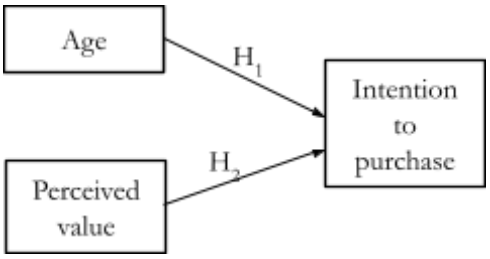


Figure 1.
Conceptual Model

3. Methodology

Data collection

This study is based on a questionnaire on the intention to purchase electric motorcycles among the society in the city of Surakarta, Indonesia. We distributed the survey to respondents from September 2017 to January 2018.

The population of this study comprises Surakarta residents aged between 15 and 49. In Surakarta, 288,359 people were 15 to 49 years old in 2017 (BPS Kota Surakarta, 2018). We obtained responses from 184 participants. Based on Slovin's formula and a 10% margin of error, this was sufficient, as the minimum sample should have been 99.97 respondents.

Due to Surakarta's diversity, we employed cluster sampling from each sub-district: Pasar Kliwon, Jebres, Banjarsari, Laweyan, and Serengan. According to Badan Pusat Statistik Kota Surakarta, the population was divided thus: 19% in Laweyan, 10% in Serengan, 16% in Pasar Kliwon, 25% in Jebres, and 30% in Banjarsari. Table 2 displays our respondents' provenience, with the highest percentage having been from Banjarsari (25.4%) and the lowest from Serengan (13.5%).

We obtained the questionnaire responses via Google Forms, distributed directly to the study's participants. The online format was implemented to facilitate data recording, with direct distribution to ensure that participants filled out the survey themselves and to control the randomness of data sampling.

Data Analysis and Modeling

This study applies two independent variables: age (x_1) and perceived value (x_2). Age (x_1)

is measured as continuous data based on year, discretized into seven age groups (Table 1). A Likert scale of 1 (strongly disagree) to 5 (strongly agree) is implemented to measure perceived value $\left(x_2\right)$. This is a latent variable gauged in five questions. Table 1 presents each of the questions on perceived value.

The first two questions relate to psychology, i.e., respondents' feelings when using an electric motorcycle. The third and fourth questions pertain to price, and the fifth question addresses performance value. The perceived value is the sum of these five questions' Likert-scale scores. Thus, five is the smallest and 25 the largest perceived value.

Table 1.
Indicators of Perceived Value

Questions	Sources
I feel happy when using an electric motorcycle (PV1)	Iriani (2014)
I feel fantastic when I use an electric motorcycle (PV2)	Iriani (2014)
I perceive that the price of the electric motorcycle is cheap (PV3)	Iriani (2014)
I perceive that the cost of the electric motorcycle is cheap (PV4)	Iriani (2014),
I perceive that electric motorcycle performance is good (PV5)	Sweeney et al. (1999)
I will buy an electric motorcycle in the next five years	(Plötz et al., 2014)

The dependent variable, which is the intention to purchase the electric motorcycle (y) within the next five years, is measured using a five-point ordinal scale. Value 1 is for "will not buy," 2 for "will maybe not buy," 3 for "neutral," 4 for "will maybe buy," and 5 for "will buy." This value is a non-latent variable and a discrete number.

We measure the reliability and validity of the latent variable (perceived value) via the Pearson-correlation test and Cronbach's alpha; and we apply ordinal logistic, since the independent variable is ordinal data. This type of analysis has been employed in various studies, such as Imaslihkah et al. (2013). The cumulative ordinal logistic equation in this study is adopted from Agresti (2013). The equation is presented as Equation 1.

$$logit\left[P\left(Y{\leq}j|x_i\right)\right] = \pi(x) = \frac{\exp exp\left(\beta_{0j}+\sum_k^p \beta_k x_{ik}\right)}{1+\exp exp\left(\beta_{0j}+\sum_k^p \beta_k x_{ik}\right)} \quad (1)$$

Where $x_i = \left(x_{i1},\ ...,\ x_{ip}\right)$, p is the number of independent variables, $j = 1,\ ...,\ J-1$, where J is all response categories. In this study, there are five response categories. Hence, the estimated probability of each category is measured by using these equations:

$$logit[P(Y{\leq}1)] = logit[P(Y=1)] = \pi(1) \quad (2)$$

$$logit[P(Y=2)] = \pi(2) = logit[P(Y{\leq}2)] - logit[P(Y{\leq}1)] \quad (3)$$

$$logit[P(Y{\leq}3)] = \pi(3) = logit[P(Y{\leq}3)] - logit[P(Y{\leq}2)] \quad (4)$$

$$logit[P(Y\leq 4)] = \pi(4) = logit[P(Y\leq 4)] - logit[P(Y\leq 3)] \quad (5)$$

$$logit[P(Y\leq 5)] = \pi(5) = 1 - logit[P(Y\leq 4)] \quad (6)$$

The likelihood ratio test or *G*, Pearson Chi-Square $\left(\chi^2\right)$, and deviance $\left(G^2\right)$ use equations described by Agresti (2013).

This study applies two independent variables, age (x_1) and perceived value (x_2), to determine the intention to buy an electric motorcycle. Age is divided into seven categories: 15–19, 20–24, 25–29, 30-34, 35-39, 40-44, and 45-49. The model is presented in Equation 7.

$$logit[P(Y\leq j)] = \pi(x) = \frac{\exp exp\left(\sum_{j=1}^{4}\beta_{0j} + \sum_{j=2}^{7}\beta_{1j}x_{\cdot}\right.}{1+\exp exp\left(\sum_{j=1}^{4}\beta_{0j} + \sum_{j=2}^{7}\beta_{1j}\right.}$$

Where β_{0j} is a constant parameter for *j*-categories of variable intention to buy. We have five categories in this part of the study: 1 for "definitely not intending to buy an electric motorcycle," 2 for "probably not intending to buy an electric motorcycle," 3 for "neutral," 4 for "probably intending to buy an electric motorcycle," and 5 for "definitely intending to buy an electric motorcycle." Using equations 2 to 6, we have five equations. Meanwhile, β_{1j} is a parameter for *j*-categories of age and β_2 is a parameter for perceived value.

4. Findings and Discussion

Findings

Table 2 displays questionnaire respondents' demographic distribution. Most respondents lived in Banjarsari, Pasar Kliwon, and Jebres. Meanwhile, gender in this study was almost equally distributed between female and male. Most were aged 15–19 and 20–24.

As mentioned, we measure perceived value via five questions, as presented in Table 1. The validity and reliability tests for such questions are shown in Table 3. Although the validity of the first and last questions is lower than 0.8, our results indicate that all questions are valid, as they exceed 0.7 in the validity test. The Cronbach reliability test shows similar results, with the questions being considered reliable at 0.86. This implies that all questions can represent the variables of perceived value.

Table 4 illustrates respondents' distribution regarding the perceived value of electric motorcycles and their behavioral intention. It is apparent that most answers were "neutral." Most respondents were hesitant, as most did not own an electric motorcycle. The second most frequent answer was "agree," except for the question "I feel cool when I use an electric motorcycle," to which more participants answered "disagree" than "agree."

The survey respondents tended to agree with the statements related to cost—price of motorcycles (PV3) and price of electric motorcycle (PV4)—as well as performance (PV5) of the electric motorcycles. This indicates that most respondents perceived electric motorcycles' price, costs, and performance more than reasonable.

Table 2.
Respondents' Identity

	Percentage
Location	
Jebres	21.1
Pasar Kliwon	23.8
Serengan	13.5
Laweyan	16.2
Banjarsari	25.4
Gender	
Male	53.0
Female	47.0
Age	
15–19	26.6
20–24	29.7
25–29	9.7
30–34	14.6
35–39	4.9
40–44	7.6
45–49	7.0

Table 3
Validity and Reliability Test of Perceived Value

Questions	Validity	Reliability
PV1	0.767	0.8604
PV2	0.819	
PV3	0.862	
PV4	0.809	
PV5	0.747	

Meanwhile, for the intention to purchase electric motorcycles, the highest percentage corresponds to "probably intending to purchase an electric motorcycle over the next five years." This indicates that more people were interested in buying electric motorcycles over the next five years than those who were not. At the same time, the smallest percentage corresponds to those who answered with "definitely will buy electric motorcycle." This could suggest respondents tend to be unsure about buying, although interested in buying.

Table 4.
Percentage of Answers to Each Question

Question	Scale				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
PV1	0	13.40	59.24	21.20	6.52
PV2	2.17	20.65	54.89	15.22	7.07
PV3	1.63	11.96	51.09	27.72	7.61
PV4	1.09	11.96	51.63	27.17	8.15
PV5	0	10.87	55.43	28.26	5.43
	Definitely do not intend to buy electric motorcycle	Probably do not intend to buy electric motorcycle	Maybe intend to buy electric motorcycle	Probably intend to buy electric motorcycle	Definitely intend to buy electric motorcycle
BI	9.24	21.74	22.83	38.04	8.15

Parameter estimation of the ordinal logistic regression model is presented in Table 5. In referring to the model presented in Equation 7, the general equation of the model is presented in Equation 8. $\hat{\beta}_{0j}$ is the constant parameter of each level of response, where j = 1, 2, ..., 5. $\hat{\beta}_{01}$ refers to the response "will not buy," $\hat{\beta}_{02}$ to "maybe will not buy", $\hat{\beta}_{03}$ to "neutral," and $\hat{\beta}_{04}$ to "maybe will buy." Since in logistic regression, the last category is compared to another category, we only have four constants in the model: $\hat{\beta}_{01}$ (5.423), $\hat{\beta}_{02}$ (7.219), $\hat{\beta}_{03}$ (8.598), and $\hat{\beta}_{04}$ (12.047). Meanwhile, the probability estimation for each category of intention to buy follows Equation 2 to Equation 6. Figure 1 depicts the estimation probability for each response.

Based on the logistic regression analysis in Table 5, in the 25–29, 30–34, and 35–39 age groups, age is not significant. This means those age levels did not influence intention to buy an electric motorcycle among our sample.

Table 5.
Output of Ordinal Logistic Regression

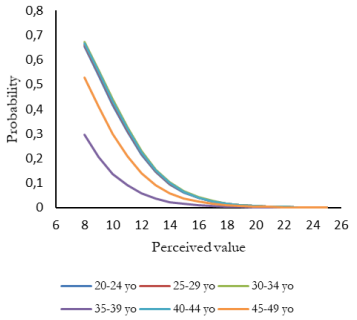
Predictor	Coefficient (p-value)	Odds Ratio
Constant 1 ($\hat{\beta}_{01}$)	5.423 (0.000)*	
Constant 2 ($\hat{\beta}_{02}$)	7.219 (0.000)*	
Constant 3 ($\hat{\beta}_{03}$)	8.598 (0.000)*	
Constant 4 ($\hat{\beta}_{04}$)	12.047 (0.000)*	
Age		
20-24 years old ($\hat{\beta}_{12}$)	-0.924 (0.015)*	0.40
25-29 years old ($\hat{\beta}_{13}$)	-0.896 (0.096)	0.41

30-34 years old ($\hat{\beta}_{14}$)	-0.837 (0.065)	0.43
35-39 years old ($\hat{\beta}_{15}$)	-2.433 (0.001)*	0.09
40-44 years old ($\hat{\beta}_{16}$)	-0.867 (0.141)	0.42
45-49 years old ($\hat{\beta}_{17}$)	-1.441 (0.018)*	0.24
Perceived value ($\hat{\beta}_{2}$)	-0.483 (0.000)*	0.62

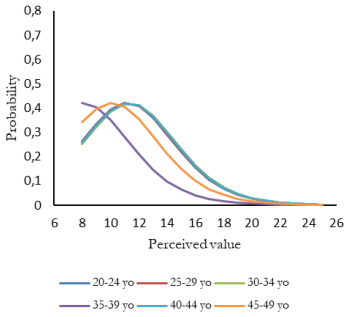
* Significant at 5%

$$logit[P(Y \leq j)] = \pi(x) = \frac{\exp exp\left(\hat{\beta}_{0j} - 0.92x_{12} - 0.9x_{13} - 0.84x_{14} - 2.43x_{15} - 0.87x_{16} - 1.44x_{17} - 0.48x_{2}\right)}{1 + \exp exp\left(\hat{\beta}_{0j} - 0.92x_{12} - 0.9x_{13} - 0.84x_{14} - 2.43x_{15} - 0.87x_{16} - 1.44x_{17} - 0.48x_{2}\right)} \quad (8)$$

The estimation parameter for age in this model is negative as compared to the last category of the intention to buy variable, i.e. "will buy." Therefore, to predict the probability of each category of intention for each age group and level of perceived value, we present Figure 2.



(a)



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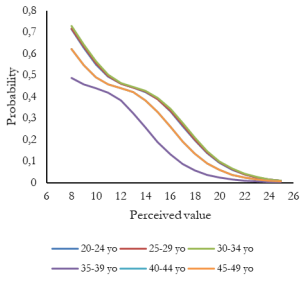

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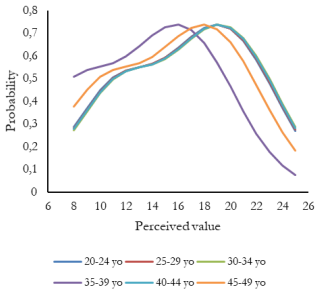
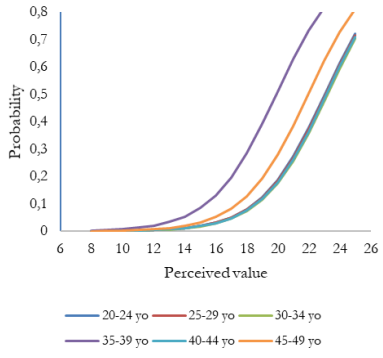


(d)



(e)

Figure 2.
Estimated Probability for Intention to Purchase Electric Motorcycle for (a) π(will not buy), (b) π(maybe not buy), (c) π(neutral), (d) π(maybe buy), and (e) π(will buy).

The *x*-axis in Figure 1 is the perceived value (x_2). Since perceived value has five indicators, measured on a five-point Likert scale, the smallest value is 5 (5 questions x 1) and the largest is 25 (5 questions x 5). Meanwhile, the *y*- axis represents the probability of buying, and as previously discussed, we use five different groups of intention to buy. The age (x_1) group is presented in different colors.

Figure 2 (a) shows the probability respondents will not buy an electric motorcycle. In the lower perceived value, the 20–24, 25–29, 30–34, and 40–44 age groups showed the highest probability of "will not buy" an electric motorcycle. The value ranges from 0.3 to 0.7. A rise in perceived value reduces the intention not to buy an electric motorcycle.

The trend of "will not buy" is similar to the probability of being "neutral" (Figure 2(c)). A rise in perceived value reduces the neutrality toward buying an electric motorcycle.

The probability of the intention of "maybe not buying" is presented in Figure 2(b). From that figure, it is apparent that the probability of "maybe not buying" an electric motorcycle is low in terms of perceived value. However, at the specific perceived value, the intention to perhaps not buy this type of vehicle reaches its peak and then plummets to a lower probability as the perceived value rises.

In this study, the highest probability value of "maybe not buying" an electric motorcycle is at around 0.4. The group aged 35–39 reaches the highest probability (around 0.4) of "maybe not buying" when the perceived value is 8. Meanwhile, the group aged 45–49 has the highest probability of "maybe not buying" when the perceived value is at around 10.

The probability of "maybe not buying" is similar to "maybe buying" (Figure 2(d)). The lower perceived value tends to be associated with the low probability of "maybe buying." When the perceived value rises, it is followed by the probability of "maybe buying"—which reaches its peak of probability at a specific value of perceived value. Subsequently, the probability of "maybe buying" decreases as the perceived value increases.

The last figure is Figure 2(e), which pertains to the probability of the intention to buy an electric motorcycle. The trend in this category differs from all previous intention groups. The higher perceived value increases the intention to buy, which is consistent with the opposite in Figure 2(a): At a lower perceived value, people will have a higher intention of not buying an electric motorcycle. In other words, these people have a lower intention to buy an electric motorcycle. In this study, those 35–39 years old in the sample displayed the highest intention to buy electric motorcycle.

The likelihood ratio of this model (G^2) is 102.48, with a *p*-value of 0.000. At the significant value of $a = 0.05$, this model is able to present the data. Meanwhile, the model of Pearson Chi-Square $\left(\chi^2\right)$ and deviance are 302.9 (0.038) and 199.064 (0.998). The concordant ratio is 77.4%. Therefore, we can conclude that the model fit is high. Meanwhile, the Somers' D, Goodman-Kruskal Gamma, and Kendall's Tau values for measuring the association are 0.57, 0.59, and 0.43, respectively. This model testing shows that the association of age and perceived value to the intention to buy an electric motorcycle is significant.

However, not all levels of age in our sample determined purchase intention for electric motorcycles. This is demonstrated by the

significant value of the parameter, which is more than 5%. The ages of 25–29, 30–34, and 45–49 in our sample are found not to have influenced purchase intention.

Figure 3 shows respondents' age distribution based on the level of intention. Those 20–24 years old are found to have selected "maybe buying" an electric motorcycle the most often among all age groups, followed by those 30–34 years old. Meanwhile, those 35–39 years old chose "neutral," "maybe not buying," and "will not buy" the most often, followed by those 20–24 years old. Nevertheless, the latter also said that they would buy an electric motorcycle more often than all the others, followed by the 30–34, 25–29, and 35–39 age groups.

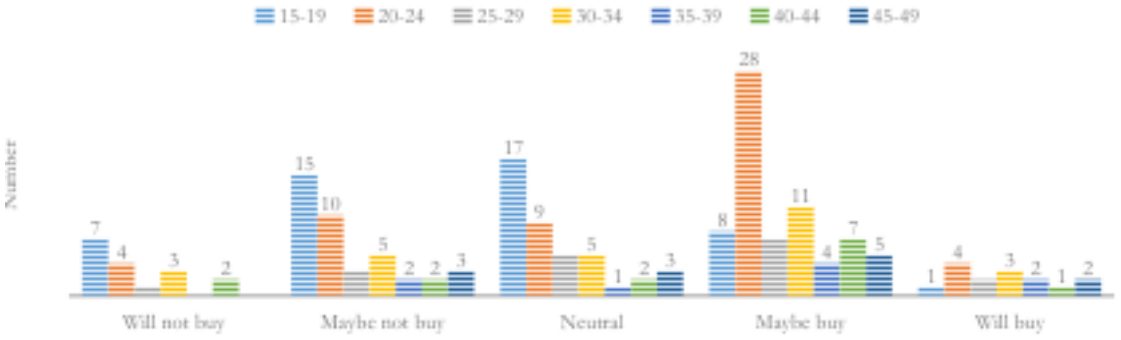


Figure 3.
Distribution of Intention to Purchase Electric Motorcycle Based on Age Group

Table 6 presents the average perceived value based on the level of intention to purchase an electric motorcycle. It is clearly shown that the higher the average perceived value is, the higher the intention is to purchase an electric motorcycle. It is also shown that the answer "maybe buying" is the most frequent one.

Table 6.
Average of Perceived Value in Levels of Purchase Intention

Purchase intention	Sample number	Median
Will not buy	17	14.00
Maybe not buying	40	14.00
Neutral	40	15.00
Maybe buying	70	17.00
Will buy	15	20.00

Discussion

This study demonstrates that the ages 25–34 did not influence the stated decision of those in the sample to buy an electric motorcycle. This result implies that marketers should work especially hard to interest this age group in purchasing an electric motorcycle. At the same time, those 20–24 years old are shown to have a tendency to buy electric motorcycles 0.4 times higher than the youngest age group (15–19). Therefore, this study implies that the younger a person is, the more likely they are to intend to purchase an electric motorcycle.

Furthermore, it is demonstrated that the older ages in the sample, 35–39 and 45–49, played an essential role in the stated intention to buy an electric motorcycle. Hence, both the youngest and oldest in our sample showed interest in purchasing an electric motorcycle over the next five years.

This study supports research conducted by Guerra (2019), who indicated that young age

influenced the intention to adopt electric vehicles, while the study by Plötz et al. (2014) suggested that middle-aged people were more likely to adopt electric vehicles. Our study also supports findings by Qian and Yin (2017) that age influenced Chinese consumers' intention to buy both hybrid plug-in electric vehicles and battery-based electric vehicles.

In Indonesia, electric motorcycles' speed is less than 40 km/hour, and no driver's license is needed to operate this type of vehicle. Hence, more elderly people may be interested in this motorbike, as it is easier to use and slower than a traditional motorbike.

Young people may be especially prone to using electric motorcycles due to their excitement over the innovation aspect. In other words, the innovation of electric motorcycles could attract young people to it. However, they still might not buy one (see Figure 2) due to their low purchasing power. This contrasts with their senior counterparts, who have higher purchasing power.

Perceived value in this study focuses on the psychological or emotional value, economic value, and performance value of electric motorcycles. However, it neglects the environmental value of the product. This may be a topic for future research to explore.

5. Conclusion

This study aimed to gauge the relationship between age, perceived value, and the intention to buy an electric motorcycle. Our results support the corresponding hypotheses. They imply that the younger a person is, the more likely they are to have the intention to buy an electric motorcycle. The higher the perceived value of the electric motorcycle is, the higher the intention tends to be for a person to buy one. This suggests that electric motorcycle marketers and sellers should target young people, and in general those among whom that type of vehicles has high perceived value, to achieve high purchase intention.

The electric motorcycle has the potential to reach a wide market in Indonesia. However, the intention to buy such motorbikes has not been widely investigated. This study could represent initial findings toward developing a model for the electric motorcycle market in Indonesia. It shows the association of the model to be around 0.5, which means that other variables contribute to the intention to purchase an electric motorcycle. This offers an opportunity for future studies to gauge other factors determining purchase intention.

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