Jurnal
Manajemen
Teknologi

Jurnal Manajemen Teknologi, 21(1), 2022,1-13
Available online at http://journal.sbm.itb.ac.id

Consumers Choice Decision Towards Electric and Conventional Motorcycles

Prawira Fajarindra Belgiawan, Nadine Maura Ikhsani, and Sheryta Arsallia
School of Business and Management, Institut Teknologi Bandung, Indonesia

Abstract. *Air pollution is one of the most pressing emerging issues in Indonesia. To reduce emissions, people need to shift from conventional to electric motorcycles (EM). However, the number of conventional motorcycles (CM) in Indonesia is still far above electric, and there is no certainty whether the market will adopt it. Therefore, this research aims to identify significant factors that influence consumers' decision in choosing electric or conventional motorcycles and to identify preferred motorcycle type, as well as to calculate the elasticity of each factor. Choice modeling analysis is used to estimate the probability of choosing motorcycles and the attributes that influence the decision. Data is collected through an online survey sent to 470 respondents. This research used three methods in processing the data: factor analysis, multinomial logistic regression, and demand elasticities analysis. Based on the result of this research, it is found that the significant factors are purchase price, charging times, driving range, and attitude towards each motorcycle type. Additionally, it is found that most of the respondents prefer electric motorcycles to conventional ones. The results suggested that motorcycles manufacturers should consider selling EM with lower prices, develop fast charging technology, and improve driving range, while the government should provide incentives for EM users. Therefore, this research supports findings to decrease air pollution in Indonesia by increasing the use of EM.*

Keywords: *Electric vehicles, motorcycles, choice modeling, significant factors, stated preference*

Abstrak. *Polusi udara adalah salah satu masalah yang paling mendesak di Indonesia. Untuk mengurangi emisi lokal, banyak orang harus beralih dari sepeda motor bertenaga gas ke sepeda motor listrik. Namun, jumlah sepeda motor konvensional di Indonesia masih jauh di atas sepeda motor listrik, dan belum ada kepastian apakah pasar akan mengadopsinya. Oleh karena itu, penelitian ini bertujuan untuk mengidentifikasi faktor-faktor signifikan yang mempengaruhi keputusan konsumen dalam memilih sepeda motor listrik atau konvensional dan mengidentifikasi jenis sepeda motor mana yang disukai, serta menghitung elastisitas masing-masing faktor. Analisis choice modelling digunakan untuk memperkirakan probabilitas seseorang dalam memilih jenis sepeda motor dan atribut apa yang mempengaruhi keputusan mereka. Data dikumpulkan melalui survei online yang dikirimkan kepada 470 responden. Penelitian ini menggunakan tiga metode dalam mengolah data, yaitu analisis faktor, regresi logistik multinomial, dan analisis elastisitas permintaan. Berdasarkan hasil penelitian ini, ditemukan bahwa faktor signifikan yang mempengaruhi keputusan konsumen dalam memilih sepeda motor listrik adalah harga beli, waktu pengisian, jangkauan mengemudi, dan juga attitude. Selain itu, ditemukan bahwa sebagian besar responden lebih memilih sepeda motor listrik daripada yang konvensional. Maka dari itu, rekomendasi untuk perusahaan motor dalam pengembangan motor listrik adalah memperhatikan harga, mengembangkan teknologi fast charging untuk sepeda motor listrik, dan mengembangkan jarak tempuh untuk sepeda motor listrik. Pemerintah juga harus mendukung penggunakan motor listrik dengan memberikan insentif kepada penggunanya. Oleh karena itu, temuan dari penelitian ini mendukung dalam mengurangi polusi udara di Indonesia dengan cara meningkatkan penggunaan sepeda motor listrik.*

Kata kunci: *Kendaraan listrik, sepeda motor, choice modeling, faktor-faktor yang signifikan, stated preference*

*Corresponding author. Email: *fajar.belgiawan@sbm-itb.ac.id*
Received: February 11th, 2021; Revision: June 29th, 2021; Accepted: October 4th, 2021
Print ISSN: 1412-1700; Online ISSN: 2089-7928. DOI: http://dx.doi.org/10.12695/jmt.2022.21.1.1

Introduction

The current economy is overgrowing; the patterns of consumers' behavior and consumption worldwide has emerged as the leading trigger of environmental damages (Chen & Chai, 2010). According to the World Resource Institute, Indonesia ranks fifth place in countries that produce greenhouse gases ("Forests and Landscapes in Indonesia," 2015). Based on a study by Greenpeace and AirVisual IQ ("Jakarta records worst air quality in the world again," 2019), Jakarta ranks as the 161st city with the worst air quality, and it reaches an unhealthy level. Greenpeace monitoring shows that air pollution in Jakarta is at a level above the health threshold issued by World Health Organization (WHO) and also exceeds the threshold level of the National Ambient Air Quality Standards (Ruhiat & Akim, 2019). Based on the Indonesia Electrified Vehicle Study by the Ministry of Industry (Agus, 2019), in 2016 the transportation sector contributed 24.71% (127,881 grams CO2e) of the total national greenhouse gas (GHG) emissions (517,508 grams CO2e), which is the second rank after the energy production industry.

The transportation sector in Indonesia is dominated by conventional motorcycles. Müller (2020) found that in 2019, approximately 6.5 million motorcycles were distributed in Indonesia, with the total number of motorcycles in use at more than 120 million in 2018—a number far above the 16 million cars in use. Moreover, the usage of automotive vehicles, specifically cars and motorcycles, in Indonesia has been showing significant growth from year to year, and this trend is expected to continuously increase in the future (Belgiawan et al., 2014).

Electric vehicles (EVs) are considered one of the main vehicle technologies that can lessen the dependence on fossil fuel and resulting GHG emissions linked to conventional vehicles (Cvs). However, in Indonesia, electric motorcycles (EM) have experienced difficulties entering the market. There are only 3,000 EM, compared to 113 million conventional ones distributed in Indonesia (Solidiance, 2018). The main factors which prevent people from purchasing electric vehicles are limited driving range due to battery capacity, long charging times, and expensive purchase price (Degirmenci & Breitner, 2017). A shift from conventional motorcycles to electric motorcycles will improve local air quality, reducing of the primary adverse effects linked to motorcycles (Cherry, Derocher, Stirling, & Richardson, 2009). To make people shift from conventional to electric motorcycles, it is necessary to identify significant attributes that influence this action. It is also essential to identify how these attributes' value might change consumer choice so that the manufacturers can anticipate future demand changes in response to changes in such attributes, which is called "elasticity" (Koppelman & Bhat, 2006). Since the consumers' preferences on motorcycles are still unclear, it is important to identify which type of motorcycle is preferred by the consumers, based on some set of attributes.

The objective of this research is to understand significant factors that influence consumer decisions to choose electric motorcycles compared to conventional motorcycles. The structure of this paper is as follows. After the introduction, a literature review section discusses previous research on electric vehicles. Then, a method section discusses the experiment design, data collection, and the discrete choice model (multinomial logistic regression). This section is then followed by the discussion section, and finally the conclusion is drawn in the last section.

Literature Review

There are numerous earlier studies in several countries identifying the attributes influencing consumers' vehicle choice decisions. Several of those studies are shown in Table 1. This paper summarizes nine relevant attributes from previous studies that are applicable to both conventional and electric motorcycles.

Table 1.
Attributes Influencing Alternative Fuel Vehicles Purchasing Behavior

Author(s)	Attributes	Vehicles	Methods
Jensen et al. (2013)	Purchase price, fuel costs, driving range, driving performance (top speed), battery lifetime, charging possibilities	Internal Combustion vs. Electric Vehicles	Joint hybrid choice model
Adepetu and Keshav (2017)	Battery capacity, purchasing cost, driving range	Battery Electric Vehicle	Agent-based model (ABM)
Burgess et al. (2013)	Performance, speed, noise, look and style	Battery Electric Vehicle	Thematic analysis
Hidrue et al. (2011)	Driving range, purchasing cost, fuel cost, charging time	Battery Electric Vehicle	Discrete choice model analysis

This research uses nine attributes from previous studies. The attributes are considered relevant to this research because those attributes exist in both conventional and electric motorcycles. Also, the attributes are often used in research.

1. Purchase Price

According to Muratore (2016), purchase price has a positive and significant effect on buying decisions. Musti and Kockelman (2011) identified the top three attributes that consumers consider when searching for a new vehicle purchase, comprising price (30%), fuel economy (28%), and reliability (21%). Purchase price is a crucial factor that should be considered when people desire two-wheelers. It has a positive effect on the consumer's decision to buy a motorcycle (Fatihudin & Mochklas, 2017).

2. Driving Range

As conveyed by Jensen et al. (2013), driving range emerges as the most critical attribute for the electric vehicle, since the EVs' driving range is much smaller compared to CVs. Driving range affects an individual's preferences for specific electric vehicles characteristics. Dimitropoulos et al. (2013) also found that changes in driving range affect consumers' preferences for electric vehicles and other alternative fuel vehicles. Besides, they mentioned that driving range significantly emerges as a salient factor in consumers' vehicle choices. As pointed out by Egbue and Long (2012), the battery capacity and capability limits the distance an EV can run on an all-electric range or a single charge. Additionally, Hidrue et al. (2011) undertook a choice experiment between gasoline and electric vehicles. They found that finite driving range was identified as the salient concern for consumers.

3. Driving Cost

Ziegler (2012) has found that fuel or driving cost and purchase price have a negative impact on preferences of alternative fuel vehicles. Jensen et al. (2013) also demonstrated that fuel cost is one of the variables where the changes influence consumers' decisions in choosing electric vehicles. As conveyed by Helfand and Wolverton (2009), fuel costs seemingly became the encouragement for consumers to reduce their gasoline consumption through changes in driving behavior and vehicles. Some empirical studies assumed that fuel costs also affect consumers' choices of which vehicles to buy. Zhang, Yu, and Zou (2011) indicated that consumers who choose electric vehicles are significantly influenced by fuel price.

4. Charging Times

Charging an electric motorcycle can take three to six hours for a full charge, while conventional motorcycle only need 15 to 20 seconds for the full tank. Therefore, Carley, Karuse, Lane, and Graham (2013) claimed that charging times are barriers for consumers in deciding an electric vehicle in the USA. Hidrue et al. (2011) determined that charging time is one of the important attributes that become a concern when comparing electric vehicles and gasoline vehicles.

5. Top Speed

Hidayat (2012) found that top speed is the most significant attribute that influences consumers' purchase intentions. Burgess et al. (2013) indicate that performance affects consumers' preferences on electric vehicles. Jensen et al. (2013) developed attributes for an experiment between a CV and an EV encompassing purchase price, driving costs represented by fuel costs, driving performance explained as top speed, and environmental performance denoted by carbon emissions. Additional research also concluded that speed is a particularly important attribute in choosing motorcycles (Chiu & Tzeng, 1999).

6. Features

According to Kotler and Amstrong (2018), features are a competitive means to differentiate one product from another other competitor's. Product features are something unique that other similar products do not have. Features on a motorcycle can come in the form of display screens, head and back lamps, speedometers, keyhole covers, and many more. According to Kotler and Amstrong (2018), three important attributes that influence purchasing decisions are product quality, product features, and product design. Dirgahayani, Belgiawan, Prasetio, and Nasution (2020) found that features are significant attributes towards LCGC consumers purchases.

7. Safety

Motorcycles are one of the means of transportation involved in most serious road accidents. Motorcyclists are at a much higher risk of having a crash compared to car drivers (Yousif, Sadullah, & Kassim, 2020). It is due largely to the inherent weakness of motorcycles and the greater number of consequences they encounter. Therefore, safety features in motorcycles are one of the essential attributes. The safety attributes in motorcycles include anti-lock braking system (ABS), brakes, dimmer switches, alarms, and keyhole covers. Also, the acceptance of the purchase price of electric vehicles is influenced by the vehicle's degree of safety (Zhang et al., 2011).

8. Style

Product attributes encompassing quality, features, and design emerge as the factors that influence purchasing decisions (Kotler & Armstrong, 2018). The vehicle design is one of the attributes that impress customers when they encounter the product for the first time. Dirgahayani et al. (2020) found that design is the most significant attribute that influences consumers purchase on cars. Furthermore, a study by Chiu and Tzeng (1999) identified design or style as the essential attributes that influence consumers' decisions to purchase a motorcycle.

9. Attitude

Other than attributes, consumers' choices are also affected by four psychological factors: motivation, perception, learning beliefs, and attitudes. Attitude is an individual's inner experience related to a behavioral tendency (Ajzen, 1991). As conveyed by Noel (2009), some attitudes can be generated from customers' research, such as from reading reviews concerning an impressive product and discussing it with friends, which eventually leads to the emergence of a perspective based on the information they attained. Additionally, customers are likely capable of generating an attitude toward a product by experiencing it. Tu and Yang (2019) found that when consumers believe that EVs are more beneficial for

the individual, environment, or the nation, or they believe that the usage of EVs is simpler and more convenient, they will show a more positive attitude toward the EVs. This attitude might translate into the decision to own one. In this research, attitude towards electric and conventional motorcycles is the latent variable for the model.

Research Methodology

This research conducts a stated preferences (SP) approach and uses primary data. In the questionnaire development phase, researchers develop scenarios using NGENE software. After that, data is collected through online survey methods. Afterward, the data gathered is processed and analyzed through one of the discrete choice model tools (i.e., the multinomial logistic regression).

In this study, researchers use non-probability purposive sampling with target respondents of people aged above 17 years old, both male and females, living in Jakarta and intending to buy motorcycles in the future.

The age is chosen because it is the legal age for driving a motorcycle, and age above 17 years old is considered a productive age. Jakarta is chosen as the case study because of the severe air pollution in Jakarta as explained in the introduction section, to which conventional vehicle use is one of the strongest contributors. Moreover, this research is problem-solving research because the findings are used to support decisions that tackle specific marketing problems. According to Malhotra, Nunan, and Birks (2017), minimum sample size of problem-solving research is 200 respondents.

Respondents are given eight scenarios and two options of motorcycles where they need to choose between conventional and electric motorcycles. Each attribute has value based on the conventional and electric motorcycle facts in Indonesia. Values for purchase price, driving range, top speed, driving cost, and charging times are derived from the actual data provided on the websites of the motorcycle manufacturing companies. Style, features, and safety attribute are obtained from expert judgment. The value can be seen in Table 2.

Table 2.
Attributes, Alternatives, and Values for Experiment

No.	Attributes	Electric Motorcycle	Conventional Motorcycle
Actual Data			
1	Purchase Price (IDR 1 M)	10 M, 15 M, 18 M, 24 M	10 M, 16 M, 18 M, 20 M, 23 M
2	Driving Range on full battery (km)	35km, 50km, 70km, 120km	60km, 100km, 120km, 200km
3	Top Speed (km/hour)	40km/h, 60km/h, 70km/h	95km/h, 100km/h, 150km/h
4	Fuel/Driving Cost (IDR/km)	IDR 46/km IDR 39/km IDR 64/km	IDR 174/km, IDR 152/km IDR 141/km
5	Charging Times (min)	180min, 240min, 360min	0.33min, 0.25min
Expert Judgement			
6	Style and Design (score)	4, 6, 7, 9	3, 6, 8, 10
7	Features (score)	5, 7, 9, 10	4, 6, 8
8	Safety (score)	5, 7, 9	3, 6, 8

There are 24 combinations, or scenarios, that have been generated from NGENE and classified into three blocks, with each block consisting of eight combinations. The three blocks are divided into three questionnaires. Therefore, each questionnaire consists of eight questions. Each respondent answered eight questions.

Researchers use four methods in processing the data, namely reliability and validity, factor analysis, multinomial logistic regression, and demand elasticities analysis. The reliability test is conducted to measure the consistency of the questionnaire and the stability of the respondents' answers on each valid questionnaire. Using Cronbach Alpha, a variable is considered reliable if the value reaches 0.7 (Sekaran, 2003). The validity test, on the other hand, is conducted with Pearson's Correlation method for measuring the validity of an attitude variable. This research uses Confirmatory Factor Analysis (CFA) in SPSS to identify latent variables or constructs. The latent variable in this research refers to the attitude toward electric and conventional motorcycles.

After gathering the data, the analysis is conducted through multinomial logistic regression (MNL) techniques with Python-Biogeme (Bierlaire, 2016). The MNL model aims to identify the significant attributes, and the elasticities of each attribute in which some procedures are followed. The elasticity test aims to anticipate the influence of a change in the variable's value on the choice of an individual.

Results and Discussion

The piloting test is essential to check the validity and reliability of the questionnaires before distributing them to the large sample size. In this research, the reliability and validity tests are conducted for a latent variable, which is Attitude. The reliability test is conducted to measure the consistency of the questionnaire and stability of the answer to the question on each valid questionnaire. This research is using Cronbach Alpha for a reliability test. The results can be seen in Table 3.

Table 3.
Reliability Test Results

Variable	Cronbach Alpha	Critical Point	Reliability
Attitude toward conventional motorcycles	0.859	0.7	Reliable
Attitude toward electric motorcycles	0.874	0.7	Reliable

This research is using Pearson's Correlation method for measuring the validity of the attitude variable. This approach measures the questionnaire's validity by gathering 30 respondents and piloting the test results by finding the correlation between one variable to another, then comparing the r-statistic with the r-table (5% levels of significance). The variable is considered valid if the r-statistic exceeds the r-table score, which is 0.3494.

Table 4.
Validity Test Results

Variable	Indicator Label	Pearson Correlation	R-Table Score	Validity
Attitude toward conventional motorcycles	AC1	0.395	0.3494	Valid
	AC2	0.532	0.3494	Valid
	AC3	0.712	0.3494	Valid
	AC4	0.383	0.3494	Valid
Attitude toward electric motorcycles	AE1	0.490	0.3494	Valid
	AE2	0.708	0.3494	Valid
	AE3	0.717	0.3494	Valid
	AE4	0.691	0.3494	Valid

After the pilot test, we conducted the survey, and we have obtained a total of 470 respondents. The characteristics of the respondents can be seen in Table 5. The majority of the respondents are 17–25 years old, followed by 26–35 years old. We have more male respondents than female respondents. Regarding the income, the majority of our respondents earn between IDR 2.5 and 5 M per month.

Table 5.
Respondents Characteristics

Category	Frequency	Percentage	Variable	Frequency	Percentage
Age			**Income**		
17–25 years old	279	59.4	IDR 0–500 K	53	11.3
26–35 years old	127	27.0	IDR 500 K–1.5 M	64	13.6
36–45 years old	44	9.4	IDR 1.5 M–2.5 M	84	17.9
46–55 years old	14	3.0	IDR 2.5 M–5 M	142	30.2
56–65 years old	4	0.9	IDR 5 M–7.5 M	41	8.7
More than 65	2	0.4	IDR 7.5 M–10 M	32	6.8
TOTAL	470	100	More than 10 M	54	11.5
Gender			TOTAL	470	100
Male	301	64			
Female	169	36			
TOTAL	470	100			

Exploratory factor analysis is performed to reduce the number of variables or dimensions to avoid multicollinearity, and to be analyzed in Biogeme. The attitudinal indicators in the utility function can lead to inconsistent estimates, and there might be an endogeneity bias resulting from correlation between the indicators and the error of the utility, therefore factor analysis of the indicators and applying latent variables without the indicators is required. The researcher reduced eight components into two components.

Based on Kaser's criterion, if the total eigen value is below 1, it is considered meaningful for interpretation (Kaiser, 1958). There are two components that have total eigen value higher than 1, therefore those two components are extracted. This research is using Bartlett's refined method to extract the attitudinal (Bartlett, 1937). This method is chosen because it generates unbiased estimates of the true factor scores. Factors are rotated for better interpretation; Table 6 shows the rotated components.

Table 6.
Factor Analysis Results

Indicators	Factor 1	Factor 2
AC1		0.870
AC2		0.841
AC3		0.796
AC4		0.806
AE1	0.844	
AE2	0.843	
AE3	0.838	
AE4	0.837	

After obtaining the data, the researcher processes the data with MNL modeling technique using Python Biogeme (Bierlaire, 2016). With MNL, the significant attribute can be defined, and the researcher carries out the simulation to find the demand elasticities of each attribute with the following steps.

First, the researcher creates the modeling utility from the base equation. The utility model refers to an indicator of value to an individual or respondent. The utility maximization rule indicates that an individual will select the option from their set of available options that maximizes their utility.

The rule defines that there is a function consisting of attributes of options and characteristics of individuals that describes an individual's utility valuation for each option (Train, 2009). The option is chosen when the utility is the highest among the utility of all other options in the choice set (Train, 2009). The Biogeme software runs using the Python language, so the model specification from the utility equation of discrete model must be changed to Python, as demonstrated in Figure 1.

```
#utilityfunction
V1 = ASC_E + B_E_PR * E_PR + B_E_DR * E_DR + B_E_TS * E_TS + B_E_DC * E_DC + B_E_CT * E_CT + \
     B_E_ST * E_ST + B_E_F * E_F + B_E_SF * E_SF + B_AEM * AEM
V2 = ASC_C + B_C_PR * C_PR + B_C_DR * C_DR + B_C_TS * C_TS + B_C_DC * C_DC + B_C_CT * C_CT + \
     B_C_ST * C_ST + B_C_F * C_F + B_C_SF * C_SF + B_ACM * ACM
```

Figure 1.
Discrete Choice Equation in Python language

Where:
ASC_E = Alternative Specific Constant Electric Motorcycle
ASC_C = Alternative Specific Constant Conventional Motorcycle

In this research, the researcher set conventional motorcycles as a reference option, or as the base option, because most people are accustomed to them in their daily lives and are still unfamiliar with electric motorcycles.

The other option (electric motorcycle) is compared with the base option. The option-specific constant represents preferences that are inherent and independent to a specific attribute's value.

The MNL results can be seen in Table 7. The EM constant is positive significant. It means that, ceteris paribus, people will be more likely to choose EM compared to CM.

Table 7.
MNL Model Results

No.	Attributes and Attitude	Parameter Estimate	Robust T-test
1	Electric Motorcycle Constant	1.43	3.10
2	Purchase Price of Conventional Motorcycle	-0.07	-7.24
3	Safety of Conventional Motorcycle	0.08	3.82
4	Charging Times of Electric Motorcycle	-0.002	-2.20
5	Purchase Price of Electric Motorcycle	-0.07	-5.30
6	Driving Range of Electric Motorcycle	0.003	2.47
7	Attitude toward Conventional Motorcycle	0.587	14.90
8	Attitude toward Electric Motorcycle	0.765	18.80

It seems that the purchase price attribute is a significant attribute, as the robust T-test value is -7.24, with the negative indicating that it is negatively significant to customer's choice on conventional motorcycle. It can be interpreted that the respondent prefers the conventional option if the price is getting cheaper, or when the price increases, consumers tend to choose another alternative over conventional motorcycles. Meanwhile, safety of conventional motorcycles is positively significant to consumer choice because the test value is 3.82, which means that if the value of safety improved, respondents are more likely to choose conventional motorcycles. The safer a conventional motorcycle is, the more people will choose it among other options. Charging times of electric motorcycles are a significant negative attribute, as the robust T-test value is -2.2.

This means that charging times is one of the important attributes that influence consumers' decisions. If the charging time value decreases, respondents will prefer to choose electric motorcycles. In other words, the faster the charging times, the higher the probability that consumers will choose electric motorcycles. Moreover, purchase price of an electric motorcycle is also a significant attribute since the robust T-test value is -5.3, where the negative value means that it is negatively significant to consumers' choices on electric motorcycles. It can be inferred that the respondent will prefer to choose the electric option if the price is getting cheaper, or when the price increases, consumers tend to choose another alternative over electric motorcycles.

This case is the same as the purchase price of a conventional motorcycle. For an electric vehicle's driving range, it is positively significant to consumers' choice since the robust T-test value is 2.47. This implies that if the driving range value improved, consumers would be more likely to choose the electric motorcycle. Overall, we found that the significant attributes that influence consumers' decisions in choosing electric motorcycles are the purchase price, charging times, and driving range, as used in Jensen et al. (2013), Adeptu and Keshav (2017), and Hidrue et al. (2011).

Attitude toward conventional motorcycle is positively significant to consumers' choice as the robust T-test value is 14.9. It implies that if the value improved, it will increase customer choice significantly. In other words, when the attitude toward conventional motorcycles increases, there is a possibility that consumers are more likely to choose conventional motorcycles. Attitude toward electric motorcycles is also positively significant to consumers' choice as the robust T-test value is 18.8, demonstrating that if the value improved, it will increase customer choice significantly. In other words, when the attitude toward electric motorcycles increases, consumers are more likely to choose electric motorcycles.

The next step is to execute elasticity analysis for the significant attributes. Using Biogeme, the researchers can find and analyze which attributes are elastic or inelastic. The detail of the elasticitiy calculation can be seen in Table 8. Note that we consider respondents' characteristics when calculating the elasticity.

Table 8.
Significant Attributes' Elasticity

Attributes	Elastic Standard	Electric	Conventional	Conclusion
Purchase Price	$x \geq 1$	-0.615	-0.865	Inelastic
Driving Range	$x \geq 1$	0.300	-	Inelastic
Charging Times	$x \geq 1$	-0.285	-	Inelastic
Safety	$x \geq 1$	-	0.213	Inelastic

From all of the significant attributes, all attributes are theoretically inelastic. This means that a slight change in the attribute's value will not affect the respondent's decision. In other words, if there is 1% change in an attribute's value, there will be less than 1% change in selection. For instance, if the price of electric motorcycle increases by 10%, people choosing electric motorcycles will decrease by about 6%. If the number is below 10%, it means that the change is not significant to the consumer's choices. The changes in the attribute's value would have less than 10% impact on consumers' choice. However, purchase price on conventional motorcycles is almost elastic, as can be seen when the price of conventional motorcycles increases by 10%, the demand for conventional motorcycles decreases 8%. The changes are almost significant, and the attribute is almost elastic.

Conclusion

Based on the results of this research, it is found that the significant attributes that influence consumers' decision in choosing electric motorcycles are the purchase price, charging times, and driving range, as used in Jensen et al. (2013), Adeptu and Keshav (2017), and Hidrue et al. (2011). The results also show that charging times and purchase price are negative

significant attributes, which means that when the value of the attributes are increasing, consumers will prefer the other alternative to electric motorcycles. In other words, the more expensive the price is, the higher the probability that consumers choose the other alternative. Supporting the previous research regarding electric vehicles, this research also found that charging time is the essential attribute that influences consumers to choose electric motorcycle. Results shows that the faster the charging times, the higher the probability of a consumer choosing an electric motorcycle. On contrary to that, the driving range is a positive significant attribute, which indicates that when the driving range is increased, consumers will prefer to choose electric motorcycles over the other alternative.

In addition, an attitude toward electric motorcycles is also positively significant to consumers in choosing electric motorcycles. This means that when the attitude toward electric motorcycles increases, consumers are more likely to choose electric motorcycles over conventional ones. Attitude in this case is the positive evaluation with respect to flexibility, convenience, comfort, happiness, and personal values. Results show that an attitude of proudness, happiness, comfort, and belief in the advantages are positively significant to consumer decisions. The greater the level of comfort people have using an electric motorcycle, the higher the likelihood of people choosing an electric motorcycle.

Furthermore, based on the elasticity analysis in this research, all significant attributes are inelastic, which means that a change in an attribute's value will not affect the consumer's decision; in other words, the demand remains unchanged. For instance, when the price in the choice set goes up, respondents still choose electric motorcycles. The significant attributes that influence the consumer's decision in choosing conventional motorcycles are safety, purchase price, and attitude. The safety attribute is positively significant, and the purchase price attribute is negatively significant to consumers in choosing conventional motorcycles.

This means that the safer the motorcycle, the higher the probability consumers will choose it. Attitude toward conventional motorcycles is also positively significant to a consumer's decision to choose conventional motorcycle. The results show that attitude of proudness, happiness, comfort, and convenience give a significant impact to a consumer's decision.

The other findings found in this research is that the preferred alternative chosen by the respondents is electric motorcycle. 1881 of 3760 scenarios answered with electric motorcycle. Moreover, from the attributes' values that were being provided, electric motorcycles are the most chosen alternative. In addition, most respondents (49.4%) are college students, which can be interpreted as college students preferring to choose electric motorcycles than conventional motorcycles in this experiment. Therefore, consumers have already started to shift, and those significant attributes are influencing their decision.

References

Adepetu, A., & Keshav, S. (2017). The relative importance of price and driving range on electric vehicle adoption: Los Angeles case study. *Transportation*, *44*(2), 353–373. doi: 10.1007/s11116-015-9641-y

Agus, P. (2019). Indonesia Electrified Vehicle Study Case: Bandung City and Surrounding Areas.

Ajzen, I. (1991). The Theory of Planned Behavior Organizational Behavior and Human Decision Processes. *Organizational Behavior and Human Decision Processes*, *50*(2), 179–211.

Bartlett, M. S. (1937). Properties of sufficiency and statistical tests. *Proceedings of the Royal Society of London. Series A - Mathematical and Physical Sciences*, *160*(901), 268–282. doi: 10.1098/rspa.1937.0109

Belgiawan, P. F., Schmöcker, J.-D., Abou-Zeid, M., Walker, J., Lee, T.-C., Ettema, D. F., & Fujii, S. (2014). Car ownership motivations among undergraduate students in China, Indonesia, Japan, Lebanon, Netherlands, Taiwan, and USA. *Transportation*, *41*(6), 1227–1244. doi: 10.1007/s11116-014-9548-z

Bierlaire, M. (2016). *PythonBiogeme: a short introduction*.

Burgess, M., King, N., Harris, M., & Lewis, E. (2013). Electric vehicle drivers' reported interactions with the public: Driving stereotype change? *Transportation Research Part F: Traffic Psychology and Behaviour*, *17*, 33–44. doi: 10.1016/j.trf.2012.09.003

Carley, S., Krause, R. M., Lane, B. W., & Graham, J. D. (2013). Intent to purchase a plug-in electric vehicle: A survey of early impressions in large US cites. *Transportation Research Part D: Transport and Environment*, *18*(1), 39–45. doi: 10.1016/j.trd.2012.09.007

Chen, T. B., & Chai, L. T. (2010). Attitude towards the Environment and Green Products: Consumers' Perspective. *Management Science and Engineering*, *4*(2), 27–39. Retrieved from www.cscanada.org

Cherry, S. G., Derocher, A. E., Stirling, I., & Richardson, E. S. (2009). Fasting physiology of polar bears in relation to environmental change and breeding behavior in the Beaufort Sea. *Polar Biology*, *32*(3), 383–391. doi: 10.1007/s00300-008-0530-0

Chiu, Y. C., & Tzeng, G. H. (1999). The market acceptance of electric motorcycles in Taiwan experience through a stated preference analysis. *Transportation Research Part D: Transport and Environment*, *4*(2), 127–146. doi: 10.1016/S1361-9209(99)00001-2.

Degirmenci, K., & Breitner, M. H. (2017). Consumer purchase intentions for electric vehicles: Is green more important than price and range? *Transportation Research Part D: Transport and Environment*, *51*, 250–260. doi: 10.1016/j.trd.2017.01.001

Dimitropoulos, A., Rietveld, P., & van Ommeren, J. N. (2013). Consumer valuation of changes in driving range: A meta-analysis. *Transportation Research Part A: Policy and Practice*, *55*, 27–45. doi: 10.1016/j.tra.2013.08.001

Dirgahayani, P., Belgiawan, P. F., Prasetio, E. A., & Nasution, R. A. (2020). Green vehicle policy and demand in Indonesia. *Sustainability and the Automobile Industry in Asia* (pp. 74–94). doi: 10.4324/9781351215664-7

Egbue, O., & Long, S. (2012). Barriers to widespread adoption of electric vehicles: An analysis of consumer attitudes and perceptions. *Energy Policy*, *48*, 717–729. doi: 10.1016/j.enpol.2012.06.009

Fatihudin, D., & Mochklas, M. (2017). Analysis of Factors Affecting Consumer Decisions Buy Motorcycle (Study on City of Surabaya Indonesia). *International Journal Of Innovative Research & Development*, *6*(6), 107–118.

Forests and Landscapes in Indonesia. (2015). Retrieved July 20, 2021, from World Resources Institute website: https://www.wri.org/initiatives/forests-and-landscapes-indonesia

Helfand, G., & Wolverton, A. (2009). *Evaluating the Consumer Response to Fuel Economy: A Review of the Literature Working Paper Series*. https://doi.org/10.22004/AG.ECON.280877

Hidayat, A. S. (2012). *Analsis Faktor-Faktor Yang Mempengaruhi Minat Beli Sepeda Motor Baru Yamaha di Kota Semarang*. Universitas Diponegoro.

Hidrue, M. K., Parsons, G. R., Kempton, W., & Gardner, M. P. (2011). Willingness to pay for electric vehicles and their attributes. *Resource and Energy Economics*, *33*(3), 686–705. doi: 10.1016/j.reseneeco.2011.02.002.

Jakarta records worst air quality in the world again. (2019). *Retrieved July 20, 2021, from ChannelNewsAsia.com website: https://www.channelnewsasia.com/news/asia/jakarta-air-quality-worst-in-the-world-again-indonesia-11772442*

Jensen, A. F., Cherchi, E., & Mabit, S. L. (2013). On the stability of preferences and attitudes before and after experiencing an electric vehicle. *Transportation Research Part D: Transport and Environment*, *25*, 24–32. doi: 10.1016/j.trd.2013.07.006

Kaiser, H. F. (1958). The varimax criterion for analytic rotation in factor analysis. *Psychometrika*, *23*(3), 187–200. doi: 10.1007/BF02289233

Koppelman, F. S., & Bhat, C. (2006). A Self Instructing Course in Mode Choice Modeling: Multinomial and Nested Logit Models.

Kotler, P., & Armstrong, G. (2018). *Principles of Marketing, Seventeenth Edition*. In *Pearson*.

Malhotra, N., Nunan, D., & Birks, D. (2017). *Marketing Research: An Applied Approach* (5th ed.). Pearson.

Müller, J. (2020). In*donesia: Domestic motorcycle sales in Indonesia 2019*. Retrieved from https://www.statista.com/statistics/538411/domestically-distributed-motorcycles-in-indonesia/

Muratore, I. (2016). Teens as impulsive buyers: what is the role of price? *International Journal of Retail and Distribution Management*, *44*(11), 1166–1180. doi: 10.1108/IJRDM-08-2015-0120

Musti, S., & Kockelman, K. M. (2011). Evolution of the household vehicle fleet: Anticipating fleet composition, PHEV adoption and GHG emissions in Austin, Texas. *Transportation Research Part A: Policy and Practice*, *45*(8), 707–720. doi: 10.1016/j.tra.2011.04.011

Noel, H. (2009). *Basics Marketing 01: Consumer Behavior* (A. Publishing, Ed.). Lausanne.

Ruhiat, F., & Akim, D. H. (2019). Strategi NGO Lingkungan Dalam Menangani Polusi Udara di Jakarta (Greenpeace Indonesia). *Andalas Journal of International Studies (AJIS)*, *8*(1), 16. doi: 10.25077/ajis.8.1.16-30.2019.

Sekaran, U. (2003). *Research Methods for Business: A Skill-Building Approach* (4th ed.). New York: John Wiley and Sons.

Solidiance. (2018). *Electric Vehicles in Indonesia: The Road Towards Sustainable Transportation. Retrieved July 20, 2021, from* https://www.solidiance.com/insights/driving/white-papers/electric-vehicle-in-indonesia-a-market-report-on-e-cars-and-e-motorcycle-in-indonesia

Train, K. E. (2009). *Discrete Choice Methods with Simulation. Discrete Choice Methods with Simulation*. Retrieved from http://ebooks.cambridge.org/ref/id/CBO9780511753930

Tu, J.-C., & Yang, C. (2019). Key Factors Influencing Consumers' Purchase of Electric Vehicles. *Sustainability*, *11*(14), 3863. doi: 10.3390/su11143863

Yousif, M. T., Sadullah, A. F. M., & Kassim, K. A. A. (2020, July 1). A review of behavioural issues contribution to motorcycle safety. *IATSS Research*, 44, 142–154. doi: 10.1016/j.iatssr.2019.12.001

Zhang, Y., Yu, Y., & Zou, B. (2011). Analyzing public awareness and acceptance of alternative fuel vehicles in China: The case of EV. *Energy Policy*, *39*(11), 7015–7024. doi: 10.1016/j.enpol.2011.07.055

Ziegler, A. (2012). Individual characteristics and stated preferences for alternative energy sources and propulsion technologies in vehicles: A discrete choice analysis for Germany. *Transportation Research Part A: Policy and Practice*, *46*(8), 1372–1385. doi: 10.1016/j.tra.2012.05.016