Section A-Research paper
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Consumer Behavior Analysis in Electric Vehicle Adoption in Indonesia

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Abstract— ***PLN's electricity reserves during the Covid-19 pandemic have increased to above 40% with the new generator. Meanwhile, electricity sales growth decreased by -8.72% y.o.y. On the other hand, the transportation of individual mobility has caused damage to the world's environment due to the enormous use of fossil fuels. Seeing the benefits of using electric vehicles for the environment plus the attention from the government to increase the use of electric vehicles as an effort to minimize carbon emissions and air pollution and increase electricity sales growth, it is necessary to have a certain scheme that can attract people to switch to electric vehicles. The authors used descriptive quantitative with offline survey to 73 electric motorcycles owner and 30 electric cars owner, located in Greater Jakarta, Greater Surabaya, Bali, Bandung, and Malang. OLS regression analysis was also used. From the results of the OLS regression of electric motor users, it can be seen that the control coefficient (0.244), cognitive (0.312), and value (0.423), have a significant correlation to purchase intention. A number of respondents who have used electric motors, in general they have heard, read, and seen electric motors, and the age of the majority of them are in the range of 18-39 years.***

Index Terms—electric vehicles, OLS regression, purchase intention .

I. INTRODUCTION

PLN's electricity reserves during the Covid-19 pandemic have increased to above 40% with the new generator (CNN Indonesia, 2021). Meanwhile, electricity sales growth decreased by -8.72% y.o.y (PLN, 2021).

So, there needs to be a massive increase in electricity sales. Among them is to increase the use of Electric Vehicles (EV) so that there is an indirect effect on increasing electricity consumption.

On the other hand, the transportation of individual mobility has caused damage to the world's environment due to the enormous use of fossil fuels. The use of fuel-based vehicles is one of the main causes of climate change, air pollution (Litman, 2002), and oil dependence (Leung et al., 2017). To minimize the negative impact of motorized vehicles, mobility electrification is proposed and widely adopted by many governments around the world. Nonetheless, the stock of plug-in electric cars represented only 1% of all passenger vehicles worldwide by the end of 2020 (IEA, 2021). So it is necessary to decarbonize.

In 2025, through Presidential Regulation No. 55 of 2019, it is hoped that 2,200 electric cars will be produced, 711,000 hybrids and 2.1 million electric motorcycles will be produced. The Presidential Regulation Number 55 of 2019 also places emphasis on environmental protection issues. This aspect is very important, because carbon emissions and air pollution in big cities in Indonesia are increasingly becoming a very serious environmental problem in line with the increasing number of motorized vehicles based on fuel oil.

Seeing the benefits of using electric vehicles for the environment plus the attention from the government to increase the use of electric vehicles as an effort to minimize carbon emissions and air pollution and increase electricity sales growth, it is necessary to have a certain scheme that can attract people to switch to electric vehicles.

Thus, in this study, consumer behavior in the adaptation of electric vehicle technology in Indonesia will be studied, especially what factors determine a person's purchase of electric motorcycles and electric cars. The next thing that will be studied is how to take the right managerial strategy to attract the interest of the Indonesian people in adopting electric vehicles. In the results of previous studies, it was found that there are several factors that have an influence on EV adoption, both extrinsic factors such as the availability of charging infrastructure and vehicle attributes as well as intrinsic factors such as demographics, personal preferences, finances and environmental values.

There have been several studies that discuss EV adoption among consumers, such as Adnan et al., (2018), Chen et al., (2020), and Ng et al., (2018). Meanwhile, Mahardika et al., (2019) describe the relationship between Behavioral Expectation (BE) and Behavioral Intention (BI) variables on consumer's new technology adoption.

Previous research has attempted to better understand the motivations and barriers to EV adoption. The research shows that consumers perceive the benefits of buying an EV, which

include potential environmental benefits (Laberteaux & Hamza, 2018), purchase-based incentive policies (Bjerkan et al., 2016; Melton et al., 2017), business model development (Nian et al., 2017). al., 2019; Wu, 2019), government regulations (Lepitzki & Axsen, 2018; Melton et al., 2017), symbolic attributes (He et al., 2018; White & Sintov, 2017), using incentive-based policies (Cherchi , 2017; Mersky et al., 2016), and environmental care and awareness (Schuitema et al., 2013; Smith et al., 2017). In parallel, burdens on infrastructure development (Barisa et al., 2016; Berkeley et al., 2018), total cost of ownership (Lévay et al., 2017; Palmer et al., 2018), anxiety ranges (Melliger et al., 2018; Skippon et al., 2016), power generation mix (Choi et al., 2018; Zhao & Heywood, 2017), vehicle design and features (Barisa et al., 2016; Mohamed et al., 2018), consumer heterogeneity (Axsen et al., 2015; Huang & Qian, 2018), psychological characteristics (He & Zhan, 2018; Nayum et al., 2016), battery charge and technology (Jensen et al., 2013; Letmathe & Suares, 2017) everything stands to prevent consumers from adopting EVs. Performance measures (Globisch et al., 2018; Sovacool et al., 2018), electrical load distribution and management (Ravichandran et al., 2018; Yilmaz & Krein, 2013), charging behavior (Sun et al., 2016; Wolbertus et al., al., 2018), perceived risk (Barbarossa et al., 2015; Berkeley et al., 2018), willingness to pay (Dorcec et al., 2019; Skippon et al., 2016), marketing strategy (Barisa et al. , 2016; Shao et al., 2016), endurance charging infrastructure (Adderly et al., 2018; Ustun et al., 2016), dealer experience (Cahill et al., 2014; Matthews et al., 2017) also hinder drivers to adopt EV. Previous research related to this topic will broadly be classified into two categories, namely, the factors that can influence a person to adopt an electric vehicle (KL) and the impact of the existence of an electric vehicle (KL) on the environment with case studies from various countries using the method. diverse research. The logit model is the most widely used model (Greene et al., 2020; Guerra, 2019; E. Kim & Heo, 2019) in the first category to identify what factors can influence a person to adopt an electric vehicle (KL) while in the second category Many use emission simulation tools to find out the impact of using electric vehicles (KL) on the environment.

Several studies have stated that household characteristics have a significant effect on the adoption of electric vehicles (KL). The number of vehicles per house is greater (Javid et al., 2019; J. H. Kim et al., 2019), living in the suburbs (Mukherjee & Ryan, 2020), the number of children is increasing (Chen et al., 2020), and households with higher income levels (Chen et al., 2020; Habich-Sobiegalla et al., 2018; Mukherjee & Ryan, 2020; Sovacool et al., 2018) can significantly encourage a household to adopt electric vehicles (KL). Meanwhile (Sierzchula et al., 2014) found that the level of household income had no significant effect on the decision to adopt electric vehicles (KL) but this could be due to the KL market being small when compared to vehicle sales as a whole. In the perspective of a country, the individual still represents a small part of the total population. Therefore, the income variable may not provide a good indicator of adoption rates.

Individual factors such as gender (Chen et al., 2020; Javid et al., 2019; Sovacool et al., 2018), education level (Habich-Sobiegalla et al., 2018; Mukherjee & Ryan, 2020; Kim et al., 2019; Vergis & Chen, 2015; Sovacool et al., 2018;) and age (Mukherjee & Ryan, 2020; Chen et al., 2020) give a positive effect on individual decisions. The details (Sovacool et al., 2018) explain that most of the men with higher education and between the ages of 30-45 years and women with higher incomes and who are retired have a greater chance of using an electric vehicle (KL). Then for the availability of infrastructure which in this case is charging stations (Chen et al., 2020; Greene et al., 2020; Guerra, 2019; Habich-Sobiegalla et al., 2018; Javid et al., 2019; Neves et al., 2019; Sierzchula et al., ., 2014; Vergis & Chen, 2015) proved to have a significant effect on the number of electric vehicle adoptions.

Subsequent studies suggest that government incentives play an important role in individual electric vehicle adoption decisions (Clinton & Steinberg, 2019; Habich-Sobiegalla et al., 2018; E. Kim & Heo, 2019; Sierzchula et al., 2014; Vergis & Chen, 2015). ; Zhuge et al., 2020). in more detail, (Vergis & Chen, 2015) examines the factors that influence the adoption of BEV and PHEV separately and the result is that incentives from the government only have a significant effect on PHEV sales and the type of incentive that has an effect is the type of direct incentive such as a purchase subsidy. The same thing was also expressed by (Clinton & Steinberg, 2019) if the type of direct incentive has a significant effect on the number of electric vehicle adoptions and there is no significant difference between one brand and another. In addition, financial factors are also factors that influence the decision to adopt electric vehicles (KL). electricity prices and prices have been shown to have an effect on the number of adoptions (Chen et al., 2020; Chu et al., 2019; Vergis & Chen, 2015; Zhuge et al., 2020). In addition to fuel prices, the price of electric vehicles themselves also significantly influences adoption decisions (Guerra, 2019; Habich-Sobiegalla et al., 2018).

Several studies also mention that psychological factors also affect adoption rates. Previous experience using TOS (Chen et al., 2020; Habich-Sobiegalla et al., 2018; J. H. Kim et al., 2019), perceptions of KL risk (Wang et al., 2018) and perceptions of government incentives (J. H. Kim et al., 2019)) and the larger social environment (Habich-Sobiegalla et al., 2018) are psychological factors that influence the decision to adopt KL. In addition, technological factors such as vehicle to grid (Chen et al., 2020) battery capacity (Neves et al., 2019) technical performance (Guerra, 2019; Wang et al., 2018) and individual awareness of the environment also influence the decision to adopt electric vehicles (Chen et al., 2020; Chu et al., 2019; Habich-Sobiegalla et al., 2018; Wang et al., 2018)

From a number of literature studies above, there has been no research that discusses what factors influence a person's intention to buy electric vehicles, both cars and motorbikes, especially in the context of Indonesian society.

II. METHODS

Quantitative and descriptive method are used in this study. Descriptive approach is a type of approach that seeks to systematically describe a situation, problem, phenomenon, service, or describe an attitude towards a problem (Kumar, 2011). While the quantitative approach is an approach used to measure variations in phenomena, situations, problems, or issues and if information is collected using dominant quantitative variables and the analysis is directed to ascertain the magnitude of the variation (Kumar, 2011).

Descriptive approach and quantitative approach are used in this study. A descriptive approach is used for several purposes, namely: (1) to help describe the profile of electric vehicle users, both cars and motorbikes; (2) describe the user's perception of electric vehicles, both cars and motorcycles. This research used survey as the method. Survey research is also referred to as non-experimental research, in this type the researcher does not have control over the treatment given to research subjects and only collects data about trends in X and Y (Hardani et al, 2020). A quantitative approach is used to find out what factors significantly influence the customer's intention to buy electric vehicles. The analytical technique used in the quantitative approach in this study is logistic regression analysis.ubmit your manuscript electronically for review.

This research was conducted in Greater Jakarta, Greater Surabaya, Bali, Bandung and Malang. The research implementation starts from September to November 2021. According to Hardani et al (2020:247) research data is divided into two types, namely primary data and secondary data. Primary data is data obtained from the first source by measuring or calculating yourself in the form of interviews, filling out questionnaires, or observations. While secondary data is data obtained indirectly from other people, reports, profiles, manuals, or libraries.

In this regard, the research data consists of primary data obtained by distributing questionnaires to consumers regarding the respondents' satisfaction with the quality of electric vehicles. Data collected through questionnaires include: (1) characteristics of respondents based on demographic, social, and economic conditions such as: gender, age, occupation, income level, and education level; (2) respondent's response or responses related to respondents' satisfaction with the quality of electric vehicles. This study uses data collection methods in the form of questionnaires and documentation.

Questionnaire is a method or technique of collecting data through a list of written questions whose answers are recorded by the respondent. In the questionnaire method, respondents read the questions, interpret what is expected, then write down the answers. In this data collection method, the questions asked must be clear and easy to understand because no one can explain the meaning of the questions to the respondents. In addition, the layout of the questionnaire should be made in such a way that it is easy to read, and the order of the questions should be easy to follow. Questionnaires should be developed in an interactive style. This means that respondents must feel as if someone is talking to them (Kumar, 2011).

The scale used in this study is the Likert scale because it is the easiest and most commonly used scale. The Likert scale is based on the assumption that each statement/item on the scale has the same attitude value, 'importance' or 'weight' in terms of reflecting attitudes towards the problem in question. The instrument used in this research is a questionnaire distributed to respondents. The system used is in the form of giving a score based on a Likert scale to make it easier for respondents to answer questions, then respondents answer questions according to the code in the questionnaire.

III. RESULT AND DISCUSSION

A. Electric motorcycles

The number of electric motorcycles in Indonesia as of November 2021 is 12,464 units. However, due to limited access to customer data, the survey was conducted by means of offline snowball sampling. For respondents' domicile, 41% live in Greater Surabaya, 34% live in Bali, 25% live in Greater Jakarta, and 1% live in Malang. The survey contains a number of questions, including questions with a Likert scale of 1-4 (questionnaire attached). The total number of questionnaires that were tried to be distributed to electric motorcycle owners was 500, of which 412 filled out the questionnaire, meaning that the response rate was 82.4%. After filtering, the status of the owner of the electric motor is 98. Then, after data cleaning (incomplete data will be discarded), the number of valid respondents is 73 people.

The results of a survey conducted in several cities with a total of 73 respondents who own and use electric motors are grouped based on various things, including gender, age range, last education, occupation, monthly income, and how users get information about electric motors.

Most of the respondents were dominated by male respondents with a percentage of 58%. Furthermore, the grouping is done based on the age range of the respondents. From the data above, it can be seen that respondents aged 18-29 years are the largest number, namely 47%. After that, the tendency is that the older the respondent's age range, the lower the percentage of electric motorcycle users. More than half of the total respondents who use electric motors have at least a bachelor's, master's, and doctoral education. Then followed by respondents who have a high school education with a percentage of 34%. Only a few respondents have elementary, junior high, and diploma education.

Table 1. The OLS regression of intention to buy electric motorcycle determinant

Source	SS	df	MS	Number of obs	=	73
				F(13, 59)	=	8.55
Model	12.7421003	13	.980161561	Prob > F	=	0.0000
Residual	6.76474935	59	.114656769	R-squared	=	0.6532
				Adj R-squared	=	0.5768
Total	19.5068496	72	.270928467	Root MSE	=	.33861

avgniatbeli	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
avgsikap	.0784717	.1219581	0.64	0.522	-.1655658	.3225093
avgnorsubjektif	-.0150538	.0913021	-0.16	0.870	-.1977489	.1676412
avgkontrol	.2448758	.1113164	2.20	0.032	.0221323	.4676193
avgkognitif	.3122954	.0787076	3.97	0.000	.154802	.4697889
avgkinerja	-.115721	.0728391	-1.59	0.117	-.2614717	.0300298
avggambaran	-.0705473	.1152011	-0.61	0.543	-.3010643	.1599696
avgresiko	.0806278	.0804591	1.00	0.320	-.0803705	.241626
avgvalue	.4238175	.1252967	3.38	0.001	.1730993	.6745357
avgkegunaan	-.0632572	.091809	-0.69	0.494	-.2469666	.1204521
usia	.0236546	.0217938	1.09	0.282	-.0199546	.0672638
gender	-.0325025	.0916938	-0.35	0.724	-.2159814	.1509763
pendidikan	.0225362	.0675049	0.33	0.740	-.1125409	.1576133
pendapatan	.037748	.0541463	0.70	0.488	-.0705984	.1460945
_cons	.4371756	.4399344	0.99	0.324	-.4431311	1.317482

From the table above, the value of the variable that has a P-value of <0.05 (control, cognitive, and value), is a variable that has a significant correlation to purchase intention. Then, simultaneously, with the Adj R-squared value of 0.6532 or 65.32%, it means that all the nvariable models listed represent 65.32% of the influencing variables, meaning that there are still around 34.68% of the variables that have not been explained in the existing formulas. From the control coefficient (0.244), cognitive (0.312), and value (0.423), it can be concluded that with each variable increasing the scale by 1 scale, the purchase intention also increases by the number of each of these variables.

B. Electric cars

The number of electric cars in Indonesia as of November 2021 is 1,656 units. However, due to limited access to customer data, the survey was conducted by means of offline snowball sampling. For the respondent's domicile, 93% from Greater Jakarta, 3% from Surabaya, and 3% from Bandung. The survey contains a number of questions, including questions with a Likert scale of 1-4 (questionnaire attached). The total number of questionnaires that were tried to be distributed to electric motorcycle owners was 300, of which 111 were filled out, meaning that the response rate was 37%. After filtering, including data cleaning, the status of the owner of the electric motor is 30.

The results of a survey conducted in several cities with a total of 30 respondents who own and use electric motors are grouped based on various things, including gender, age range, last education, occupation, monthly income, and how users get information about electric motors. Respondents in this study were grouped into 5 based on their age. Most of the respondents are in the age range of 30 to 39 years, which is 40% of the total respondents. Then followed by the age range of 40-40 and 50-59 with percentages ranging from 23% and 20%, respectively. Almost all of electric car users have a bachelor's, master's, and doctoral degree, which is 97%, the rest have a diploma (3%). From the survey data, it can be seen that 57% of the respondents work as private employees, while 13% work as entrepreneurs, 10% work as civil servants/TNI/Polri, the rest work in other fields.

Table 2. The OLS regression of intention to buy electric car determinants

Source	SS	df	MS	Number of obs	=	30
				F(9, 20)	=	1.94
Model	3.71749288	9	.413054764	Prob > F	=	0.1049
Residual	4.26769244	20	.213384622	R-squared	=	0.4655
				Adj R-squared	=	0.2250
Total	7.98518532	29	.275351218	Root MSE	=	.46194

avgniatbeli	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
avgsikap	.4204178	.3129251	1.34	0.194	-.2323326	1.073168
avgnorsubjektif	.1886517	.1464686	1.29	0.212	-.1168765	.4941799
avgkontrol	-.0639361	.278184	-0.23	0.821	-.6442177	.5163456
avgkognitif	.0742651	.1953875	0.38	0.708	-.3333061	.4818362
avgkinerja	.1744486	.2116668	0.82	0.420	-.2670806	.6159779
avggambaran	.7095744	.373495	1.90	0.072	-.0695224	1.488671
avgresiko	-.5093369	.2113195	-2.41	0.026	-.9501416	-.0685321
avgvalue	-.1411612	.313059	-0.45	0.657	-.7941909	.5118685
avgkegunaan	-.2326768	.1927722	-1.21	0.242	-.6347926	.1694389
_cons	1.284924	1.038921	1.24	0.230	-.8822275	3.452076

From the results of OLS regression, it can be seen that the variable that has a significant correlation to purchase intention is only risk avgression, because the P value is below 0.05. Overall, the value of prob > F is still greater than 0.05. This means that this equation does not represent the independent variable on the purchase intention variable in a dependent manner. Meanwhile, the R-squared value of 0.4655 or 46.55% illustrates that the overall measured independent variables only represent 46.55% of the total variables that actually have a correlation with the purchase intention variable.

From the data above, we can analyze that there may be other unobserved variables that determine a person's intention to buy an electric car.

IV. CONCLUSION AND RECOMMENDATION

From the results of the OLS regression of electric motor users, it can be seen that the control coefficient (0.244), cognitive (0.312), and value (0.423), have a significant correlation to purchase intention. A number of respondents who have used electric motors, in general they have heard, read, and seen electric motors, and the age of the majority of them are in the range of 18-39 years. Meanwhile, from items psl011 to ps019 in the electric motor questionnaire, we can see that the items with the highest mean are ps013 (environmentally friendly), ps014 (fuel efficiency), and ps015 (operating costs). A number of respondents who use electric motorbikes agree that the advantages of using an electric motor are the ps052 (less operating costs), ps053 (quiet engine sound), ps054 (reduced dependence on fossil fuels), while the disadvantage is that the number of charging stations is too few (Ps064).

The expectation from electric motor users is that PLN is expected to be able to increase charging stations for electric motors, reduce electricity tariffs specifically for the use of electric motors, provide fast charging facilities, and provide battery swaps.

From the OLS regression results for electric car users, it can be seen that the avgression coefficient has a significant correlation to purchase intention, which is 0.026. For electric car respondents, it can be seen that the variables with the highest mean are pml013 (environmentally friendly), pml014 (fuel efficient), pml051 (less pollution), pml053 (quieter), and pml054 (reduced dependence on fossil fuels). . From the

results of a survey of electric car respondents regarding the advantages and disadvantages of using an electric car, it can also be seen that the disadvantage of using an electric motor is that the number of charging stations is too few (Ps064). Respondents of electric cars hope that PLN can increase the number of charging stations for electric cars, reduce the price increase for electric car users, improve the electric car ecosystem, improve charging station services, increase innovation related to electric cars, make charging stations more evenly distributed outside the city per 200 km, clarifying the information for the list of charging at home because the call center does not understand, perfecting many technical matters, especially the stability of the electricity voltage, freeing odd-even (especially electric cars) to be applied in all regions, issuing Carbon Tax Regulations in the regions, and providing tax incentives.

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