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Market Analysis of Charging Stations to Support Sustainable Transportation in Indonesia

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Abstract

Motorcycles are one of the most popular modes of transportation in Indonesia. The increasing population in Indonesia is likely to contribute to the increasing demand for motorcycles, which in turn has an impact on environmental pollution. The increase in motorcycle demand needs to be accompanied by an increase in the supply of electric motorcycles. Efforts to increase the use of electric motorcycles need to be balanced with the existence of good infrastructure, for example charging stations. Therefore, this study aims to analyze the market needs of electric motorcycle consumers related to charging stations for battery charging and battery swapping in Indonesia. The method used in this research is quantitative descriptive methods. The data used are primary data and secondary data. Primary data was obtained from a survey of electric motorcycle users using a non-probability sampling method based on snowball sampling, while secondary data was obtained from literature studies. Fulfilling consumer market needs for charging station infrastructure is expected to increase the number of electric motorcycle users in Indonesia and reduce the number of fossil fuel motorcycles.

Keywords: electric motorcycle, infrastructure, charging station, battery replacement, battery swapping

I. Introduction

Motorbikes are the most popular means of transportation. According to Pratiwi & Wibawa (2020), motorbikes are widely used in developing countries, especially in Indonesia (Mahesh et al., 2019; Pratiwi & Wibawa, 2020). Motorbikes dominate the transportation sector in Indonesia (Guerra, 2019). This is because motorbikes are used as a mode of transportation in daily activities, and are also a means or source of income for the community (Mahesh et al., 2019; Pratiwi & Wibawa, 2020). With the increasing population, the number of motorbikes is expected to continue to increase because motorbikes are more affordable, comfortable, and easy to operate (Pratiwi & Wibawa, 2020). According to BPS data, motorbike users in 2020 increased by 1.95%, and in 2021 increased by 4.19% compared to 2019.

Motorbikes are vehicles that contribute the largest emissions (Mahesh et al., 2019; Mbandi et al., 2023). According to Babar & Ali (2021), this is because the motorbike is fuelled by fossil fuels, a non-renewable natural resource that then produces energy through the combustion process. During the combustion process, carbon dioxide (CO₂), carbon monoxide (CO), and other toxic gases are produced which then cause global warming. Increased emissions cause a shift in the natural balance of the earth's ecosystem which causes decreased air quality, drought, forest fires, floods, decreased human health, and decreased agricultural productivity (Babar & Ali, 2021; Mbandi et al., 2023)

One way to reduce negative environmental impacts is the use of electric motors. The increase in motorbike users needs to be anticipated by increasing the offer of electric motorbike use. Electric vehicles are one way to reduce CO₂ emissions and are an environmentally friendly vehicle choice (Carranza et al., 2022; Guerra, 2019; Habibie & Sutopo, 2020; Pratiwi & Wibawa, 2020). Until now, the presence of electric motorbikes is still low in Indonesia. According to (Guerra, 2019), this is due to less competitive performance compared to fuel-powered motorbikes (speed, range, charging time). Apart from that, the existence of very limited charging infrastructure can also have a big impact on consumers' willingness to use electric motorbikes. Data from the Directorate General of Electricity (Gatrik) of the Ministry of Energy and Mineral Resources, as of September 2021 shows that charging stations using the battery swap method belong to private companies such as Oyika (17 units), Swap Energy (55 units) and 1 Ezzy Fast unit which is only spread across the Jakarta, Bogor, Depok, Tangerang and Bekasi (Jabodetabek).

As proof of the seriousness of the Indonesian Government in supporting the implementation of sustainable transportation, the government through the Regulation of the Minister of Energy and Mineral Resources of the Republic of Indonesia Number 1 of 2023 seeks to accelerate the provision of electricity charging infrastructure for battery-based electric motorized vehicles. Apart from that, market analysis is needed to identify and analyse market needs and market size to be able to create competitive strategies (Cather, 2022). Apart from that, market analysis is also carried out systematically to obtain knowledge that is right on target for market analysis.

This study aims to determine consumer preferences regarding understanding, satisfaction, and consumer desires for charging stations. This study uses primary data in the form of questionnaires for electric motorbike users and secondary data in the form of study literature. It is hoped that this study can improve the quality and quantity of charging stations which will ultimately increase electric motorbike users in Indonesia.

II. Methodology

This research uses quantitative descriptive methods using primary data and secondary data. Primary data was obtained by conducting interviews with electric motorbike users who use swapping batteries and charging batteries. The sample selection method used is a non-probability sampling method using snowball sampling, which is a technique for determining a sample that is initially small, then this sample selects its friends to be used as samples, and so on, so that the number of samples becomes large. Interviews were conducted directly (face to face) and filled out a list of questions (questionnaire) via the Lime Survey application from August to December 2021 in Jabodetabek (Jakarta, Bogor, Tangerang, Bekasi), Bandung and Surabaya. Apart from primary data, secondary data was obtained through literature studies to support this research.

III. Results and Discussion

Based on the results of a survey of 46 respondents, most respondents using electric motorbikes were male in the 30–39-year age group (42 percent), followed by the 20–29-year age group (28 percent) and finally the 40–49 years (10 percent). The survey results show that most respondents are still in the productive age range. Meanwhile, the main jobs of respondents are relatively spread out, ranging from private employees and entrepreneurs (24 percent), online motorcycle taxi drivers (17 percent), ASN and BUMN/BUMD employees (15 percent), to several other main types of work. Meanwhile, from the last level of education completed, high school graduates/equivalent reached 39 percent, while the percentage was relatively small for master's degree graduates.

In the results of interviews conducted there were two categories of two-wheeled consumer respondents, namely the online motorcycle taxi driver category and the private electric motorbike user category. The main reason for respondents in the online motorcycle taxi driver category for switching from conventional motorbikes to electric motorbikes is because the costs are quite economical. This economy can be translated from the operational costs incurred by users for mobility in the Jabodetabek area using two-wheeled KBLBB or relatively cheap electric motorbikes, Rp. 10,000.00 for the cost of charging the electric motorbike battery. In addition, if you use a conventional motorbike, the respondent will need to pay around Rp. 20,000.00 for petrol and does not include service costs and oil changes every month. Meanwhile, for the category of private electric motorbike users, consumers are switching to electric motorbikes for reasons of efficiency, where currently charging electric motorbike batteries can be done using the battery swap method which only takes approximately 1 minute to replace an empty battery with a new battery fully charged and ready to use.

As many as 65 percent of respondents used electric motorbikes starting in 2021, while the rest have used electric motorbikes since 2019 or 2020. Most electric motorbikes are used for personal purposes (65%), online transportation (17%), service motorbikes (1 %) and other uses (5%). In terms of brand, Viar dominates the electric motorbike brand owned by almost 40 percent of respondents. The choice of electric motorbike as a vehicle is usually due to its relatively cheap operational aspect (48%) and fast charging (20%). Meanwhile, another reason that is the main consideration for many respondents is the length of battery charging time. Then, the country of origin of the motorbike brand was the final reason for most respondents. This could happen because there are still not too many electric motorbike manufacturers officially circulating in Indonesia.

There are two types of charging for electric motorized vehicles, namely by charging the battery (battery charging) and by exchanging batteries (battery swapping). The first is the charging

station for battery charging is a place to exchange electric vehicle batteries. The time required for the process of exchanging an electric vehicle battery takes only about 1 minute. 67% of respondents used battery charging with an average charging time of 180-360 minutes. Battery charging locations are in offices at 37% with a charging duration of 120-240 minutes, and the rest are at SPBKLU with a duration of between 30-180 minutes. Respondents who charged at charging stations were mostly online drivers. This is because it makes online drivers more flexible in using charging stations and saves time compared to having to go home first. However, the charging time was quite long and took turns causing respondents to not feel comfortable. The survey shows that the highest level of consumer desire for the availability of charging station locations is at gas stations (85%), shopping centres (52%), offices (48%), apartments/houses (46%), the rest in rest areas, hotels, sports centres, and electric motorbike dealer.

The second type is battery swapping, 39% of respondents used this type of battery. This battery can only be used at a battery swapping station. Most of these respondents exchanged batteries in their neighbourhood or at the nearest minimarket. Respondents' desire for battery swapping locations was highest at gas stations (78%), followed by shopping centers/supermarkets/minimarkets at 75%, then offices (48%) and the rest were housing, parking lots, sports stations, and electric motorbike dealers. Based on the survey results, respondents stated that there is a need to increase the number of services and distribution of charging stations for swapping batteries so that they are more easily accessible, especially when traveling long distances. Apart from that, many respondents also hope that services can be improved by adding supporting facilities, such as shelter and seating. Several respondents also suggested that the charging station be accessible 24 hours a day.

In addition, the results of the market research survey showed that cash payment was the respondents' favourite payment method because it was chosen by 36 percent of the total respondents. Digital wallets were the second favourite choice chosen by 25 percent of respondents. Payment by cash or digital wallet is considered the most suitable because the battery exchange rates are relatively affordable for respondents. Meanwhile, the payment system using e-money was chosen by respondents with a percentage reaching 18 percent.

The charging stations visited belonged to PT Oyika Powered Solutions (charging station for battery replacement) and PT Swap Energi Indonesia (charging station for battery swapping). Based on the survey results, the charging station profiles owned by the two companies can be described as follows:

1. Several charging station companies have collaborated with Alfamart to provide land that can be used as a charging station.
2. PT Oyika Powered Solutions' charging station is situated in a car repair shop, but some of the battery exchange machines are not visible to electric motorbike users and are not well maintained. Apart from that, there is also a former shophouse where you can rent electric motorbikes. The condition of the shophouse at the time of the survey was empty or no longer in use, so the condition of the shophouse was not good.
3. Initially, the placement of PT Oyika Powered Solutions' charging stations was around 15 km between charging stations, but now it is closer to 8 km, and in the future, it will be 1-2 km apart. However, the charging availability for users is only 2-3 slots and the quality of the machine must always be improved because machines like to make errors. For example, the battery cannot be charged to 100%, but only around 80%, even though it has been charging for more than 1 hour.

4. The charging station owned by PT Oyika Powered Solutions and PT Swap Energi Indonesia does not have a guard, making it difficult for new users to use the charging station.
5. PT Oyika Powered Solutions has two types of charging station machines, namely with a capacity of 12 batteries and 6 batteries. The shape is vertical, making it a little difficult for female electric motorbike users when exchanging batteries. Meanwhile, PT Swap Energi Indonesia only has one type of SPBKLU machine with a slot for 3 batteries and a horizontal shape, making it easier to exchange batteries.
6. Electric motorbikes issued by PT Oyika Powered Solutions and PT Swap Energi Indonesia cannot be charged at home. This is because there is no connector from the SPLU to the electric motorbike.
7. By looking at the real conditions in the field, from several charging station locations in the field, most SPBKLUs experience very minimal battery exchange activity. Several SPBKLUs surveyed exchanged batteries 1-3 times in one day, some even had no battery exchange activities at all. Battery exchange activities at SPBKLU mostly occur during the day and night.

In general, several obstacles expressed by consumers regarding charging stations are (i) the number of charging stations is still minimal, (ii) the distance between charging stations is quite far because the number is still small, (iii) some charging stations have errors in charging the battery (cannot 100%). The cause of the error needs to be explored, whether it is the charging station machine or the battery which is starting to decline in capability, and (iv) The battery design is not ergonomic (especially the vertical one) and the placement point is not suitable, making it difficult for users to exchange batteries on average. weighs 10 kg. Conditions like this were found at several charging stations in Bogor City.

In this market research, respondents were also asked to provide suggestions regarding the development of SPBKLU, SPLU services, as well as strengthening related policies to increase the use of exchange services or battery charging services. Firstly, respondents suggested developing charging station services, namely increasing the number of services and distribution of charging stations so that they are more easily accessible, especially when traveling long distances. Apart from that, many respondents hope that charging station services will also be improved by adding supporting facilities such as shelter and seating. Several respondents also suggested that the charging station be accessible 24 hours a day.

In terms of government policy regarding increasing charging station services and the use of electric motorbikes in Indonesia, many respondents highlighted the comparative price of electric motorbikes, which are relatively more expensive compared to conventional motorbikes. Still related to vehicle prices, many respondents hope that the government can increase the price of petrol (disincentive), but also increase incentives for the use of electric motorbikes. Regarding the ease of doing business in the charging station sector, respondents hope that the government can provide conditions that make it easier to grow the charging station business so that charging station locations become more numerous and affordable. In general, respondents also hope that the government will provide more outreach directly or through various media regarding electric motorbikes or collaborate with various parties.

Meanwhile, suggestions from consumers who use battery charging are that charging stations for battery charging have more SPLU points and are more widespread. Apart from that, respondents hope that the charger used will be universal for various types and brands of electric motorbikes. Respondents also hope that the charging process can be faster because there are still many respondents who feel that charging takes too long, fast charging technology is really hoped for by respondents. Apart from that, one of the interesting suggestions from respondents was the need to provide a payment system using a digital wallet because in general charging an electric motorbike does not cost as much as charging an electric car.

IV. Conclusions and Recommendations

Fossil fuel motorbikes are a source of greenhouse gas emissions. Therefore, the increase in demand for motorbikes needs to be addressed by increasing the supply of electric motorbikes. Electric motorbikes are sustainable transportation because they can reduce greenhouse gas emissions. The limited number of charging stations makes fossil fuel motorbike users reluctant to switch to electric motorbikes. Therefore, the offer of electric motorbikes needs to be accompanied by increasing the quality and quantity of charging station infrastructure.

The results of this study show that charging stations need to be increased and spread more widely. In addition, the charging station is expected to be accessible 24 hours with comfortable waiting facilities such as seating, shelter/resting areas, and free internet connection. Especially for battery replenishment users, they hope that there will be new technology that can speed up charging and create a single plug in so that users can use all charging stations.

Referring to the suggestions above, several policy points that can be recommended are as follows:

- The private sector needs to be involved to become one of the SPLU service providers.
- Permits and the process for establishing SPBKLU and SPLU infrastructure are made easier and cheaper.
- The use of gasoline needs to be more stringent.
- Incentives for using KBLBB need to be increased.
- Socialization of the use of KBLBB needs to be intensified through various media in collaboration.

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