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Consumer Behavior and the Adoption of Electric Vehicle in Indonesia

Sunaini Rofi'ah[1*], Egi Pranajaya[2]
[1]*Department of International Trade, Mbojo Bima University, Indonesia*
[2]*School of Business Management, Bandung Institute of Technology, Indonesia*

*) Coresponding Author: (e-mail: sunainirofiah@gmail.com)

Abstract
This study explores the key factors influencing the adoption of electric vehicles (EVs) in Indonesia, focusing on economic conditions, government policies, infrastructure availability, and public awareness. Using a qualitative approach, relevant peer-reviewed sources were carefully selected and thematically analyzed. The findings reveal that government subsidies and supportive policies have significantly increased EV adoption, particularly between 2020 and 2022. Improved charging infrastructure in urban areas has alleviated range anxiety, while macroeconomic conditions influence consumer purchasing power. However, significant challenges remain, including limited rural infrastructure, high upfront costs, and low public awareness. The study makes a theoretical contribution by integrating consumer behavior theories with economic and policy factors, offering a comprehensive framework that enhances the understanding of EV adoption in developing countries and serves as a foundation for future research and policymaking.
Keywords: **Consumer Behavior, Economic Conditions, Electric Vehicle Adoption**

INTRODUCTION

Air pollution in Indonesia has become a critical environmental issue, significantly contributing to the country's greenhouse gas emissions and exacerbating global environmental problems. The impact of harmful pollutants such as lead (Pb), suspended particles (SPM), nitrogen oxides (NOx), sulfur dioxide (SO2), hydrocarbons (H.C.), carbon monoxide (C.O), and photochemical oxidants (Ox) emitted by motor vehicles has long been recognized as one of the primary causes of urban air pollution (Julismin, 2013; Ismiyati, 2014). Over the past few years, Indonesia has experienced considerable growth in motorized vehicles, leading to increased air pollution, especially in major cities such as Jakarta, Surabaya, and Bandung. Over the past 50 years, it has been generally recognized that urban air pollution affects human health and the environment (Rauf *et al*., 2014).

In metropolitan cities such as Jakarta, Surabaya, and Bandung, the increasing number of motor vehicles is directly correlated with worsening air quality, a situation that threatens both public health and the environment. According to Ferdinand (2016), the annual increase in

the number of vehicles directly correlates with worsening air quality. In fact, approximately 50% of the air pollution in Indonesia is caused by motor vehicles, as stated by Transportation Minister Budi Karya Sumadi.

The transition to electric vehicles (EVs) is widely seen as a critical solution to mitigating air pollution and meeting Indonesia's climate targets. Indonesia is among the nations pledged to address the climate issues outlined in the 2015 Paris Agreement. The government has enacted several policies, such as Presidential Regulation No. 79 of 2023, which offers financial incentives for businesses and individuals to adopt electric vehicles, helping to reduce reliance on fossil fuels and lowering carbon emissions. Despite this, there are still obstacles hindering the adoption of electric vehicles in Indonesia, the main one being people's preference for fossil fuel-powered cars. The relatively higher price of electric cars than conventional vehicles, the absence of charging infrastructure, and public ignorance about the advantages of electric cars are some of the factors influencing consumers' decision to use them.

Macroeconomic uncertainty significantly affects consumer purchasing decisions regarding green technologies, including electric vehicles (EVs). As Ferriani *et al*., (2024) explain, macroeconomic instability, such as inflation, exchange rate fluctuations, and interest rate uncertainty, can dampen consumer spending, especially on high cost items like EVs. Deloitte (2023) highlights that consumers with stable economic conditions, particularly those with higher incomes, are more likely to engage in sustainable behaviors, including adopting green technologies. However, many Indonesian consumers still face financial constraints that hinder their ability to purchase electric vehicles despite the government's efforts to incentivize the transition through subsidies and tax breaks. Additionally, macroeconomic factors such as GDP growth and inflation significantly affect

In addition to economic factors, the development of adequate charging infrastructure is crucial for supporting electric vehicles adoption, and its role is increasingly significant in consumer decisions. Sierzchula *et al*., (2024) emphasize the importance of accessible charging infrastructure in increasing electric vehicles adoption, noting that factors such as fast charging facilities and workplace charging can significantly enhance the attractiveness of EVs. As Morozova *et al*., (2021) emphasize, insufficient charging infrastructure remains a key deterrent for consumers in both developed and developing countries, as it directly impacts the convenience and feasibility of switching to electric mobility. Li *et al*., (2023) show that environmental awareness and governmental incentives also drive electric vehicles adoption, but these factors are often secondary to the practical issue of infrastructure. In particular, the rise of ultra-fast charging stations has shown promise in addressing these concerns. According to Wang *et al*., (2022), such innovations significantly mitigate range anxiety by reducing

charging time to mere minutes, enhancing the overall consumer experience. This kind of infrastructure is pivotal in making electric vehicles a convenient and accessible option, especially in countries like Indonesia, where long distance travel is common. Therefore, the development of hitech charging stations is not just about meeting consumer demand, it is also about creating a more efficient, reliable, and consumer-friendly environment for electric vehicles adoption, especially in light of the macroeconomic uncertainties that can otherwise constrain consumer confidence and spending power.

A crucial barrier highlighted in previous studies is the role of macroeconomic conditions in shaping consumer purchasing decisions for green technologies like electric vehicles. Research by Rezvani *et al*., (2015) study shows how macroeconomic uncertainty (such as inflation, exchange rate volatility, and fluctuating interest rates) can affect consumer purchasing decisions, especially regarding the use of green technology. In Indonesia, these macroeconomic factors, combined with relatively low household incomes and high price sensitivity, further inhibit the adoption of electric vehicles. Moreover, as Zhang *et al*., (2022) observe, economic stability plays a crucial role in enabling consumers in emerging economies, such as Indonesia, to afford the initial investment required for electric vehicles, with many consumers still finding electric vehicles too expensive, even when subsidies are available. Sierzchula *et al*., (2014) emphasize the importance of accessible and widespread charging stations in ensuring consumer confidence and convenience. Morozova *et al*., (2021) further argue that the insufficient availability of charging stations remains a primary obstacle to electric vehicles adoption, as it directly affects the convenience and feasibility of switching to electric mobility.

This study seeks to fill an important gap in the existing literature by exploring how macroeconomic factors and the development of charging infrastructure intersect in influencing the adoption of electric vehicles in Indonesia. Most prior research has predominantly focused on technological advancements or policy incentives, but less attention has been paid to how economic instability, combined with infrastructure gaps, creates a complex barrier to electric vehicles adoption in developing countries. By examining these intertwined factors, this research provides a more nuanced understanding of the challenges to electric vehicles adoption in Indonesia and offers actionable insights for policymakers, industry stakeholders, and other relevant entities. This research also highlights the importance of collaboration among the government, private sector, and society in fostering an ecosystem that supports sustainable mobility. Addressing these barriers will be crucial for Indonesia to accelerate the transition to electric vehicles, improving air quality, reducing dependence on fossil fuels, and contributing to the global fight against climate change.

LITERATURE REVIEW

Consumer Behavior and Electric Vehicle Adoption

Consumer behavior is essential in adopting new technologies, including electric vehicles. Various consumer behavior theories, such as the Theory of Planned Behavior (TPB) and the Technology Acceptance Model (TAM), have been used to understand how psychological and social factors influence consumer intentions and decisions (Ajzen, 1991; Davis, 1989). The TPB, for example, emphasizes that a person's intention to perform a particular behavior is influenced by attitudes toward the behavior, subjective norms, and perceived behavioral control. In the context of E.V. adoption, positive attitudes toward the environment and social norms supporting green technologies can increase consumers' intention to purchase electric vehicles (Rezvani *et al*., 2015).

Rezvani, Jansson, and Bodin's (2015) study emphasizes that consumers with high environmental awareness tend to adopt green technologies like electric vehicles. Li *et al*., (2017) revealed that consumers' decision to adopt electric vehicles is significantly influenced by their perception of this technology's economic and environmental benefits. Consumers who see electric vehicles as a solution to reduce fuel costs and environmental impact are likelier to adopt this technology. However, perceived risks, such as concerns about mileage and availability of charging infrastructure, are still significant barriers to electric vehicle adoption, especially in developing countries, including Indonesia (Hardman *et al*., 2018). The Diffusion of Innovation theory proposed by Rogers (2003) is also relevant in this context. This theory highlights that the adoption of new technologies is influenced by how innovations are accepted by society. Social norms, the influence of reference groups, and society's views on green technology can influence individuals' decisions to adopt electric cars (Bunce *et al*., 2014).

Furthermore, research by Zhang *et al*., (2014) indicates that electric vehicles adoption in different countries is often influenced by government policies and incentives that can encourage consumers to adopt this new technology. Subsidy policies and fiscal incentives significantly affect electric vehicles adoption rates in different countries, underscoring the importance of the government's role in supporting the transition to green technologies.

Economic Factors in Electric Vehicle Adoption

Economic factors such as price, incentives, and infrastructure significantly affect the adoption of electric vehicles. Research by Jenn, Azevedo, and Ferreira (2013) shows that financial incentives, such as subsidies and tax reductions, can increase the adoption of green

technologies, including electric vehicles, by making them more affordable for consumers. These incentives can be in the form of luxury tax reductions, income tax incentives, and direct assistance in the form of rebates offered by the Indonesian government to encourage the adoption of electric vehicles.

Further research by Wang, Tang, and Pan (2019) highlighted the importance of charging infrastructure in driving electric vehicle adoption. They found that adequate charging stations are essential for increasing electric vehicle adoption. Electric vehicle adoption is higher in countries with better charging infrastructure. In the Indonesian context, charging infrastructure still needs to be improved, especially outside major cities such as Jakarta and Bali, which is a barrier for consumers to switch to electric vehicles. Bakker & Trip's (2013) study also shows that the higher price of electric vehicles compared to fossil fuel vehicles is one of the main barriers to adopting this technology. While electric vehicles offer long-term benefits, such as lower operating costs and less environmental impact, the high initial purchase price is often prohibitive for many consumers. This is especially true in developing countries such as Indonesia, where consumer purchasing power is relatively lower than in developed countries.

On the other hand, inflation and interest rates also play an essential role in influencing the adoption of electric vehicles. High inflation can reduce consumers' purchasing power, reducing their ability to make large purchases such as electric cars. Meanwhile, high interest rates can increase borrowing costs, making consumers reluctant to use financing schemes to purchase electric vehicles. Hackbarth & Madlener (2016) note that macroeconomic stability, including inflation and interest rates, is crucial to adopting new technologies such as electric vehicles.

Government Policy and Electric Vehicle Adoption

Government policies are essential in driving electric vehicle adoption, primarily through financial incentives and infrastructure development. Research by Rietmann & Lieven (2019) shows that supportive policies, such as subsidies and tax incentives, can significantly increase the adoption of electric vehicles by reducing the initial purchase price and increasing consumer purchasing power. In addition, the government should invest in developing charging infrastructure to support the use of electric vehicles. Helveston *et al*., (2015) emphasized that the availability of adequate infrastructure is crucial to drive the adoption of electric vehicles. With adequate infrastructure, consumers may be able to switch to electric vehicles due to travel distance issues and charging station availability.

The government has encouraged the adoption of electric vehicles in Indonesia, including by issuing Presidential Regulation No. 55/2019 on the Acceleration of the Battery Electric Vehicle Program for Road Transportation. This regulation aims to reduce greenhouse gas emissions and dependence on fossil fuels and support the transition to cleaner energy. However, despite supportive policies, implementation challenges still need to be addressed. Research by Mersky *et al*., (2016) shows that the success of government policies in driving the adoption of electric vehicles is highly dependent on several factors, such as inter-agency coordination, support from the private sector, and public acceptance of new technologies.

METHOD

Research Approach

This study adopts a qualitative research approach to explore the adoption of electric vehicles (EV's) in Indonesia, with a focus on understanding the complex interplay of socio-economic and infrastructural factors that influence consumer behavior and policy decisions. Qualitative research is particularly appropriate for this study, as it enables an in-depth investigation of how macroeconomic conditions, consumer perceptions, and government policies impact the adoption of electric vehicles, which cannot be fully captured through quantitative methods. For this research, document analysis was employed as the primary method of data collection, which allowed for the analysis of government reports, policy documents, industry publications, and case studies related to electric vehicles adoption in Indonesia. This method is particularly suitable for qualitative studies, as it allows the researcher to extract key themes and insights from existing data, rather than generating new data through surveys or interviews.

The integration of these factors into a qualitative framework allows for the development of a holistic understanding of the challenges faced in electric vehicles adoption in Indonesia. This method facilitates the discovery of interactions between macroeconomic stability, government policies, and charging infrastructure, which is not always visible in quantitative research. Furthermore, qualitative research enables a deeper investigation into the social perceptions and cultural attitudes that influence consumer decisions about electric vehicles's. As Patton (2002) asserts, qualitative research is essential when exploring complex social phenomena, as it offers rich, contextual insights that help explain the reasons behind consumer behavior and policy choices. In summary, a qualitative approach is the most suitable method for this research because it allows for a deeper, more nuanced exploration of the factors that shape the adoption of electric vehicles in Indonesia. By analyzing existing documents and synthesizing key themes, this research provides valuable insights into the barriers and

opportunities surrounding electric vehicles adoption and contributes to the development of policy recommendations aimed at accelerating the transition to greener transportation in Indonesia.

RESULTS AND DISCUSSION

RESULTS

Adopting Electric Vehicles (EV's) is a critical step for Indonesia in addressing environmental challenges, such as reducing greenhouse gas emissions and improving air quality. As a growing economy with high levels of urbanization and industrialization, Indonesia faces substantial environmental pressure, particularly from the transportation sector, which is heavily reliant on fossil fuels. Transitioning to EV's offers a viable solution to mitigate these issues by reducing carbon emissions, enhancing energy efficiency, and supporting sustainable development goals. Despite these benefits, the widespread adoption of EV's in Indonesia remains slow, influenced by several complex and interrelated factors, including economic conditions, infrastructure limitations, government policies, and cultural perceptions.

Understanding the behavior of consumers is key to understanding the adoption of electric vehicles in Indonesia. Consumer decisions are shaped by a variety of influences, from economic concerns about the high initial costs of electric vehicles to practical considerations such as the availability of charging infrastructure. The role of government policy, consumer awareness of environmental issues, and societal acceptance of new technologies also play significant roles in determining adoption rates. As research suggests, consumer adoption of EV's is not solely driven by environmental concern but is deeply intertwined with socio-economic factors, technological trust, and the perceived feasibility of adopting new technologies (Sierzchula *et al*., 2014; Egbue & Long, 2012). These elements are particularly relevant in the Indonesian context, where the combination of rapid urban development, an evolving middle class, and emerging environmental consciousness makes electric vehicles adoption both a challenge and an opportunity.

Several studies have identified key factors that influence the adoption of electric vehicles in Indonesia, revealing a complex interplay of economic, infrastructural, policy, and consumer behavior elements. Economic factors, particularly the high initial costs of electric vehicles and macroeconomic conditions such as inflation and interest rates, have a significant impact on the affordability and purchasing decisions of consumers. According to the Ministry of Finance (2020), the initial cost of electric vehicles remains a major barrier for many consumers, as the price of electric vehicles is still higher compared to conventional vehicles, despite the lower operational costs in the long term. This issue is compounded by fluctuating

inflation rates and higher interest rates, which limit consumers' ability to finance these vehicles. In addition, the availability of charging infrastructure is critical in overcoming practical barriers to electric vehicles adoption. Research by Sierzchula *et al*., (2014) emphasizes that the presence of adequate charging stations reduces concerns such as range anxiety and makes electric vehicles more viable for daily use. However, the availability of charging stations remains limited, especially outside urban centers like Jakarta, where reports indicate that only 20% of the country's charging stations are located in rural areas, further hindering widespread adoption (E-Mobility Report, 2021).

Government policies, particularly incentives and subsidies, also play a crucial role in facilitating or hindering electric vehicles adoption. The Indonesian government's current policy framework includes tax reductions and subsidies for manufacturers, but many reports highlight that these incentives are insufficient in encouraging widespread consumer adoption. According to the National Energy Policy (2020), while the government's efforts are a step in the right direction, a more cohesive and comprehensive approach is needed, particularly in expanding consumer facing incentives like subsidies for electric vehicles buyers, which are currently limited to high-end models.

Exploring the Role of Subsidies in the Adoption of Electric Vehicles in Indonesia

The Indonesian government has taken substantial steps to encourage the adoption of electric vehicles (EV's), including several subsidy policies and supporting laws. One of the essential regulations is Presidential Regulation No. 55 of 2019 on Accelerating the Battery Electric Vehicle Program for Road Transportation. This legislation establishes the groundwork for developing electric vehicles infrastructure by providing incentives for manufacturers and customers, including import duty reductions, tax breaks, and direct subsidies for electric vehicles purchases. In addition, Minister of Industry Regulation No. 6 of 2023, later amended by Minister of Industry Regulation No. 21 of 2023, provides specific guidelines for the disbursement of government assistance for purchasing two-wheeled battery based electric motorized vehicles. This regulation aims to make these vehicles more affordable to the public by offering a subsidy of IDR 7,000,000 per vehicle. These regulations are part of Indonesia's broader strategy to achieve its Net Zero Emission (NZE) target by 2060, as they are designed to reduce dependence on fossil fuels and lower carbon emissions.

These subsidies include the exemption of sales tax on luxury goods (PPnBM) for EV's, purchase incentives in direct rebates, and the development of charging station infrastructure. Based on previous research, effective subsidy policies can significantly influence consumer behavior in adopting green technologies such as electric vehicles (Hao *et al*., 2020). This study

will elaborate on the impact of electric vehicle subsidy policies in Indonesia on consumer behavior by reviewing recent data and using microeconomic analysis according to consumer behavior theory.

Table 1. Number of E.V. Users in Indonesia

Year	Number of Number of EV Users
2020	2,012
2021	5,486
2022	7,679

According to data from Indonesia's Ministry of Energy and Mineral Resources 2023 (see table 1), the use of electric vehicles has increased markedly since the subsidy scheme was introduced. The impact of this regulation has been proven, with a significant increase in electric vehicle adoption by 2023, indicating a shift in consumer behavior from conventional to electric vehicles.

They were similarly based on IESR. The number of electric vehicle users in Indonesia has increased dramatically, reaching 2,012 in 2020, 5,486 in 2021, and 7,679 in 2022. This growth is primarily due to government subsidies and incentives, such as sales tax exemptions for luxury items (PPnBM) and reductions in vehicle title transfer fees (BBNKB) and vehicle tax (PKB). Furthermore, the rapid expansion of charging infrastructure, particularly in Jakarta and Bali, has alleviated range anxiety among potential buyers. Public awareness and acceptance have also grown due to visibility at high-profile events such as the G20 Summit in Bali and the economic benefits of lower operating costs compared to internal combustion engine vehicles. These combined efforts have significantly increased electric vehicle usage in Indonesia (IESR, 2023). Jenn, Azevedo, and Ferreira (2013) highlight that financial incentives, including subsidies, are crucial in making electric vehicles more financially accessible to consumers. Similarly, Helveston *et al*., (2015) emphasize that government subsidies in countries like the U.S. and China have significantly contributed to the adoption of electric vehicles, a dynamic that is also relevant to the Indonesian context. Rietmann & Lieven (2019) further stress the importance of government intervention and supportive policies in driving electric mobility adoption.

Examining the Macroeconomic Context of Electric Vehicle Adoption in Indonesia

To analyze the role of macroeconomic factors in electric vehicle (EV) adoption in Indonesia, several key economic indicators such as GDP growth, inflation, and interest rates were examined. These indicators provide valuable insights into how macroeconomic conditions influence consumers' purchasing power and their willingness to adopt new

technologies such as electric vehicles. The data presented in Table 2, sourced from the BPS (Statistics Indonesia), reveals key trends in the country's economic performance from 2018 to 2023. As shown, GDP per capita in Indonesia steadily increased from $3,932.58 in 2018 to $4,919.7 in 2023, signaling greater economic growth and improved consumer purchasing power. This increase in GDP per capita typically correlates with higher disposable income, enabling more consumers to afford new technologies such as electric vehicles. Research supports this trend, indicating that as GDP per capita rises, so does the likelihood of consumers investing in innovative technologies.

The relationship between inflation and electric vehicle adoption is more complex, as inflation can affect both the cost of electric vehicles and the broader economy. The BPS report also indicates fluctuations in the inflation rate, which peaked at 5.51% in 2022 before dropping to 2.61% in 2023. As shown in Table 2, these inflationary pressures can influence the cost of materials required for electric vehicle production, such as lithium for batteries, which are essential for the transition to electric mobility. Economic theories like cost-push inflation explain that as demand for raw materials increases with rising electric vehicles adoption, the prices of these materials may increase, resulting in higher production costs and price inflation in the broader economy (Lee & Ni, 2002). Conversely, as electric vehicle adoption reduces the demand for fossil fuels, it can lower oil prices, potentially reducing inflationary pressures in the energy sector. In the long run, technological improvements in electric vehicles production can reduce costs, which may lower consumer prices and mitigate inflation. Thus, the inflationary impact of electric vehicles adoption depends on the balance between the short-term increase in costs and the long-term benefits of technological efficiency.

Table 2. Macroeconomic Indicators

Indicator	2018	2019	2020	2021	2022	2023
GDP per capita (US$)	3.932,58	4.192,78	3.927,33	4.349,17	4.783,9	4.919,7
Inflation (%)	3.13	2.72	1.68	1.87	5.51	2.61
Interest Rate (%)	6.0	5.0	3.75	3.50	5.5	6.0

Interest rates are another critical macroeconomic factor influencing the financing of electric vehicles. The BPS data in Table 2 shows interest rates fluctuating from 6.0% in 2018 to 3.5% in 2021, before rising to 6.0% again in 2023. Lower interest rates generally make it easier for consumers to finance the purchase of electric vehicles, as the cost of loans and installment payments becomes more manageable. For manufacturers, low interest rates offer the opportunity to borrow at a lower cost, supporting investment in technology, the development of charging infrastructure, and scaling production. However, as interest rates rise,

as observed in 2023, the cost of financing increases, potentially deterring consumers from purchasing electric vehicles and limiting manufacturers' ability to invest in the necessary infrastructure and production expansion. Higher interest rates may, therefore, restrict the growth of the electric vehicle sector and delay the shift toward cleaner technologies. Studies by Diamond (2009) highlight the importance of low interest rates in stimulating the expansion of the electric vehicle market and reducing reliance on traditional fossil fuel-powered vehicles.

The analysis of the macroeconomic indicators in Table 2, based on data from BPS (Statistics Indonesia), reveals that GDP growth, inflation, and interest rates each play a critical role in shaping the adoption of electric vehicles in Indonesia. The increase in GDP per capita has boosted consumer purchasing power, making it easier for individuals to consider purchasing electric vehicles. However, inflation can drive up production costs, which may slow adoption in the short term. Additionally, low interest rates are essential for making electric vehicles more affordable and for supporting manufacturers' investments in infrastructure and technology. Overall, the success of electric vehicle adoption in Indonesia depends on managing these macroeconomic factors effectively and balancing the immediate challenges with long-term opportunities for growth in the electric mobility sector.

Charging Infrastructure and Implementation Challenges

Charging infrastructure is critical to supporting the adoption of electric vehicles. Consumers may hesitate to switch to electric vehicles without adequate infrastructure due to concerns about the availability of charging stations and the limited range of the vehicles. As highlighted by Sierzchula *et al*., (2014), the widespread availability of charging infrastructure is an essential prerequisite for increasing the adoption of electric vehicles in various countries. Without sufficient charging stations, particularly fast-charging options, the convenience and practicality of using electric vehicles is significantly diminished.

In Indonesia, the development of charging infrastructure is still in its early stages, with the majority of charging stations concentrated in major urban areas such as Jakarta, Medan, Surabaya, and Bali. According to Table 3, as of 2024, Java has the highest concentration of charging stations with 966, followed by Sumatra with 165, and Bali-Southeast Nusa Tenggara with 116. This limited distribution of charging stations presents a significant barrier for potential EV users in rural or less developed areas, where the infrastructure is sparse. The lack of charging stations outside major cities creates range anxiety among consumers, where the fear of running out of battery without access to a nearby charging point deters many from adopting electric vehicles.

Tabel 3. Number of Electric Vehicle Charging Stations in Indonesia (2024)

Region	Number of Charging Stations
Java	966
Sumatra	165
Bali-Southeast Nusa Tenggara	116

Source: Katadata

Morrissey, Weldon, and O'Mahony (2016) emphasize that the development of fast-charging technology, which can drastically reduce charging times, is key to increasing convenience for electric vehicles users. However, as they point out, creating this infrastructure requires substantial investment and strong policy support. To address this, the Indonesian government must collaborate with the private sector to expand the network of fast charging stations and ensure equitable access to charging infrastructure across all regions of the country.

The research by Coffman, Bernstein, and Wee (2017) further suggests that extensive and easily accessible charging infrastructure is a vital factor in promoting electric vehicle adoption. Additionally, innovations in infrastructure, such as portable charging solutions or more efficient home charging systems, could also help reduce barriers for consumers who need easy access to public charging stations (Sovacool *et al*., 2018). Expanding and upgrading the charging infrastructure network is crucial for accelerating the transition to electric mobility in Indonesia, particularly in less urbanized areas.

DISCUSSION

The adoption of electric vehicles (EV's) in Indonesia faces significant challenges, including high initial costs, limited infrastructure, and insufficient consumer awareness. These findings align with global trends observed in other countries, where the transition to electric mobility is also hindered by similar barriers. As highlighted by the increase in GDP per capita in Indonesia, which rose from $3,932.58 in 2018 to $4,919.7 in 2023 (BPS, 2023), rising consumer purchasing power can facilitate the adoption of new technologies like electric vehicles. This observation supports the findings of Jenn, Azevedo, and Ferreira (2013), who noted that higher purchasing power is often a driving factor in EV's adoption. However, despite these positive economic indicators, electric vehicles remain unaffordable for many consumers due to their high upfront costs, underscoring the need for continued government intervention in the form of financial incentives and subsidies.

The issue of limited charging infrastructure in Indonesia further exacerbates the barriers to electric vehicles adoption. As indicated in Table 3, the majority of charging stations are

concentrated in urban areas like Jakarta and Surabaya, with only 116 stations in Bali-Southeast Nusa Tenggara and 165 in Sumatra. This uneven distribution highlights the significant challenge of "range anxiety," as identified by Sierzchula *et al*., (2014), who emphasized the importance of an extensive charging network in boosting consumer confidence in electric vehicles. While countries like China have seen rapid adoption of electric vehicles due to widespread charging infrastructure (Yang & Xie, 2019), Indonesia faces a more gradual transition. To address this, the government must collaborate with the private sector to expand the network of charging stations, particularly in rural and less developed areas, to make electric vehicles a practical option for all consumers. In addition to infrastructure, consumer education and environmental awareness are key factors that could drive the adoption of electric vehicles. As noted by Morrissey, Weldon, and O'Mahony (2016), educating the public about the environmental and economic benefits of electric vehicles plays a pivotal role in changing consumer perceptions. This aligns with findings from the Indonesian Electric Vehicle Association (2021), which highlighted that public awareness campaigns could significantly increase the acceptance of electric vehicles, especially in urban centers where pollution is a major concern. In contrast, rural areas in Indonesia, where electric vehicles are still largely unknown, exhibit more resistance to adopting this technology. Strengthening these awareness campaigns and highlighting the long-term benefits of electric vehicles such as lower operational costs and less environmental impact will be crucial in shifting public opinion.

Finally, improving coordination between the government and the private sector is essential for implementing policies effectively. Existing subsidies and incentives must be better targeted to ensure they reach the appropriate consumer segments, particularly middle and lower-income groups. Additionally, fostering the development of a second-hand electric vehicle market could make this technology more accessible to a broader population, as seen in the UK’s efforts to create an affordable electric vehicles market through second hand car sales (Harris *et al*., 2020). A more integrated approach, where policy makers, businesses, and consumers collaborate, is needed to address the various barriers to electric vehicles adoption in Indonesia.

CONCLUSION

Adopting electric vehicles (EVs) in Indonesia represents a crucial step toward reducing greenhouse gas emissions and meeting national environmental goals. However, this research highlights that the widespread adoption of electric vehicles in Indonesia still faces several complex challenges. Key challenges include economic factors, infrastructure limitations, and the macroeconomic environment. While the Indonesian government has implemented

supportive policies, such as subsidies and tax incentives, the high initial cost of electric vehicles remains a significant barrier to adoption. These policies, particularly Presidential Regulation No. 55 of 2019, have had a positive impact, leading to an increase in the number of electric vehicles users, from 2,012 in 2020 to 7,679 in 2022. However, the cost of EVs continues to be a primary issue, particularly for consumers with lower purchasing power.

In addition to economic constraints, the development of charging infrastructure plays a critical role in driving electric vehicles adoption. As this study indicates, while urban centers like Jakarta and Bali have made progress in expanding charging stations, many areas outside these cities remain underserved. The limited availability of charging stations in rural and suburban areas exacerbates consumers' concerns about the practicality and convenience of owning electric vehicles, particularly due to range anxiety. The International Energy Agency (IEA, 2025) reports that globally, the number of charging points surpassed 5 million by 2024; however, Indonesia's infrastructure is still in its early stages. Therefore, expanding charging infrastructure to more remote areas is essential for increasing electric vehicle adoption across the country.

Moreover, technological advancements in charging infrastructure are vital to addressing consumer concerns about charging time and range anxiety. Innovations such as ultra-fast charging stations, as discussed by Wang *et al*., (2022), are essential in making electric vehicles more convenient and accessible, particularly in countries like Indonesia where long-distance travel is common. The development of such infrastructure not only mitigates the concerns of potential consumers but also provides a more reliable and efficient system for electric vehicle adoption. These findings highlight the need for a collaborative effort between the government, industry, and society to overcome existing barriers. The government can continue to expand subsidies and invest in charging infrastructure, while increasing public awareness about the long term benefits of electric vehicles, including reduced operational costs and lower environmental impacts. By strengthening policies, improving infrastructure, and ensuring effective implementation, Indonesia can accelerate the transition to greener transportation. This effort will not only help reduce carbon emissions but also improve air quality and contribute to global climate change mitigation.

Policy Recommendations

Based on the analysis conducted, several recommendations can be proposed to increase the adoption of electric vehicles in Indonesia. To accelerate the adoption of electric vehicles, the government must implement several strategic measures. Firstly, increasing financial incentives and subsidies is crucial to making electric vehicles more affordable for consumers.

Direct subsidies and tax reductions have proven effective in lowering the purchase cost and enhancing the appeal of electric vehicles. Secondly, significant investment in charging infrastructure is necessary to support the growing use of electric vehicles. Collaboration between the government and the private sector is essential to expand the charging station network, particularly in areas beyond major urban centers. Thirdly, public education and environmental awareness campaigns should be intensified to inform various segments of society about the long-term benefits of electric vehicles. Fourthly, better policy coordination is needed to ensure effective implementation, including improved cooperation between central and local governments and with the private sector, so that incentives and subsidies reach the appropriate target groups and foster an inclusive electric vehicle market. Lastly, investing in technological development and innovation, especially to reduce the cost of battery production can help lower the overall cost of electric vehicles and make them more accessible to a broader range of consumers.

The adoption of electric vehicles in Indonesia faces various challenges but also offers excellent opportunities to reduce greenhouse gas emissions and improve city air quality. Achieving the full potential of electric vehicles requires collaborative efforts from all stakeholders, including government, industry, and communities. By addressing the barriers and capitalizing on the opportunities, Indonesia can accelerate the transition to greener and more sustainable vehicles and achieve its environmental targets.

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