THE TRANSITION TO ELECTRIC VEHICLES FOR THE SUSTAINABLE FUTURE OF THE JAKARTA METROPOLITAN AREA

TRANSISI KENDARAAN LISTRIK UNTUK MASA DEPAN BERKELANJUTAN WILAYAH METROPOLITAN JAKARTA

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ABSTRAK

Pertumbuhan populasi global dan peningkatan transportasi berdampak signifikan terhadap emisi gas rumah kaca di Wilayah Metropolitan Jakarta. Pemerintah Provinsi DKI Jakarta telah menerapkan kebijakan untuk mendorong adopsi kendaraan listrik, namun pertumbuhan kendaraan listrik di Wilayah Metropolitan Jakarta masih menghadapi tantangan. Penelitian ini bertujuan untuk menyelidiki faktor psikologis dan sosial yang memengaruhi niat orang untuk beralih ke kendaraan listrik dan kontribusi mereka terhadap Tujuan Pembangunan Berkelanjutan (SDGs) di wilayah tersebut. Pendekatan kuantitatif diambil dengan menggunakan metode survei online pada 200 komunitas di Wilayah Metropolitan Jakarta dengan teknik pengambilan sampel *purposive sampling*. Penelitian ini memilih teknik analisis *Partial Least Square-Structural Equation Modeling* (PLS-SEM). Hasil analisis menunjukkan bahwa pengetahuan tentang kendaraan listrik dan kepedulian lingkungan berpengaruh positif signifikan terhadap norma subjektif, sikap, dan kontrol perilaku yang dirasakan. Ketiga pendorong psikologis tersebut memainkan peran dalam niat untuk beralih ke kendaraan listrik dan Kontribusi terhadap SDGs. Rekomendasi berfokus pada penguatan kebijakan fiskal transportasi, dukungan infrastruktur, dan perencanaan transportasi berkelanjutan di tingkat Jakarta Metropolitan dan nasional.

Kata kunci: Sikap, Pengetahuan Kendaraan Listrik, Kepedulian Lingkungan, Kontrol Perilaku yang Dirasakan, Norma Subjektif

ABSTRACT

Global population growth and improved transportation The Jakarta metropolitan area contributes significantly to greenhouse gas emissions. The DKI Jakarta Provincial Government has implemented policies to encourage the adoption of electric vehicles. However, the growth of electric vehicles in the Jakarta Metropolitan Area still needs to be improved. The study investigates the psychological and social factors influencing people's intention to switch to electric vehicles and their Contribution to the region's Sustainable Development Goals (SDGs). The quantitative approach was taken using an online survey method on 200 Jakarta metropolitan communities with a purposive sampling withdrawal technique. This study chose the Partial Least Square-Structural Equation Modeling (PLS-SEM) analysis technique. The analysis showed that electric vehicle knowledge and

environmental concern significantly positively affected subjective norms, attitudes and perceived behavioural control. These three psychological drivers found their role in the intention to switch to electric vehicles and SDGs Contribution. Recommendations focused on strengthening fiscal transportation policies, supporting infrastructure and sustainable transportation planning at metropolitan Jakarta and national scales.

Keywords: *Attitude, Electric Vehicle Knowledge, Environmental Concern, Perceived Behavioral Control, Subjective Norm*

INTRODUCTION

With global population growth over the past few decades and increased demand for personal transportation, the use of fossil fuels has also increased, resulting in increased greenhouse gas (GHG) emissions. There is a strong link between mobility and demand for personal transport and national income and level of development. As national incomes rise, vehicle ownership also rises, creating an unsustainable link between increased revenues and GHG emissions (Ghorbani et al., 2023; Wessel, 2020). Increased carbon emissions can harm air quality and contribute to rising global temperatures, global warming on Earth, and damage to natural ecosystems. Global warming occurs with a rate of temperature increase of about 0.15° C to 0.2° C per decade (Zhang et al., 2022).

The transportation sector is one of Indonesia's most significant contributors to emissions, especially in Jakarta. Based on data from the Ministry of Environment and Forestry (MoEF) in 2021, the transportation sector contributed around 23% of total national GHG emissions in 2021 (Firdaus, 2023). In Jakarta, the transportation sector accounts for about 44% of total emissions. The rapid growth in motor vehicles and the lack of adequate transportation infrastructure are significant triggers (Lestari et al., 2022). The sustainability of transportation is hindered by severe traffic congestion, forcing vehicles to operate at low speeds and increasing exhaust emissions (Fatmah, 2023). This condition makes the transportation sector the biggest challenge in Indonesia's Sustainable Development (SDGs) targets.

All countries, especially those that joined the G20 community after Indonesia took office, are building a vision for 2030 with a target of reducing greenhouse gas (GHG) emissions by at least 45% (Xu et al., 2021). Climate protection strategic plans, including GHG emission reductions at the local level and strategic management of energy supplies, are key factors attracting policymakers' attention in reducing fossil fuel consumption. Sustainable development policies are needed to balance climate, energy, and economic policies and create harmony in

economic, social, and environmental aspects to achieve this target. The scientist emphasized that most strategies to achieve sustainable transportation involve reducing fuel consumption in conventional motor vehicles, increasing the utilization of alternative fuels, promoting environmentally friendly vehicles, and developing alternative car technologies (Hailemariam & Erdiaw-Kwasie, 2023; Raihan et al., 2022; Syafrizal et al., 2016). In addition, the implementation of standards and the application of various types of taxes on fossil fuels and fossil fuel motor vehicles is expected to reduce the mobility of fossil fuel vehicles (Li & Wang, 2022).

Electric Vehicles are recognized as a potential solution to realize a sustainable transportation system and reduce the transportation industry's dependence on petroleum fuel and carbon emissions. Using electric vehicles can reduce carbon emissions by 30–50% and an increase in fuel efficiency of around 40–60% on average (Langbroek et al., 2019). Therefore, several countries, including the United States, China, and European Union countries such as Norway, the United Kingdom, and France, have implemented various financial policies to support and encourage the use of electric vehicles (Müller, 2019). They are also changing fuel economy regulations to create incentives for promoting and adopting electric vehicles. The advantages of electric cars involve various aspects, such as economic growth, consumption cost savings, ease of use, environmental sustainability, and energy security (Higueras-Castillo et al., 2023).

Indonesia has set a grand strategy to develop an electric car and electric vehicle (EV) battery ecosystem. This plan is explained in Presidential Regulation Number 55 of 2019 concerning the Acceleration of the Battery Electric Vehicle (BEV) Program for Road Transportation (Haryadi et al., 2023). The government also issued a regulation on providing subsidy assistance for purchasing Battery-Based Electric Motor Vehicles (BBEMV), namely electric motorcycles and electric cars, starting on March 20, 2023 (Yuniza et al., 2021). The purpose of this incentive is to accelerate the growth of the KBLBB industry in Indonesia. In addition, these acceleration efforts are directed at improving energy efficiency and security, as well as creating clean air and a friendly environment.

The DKI Jakarta Provincial Government responds to the existence of electric vehicles with various policies aimed at encouraging the use of electric vehicles and reducing emissions from the transportation sector. One of the policies developed is the Exemption of Motor

Vehicle Name Reverse Tax (MVNRT) for Electric vehicles following Governor Regulation Number 3 of 2020, the development of Electric vehicle charging infrastructure and the Exemption of the odd-even rule for Electric vehicles (Heryanto et al., 2020). The DKI Jakarta Provincial Government also encourages using electric vehicles in Metropolitan Jakarta's sustainable development planning. These efforts are realized in the DKI Jakarta Regional Medium Term Development Plan (RMTDP) 2022-2027, which targets 10% of total vehicles in Jakarta to use electric vehicles by 2027. (Dwiananto et al., 2022). The DKI Jakarta Provincial Government will continue to encourage the development of electric vehicles and their supporting infrastructure and increase public awareness of the importance of using electric vehicles.

The DKI Jakarta Provincial Government has implemented several strategic steps to encourage using electric vehicles in the Jakarta Metropolitan Area. These strategic steps are a form of implementation of the vision of DKI Jakarta Province as a sustainable cultural metropolitan epicentre by the DKI Jakarta Province RMTDP for 2023-2026. However, some evidence finds that the practice of electric vehicles in the Jakarta Metropolitan Area still needs to improve. Based on data from the Central Statistics Agency (CSA), in 2023, the number of electric vehicles in Indonesia will only reach 10,000 units. Of these, only about 1,000 units are in Jakarta (Eldiansyah & Suwarni, 2023). This condition is caused by many people who do not understand the benefits and advantages of using electric vehicles. This situation shows that the growth of electric vehicles in the Jakarta Metropolitan Area faces significant challenges that can potentially affect achieving sustainability targets. Therefore, a deeper understanding of the factors influencing the intention to switch to electric-based transportation is needed to guide the fleet electrification process. Research on factors influencing electric vehicle adoption is still limited to developed countries (Higueras-Castillo et al., 2023; Isik et al., 2021; Maybury et al., 2022). In addition, previous literature has tended to focus on the motivations behind the use of electric vehicles (Zhang et al., 2022); meanwhile, barriers that might prevent people from adopting electric vehicles are rarely explored. While critical, psychological perspectives on adopting electric vehicles or eco-friendly technologies have not been widely associated with contributing to the Sustainable Development Goals (SDGs). Research combining these two perspectives will provide a more comprehensive insight into the behavioural

factors underlying adoption decisions and the contribution of Jakarta's metropolitan community to the DKI Jakarta Provincial SDGs vision.

Behavioural Reasoning Theory (BRT) and Theory of Planned Behaviour (TPB) form the basis for explaining the adoption of electric vehicles in both developing and developed countries. SDGs are considered well-established and tested theories for evaluating the acceptability of technology with a focus on attitudes, subjective norms, and perceived behavioural control (Xu et al., 2022). BRT provides a behavioural framework similar to the SDGs but offers more profound insight into customer beliefs, reasons, global motives, intentions, and behaviours (Acikgoz et al., 2023). The advantages of using BRT involve a better understanding of the reasons for or against a behaviour. BRT also provides a more holistic interpretation of the cognitive processes behind reasoning, increasing understanding of human decision-making (Tufail et al., 2022). In addition, BRT highlights the role of values or beliefs in user reasoning, providing deeper insight into those factors in the context of electric vehicle acceptance (Chatterjee et al., 2022).

In improving attitudes, subjective norms, and perceived behavioural control towards adopting electric vehicle

technology, variables of knowledge and environmental concern play a key role. A good knowledge of electric vehicles can increase a positive attitude towards the technology (Chuang et al., 2020). A deeper understanding of environmental impacts can strengthen sustainability concerns (Nanggong & Rahmatia, 2019). High knowledge can form positive subjective norms through social influences and recommendations from the surrounding environment. Environmental concern plays an important role in shaping positive attitudes and subjective norms, as increased awareness of environmental issues encourages supportive social norms (Roh et al., 2022). Meanwhile, understanding environmental concerns can also strengthen perceived behavioural control, as people tend to feel more capable and accountable for their actions in support of sustainability, thus encouraging the adoption of electric vehicles (Li et al., 2020).

This research also highlights concern for the vision of Sustainable Development Goals (SDGs) as a crucial factor. This concern includes public awareness of sustainable development goals, support for implementation solutions, and emotional reactions to issues related to the SDGs (Perwitasari, 2023). This research outlines the role of concern for achieving sustainable development goals in

consumer decision-making regarding environmentally friendly products, including electric vehicles, from a comprehensive perspective towards the SDGs vision (Ebolor et al., 2022). This understanding is expected to help design effective strategies to increase the adoption of technologies that support the SDGs. By emphasizing the role of concern for the SDGs' vision, this study aims to strengthen the relationship between public awareness, support for sustainable solutions, and emotional responses to SDGs issues to achieve wider acceptance of environmentally friendly products such as electric vehicles.

The study above aims to investigate the behavioural reasoning process of the Metropolitan Jakarta community regarding the transition of transportation modes to electric vehicles and the contribution of SDGs. This study explores the determinants of intention factors to switch from conventional oil-fueled to electric vehicles with a single theoretical framework and integrates the investigation of SDGs contributions. The study provides in-depth insight into the psychological and social factors that motivate or hinder people's intention to adopt electric-based vehicles by analyzing subjective perceptions, attitudes, and norms related to vehicle adoption. In addition, this study also evaluates the extent to which the

adoption of electric vehicles can positively contribute to achieving SDG targets in the Jakarta Metropolitan area. Thus, the results of this study are expected to provide valuable guidance for sustainable transportation policies and support the SDGs vision of DKI Jakarta Province. Check the appropriate writing style for the references.

RESEARCH METHODOLOGY

The study chose a survey-based quantitative approach to examine antecedents of intention to switch to electric vehicles. This study focuses on the DKI Jakarta Prov ince area as a research location, considering the complexity of mobility and the high population density. This choice provides relevant context for analysing the changing dynamics of vehicle preferences towards eco-friendly options. The literature review results form a proposed research model in Figure 1.

The questionnaire was developed in three main parts: introduction, main questionnaire, and research demographic questionnaire. The main research questionnaire items were developed from previous research. Variable Electric Knowledge (5 Items) and Environmental Concern (4 Items) were adapted from previous research (Arend et al., 2019; Huang et al., 2021; Nguyen-Phuoc et al., 2023). Variabel Subjective Norm (3 Item),

Attitude (3 Item), and Perceived Behavioral Control (3 Item) were obtained from some literature of Sharda et al. (2024), Uhrich (2022), and Zhu et al. (2023). Intention to Switch was developed as many as three from the research of Nguyen-Phuoc et al. (2023). Finally, SDG's Contribution of as many as 7 Items came from Burton & Salama (2023) and Chaudhary (2023) research. Figure 1 is a proposed research model with 12 research hypothesis paths.

People in Jakarta Metropolitan Areas (Central Jakarta, West Jakarta, East Jakarta, South Jakarta, and North Jakarta) who still need to own electric vehicles are selected as the population. Purposive sampling techniques are chosen for research that requires participation from communities or groups that understand
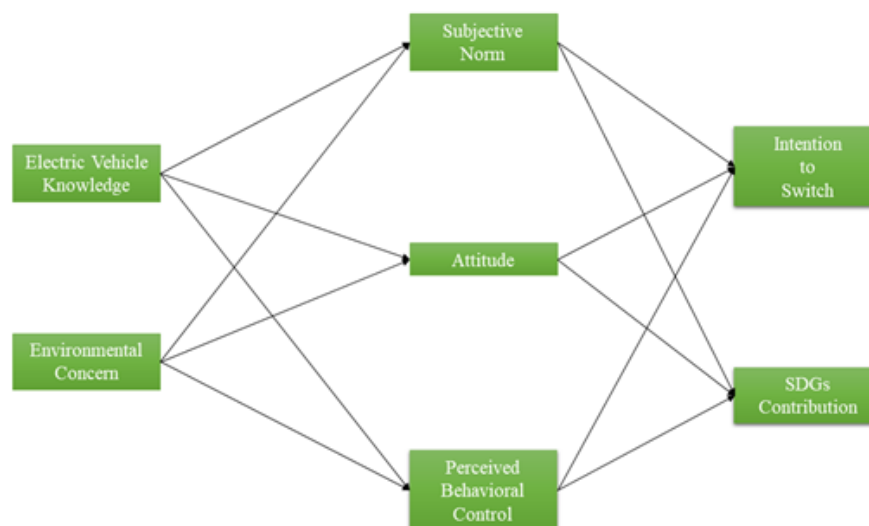

Figure 1. Research Model

Hypothesis paths:
H1: Electric vehicle knowledge has a significant positive effect on subjective norm
H2: Electric vehicle knowledge has a significant positive effect on attitude
H3: Electric vehicle knowledge has a significant positive effect on perceived behavioural control
H4: Environmental concern has a significant positive effect on subjective norm
H5: Environmental concern has a significant positive effect on attitude
H6: Environmental concern has a significant positive effect on perceived behavioural control
H7: Subjective norm has a significant positive effect on the intention to switch
H8: Subjective norm has a significant positive effect on SDGs Contribution
H9: Attitude has a significant positive effect on the intention to switch
H10: Attitude has a significant positive effect on SDGs Contribution
H11: Perceived Behavioral Control has a significant positive effect on the intention to switch
H12: Perceived Behavioral Control has a significant positive effect on SDG contribution

electric vehicles and are effective with a vast population position. The criteria set by the research team on respondents are that they are over 20 years old, have a driver's license (SIM), and have a permanent job with a minimum income of Rp. 5,067,381 or UMR DKI Jakarta Province. The basis for setting criteria is adjusted to the respondents' ability to buy electric vehicles in the future, using both instalment and cash purchase schemes. According to the opinion, the minimum sample that researchers need to achieve is five times the total indicator of 28 items (Hair et al., 2019), so the minimum sample needed is 140 respondents.

The data collection process is online using Google Forms to validate the research model and hypotheses developed. The questionnaire was distributed through the research team's social media and direct field visits. The research was conducted for two months, from December 2023 to January 2024. This study chose the Structural Equation Modelling-Partial Least Square Analysis (SEM-PLS) technique to test complex causal relationship models, including models with nonlinear relationships. In addition, SEM-PLS does not require the assumption of data normality, so it is more practical to use data that is not normally distributed (Sarstedt et al., 2019). Data researchers cause this condition obtained from surveys with heterogeneous respondents. SEM-PLS has more diverse goodness-of-fit measures than other data analysis techniques (Afthanorhan et al., 2021). The SEM-PLS analysis procedure using the SmartPLS Version 3 application starts with the Measurement Outer Model, which evaluates the validity and reliability of the indicators. Then, path analysis is carried out at the Inner Model Structural stage to test the relationship between latent variables. Bootstrapping testing is used to measure statistical significance. This process includes an iterative model refinement stage (Purwanto & Sudargini, 2021).

RESULTS AND DISCUSSIONS
Characteristics of Respondents

The data collection process from December 10, 2023, to January 10, 2024, received 200 participants from the Jakarta metropolitan community. Most respondents were men (72%), with most

Table 1. Characteristics of Respondents

Characteristic	Total	%	Characteristic	Total	%
Gender			*Education Level*		
Male	145	72%	Senior High School	37	18%
Female	55	28%	Bachelor/Diploma	100	50%
Age			Master's degree/PhD	63	32%
21-25 Year Old	35	17%	*Occupation*		
26-30 Year Old	49	24%	Full-Time Employee	110	55%
31-35 Year Old	63	32%	Part-Time Employee	90	45%
36-40 Year Old	22	11%	*Income*		
41-45 Year Old	11	6%	< Rp. 5.000.000	23	11%
>45 Year Old	20	10%	Rp. 5.000.001-Rp. 10.000.000	54	27%
Metropolitan Demographics			Rp. 10.000.001-Rp. 20.000.000	49	24%
Central Jakarta	104	52%	Rp. 20.000.001-Rp.30.000.000	40	20%
South Jakarta	58	29%	Rp. 30.000.001-Rp. 40.000.000	11	6%
West Jakarta	5	2%	Rp.40.000.001-Rp.50.000.000	9	5%
East Jakarta	20	10%	< Rp. 50.000.000	14	7%
North Jakarta	13	7%			

aged 31-35 (32%). Most respondents came from Central Jakarta (52%), followed by South Jakarta (29%).

Educationally, most respondents have a bachelor's degree/diploma (50%), followed by a master's/doctorate (32%), and the rest are high school graduates (18%). The majority of the respondents are full-time employees (55%). In terms of income, the majority are in the range of Rp. 5,000,001-Rp. 20,000,000, with 27% having an Rp income. 5,000,001-Rp. 10,000,000 and 24% in the range of Rp. 10,000,001-Rp. 20,000,000. Table 1 conveys the results of further data tabulation.

Measurement Outer Model

Before testing the significance of the hypothesis, it is necessary to evaluate the reliability and validity of the construct in the measurement outer model stage. Convergence and differentiation are the main focus of validity tests.. Convergent validity checks whether the latent construct indicator reflects that construct with a loading factor value above 0.7 (Chan & Lay, 2018). Average Variant Extracted (AVE) values are also supported with a minimum value of 0.5 (Afthanorhan et al., 2020). In Table 2, the outer loadings value of each variable indicator is above 0.7, and the AVE value of this research variable is above 0.5 so that convergent validity is successfully achieved.

In reliability tests, attention is paid to Composite Reliability (CR), which should be above 0.6, indicating the degree of consistency of the latent construct. In addition, a Cronbach's alpha (α) value above 0.7 signifies adequate reliability (Becker et al., 2023). The test results in

Table 2. Outer Model: Construct Validity and Reliability

Variable	Outer Loadings	AVE	CA	CR
Electric Vehicle Knowledge		0.561	0.798	0.863
EVK1- I have a good knowledge of how electric vehicles operate	0.771			
EVK2- I know the different types of electric vehicles available on the market today	0.881			
EVK3- I am able to identify the environmental benefits that electric vehicles have compared to conventional vehicles	0.814			
EVK4- I understand how electric vehicle charging is done and regulated	0.828			
EVK5- I know about government incentives and programs that support the use of electric vehicles in Jakarta	0.818			
Environmental Concern		0.750	0.889	0.923
EC1- I care about the environmental impact of using electric vehicles	0.866			
EC2- I believe that switching to electric vehicles can help reduce air pollution in Jakarta	0.791			
EC3- The availability of electric vehicle charging infrastructure in Jakarta is a major factor in raising my environmental awareness	0.880			
EC4- I am willing to pay more for an electric vehicle to support environmental conservation efforts in the city of Jakarta	0.820			
Subjective Norm		0.782	0.860	0.915
SN1- Using electric vehicles is an accepted action by the community	0.769			
SN2- My family and friends support the use of electric vehicles	0.798			
SN3- Social norms of society encourage the use of electric vehicles as an environmentally friendly option	0.786			
Attitude		0.781	0.858	0.914
AT1- I am convinced that the use of electric vehicles can help reduce air pollution levels	0.921			
AT2- I feel that electric vehicles are a more environmentally friendly option than conventional fuel vehicles	0.726			
AT3- I am willing to consider using an electric vehicle as an alternative to my vehicle	0.804			
Perceived Behavioral Control		0.782	0.860	0.915
PBC1- I feel I have enough knowledge and skills to use electric vehicles	0.885			
PBC2- I am confident that I can overcome the technical obstacles that may arise when using electric vehicles	0.894			
PBC3- I feel I have control over the factors that influence the decision to switch to electric vehicles	0.873			
Intention to Switch		0.802	0.876	0.924
ITS1- I will switch to electric vehicles in the next two years	0.923			
ITS2- I feel interested in using electric vehicles as an alternative to conventional motor vehicles	0.799			
ITS3- I believe that the use of electric vehicles can have a positive impact on the environment	0.735			
SDGs Contribution		0.556	0.846	0.896
SDGs1- Electric vehicles can help reduce greenhouse gas emissions and support climate change mitigation efforts	0.708			
SDGs2- The use of electric vehicles can reduce air pollution in cities, improve air quality, and have a positive impact on public health	0.809			
SDGs3- Electric vehicles can help reduce dependence on fossil energy sources, support renewable energy sources, and improve energy sustainability	0.836			
SDGs4- The provision of electric vehicle charging infrastructure in Jakarta can improve accessibility and support the adoption of electric vehicles among the community	0.828			
SDGs5- The use of electric vehicles can help reduce noise levels in cities, create quieter environments, and have a positive impact on people's well-being	0.715			
SDGs6- Adoption of electric vehicles in Jakarta can create new jobs and support sustainable economic growth	0.773			
SDGs7- Increasing the number of electric vehicles in Jakarta can be a strategic step to achieve sustainable development targets (SDGs) related to transportation and the environment	0.757			

Table 2 show that all variables have obtained CA and CR values above the minimum criteria or achieved good reliability.

Discriminant validity measures the extent to which different latent constructs can be distinguished. Dissentinant validity tests are important to ensure that the latent constructs measured in the study have different meanings (Sarstedt et al., 2022). There are two criteria for discriminant validity HTMT.

Heterotrait-Monotrait (HTMT) criterion measures the validity of the

Table 3. Outer Model: Heterotrait-Monotrait (HTMT)

	AT	EVK	EC	ITS	PBC	SDGs	SN
AT							
EVK	0.697						
EC	0.413	0.709					
ITS	0.404	0.708	0.709				
PBC	0.458	0.687	0.747	0.751			
SDGs	0.700	0.756	0.717	0.798	0.711		
SN	0.538	0.759	0.770	0.795	0.708	0.754	

Table 4. R-Squared Test Results

	R-Squared	Adjusted R-Squared
Attitude	0.701	0.705
Intention to Switch	0.772	0.770
Perceived Behavioral Control	0.888	0.887
SDGs Contribution	0.962	0.962
Subjective Norm	0.723	0.721

disshipment by comparing the extraction variance ratio (AVE) of each latent construct with the total variance of that latent construct. HTMT criteria have threshold values that can be used as a reference in assessing convergent validity and differentiation. Generally, HTMT values less than 0.85 support the validity of differentiation between constructs, while higher HTMT values indicate overlap between constructs (Roemer et al., 2021). The test results in Table 3 show that there is no HTMT value above 0.85, so it can be concluded that the validity of the discriminant has been achieved.

Inner Model Structural

The inner structural model process is essential to the Structural Equation Modeling (SEM). Its function is to assess the relationship between latent variables in a model by calculating the values of structural path coefficients. The Bootstrapping 5000 resampling method can be used to obtain structural model estimates. Performance assessment of structural models can be done through evaluation using R-squared and the significance of hypothesis paths (Streukens & Leroi-Werelds, 2016).

R-square can measure how much a latent dependent variable can explain variation in the latent dependent variable. A high R-squared value indicates that the independent latent variable significantly impacts the latent bound variable. According to Ozili (2023), the R-squared criterion is used to assess the extent to which the model can explain the variation of the dependent variable (Ozili, 2023). When the R-squared > 0.67, it is considered strong, signalling that the model effectively explains the high variability. The model can explain most variation if $0.33 < $ R-Squared $ < 0.67$, categorised as

Table 5. Hypothesis Testing Results

Hypothesis	Path Coeffi-cient	t-test	p-value	Decision
Electric Vehicle Knowledge → Subjective Norm	0.305	6,782	0.000	Accepted
Electric Vehicle Knowledge → Attitude	1.099	27,877	0.000	Accepted
Electric Vehicle Knowledge → Perceived Behavioral Control	0.714	32,441	0.000	Accepted
Environmental Concern → Subjective Norm	0.526	11,827	0.000	Accepted
Environmental Concern → Attitude	0.501	9,098	0.000	Accepted
Environmental Concern → Perceived Behavioral Control	0.270	11,058	0.000	Accepted
Subjective Norm → Intention to Switch	0.415	11,216	0.000	Accepted
Subjective Norm → SDGs Contribution	0.651	31,905	0.000	Accepted
Attitude → Intention to Switch	0.067	2,780	0.000	Accepted
Attitude → SDGs Contribution	0.276	16,806	0.000	Accepted
Perceived Behavioral Control → Intention to Switch	0.567	15,517	0.000	Accepted
Perceived Behavioral Control → SDGs Contribution	0.219	10,875	0.000	Accepted

moderate. An R-squared < 0.33 is considered weak, indicating that the model has limitations in explaining data variation. The results of the R-squared test in Table 4 show that the variable "SDGs Contribution" has the highest R-squared (0.962), indicating that the independent variable can explain the large variability in the dependent variable. "Perceived Behavioral Control" and "Intention to Switch" also had high R-Squares (0.888 and 0.772), indicating significant impacts on related variables. The overall result of the dependent variable is above 0.67, showing a good explanation of variability in the dependent variable, corresponding to a relatively high R-squared value and a consistent Adjusted R-squared.

Hypothesis testing in the PLS-SEM analysis technique involves testing the significance of the structural path coefficient. A significant structural path coefficient indicates a causal relationship between these latent variables. The general criteria for accepting or rejecting hypotheses in SEM PLS are positively charged path values, a minimum t-test of 1.96 and a maximum p-value of 0.05 (Hair et al., 2019).

The hypothesis testing results show that all model relationship path variables are accepted. Electric Vehicle Knowledge had a significant positive impact on Subjective Norm (0.305), Attitude (1.099), and Perceived Behavioral Control (0.714). Environmental Concern also had a significant positive effect on Subjective Norm (0.526), Attitude (0.501), and Perceived Behavioral Control (0.270). In addition, Subjective Norm, Attitude, and Perceived Behavioral Control contribute

positively and significantly to the Intention to Switch and SDGs Contribution, respectively. Based on the t-test score, the strongest relationship is shown between Subjective Norm and SDGs Contribution (t-test = 31.905), followed by Electric Vehicle Knowledge and Attitude relationship (t-test = 27.877). Both relationships show a significant and strong impact on the model.

Discussion

Electric vehicle knowledge has an important role in improving the subjective Norms of Jakarta society. In this context, a path coefficient value of 0.305 with a t-test of 6.782 and a p-value of 0.000 indicates that knowledge of electric vehicles significantly contributes to forming subjective norms. The acceptance of the first hypothesis is in line with previous studies that mention the crucial role of knowledge in strengthening concern for environmentally friendly technology products (Kowalska-Pyzalska et al., 2021; Liguo et al., 2023; Roh et al., 2022; H. Zhang et al., 2023). Increasing knowledge about electric vehicles can create a better understanding among the people of Jakarta, encouraging the formation of positive norms related to electric vehicles. These norms may include a positive view of environmental sustainability, reduction of greenhouse gas emissions, and support

for government policies regarding environmentally friendly vehicles. Thus, Electric Vehicle Knowledge acts as technical knowledge and a driver of normative change in society, accelerating the acceptance and adoption of electric vehicles in Jakarta.

Electric Vehicle Knowledge is crucial in improving Jakartans' attitudes towards electric vehicles. The acceptance of the second hypothesis suggests that the higher the knowledge about electric vehicles, the more positive people's attitudes towards them. This positive impact is reflected in the high path coefficient value of 1.099, tested for significance with a t-test of 27.877 (p-value = 0.000), indicating that the relationship between electric vehicle knowledge and attitude is very significant.

These results align with previous studies that found the role of knowledge in improving attitudes towards eco-friendly technology products (Gautam, 2022; Westerhof et al., 2023). In-depth knowledge can shape positive perceptions of electric vehicles, including understanding their environmental and sustainability benefits. Attitude predisposes a person to respond positively or negatively to an object or situation.

Knowledge about electric vehicles can improve the positive attitude of Jakartans towards electric vehicles in two

ways. First, knowledge about electric vehicles can increase Jakartans' awareness of the benefits of using electric vehicles. Awareness of these benefits can make the people of Jakarta feel that using electric vehicles is beneficial. This situation can increase the positive attitude of the people of Jakarta towards electric vehicles. Secondly, knowledge about electric vehicles can increase the confidence of the people of Jakarta in using electric vehicles. When Jakartans have a good knowledge of how electric vehicles work, they will feel more confident about using electric vehicles.

Knowledge about electric vehicles has an important role in improving the perceived behavioural control of the people of Jakarta. The results of testing the third hypothesis showed a positive and significant relationship between Electric Vehicle Knowledge and Perceived Behavioral Control (0.714; t-test = 32.441; p-value = 0.000). The results indicate that the higher the level of knowledge of the people of Jakarta about electric vehicles, the stronger their perception of behavioural control related to the use of electric vehicles.

These results align with the literature that finds an understanding of the function of environmentally friendly technology innovation in creating behavioural control (Dudenhöffer, 2013). With a better understanding of the technology and benefits of electric vehicles, people can feel more confident and able to adopt environmentally friendly behaviours. Information related to energy efficiency, greenhouse gas emission reduction, and charging infrastructure will help increase public awareness and understanding of environmental sustainability. That way, Jakarta will find it easier to control its transportation choices, increasing the tendency to switch to electric vehicles. The perception that using electric vehicles is a step that can be easily overcome will reduce community resistance to behaviour change, creating an environment that supports adopting environmentally friendly vehicles in the Jakarta Metropolitan Area.

The environmental concern of the people of Jakarta has an important role in improving subjective norms related to electric vehicles. The acceptance of this fourth hypothesis is reflected in the positive and significant path coefficient between environmental concern and subjective norm (0.526). This result aligns with previous studies that found public concern about green environmental issues can increase the subjective norm of environmental technology products (Ashraf, 2023; Sajjad et al., 2020). People who care about the environment, green and sustainability tend to form positive views

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and subjective norms that support the use of electric vehicles. Thus, increasing environmental awareness in Jakarta can be a key driver in shaping social norms that support the transition to electric vehicles, positively contributing to efforts to protect the environment and adapt to sustainable transportation solutions.

The results of the fifth hypothesis test show that the environmental concerns of the people of Jakarta have an important role in improving subjective norms regarding electric vehicles. A significant relationship between environmental concern and attitude (0.501) confirms that the higher the environmental concern, the more positive people's attitudes towards electric vehicles. These results align with previous studies that shed light on the relationship between environmental concerns and attitudes toward adopting battery vehicle technology by Koreans (Ju & Hun Kim, 2022).

High concern over environmental issues plays a key role in shaping positive attitudes towards electric vehicles. Awareness of the environmental benefits of electric vehicles, such as low emissions, triggered a positive response and improved public perception of the technology. Therefore, through increasing environmental concern, the people of Jakarta can play an active role in changing their attitude towards electric vehicles,

encouraging the adoption of environmentally friendly technologies, and contributing to global efforts to reduce the impact of transportation on the environment.

Perceived behavioural control is a person's perception of the ease or difficulty of certain behaviours. Perceived behavioural control can be influenced by various factors, one of which is a concern for the environment, as conveyed by previous research (Fang et al., 2023; Wu et al., 2019). The results of hypothesis testing show that environmental concern has a positive and significant relationship with perceived behavioural control of electric vehicles (0.270).

The higher the concern for the environment, the greater the community's feeling of control towards using electric vehicles. Concern for the negative impact of conventional transportation on the environment can encourage the people of Jakarta to feel more empowered to adopt electric vehicles as a more environmentally friendly alternative. This factor creates confidence that society has the ability and control to change its transportation behaviour towards more sustainable options.

With the increase in perceived behavioural control, Jakarta can feel more comfortable and able to overcome obstacles related to electric vehicles, such

as the availability of charging infrastructure and costs. Therefore, environmental concern is not only a moral impetus for change but also plays an important role in increasing people's confidence and ability to adopt electric vehicles as part of their daily transportation choices.

The results of testing the seventh hypothesis show that subjective norm significantly affects the intention to switch, namely, a person's intention to switch from conventional to electric vehicles. As the centre of urbanisation and high mobility, Jakarta pays great attention to environmental and sustainability issues. If society's subjective norms support using electric vehicles as an environmentally friendly alternative, society will likely have a stronger intention to switch. The importance of positive perceptions of the social environment related to electric vehicles can influence society to adopt the technology.

Suppose the people of Jakarta collectively appreciate sustainability and attach importance to using electric vehicles. In that case, this will motivate people to have greater intentions to switch to electric vehicles as their transportation option. In other words, positive subjective norms towards electric vehicles in Jakarta can strongly influence people's intentions to switch to more sustainable and environmentally friendly transportation technologies.

On the other hand, this study accepts the eighth hypothesis, which means the subjective norm of Jakarta society regarding electric vehicles impacts the SDGs' contribution. Suppose the people of Jakarta collectively support using electric vehicles as a positive norm. In that case, this will positively contribute to the SDGs related to the environment, especially SDG 7 (Clean and Affordable Energy) and SDG 13 (Action on Climate Change). Widespread acceptance of electric vehicles could reduce greenhouse gas emissions and reliance on fossil fuels, supporting efforts to achieve sustainable development goals focused on environmental protection and sustainable energy.

Next, testing the ninth and tenth hypotheses shows that attitude significantly affects the intention to switch to electric vehicles and the SDGs' contribution. Attitude is a predisposition to react positively or negatively to an object. In the context of using electric vehicles, attitude can be interpreted as a person's perception of electric vehicles, both positive and negative.

Environmental concerns, energy efficiency, and operational costs can shape positive attitudes toward electric vehicles. Suppose society considers electric vehicles an environmentally friendly solution that

can reduce air pollution and dependence on fossil fuels. In that case, This positive attitude can be a key driver in forming the intention to switch. In addition, government policies that support electric vehicles and adequate infrastructure can also influence people's attitudes.

On the other hand, the attitude of the people of Jakarta towards electric vehicles impacts the SDG's contribution. When Jakartans have a positive attitude towards electric vehicles, this can contribute directly to several related SDGs. First, electric vehicles can support SDG 7 (Clean and Affordable Energy) by reducing dependence on fossil energy and stimulating the transition to cleaner energy sources. In addition, increasing the use of electric vehicles also supports SDG 13 (Action on Climate Change) by reducing greenhouse gas emissions and responding to climate change issues. A positive attitude towards electric vehicles creates greater demand, drives innovation, and shapes markets for green technologies, all contributing to achieving environment-related SDGs.

Finally, testing the tenth and eleventh hypotheses results show that perceived behavioural control significantly affects the intention to switch to electric vehicles and SDGs contribution. Perceived behavioural control factors include the perceived ease and constraints of using electric vehicles. If people feel that using electric vehicles is easy, affordable, and practical, they tend to have a stronger intention to make the switch. Aspects of charging infrastructure availability, operational costs, and understanding of electric vehicle technology can influence perceptions of behavioural control. Suppose Jakarta people feel that they can easily access charging. In that case, the operational costs are affordable, and they understand how electric vehicles work, which can increase their intention to make the switch. Thus, creating a positive perception of behavioural control, where people can overcome possible obstacles, can be a key factor in stimulating interest and desire to switch to electric vehicles in Jakarta.

On the other hand, Jakarta's increased perceived behavioural control of electric vehicles could accelerate the transition to sustainable transportation. With improved charging infrastructure, fiscal incentives, and public education, Jakartans can be more confident and adopt electric vehicles. This awareness creates energy efficiency and reduces carbon emissions, supports sustainable mobility, and contributes positively to achieving sustainable development goals at the metropolitan level.

CONCLUSION AND RECOMMENDATION

Conclusion

This research highlights the crucial role of Electric Vehicle Knowledge in shaping subjective norms, attitudes, and perceived behavioural control of Jakarta people towards electric vehicles. The results show that increased knowledge of electric vehicles significantly contributed to forming positive subjective norms. In addition, this knowledge also influences the attitude of the people of Jakarta towards electric vehicles, with significant positive effects.

A better understanding of electric vehicle technology and its benefits increases awareness and confidence, motivating electric vehicle adoption. Furthermore, the research highlights the role of environmental concern in improving subjective norms, attitudes, and perceived behavioural control.

Awareness of environmental issues in Jakarta was identified as a key driver in shaping subjective norms that support the transition to electric vehicles. It also influences positive attitudes towards electric vehicles, which creates a positive perception of behavioural control. Finally, the results show that subjective norms and perceived behavioural control significantly influenced the intention to switch to electric vehicles and contributed positively to the environment-related Sustainable Development Goals (SDGs) at the metropolitan level of Jakarta. The study finds a central point of environmental knowledge and awareness in stimulating the adoption of electric vehicles, creating a society that supports sustainable transportation, and contributing to sustainable development goals.

This research has significant theoretical implications for electric vehicle adoption in Jakarta society. The finding that knowledge about electric vehicles positively influences people's subjective norms and attitudes highlights the important role of technological literacy in shaping transportation preferences.

In addition, environmental awareness is identified as a key factor in shaping subjective norms supporting the transition to electric vehicles, suggesting that sustainability aspects play a central role in transportation decision-making. These results provide important insights into how introducing technology and attention to environmental issues can motivate the adoption of electric vehicles.

Furthermore, the linkage between subjective norms, perceived behavioural control, and intention to switch to electric vehicles provides a strong theoretical foundation to support the successful implementation of environment-related Sustainable Development Goals (SDGs) in

the Jakarta metropolitan area. The study details crucial factors that could shape people's behaviour regarding electric vehicles and provides a valuable theoretical foundation for advanced research in sustainable mobility.

Recommendation

The research results have managerial implications for various parties involved in adopting electric vehicles on Jakarta's metropolitan scale. Based on the study results, recommendations for the DKI Jakarta Provincial Government can be focused on three main aspects: increasing Electric Vehicle Knowledge, increasing Environmental Awareness, and actively supporting the adoption of electric vehicles.

Firstly, efforts must be made to increase Electric Vehicle Knowledge through education and socialisation programs for the general public and related stakeholders. Campaigns can be carried out through various media, such as mass media, social media, and public activities. Education can cover various aspects, ranging from the environmental impact of conventional motor vehicles to the benefits of electric vehicles for the environment.

Secondly, the government can strengthen environmental awareness by intensifying programs highlighting environmental issues in Jakarta. The programs can involve public campaigns, environmental education activities, and incentives for sustainable practices. Support for environmental sustainability in Jakarta can shape positive subjective norms regarding electric vehicles.

Thirdly, real efforts need to be made to support the adoption of electric vehicles. Such support could include fiscal incentives, the provision of adequate Public Electric Vehicle Charging Stations (PEVCS), the development of electric vehicle public transport and regulations that support the use of electric vehicles. Governments can engage stakeholders, including the private sector, to create an environment that supports and encourages the adoption of electric vehicles.

The Indonesian Ministry of Transportation and the Ministry of National Development Planning / Bappenas need to reformulate transportation policies, focusing on local government involvement in increasing the volume of electric vehicles and electric charging infrastructure. Fiscal incentives and electric motor vehicle assistance for the MSME business sector and the public want to avoid cross-subsidy schemes.

The government must also consider developing environmental policies that encourage automotive companies to produce environmentally friendly vehicles with tax incentives or other financial

support. Urban transportation governance planning in Indonesia must be directed in line with the principle of a smart, sustainable city to support the sustainable development goals (SDGs).

This study has presented significant findings related to the role of electric vehicle knowledge and environmental concern in shaping subjective norms, attitudes, and perceived behavioural control of the people of Jakarta towards electric vehicles. However, this study has some limitations, including generalising the findings, which can only be made to the tested population (Jakarta community) and may not directly apply to other populations and other regional representations with different socioeconomic situations. Future research needs to focus on expanding studies of electric vehicle adoption nationally and in comparison with developed countries.

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