JURNAL LOCUS: Penelitian & Pengabdian
Volume 4 No. 4 April 2025
E-ISSN 2829-7334| P-ISSN 2829-5439
Hompage: https://locus.rivierapublishing.id/index.php/jl

Switching Intention of Electric Vehicle in Indonesia

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Abstract:
The transition from fossil fuel vehicles to electric vehicles (EVs) in Indonesia is critical for reducing emissions and achieving sustainable transportation. Despite government support through policies like Presidential Regulation No. 55/2019, EV adoption remains low due to challenges such as high costs, limited infrastructure, and consumer hesitancy. This study investigates the factors influencing switching intentions to EVs in Indonesia, employing the push-pull-mooring (PPM) framework to analyze environmental concern, cost concern, perceived usefulness, financial incentives, and infrastructure readiness. Using a mixed-methods approach, the research collected data from 136 respondents in Greater Jakarta through structured questionnaires, analyzed via Partial Least Squares Structural Equation Modeling (PLS-SEM). Findings revealed that environmental concern, cost concern, and perceived usefulness significantly positively influence switching intentions, while financial incentives showed limited impact. Surprisingly, infrastructure readiness did not significantly moderate these relationships, suggesting other barriers may hinder adoption. The study contributes theoretically by adapting the PPM model to EV adoption, identifying cost concern as a push factor and financial incentives as a pull factor. Practically, it highlights the need for targeted policies, such as enhanced public awareness campaigns and improved charging infrastructure, to accelerate EV uptake. Future research should explore additional moderators like socio-cultural influences and adopt longitudinal designs to track evolving consumer behavior. This research provides valuable insights for policymakers, industry stakeholders, and researchers aiming to foster EV adoption in emerging markets like Indonesia.

Keywords: *electric vehicles; switching intention; push-pull-mooring model; Indonesia; sustainable transportation*

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INTRODUCTION

The history of Electric Vehicles (EVs) in the world have been around since the mid-1830s and early 20th century, where widely used in the United States (Milad Haghani et al., 2023). The electric car was first invented by Thomas Parker in 1884 (Xiaoli Sun et al., 2020) followed by the manufacture of the first electric car, namely by Ferdinand Porsche which was produced in Germany in 1899. New Energy Vehicles (NEV) in China (Yaoming Lie, 2018) refers to four-wheeled vehicles that use non-traditional fuels (bioethanol, biogas, dan biodiesel), including battery electric vehicles, plug-in hybrid vehicles, and fuel cell vehicles, thus contributing to the goals of transportation policy, such as improving energy safety, improve air quality, and the reduction of greenhouse gas emissions. The EV growing at the end of World War I has lost interest compared to Internal Combustion Engine (ICE) vehicles and

disappeared from the market (Hoyer, 2008). Though the EV minimizes pollution and smokes, and found a better version of the ICE due to its lighter weight and better performance in terms of acceleration (Madhav Sai, 2022). Effective use of power for regenerative braking has considerable advantages among vehicles in the market.

Electric vehicles can be easily charged either from local charging stations or homes and conserve limited fossil fuels. Electric vehicles will not be affected even if the fuel supply is disrupted or the cost of fuel increases suddenly. (R.p. Eldho and Dr. K. Deepa, 2020). While some factors contribute to the success of ICE vehicles, from the limited range and expensive batteries in EVs, are the major contributors. (Duarte et al., 2021; Patil et al., 2022). These two headwinds have continued to hinder EVs from gaining real market breakthroughs for decades (Chakraborty et al., 2020). Currently, Indonesia has entered a transition period from vehicles that use fossil fuels to vehicles that use electric materials. We can see this from the many sales of electric vehicles, both cars and motorcycles, in Indonesia and every infrastructure has been and continues to be run. The existence of this electric vehicle has received support from the government since 2019 as stated in Presidential Regulation (Keputusan Presiden) No. 55 of 2019 for the Acceleration of the Battery Electric Vehicle (BEV) Program, especially for transportation on the road. In regulation of Permenperin Nomor 27-year 2020 regarding technical specifications, EV Roadmap and Domestic Local Content Level (Tingkat Komponen Dalam Negeri - TKDN) calculation, the government has also set a roadmap for the development of the electric vehicle industry. In that plan, the government has also prepared a National Industrial Development Plan (Rencana Pengembangan Industri Nasional - RIPIN), where the priority for the development of the automotive industry for the period year 2020 – 2035 is the growing of EV and its main components, such as batteries, electric motors and inverters. In fact, Indonesia is expected to become one of the centers of the EV industry in the world.

Data from Central Statistics Association (Badan Pusat Statistik - BPS, February 29, 2024), the development of the use of fossil fuel motor vehicles in Indonesia from 2019-2022, with a total figure per year 2022 is 148.2 million users, namely 17.1 million passenger cars, 125 million motorcycles, 5.5 million goods cars and 243 thousand buses with an average increase of 4.42% compared to the previous year. In addition, the high use of fossil fuel motor vehicles has contributed to the increase in pollution in Indonesia.

Comparing the number of users with the achievement target for the next 7 years seems that is still a question of how the transition process for electric vehicles can run according to the target in Indonesia. The lack of users is a challenge for all parties, both from developments in the automotive industry, people's interest and purchasing power to the active role of the government. The government's significant efforts to develop electric vehicles must be supported by infrastructure for battery recharging. The limited electricity resources in Indonesia also determine the sustainability of electric vehicles in Indonesia. Based on data (BPS, 2021), the total installed electricity capacity by PLN is 35,516 MW, of which the majority of 33,092 MW comes from steam power. The impact that will occur is that the demand for electricity will increase sharply throughout Indonesia, while the availability of electricity is considered insufficient and even the majority of electricity availability is still centered in the Java Island area. According to the Institute for Essential Services Reform

(IESR), (CNN, 2023), electric battery charging stations and its infrastructure is still very limited. Between the target and the realization the number of battery charging stations in Indonesia, it is still far from expectations. Inadequate charging infrastructure, high costs, lack of understanding of electric vehicles, and anxiety for its sustainability, are challenges for the government to be able to shift consumer interest from fossil fuel vehicles to electric vehicles.

Previous research explained a number of important aspects related to the shift in consumer interest to electric vehicles in Indonesia. Chandra's research, (2022) said that the use of electric vehicles in Indonesia is still slow due to a stagnant market of 0.3% and high initial purchase prices, insufficient amount of charging infrastructure, and lack of incentives from the government are the main obstacles to the transition to electric vehicles in Indonesia. Meanwhile, in a study from Ade Febriyansah, (2021) said that wealthy and highly educated consumers show a moderate preference for purchasing electric vehicles (BEVs). Purchase intention is influenced by emotions (42.64%), functionality (25.94%), car identity (21.87%), and cost of ownership (9.55%). The research of McNeil et al., (2019) used a research method with a new bottom-up *modeling approach* with the Load Curve Model (LOADM), to analyze the potential for energy efficiency in Indonesia. This study integrates the total national electricity demand with the hourly end-use demand profile of the *Bottom-Up Energy Analysis System* (BUENAS). The results of the study show that the peak demand in Indonesia for electric vehicles is estimated to triple to reach 77.3 GW by 2030. These researchs provide information that supports a further understanding of factors influencing the switching in consumer intetion to electric vehicles in Indonesia.

The approach taken in this study is a qualitative method to analyze the current condition of electric vehicles in Indonesia. Quantitative data can be obtained from various sources, such as electric vehicle sales data, survey data, or data on the availability of infrastructure for electric vehicles, as well as implementation instruments of government policies regarding electric vehicles. To achieve the objectives of this study, the researcher collected literature on the subject of the history of EV development, the factors influencing the existence of EVs as well as their sustainability. This study collects literature containing the current status and development of EVs in Indonesia. Literature on EV development in other countries was also collected from a collection of journal databases. Due to limited studies on EVs in Indonesia, a combination of different types of literature is used for the current status in Indonesia. Government regulations, news, and journal papers are reviewed to present a broader view of the EV readiness status in Indonesia. The literature review seeks to identify factors influencing the shift in consumer interest toward electric vehicles (EVs) in Indonesia, focusing on several key questions. These include whether environmental concern, cost considerations, perceived benefits of EVs, and government incentive policies affect the transition from fossil fuel vehicles to EVs. Additionally, it examines the extent to which the availability of EV infrastructure strengthens these factors, including environmental concerns, cost considerations, ease of use, and financial incentive policies, in driving consumer adoption. The study aims to provide insights into the readiness of producers and the public, particularly in Jakarta, to switch from fossil fuel-based vehicles to EVs, addressing gaps in existing research on EV adoption in Indonesia (Bogue, 1969; Hsieh et al., 2012).

Electric vehicles have been widely studied due to the urgent need to reduce emissions from road transport, with research covering charging systems, incentives, safety, and environmental impacts. For instance, a denser network of renewable energy-powered charging stations correlates with higher EV adoption. While studies have explored driving factors and barriers to EV use, literature remains limited in methodological and geographic scope. The push-pull-mooring (PPM) model, originally developed for human migration research, has been

adapted to predict switching intentions in sectors like IT, marketing, and consumer behavior. In this context, push factors drive consumers away from fossil fuel vehicles, pull factors attract them to EVs, and mooring factors either facilitate or hinder the transition. This framework helps analyze the dynamics of EV adoption in Indonesia (Bogue, 1969; Hsieh et al., 2012).

RESEARCH METHOD

The author used mixed research with definition is a combination of qualitative research & quantitative research, a type of research that uses non-numerical and numerical data to understand and explore a phenomenon, so that the conclusions drawn can be more accurate. Furthermore, the study used minimal interference where the researchers do not interact with the participants to minimize the research impact. The author reduced the population only in Indonesia, especially in Greater Jakarta (Jakarta, Bogor, Depok, Tangerang and Bekasi), where Jakarta is the capital city of the country and is a densely populated city with high levels of congestion and pollution, with additional categories of analysis units as follows:

(1) People who live in the Jakarta area and its surroundings (Jabodetabek).

(2) People who have ID cards and driver's licenses.

(3) Persons who own private vehicles, motorcycles or cars.

(4) People who are 22 years old to 55 years old (because it is the productive age of work)

(5) Target is people who has income, employees (public / private), entrepreneurs and also housewives.

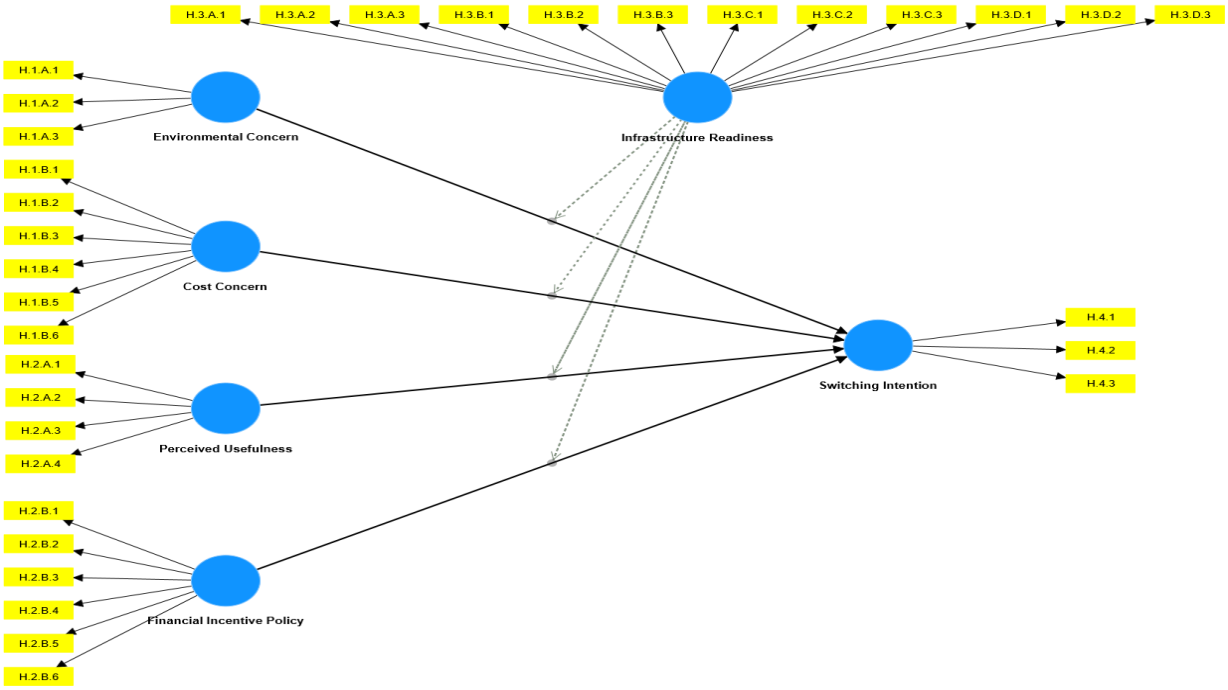
The time horizon used is a cross sectional study where it was taken at a certain time by using existing samples. The sampling method used by researcher is Quota Sampling because the population is divided into groups based on certain characteristics, and then select a number of sample members from each of these groups. The number of sample members from each group was determined based on the proportion of such caterects in the population.

The data used for this study is using a questioner provided through Google Form with the target population of Indonesia, especially those living in the Greater Jakarta area (Jakarta, Bogor, Depok, Tangerang and Bekasi). The author has limitations in collecting samples where the data used cannot present the entire population of total gasoline fuel vehicle users in the Jabedetabek area, have ID cards and driver's licenses, own a personal vehicle (motorcycle or car) and overall age coverage. The author added the type of job in filling out the questioner to increase the comparison between private/public employees, self-employed, housewives, students/students. The author has distributed questioners to more than 150 respondents and has filtered the categories that have been determined, but due to limitation time in data collection, the data results obtained are 136 respondents.

Calculation method is using Structural Equation Modelling (SEM) which are widely used to empirically investigate theoretical frameworks that are based on traditional theories and include a variety of complex relationships, such as the PPM model. (Dash, G, 2021). There are 2 (two) types of SEM that are used in parallel, namely Covariance Based SEM (CB-SEM) and Partial Least Squares SME (PLS-SEM). The calculation currently used by the author is using PLS-SEM because the purpose of the research is to predict or identify the construction of the model and the development of pre-existing structural theories. Meanwhile, the software used for the calculation in the study is SmartPLS version 4.1.0. The measurement carried out is to see validity or validity and reality test or feasibility test.

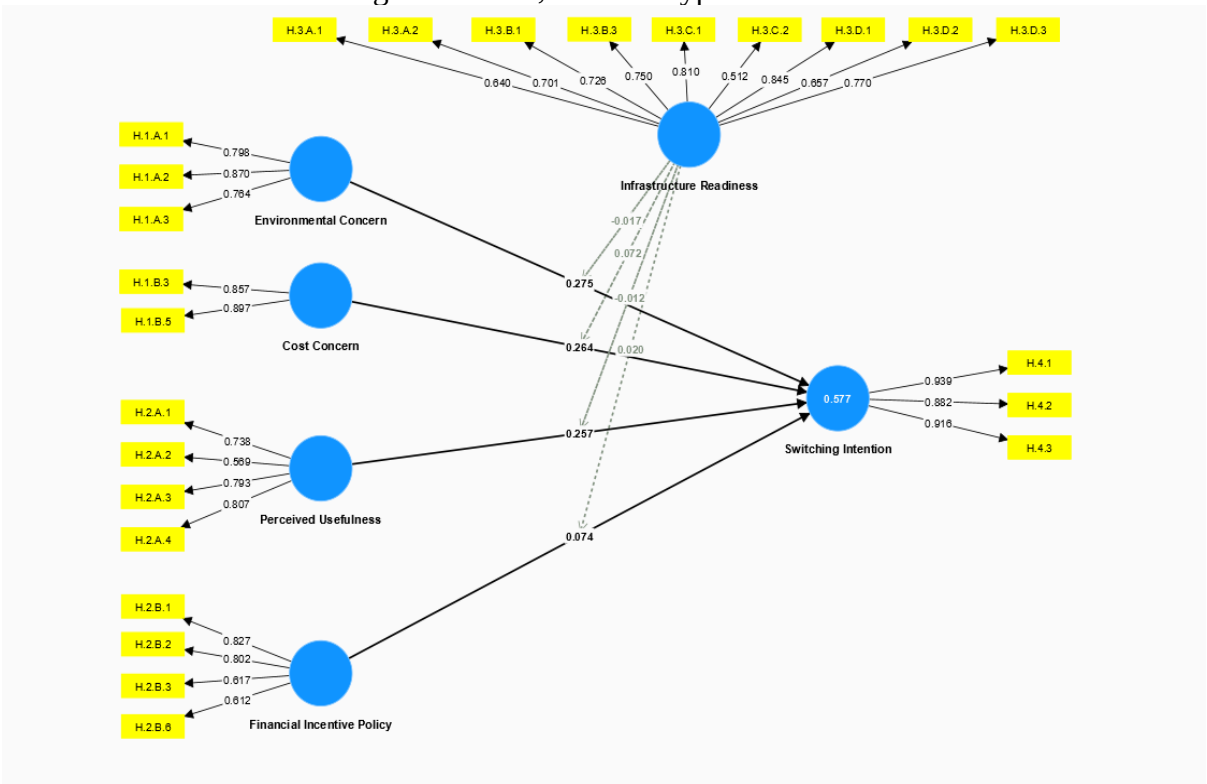
RESULTS AND DISCUSSION

Initial Hypotheses



Hypothesis Testing

After the outer loading is removed, the next hypothesis result is:



Hypothesis	Path	Beta	Result
H.1.A	Environmental Concern	0.275	Accept
H.1.B	Cost Concern	0.264	Accept
H.2.A	Perceived Usefulness	0.257	Accept
H.2.B	Financial Incentive Policy	0.074	Accept
H.3.A	Infrastructure Readiness x Environmental Concern	-0.017	Reject
H.3.B	Infrastructure Readiness x Cost Concern	0.072	Accept
H.3.C	Infrastructure Readiness x Perceived Usefulness	-0.012	Reject
H.3.D	Infrastructure Readiness x Financial Incentive Policy	-0.020	Reject

Rule: Hypothesis accepted when in Beta > 0.01
From the results of data measurement, it shows 3 (three) hypotheses that do not have a significant effect in switching EV in Indonesia, - infrastructure readiness can moderate environmental concerns, infrastructure readiness moderates the perception of benefits and infrastructure readiness moderates financial incentive policies.

Path	Orginal Sampel	Sample Mean (M)	STDev	T-Statistic	P-values
CC -> SI	0.264	0.257	0.094	2.810	0.002
EC -> SI	0.275	0.277	0.095	2.897	0.002
FIP -> SI	0.074	0.063	0.092	0.812	0.208
PU -> SI	0.257	0.262	0.077	3.318	0
IR x EC -> SI	-0.017	-0.026	0.094	0.177	0.430
IR x CC -> SI	0.072	0.079	0.101	0.714	0.238
IR x PU -> SI	-0.012	-0.033	0.093	0.134	0.447
IR x FIP -> SI	0.02	0.018	0.078	0.258	0.398

Note: If the p-value > 0.05 it has no significant effect and if the p-value < 0.05 it means the effect is significant. From the data results, Financial Incentive Policies do not have a significant effect in Switching Intention. Likewise, the moderation of Infrastructure Readiness for Environmental Concerns, Cost Concern, Perceive of Usefullness and Financial Incentive Policies, the results of which did not have a significant effect on the shift of interest.

CONCLUSION

This study provides theoretical insights into the switching intention from gasoline vehicles to electric vehicles (EVs) in Indonesia using the push-pull-mooring (PPM) framework, confirming that environmental concern, cost concern, perceived usefulness, and financial incentive policies significantly influence adoption, while infrastructure readiness did not significantly moderate these relationships. The research introduces a novel application of PPM by positioning cost concern as a push factor and financial incentives as a pull factor, offering new theoretical foundations for future studies. However, further development is needed to enhance the framework's effectiveness, involving stakeholders such as individuals, communities, institutions, and policymakers. Future research should explore alternative moderators (e.g., socio-cultural influences, technological literacy) or mediators, adopt longitudinal approaches to track evolving consumer intentions, and expand the PPM model with additional variables like social influence or risk aversion. Comparative regional studies and qualitative methods (e.g., interviews) could also provide deeper insights into Indonesia's EV adoption dynamics, improving both theoretical understanding and practical strategies for emerging markets.

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