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Exploring Electric Car Adoption Intent: Role of Current Travel Characteristics Among Daily Car Users

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ABSTRACT: Electric vehicles (EVs) have garnered significant attention in the context of sustainable transportation. Despite this growing interest, the adoption of electric cars in Indonesia, particularly in Medan city, remains at an early stage. Medan is a worthwhile case study of a fast-growing city in a developing country. Several existing literatures have taken Indonesia uniquely into context and emerged as a foundation framework. However, there still remains little comprehension regarding the perceptions and intentions of conventional car users. To address the gap in research, this study focuses on the intention of car drivers in Medan to adopt electric cars through conversion rather than addition. By examining the factors influencing this adoption intention, we contribute early insights into the context of a developing city (Medan) in developing countries. Our structured questionnaire collected responses from 390 car drivers in Medan Selayang Sub-district. We employ an ordinal logistic regression (OLR) to model the impact of explanatory variables, including socioeconomic background, attitudinal perception, and specific travel characteristics, on the adoption intention. An OLR model was used since our dependent variable (adoption intention) is in ordinal form. Our findings reveal significant links between socioeconomic and attitudinal variables and adoption intention. Notably, variables such as car ownership, daily driving range, and monthly maintenance expenses of conventional cars owned by respondents positively influence the likelihood of adopting electric cars in the future. The result indicates middle-to-high income people as the potential electric car market in this context. We further discuss how the maturity of widespread information regarding electric cars might influence the perception of current conventional car users. These findings hold implications for the design of targeted interventions to promote electric car adoption in Medan city and similar contexts.

KEYWORDS: Travel characteristics; Electric car conversion; Adoption intention; Car drivers

1. INTRODUCTION

The need for transportation has always been essential to human life. Technological advancements have eased the difficulties of our way of transportation, primarily through the invention of motorized vehicles. However, it has also led to a concerning environmental issue, such as the rising intensity of harmful combustion waste and emissions (Colvile et al., 2001). The issue not only poses threats to human beings but also to the planet in general. The concept of sustainable transportation was introduced as a paradigm aiming to promote a more environmentally-friendly transportation system. The concept has numerous definitions across different perspectives but can be described simply as the need to limit pollution generated by the means and process of transportation (Gudmundsson et al., 2016). Among the various aspects, two prominent studies area involve the promotion of non-fossil-fueled vehicles and the shift toward mass transportation.

Indonesia is one of the prominent contributing nations to air pollution due to its increasing population, motorization, and low fuel emission standards (Greenstone et al., 2022). Addressing this matter, the government took the step to join the worldwide movement of promoting Electric Vehicles (EVs). This effort was formalized in the Presidential Regulation about nationwide conversion and aligns with the goals of the Paris Agreement. According to Presidential Regulation No. 55 of 2019, the government has set an official target of 20% EV share of all vehicles on the road by 2025. This has put Indonesia as one of several countries in Asia that lead the EV adoption. China has been the leader with an impressive 67% New Energy Vehicle market in 2022, according to the Ministry of Public Security of the Chinese government. Thailand has set the target of 50% electric vehicle share by 2030 and has been working on suitable policies, according to the Asian Development Bank (ADB) report. According to Malaysia's National Automotive Policy (2020), the country has moved towards electric vehicles as an energy-efficient vehicle and predicted a total of 20% electric vehicle sales by 2025 (Muzir et al., 2022). Nevertheless, some mutual critical issues remain and need to be addressed among these countries. The challenge revolves around two main issues, namely the insufficient establishment of EV charging infrastructures and battery production capacity (Maghfiroh et al., 2021). On the financial side, the Indonesian government has introduced controversial incentive measures, including purchasing price subsidies. The idea was to make EVs a more affordable and appealing choice for potential consumers. The same price incentives strategy (including tax breaks) is also implemented in the previously mentioned countries: Thailand and Malaysia.

Generally, there are several types of electric cars available in the market. The most common one is the Battery Electric Vehicle (BEV). This type runs and relies solely on electric power stored in a large battery pack. BEV's driving range varies based on the capacity of the battery. The second type is the Plug-in Hybrid Electric Vehicle (PHEV). The term hybrid comes from the combination of a conventional internal combustion engine and an electric motor. PHEV can run on electric power and also extend the range with its combustion engine. The third type is called Hybrid Electric Vehicle (HEV), which uses both an internal combustion engine and an electric motor. The difference between PHEV and HEV is that HEV is not rechargeable by means of an external power source. HEV is charged through its internal braking system. Notably,

PHEV could contribute more significantly to cleaner air than HEV, especially in the urban setting (Salisa et al., 2010). This is particularly due to its ability to operate in electric-only mode for a certain distance.

From an environmental perspective, EVs are central to discourses concerning the reduction of greenhouse gas emissions in the transportation sector (Eberle & Von Helmolt, 2010). On the other hand, from the transportation science perspective, there is no practical difference between a private electric car and a conventional car as a traffic element. Both count as traffic load and a potential cause of congestion. Despite EVs' potential to help reduce air pollution from land transport emissions, there is a risk of an induced growth of private cars instead of only conversion. While owning a modern electric car could give social pride (Febransyah, 2021), it was also known that income level and social prestige could motivate at least one car ownership (Sefriyadi et al., 2023). It was also found that travel patterns and characteristics contribute to the motivation of choosing at least one type of electric car (Langbroek et al., 2017; Nazari et al., 2019).

Medan is one of the largest, fast-growing provincial capitals in Indonesia and a beneficiary of Sustainable Urban Mobility Plan funding under the MobiliseYourCity partnership. The prominent partnership currently has 70 cities worldwide, from Latin America to Asia. This partnership has put Medan as one of the worldwide examples of sustainable mobility planning and policy development. This city was one of the pioneering cities on Sumatera Island chosen by the government for the implementation of EV charging infrastructures. Currently, Medan City lacks of adequate and accommodating public transportation, which has led people to rely heavily on private vehicles. More than 80% of trips are made using either a private car or motorcycle (Egis Rail, 2022). Given the current amount of attention related to sustainable development received by this city, Medan is one of Indonesia's potential centers of EV market development. In summary, most developing cities in developing countries are similar to Medan, particularly in terms of high private vehicle ownership (especially motorcycle), lack of public transport, and fast-growing population. This study attempts to make Medan a case study and comparison regarding EV introduction in a developing city of developing countries.

While existing studies have attempted to investigate the electric vehicle adoption intention topic in the context of the Indonesian population (Febransyah, 2021; Gunawan et al., 2022; Prasetio et al., 2019; Wicaksono & Aprianingsih, 2021), the focus on the fast developing city like Medan in the developing countries, remains scarce. This is unfortunate since Medan holds promise as a potential hub for EV market development. Furthermore, these past studies have yet to examine the intention specifically for electric cars. Coffman et al. (2017) summarized a list of essential user characteristics to explain the intention. However, the driving range is the only car travel characteristic mentioned in the study. Choo & Mokhtarian (2004) found long before that, travel distance can influence the decision to choose a certain type of car. This is due to certain types of cars being considered preferable for shorter/longer distances.

To address this gap, in our study, we included several car travel characteristics and focused the analysis on electric car adoption, particularly in the unique context of car drivers and Medan. We defined the electric car as any kind of battery electricity-powered (pure BEV) car available in the market. Therefore, the primary objective of this research is to explore and investigate the influential variables that could explain car drivers' intention to adopt electric cars in the future. Our findings hold the potential to contribute valuable insights for developing future policies concerning private cars and sustainability.

2. METHODOLOGY

We conducted a survey using a structured questionnaire in January 2023 to the car-user citizens of Medan Selayang Subdistrict within the city of Medan, as illustrated in Figure 1. This sub-district was particularly chosen for its economic and geographical characteristics. Since there are only two charging stations currently installed in Medan City, we first focus our attention on each sub-district, which is within a 7.5-km radius of the charging stations. As trips in Medan are mostly made between 5 to 10 km, we opted for the midpoint distance between residences and charging stations as a reasonable criterion. Among these sub-districts, we next identify the sample location selection by paying attention to its population size, economic disparity, and economic development. The income-expenditure ratio of Medan Selayang Sub-district indicates a strong economic development while also having a high economic disparity (Hasanah et al., 2020). These two criteria (high economic disparity and high consumption behavior) ensured good variation in respondents and avoided bias, especially income-wise. This sampling restriction is our effort to ensure fewer captive answers. It is not worthwhile to collect data if the respondent lives so far from charging stations.

The respondents were randomly sampled, aged over 20 years old, and must own at least one private car in their household for daily use. Individuals who own cars only for rentals or similar business purposes were not eligible for this survey. We calculated that the minimum number of samples needed was 384, given a 95% confidence interval and a margin of error of 5. In order to collect this primary data, we focused the survey locations on residential complexes, carwash stores, and café/restaurants. Those who met the survey criteria were asked in advance for consent and then given 5-10 minutes of explanation about the survey and pertinent knowledge about electric cars in Indonesia.

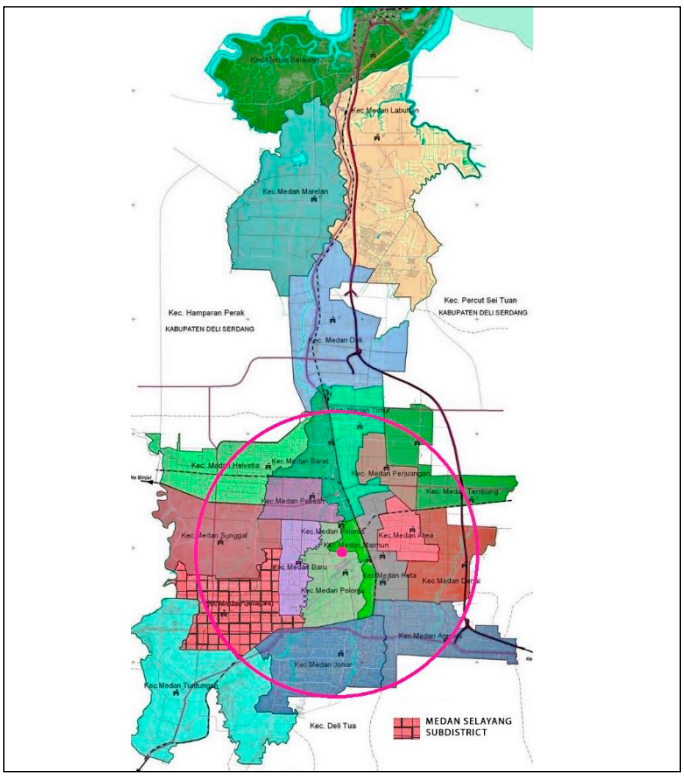

Figure 1. Map of Medan city and its sub districts

The questionnaire was divided into three parts, comprising, firstly, individual current daily travel characteristics (chosen mode of transport, travel distance/range, travel

duration, operational expense, and fuel expense). In the second part, respondent was asked to address four attitudinal statements related to environmental concern, technology conversion, financial compliance towards the electric car, and lastly, their adoption intention. We use a five-point Likert scale ranging from "1=strongly disagree", "2=disagree", "3=fair", "4=agree", and "5=strongly agree" to indicate the attitude towards each of the given statements. Finally, in the third part, we asked about their general socioeconomic characteristics (age, gender, marital status, etc.). The first and third parts of this questionnaire are in a multiple-choice model. When explaining and asking about electric cars to the respondents, we defined the electric car as any kind of battery electric car (pure BEV).

We explore the relationship between current individual car travel characteristics and the intention to adopt electric cars through statistical modeling. Ordinal logistic regression (OLR) was applied since the dependent variable (adoption intention) was presented in ordinal form. Instead of using a yes-no binary outcome, ordered responses allow respondents to be more flexible in stating their level of willingness to adopt. In discrete choice modeling, the logistic regression method helps compute the probability or likelihood of one of the response outcomes to be chosen. In the OLR model, the cumulative probability of an equal or smaller ordinal outcome is compared to the cumulative probability of a larger ordinal response outcome. In mathematical terms, it is the ratio between $P(Y \leq k)$ and $P(Y > k)$, where Y is the ordinal outcome with K categories, and k is the specific category of the outcome variable ($k = 1,2,\ldots, K\text{-}1$). The logit model, also known as log odds, is depicted as follows (Hosmer Jr et al., 2013):

$$(1)\quad \log\left[\frac{P(Y \leq k)}{P(Y > k)}\right] = \log it\left[P(Y \leq k)\right]$$

$$(2)\quad \log\left[\frac{P(Y \leq k)}{P(Y > k)}\right] = \alpha_k + \beta_1 x_1 + \ldots + + \beta_n x_n$$

, where x_n is the explanatory variable, n is the number of explanatory variables, α_k is the ancillary parameters, and β_n is the estimated ordered logit regression coefficient for each explanatory variable. Ancillary parameters represent different levels of the outcome variable. OLR model is then interpreted based on the logit coefficients (β_n) but not the ancillary parameters. This is because of the assumption of proportional odds. The assumption is that the relationship between each ordinal outcome categories and the next one (lower or higher) is the same. Furthermore, therefore, there is only one set of logit coefficients. These coefficients could be converted to what we call the Odds Ratio (OR) by exponentiating the coefficients. The term odds ratio will be used more in the result section to also explain the likelihood insight found from the statistical modeling.

3. RESULTS AND DISCUSSION

A total of 410 filled forms were obtained, of which twenty forms were omitted due to substantial error and unreasonableness in the answers. Therefore, the final number of 390 responses from car drivers was used for analysis. The summary of socioeconomic characteristics is presented in Table 1. More than 3-quarter of the respondents were older than 25 years old. The ratio of female and male respondents is one-third. Over half of the respondents are highly educated, having finished college degrees and graduate school. Occupational distribution is dominated by those working in the private sector and those who open businesses or are entrepreneurs. Only a small number are categorized as 'other' for working at home or being a housewife. Around 41% of the respondents earn up to nearly 5 million Rupiah monthly, whereas around 25% earn almost 10 million Rupiah monthly. The distribution statistics of monthly expenditure show that most respondents spend up to nearly 3 million Rupiah monthly for their needs, including transportation expenses.

Regarding transportation characteristics, there are only four major daily modes of choice: motorcycle, car, angkot (paratransit), and app-based ride-hailing services. Since our survey targeted people with at least a car in their household, it is expected that the majority of the respondents would be daily private vehicle users, gathering over 98% of the total sample. The travel range of the samples is mostly inside the city or between sub-districts, in which they spent between 1 to 7 hours a day driving. Concerning operational transportation expenses, the survey data shows a fairly small difference between fuel and maintenance expenses. Most of the respondents (69%) reported fuel expenses between 300 thousand Rupiah up to 1 million Rupiah per month. In contrast, for car maintenance, the majority of respondents (65%) spend money for maintenance around 100 to 499 thousand Rupiah monthly.

Finally, out of 390 responses related to environmental concerns, most (59%) believe that electric cars will reduce air pollution. However, around 32% have no opinion regarding that matter. Regarding financial compliance, the responses are evenly distributed between tendencies to agree, fair or having no opinion, and tendencies to disagree, as all three fairly have an equal percentage of responses (> 30%). Lastly, in relation to technology updates or conversion, many respondents (47%) stated they are interested in following new technology, such as electric-powered cars. However, 39% of the respondents neither agree nor disagree.

As the intention to adopt is in ordinal numerical data, we used ordered logit regression to estimate the effect of each explanatory variable in predicting the probability of a particular ordinal outcome. There are, in total, 15 explanatory variables included in the model. The car ownership variable is in continuous numerical data. Whereas marital status, occupation, and education level are all Boolean categorical data. The rest, including monthly income, expenditure, driving range, driving duration, fuel expenses, maintenance expenses, and all attitudinal perception, are in ordinal form.

There was no multi-collinearity issue found between all tested explanatory variables. The result of parameter estimation using Stata statistical software is indicated in Table 2. Pearson goodness-of-fit test results in a p-value lower than 0.05, which means the generated model fits well. In the Ordinal Logistics model, the parallel odds assumption means that the coefficient of each explanatory variable should be the same across the threshold or response categories. Our test of parallel lines concluded that this assumption holds. A positive parameter estimate indicates that the intention to adopt electric cars increases as the corresponding explanatory variables increase. For categorical variables, which have only binary values, such as marital status, occupation, education level, and car-as-daily mode, positive parameter estimates mean that when the variable value is "True" or 1, instead of zero, the intention increases. The value of the coefficient shows the effect size of each predictor. A greater coefficient, whether positive or negative, means a greater effect on the probability of the predicted level of intention. Furthermore, for the explanatory variable to be statistically significant, the p-value must be less than 0,01; 0,05; and 0,1 at 99%, 95%, and 90% confidence intervals, respectively.

Nine out of fifteen tested predictors are significant at different confidence intervals. There are three significant variables at 99% confidence, which are monthly maintenance expense, environmental concern, and technology conversion. Four predictors are significant at 95%: jobs in the public sector,

Characteristics	Stats, N = 390				
Age:	17 - 25 years old	26 - 35	36 - 45	46 - 60	> 60
	23.8%	*37.9%*	*17.4%*	*17.9%*	*2.8%*
Gender:	male	female			
	74.6%	*25.4%*			
Marital status:	married	not married			
	65.9%	*34.1%*			
Household (HH) size:	single HH	2-4 person	5-7 person	8 or more person	
	14.1%	*55.4%*	*29.2%*	*1.3%*	
Education level:	Highschool /lower	Vocational	Undergrad.	Grad. school	Other.
	31.3%	*9.7%*	*53.8%*	*4.6%*	*0.5%*
Occupation:	Private sector	Public sector	Business	Student	Other.
	34.6%	13.8%	32.1%	9.7%	*9.7%*
Monthly income:*	< 1 mil rupiah	1 - 2.9	3 - 4.9	5 - 9.9	>= 10
	6.4%	*23.3%*	*41.3%*	*24.9%*	*4.1%*
Monthly expenditure:*	< 1 mil rupiah	1 - 2.9	3 - 4.9	5 - 9.9	>= 10
	16.4%	*50.3%*	*24.9%*	*6.9%*	*1.5%*
Daily mode of choice:	Motorcycle	Car	Angkot	Ride-hailing	Other.
	37.7%	*60.5%*	*0.5%*	*1.3%*	*0.0%*
Daily driving distance/range:	Inside city	Intercity	Interprovincial		
	85.9%	*13.6%*	*0.5%*		
Daily time spent for driving:	< 1 hour	1 - 3	4 - 7	8 or more hour	
	22.6%	*53.3%*	*20.8%*	*3.3%*	
Monthly car fuel expense:*	< IDR100 thousand	100 – 299	300 – 499	500 – 1 mil	>IDR 1 mil
	6.9%	*27.7%*	*37.7%*	*21.5%*	*6.2%*
Monthly car maintenance expense:*	< IDR100 thousand	100 – 299	300 – 499	500 – 1 mil	>IDR 1 mil
	7.7%	*34.6%*	*30.0%*	*20.0%*	*7.7%*
Environmental concern:	*I believe that electric car will reduce air pollution*				
	Strongly disagree	Disagree	Fair	Agree	Strongly agree
	0.3%	*8.7%*	*32.1%*	*41.8%*	*17.2%*
Financial compliance:	*Electric car is still enticing even if the buy price is expensive*				
	Strongly disagree	Disagree	Fair	Agree	Strongly agree
	10.0%	*20.5%*	*36.9%*	*26.4%*	*6.2%*
Technology conversion:	*I like to follow updates on newly introduced and modern car technology*				
	Strongly disagree	Disagree	Fair	Agree	Strongly agree
	0.8%	12.3%	*39.2%*	*31.0%*	*16.7%*

* Indonesian Rupiah (IDR) 1 million = 64 US Dollar ,or 59 Euro

Table 1. Summary of socioeconomic characteristics of respondents

monthly income, education level at higher education, and car ownership. Lastly, two variables are significant at 90%, such as marital status, and car driving travel range.

3.1 The influence of socioeconomic factors on adoption intention

The model suggests that marital status plays a role in shaping individuals' inclination toward adopting electric cars. It shows that married people are more likely to have less intention to adopt electric cars. The odds that unmarried people adopt an electric car is approximately 1.8 higher than if the person is married. This could be caused by the distinct decision-making dynamics between single individuals and couples. In general, a single person would have more independence and freedom to try or follow new things. Given the role and peer effect of both individuals (Verma & Kapoor, 2003; Zhao et al., 2022), a married couple might not have the same flexibility to decide.

Those who work in the public sector, such as public servants, are less intent on owning an electric car. While the exact reason behind this needs to be clarified, the plausible association with monthly income, which is also a significant predictor—might exist. Notably, people with higher incomes are more likely to have greater intention to use an electric car. This is expected since car ownership and income are interconnected. Moreover, income is directly influenced by household size and employment (Gao et al., 2008). Additionally, education level has an effect on the intention to use. People who graduated at least with a college or graduate degree will be more likely to have higher intentions.

3.2 The influence of driving characteristics on adoption intention

Based on the current travel characteristics, being a daily car driver does not affect the intention to own an electric car. However, having more cars does have a positive effect. We found that the odds of adopting an electric car are twice higher than people who currently have fewer cars. For a one-unit increase in car ownership, the odds of being highly interested versus indifferent and not-interested categories of EV adopting intention are 1.9 times greater. This particular finding raises a question pertaining to how electric cars would affect

Explanatory Variables	Parameter estimates	Odds Ratio	Standard Error	p-value (Sig.)	
Marital status *(1=married; 0=not married)*	-0.494	0.610	0.276	0.073	*
Occupation *(ref variable = other than the three)*					
Private sector *(1=yes; 0=no)*	-0.369	0.692	0.361	0.307	
Public sector *(1=yes; 0=no)*	-0.937	0.392	0.445	0.035	**
Business/Entrepreneur *(1=yes; 0=no)*	-0.361	0.697	0.362	0.319	
Monthly income	0.381	1.464	0.190	0.045	**
Monthly expenditure	-0.206	0.814	0.198	0.299	
Education level					
Higher education degree *(1=college graduate; 0=lower than college)*	0.505	1.657	0.242	0.037	**
Current driving travel characteristics					
Car ownership	0.666	1.947	0.287	0.020	**
Daily driving range	0.559	1.749	0.316	0.077	*
Daily driving duration	-0.014	0.986	0.170	0.933	
Monthly Fuel expenses	-0.140	0.870	0.156	0.370	
Monthly Maintenance expenses	0.418	1.520	0.139	0.003	***
Attitude					
Environmental concern	0.848	2.334	0.182	0.000	***
Financial compliance	0.068	1.070	0.142	0.632	
Technology conversion	2.520	12.424	0.227	0.000	***
No. of samples	390				
Restricted loglikelihood	980.649				
Final loglikelihood	558.764				
McFadden pseudo R-squared	0.429				
Pearson goodness-of-fit (Sig.)	0.000				
The proportional odds assumption is **satisfied** since we fail to reject the null hypothesis in the test of parallel lines					

***significant at 99%, **significant at 95%, *significant at 90%

Table 2. Ordinal logit model estimates for intention to adopt electric car

car ownership in the future, especially in Medan City. Will people replace their conventional cars or get an electric car to add more cars to their garages? Similarly, the range of car driving a person makes every day has an effect on electric car adoption intention. For example, people who drive intercity would be more likely (1.7 times higher odds) to adopt an electric car than those who drive only city-wide. In practice, one trip of city-wide driving in Medan ranges between 5 to 10 km, and therefore we consider daily driving range of more than 10 km as intercity daily drive. However, it should be noted that driving range is not necessarily vehicle-km-travelled which is the amount of distance covered in a day. Current conventional car maintenance expense also has a positive effect on people's intention to use an electric car. It seems that people perceive electric cars as a more economical day-to-day option for longer routine trips than a conventional car. For a one-unit increase in monthly maintenance expenses (approximately IDR 200-400 thousand; USD 13-26), the odds of being highly interested versus indifferent and not-interested categories of EV adopting intention are 1.5 times greater. However, it cannot necessarily be said that people perceive the electric car as cheap because our questionnaire does not directly elicit that perception. Contrary to the driving range variable, the current fuel expenses on their conventional car and current travel duration as a car driver apparently do not affect adoption intention.

Car drivers' attitude related to environmental concern appears to be a positive predictor of the intention to adopt an electric car. The electric car has been advertised as an environmental aid for pollution in the transport sector by the Indonesian government, and many people resonate with this notion. Similarly, the idea of converting to a newly introduced and arguably more modern technology heavily influences the likelihood of a car owner owning an electric car in the future. The odds of a person who is "strongly agree on like to follow car technology update" are 12 times higher than the person who simply "agree". The more inclined a person to follow technological updates, the more likely that person intends to own an electric car. In comparison, willingness to spend on pricy electric cars does not have a statistically significant effect.

3.3 Discussion

The rise of electric vehicles in Indonesia is still at an early stage. Each time new technologies are promoted, they initially induce curiosity among consumers. We can observe this not only in the gadget market but also in the automotive industry. At this stage, the amount of legitimate information shared with the public determines how people perceive, consider, and analyze their choices. In the case of electric cars, factors that drive the intention would be based on the perceived value and trust of an electric car, which is driven by how well the individual is informed about electric car technology and operation (Wang et al., 2021; Zhang et al., 2022). It should be noted that our study took place in Medan city, a provincial capital of North Sumatera, whose society could be or is relatively not as well-informed as the national capital of Indonesia, Jakarta. For instance, contrary to what we found, Brase (2019) found that car drivers are more concerned about an electric car's driving range performance. A real-life experiment in the literature also suggested that electric car usage tends to have less average trip and journey length (Jensen & Mabit, 2017). There is a chance that the driving range variable in our model could change, given the lack of

real-life experience with electric cars (Jensen et al., 2017). The different results that we found could indicate a lack of initial information or even a misbelief among the respondents.

There is a possibility that the probability of intention might lean more toward an emotional choice rather than a logical choice to accommodate functionality needs. It was reported that emotional criteria such as personal pleasure or pride are the major criteria to explain adoption intention among Indonesians (Febransyah, 2021; He & Hu, 2022). This is reasonable at this point of development when there is still a small number of electric car users and the market is still immature. Individual preferences might also change over time while people get to know more about electric cars. As of June 2023, the purchasing price for most electric cars is more expensive than conventional cars, even with the price incentives given by the government. Even though our model shows that complying to finance an electric car is not a significant predictor, previous literature suggested otherwise (Haustein & Jensen, 2018). Furthermore, contrary to the German case by Degirmenci & Breitner (2017), in the case of Indonesian people, the quality of pollution reduction might not be more important than the purchase price when deciding to own an electric car (Prasetio et al., 2019). Having the knowledge that an electric car could lower air pollution and having the motivation to aid the environment are two different things.

Our model suggests that car users' socioeconomic background and current travel characteristics are prominent factors in predicting the intention probability to own an electric car. Consistent with past studies, both are reported as determining factors that affect adoption (Coffman et al., 2017). In our model, travel characteristics have larger effects, and one of the variables is more statistically confident. It is understandable, given that the basic reason for owning a private vehicle would be to fulfill daily mobility needs. Furthermore, from an environmental standpoint, in order to have more conventional cars converted to electricity-based cars, more information related to electric car performance should be more intensely spread to the public. This way, people can have better judgment and decisions based on their daily car travel characteristics. Nevertheless, there should also be a market-driving policy from the government to ensure the main goal of conversion and not owning more cars. In this regard, an unsatisfying incentive policy alone could not significantly affect the intention (Wang et al., 2021).

At the moment, the electric car is only more popular among the mid-to-high-income population because of the high buying price. It is also popular among people who have an interest in technology development. The higher-income group is more likely to spend resources on private cars (Jong et al., 2004). The idea of electric car conversion might not be too enticing for lower incomes as the price barrier remains or there is no improvement in the income level. Price incentives are not as reliable as the government would suggest. This is true because the government can only financially support so much that their budget could hold. It is arguably not a sustainable way of promoting electric car conversion. On the other hand, promoting the electric car technological advancement could drive a positive image and intention, as our model suggested. This is truer for the younger generation, who is known to have more interest in following new technology, including when it comes to mobility needs (Circella et al., 2016).

4. CONCLUSIONS

Electrification is considered one of the most promising ways to promote sustainable development in transportation. On the other perspective, sustainability in transportation also means less private cars and more public transport usage on the road. Therefore, 'more electric cars' should be specifically translated to more electric car 'conversion'.

This research aims to explore whether car drivers' travel characteristics influence the intention to adopt electric cars in the future. In addition, we also tested several socioeconomic characteristics and attitudinal perceptions in the model. In this study, we take the context of a fast-growing city (Medan) in a developing country. We found that all three groups of variables are influential to the probability of owning an electric car. Marital status, occupation as a public sector employee, monthly income, and education level are the socioeconomic variables that affect the intention. Perception of how electric cars could lower air pollution and the personal interest in keeping updated on new and modern car technology are the attitudinal variables with a statistically significant effect on the adoption intention. Lastly, car ownership, daily driving range, and monthly maintenance expense of the currently owned conventional car are the car drivers' travel characteristics that positively influence the probability of adopting electric cars in the future. The more number of car owned by a household, the greater odds of adopting electric vehicle. Practically people who drive intercity (approximately longer than 10 km) on a daily basis have greater odds of adopting electric vehicle. And, people who spend larger budget (between 200-400 thousand more) on their monthly car maintenance have greater odds of adopting electric vehicle.

The authority is encouraged to distribute more public information related to electric cars in order to improve public understanding toward the technology and increase the intention to convert to electric cars. Lastly, at this point, the electric car is relatively more interesting for the higher income group, practically because of the high upfront cost. Further studies should address how to motivate electric car conversion among middle-income group people. The idea of financial support is the current trend, but could there be another alternative to promoting more conversion?

This study attempted to contribute meaningful insight and helpful literature on the adoption intention of electric cars, especially in the case of Medan. Like other studies, this research has its own limitations. One of the limitations of this study is the generalization of electric cars. Further study should consider a specific type of electric car or a comparison between types. The other improvement can be made in the choice of sampling area. City-wide data sampling might give more or even better understanding. Lastly, path analysis or structural equation modeling could be applied in further study, using variables that were found significant across past studies to gain a more complex causal analysis.

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