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STUDY ON INTENTION TO SWITCH TO ELECTRIC VEHICLES IN THE LOW - EMISSION ZONE IN HANOI

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Abstract. Air pollution is one of the most critical environmental challenges worldwide, encouraging governments to promote electric motorcycles (EMs) and implement Low-Emission Zones (LEZs) as key instruments for achieving sustainable urban mobility. In Vietnam, especially in large cities such as Hanoi, emerging policies restricting gasoline-powered motorcycles are expected to significantly influence individual travel behavior. This study investigates the factors affecting individuals' intention to switch from conventional gasoline motorcycles to EMs in Hanoi under the context of these policy changes. The analysis is based on primary survey data collected from 409 respondents. Exploratory Factor Analysis (EFA), multiple regression analysis, and ANOVA are employed to examine the impacts of psychological, socio-demographic, and mobility-related factors on EM adoption intention. The findings reveal that psychological factors play a prominent role, besides socio-demographic characteristics, in shaping switching intention. Perceived value is identified as the strongest positive determinant, followed by environmental concern, while perceived risk negatively influences intention. The results provide valuable insights for policymakers in designing effective measures to promote electric motorcycle adoption and support sustainable transport transitions in urban Vietnam.

Keywords: Electric motorcycles, Low-Emission Zones, urban sustainable transport, air pollution

1. INTRODUCTION

Air pollution has emerged as one of the world's most significant environmental issues, threatening human health, ecosystems, and economic progress. According to IQAir, the average PM2.5 concentration in European and American countries is currently two to three times higher than recommended levels, while several Middle Eastern and Asian countries have air pollution levels that exceed safe criteria by up to ten times [1]. In Hanoi, according to IQAir, from December 2025 to early January 2026, the average PM2.5 concentration is double, sometimes triple the WHO global standard, with the highest being 196 µg/m³ [2].

In response to reducing air pollution, many governments worldwide have adopted Low-Emission Zones (LEZs) as a policy instrument to improve urban air quality. LEZs are designated area where access is restricted or regulated for high-polluting vehicles. Existing evidence supports the environmental effectiveness of LEZs, documenting the significant reductions in harmful emissions like nitrogen oxides (NOx), particulate matter (PM2.5 and PM10), and carbon dioxide (CO_2), which help reduce harmful substances linked to smog, respiratory issues, and poor urban air quality. [3]

Hanoi's transportation system faces significant challenges arising from rapid urbanization and a heavy dependence on private vehicles. The city has nearly 7 million registered motorcycles and scooters, in addition to an increasing number of automobiles [4]. Public transportation, including buses and the nascent metro system, accounts for only a fraction of total trips, whereas motorcycles account for approximately 80% of the total trips [5]. This vehicle structure contributes significantly to traffic congestion, fuel consumption, and air pollution, further exacerbated by aging vehicle fleets and limited regulatory enforcement.

Unlike many European cities that enforce a full-time ban within their LEZs [6], Hanoi will introduce time-based LEZs starting July 1st, 2026. Initially, nine wards within Ring Road 1 will be affected, with plans to extend to Ring Road 2 by 2028. These zones are expected to operate during peak hours, from 07:00 to 09:00 and 17:00 to 19:00. This approach aims to reduce emissions during busy periods while minimizing disruption to residents' daily routines. However, this time-based approach raises an important question about people's willingness to adopt EMs. The core uncertainty is whether a partial restriction generates enough pressure to justify the cost of switching to EMs. Rather than opting for a new EM, many individuals might simply alter their travel plans to avoid the restricted hours.

Consequently, the study aims to identify factors influencing Hanoi residents' intention to adopt electric motorcycles, in the context of upcoming LEZ regulations, without regarding the policy itself as a direct cause. Using Exploratory Factor Analysis (EFA), multiple regression and ANOVA, we evaluate how perceptual, socio-demographic, household and mobility factors relate to intentions to switch to EMs. The results inform policymakers and manufacturers about consumer motivations and practical barriers to adoption, and to lay out the groundwork for future research.

The rest of the current paper includes 4 sections. Section 2 provides some related reviews while Section 3 describes data analysis in terms of methods and results. Section 4 discusses the findings and proposes some policy implications before Section 5 concludes with this paper.

2. LITERATURE REVIEW

2.1. Review of existing electric vehicle research

Across the world, substantial research has been conducted on the intention of purchasing, shifting or adopting electric vehicles (EVs) for daily use, especially in Asia-Pacific nations

where the primary modes of transportation are personal motorcycles. Chen et al. reported that perceived risk and perceived value directly influenced consumer attitude, which in turn decides EV purchase intention in Taiwan, the country with the highest motorcycle density in Asia [7]. Pramono et al. revealed that environmental concerns, perceived economic benefits, social influence, and brand awareness impacted consumer attitudes positively whereas perceived risks like safety concerns and inadequate infrastructure negatively affected it in Indonesia [8]. Government policies, on the other hand, had little effect. A study conducted by Anwar et al. amid smog concerns in Pakistan concluded that an understanding about the current environmental situation, health risk perception, self-efficacy, willingness to pay, and alternative attractiveness significantly encouraged the switch from conventional to green vehicles, while normative and regulative environments showed little influence [9]. According to Jayasingh et al., perceived economic benefits were the most noticeable influence that affects EVs purchase intention in India, where electric two-wheelers adoption is in a nascent stage, followed by environmental concerns, charging infrastructure and social attitude [10].

In Vietnam, studies have also been conducted on the same topic, albeit with comparatively limited scope and availability. This reflects the fact that the research area is a relatively new and underexplored one. Nguyen and Urmee reported that the EVs purchase intention of Vietnamese citizens are chiefly driven by economic suitability, a dominant motorcycle culture, government policies, consumer perception and environmental concerns while initial costs and concerns of infrastructure inadequacy dampened consumer interests [11]. Hsu et al. demonstrated, through quantitative research, that environmental concerns, government incentives, performance and costs noticeably impacted the decision to adopt EVs in Vietnam, in contrast to personal needs, preexisting charging infrastructure and product knowledge [12]. According to [13], perceived value, behavioral control and attitude shared a positive correlation towards the intention to use EVs among surveyed individuals, with perceived value having the most prominent effect. A study conducted by Nguyen et al. revealed that environmental concerns were crucial in driving electric motorcycle adoption, along with knowledge about EMs and social norms [14]. Meanwhile, barriers of perceived risks, age, and daily travel distance deterred adoption. Findings from Tran et al. reported perceived usefulness to be the chief determining factor on the adoption of EVs whereas perceived risk hinders it. Age moderates the link between ease of use and adoption intention, while income shapes the impact of perceived risk on adoption [15].

Despite the breadth of research on related topics, there remains a lack of studies conceived specifically to address the intention of switching from conventional to EMs in the context of an impending LEZ establishment. This study seeks to address the perceived gap by investigating the intention to switch from conventional motorcycles to electric motorcycles in the context of Hanoi's forthcoming program of time-based LEZs.

2.2. Determinants of EM adoption and research model

Building on prior empirical evidence, this study synthesizes findings from the existing literature to identify a set of key determinants that have been frequently examined in previous EV and EM adoption studies. These variables are subsequently applied and tested within the specific regulatory and geographical context of Hanoi, thereby extending the literature by assessing their relevance under a novel policy design and in an underexplored urban setting.

Socio-demographic variables have been widely examined in various research, yet findings are far from consistent. Regarding gender, while other studies find no statistically significant

gender differences in adoption intention [13,15], some recent findings indicate that women also showed higher intention adoption [16]. Similarly, education and income levels also show mixed influences. While some studies indicating educated individuals tend to opt for EMC [17], other studies, such as [12], do not show a clear or statistically significant role of education in explaining adoption intention. Income effects are likewise inconclusive. Evidence from Indonesia suggests that individuals from lower-income households are more likely to adopt conversion schemes [17].

Employment status is often included in a descriptive or control role rather than being direct determinants of adoption intention. Most studies report no clear direct effect of job characteristics on adoption intention [12,15]. However, evidence suggests that individuals working from home or with flexible work schedules tend to experience lower range anxiety due to reduced commuting requirements and greater flexibility in managing charging routines, which may enhance the perceived attractiveness of EV ownership [18]. While some studies mention marital status without identifying significant effects, recent evidence indicates that it may play a moderating role, particularly by influencing the relationship between perceived risk and adoption intention [15].

Living areas have been considered in prior research as a key factor reflecting differences between urban and non-urban contexts. Existing studies generally suggest that residents in urban areas tend to exhibit higher adoption intentions toward electric vehicles compared to those living in semi-urban and rural areas [19]. However, empirical evidence on the direct influence of living area remains highly context-specific and varies across geographical and policy settings. In the present study, living area is operationalized based on respondents' residential location relative to Ring Road 1, Ring Road 2, and areas outside Ring Road 2. This classification is particularly relevant in the Hanoi context, as the forthcoming LEZ policy is expected to be implemented with spatially differentiated restrictions across these areas, implying varying levels of policy exposure, mobility constraints, and incentives to switch to electric motorcycles.

Mobility-related characteristics also contribute to adoption behavior. The primary mode of transportation reflects habitual behavior and long-term vehicle dependence. Individuals who mainly rely on internal combustion engine motorcycles or other conventional vehicles tend to exhibit lower intention to switch to electric alternatives [20]. Meanwhile, prior experience with EVs is expected to influence adoption intention, as familiarity with this mode may reduce hesitation and increase acceptance.

Perceptual variables have been shown to play an important role in adoption decisions. Environmental concerns measure respondents' awareness of environmental issues. Prior studies find a positive association between environmental concern and intention to adopt electric motorcycles [14]; however, some studies report insignificant effects, suggesting that environmental awareness may not be sufficient to motivate switching behavior [21]. Perceived risk refers to concerns related to technological reliability, battery performance, charging infrastructure availability, safety, emotional and social concerns. Several studies have indicated that higher perceived risk is associated with lower adoption intention [8,15,22], highlighting its role as a key barrier to EM uptake. Perceived value represents the respondents' overall assessment of the benefits of EMs. Previous studies consistently report a positive relationship between perceived value and adoption intention [7,13], suggesting that individuals are more likely to switch when electric motorcycles are perceived as offering superior or comparable value to conventional alternatives.

Based on the determinants discussed above, a model is developed to examine the factors influencing individuals' intention to adopt EMs. The framework integrates socio-demographic characteristics, household characteristics, transportation-related factors and perceptual variables identified in previous studies (Figure 1).

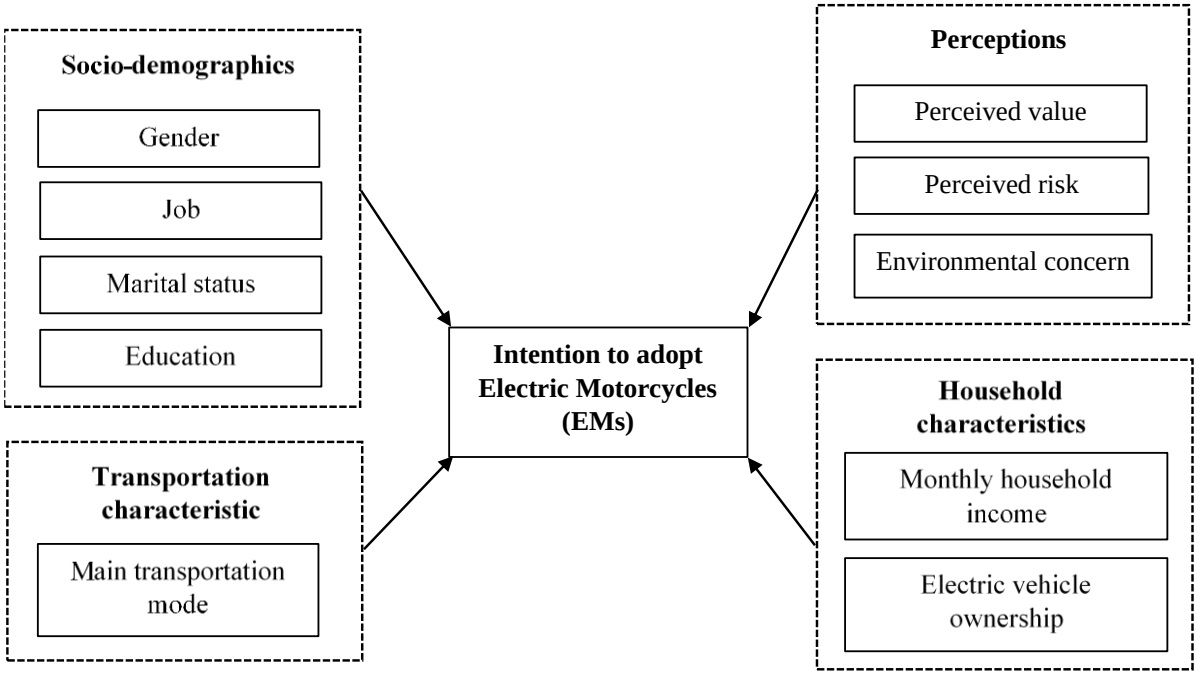

Figure 1. Research model for EM adoption intention.

3. DATA ANALYSIS

3.1. Data collection

This study employed primary data collected in October 2025 via face-to-face interviews, designed to examine the intention to switch to EMs in the context of recently proposed policy on restricting gasoline motorcycles and establishing LEZs in urban areas.

The questionnaire consisted of three main sections. The first section collected information on respondents' socio-demographic characteristics, including gender, age, education level, marital status, job, monthly household income and living area. The second focused on mobility-related characteristics, capturing main transportation mode and electric vehicles ownership. The third section examined respondents' opinions and attitudes toward electric vehicles, including environmental concerns, perceived risk, perceived value and adoption intention. Most attitudinal items were measured using a Likert-scale format.

The survey was conducted offline using paper-based questionnaires in various areas of Hanoi, covering location within Ring Road 1, Ring Road 2 and areas outside Ring Road 2. Participation was voluntary and anonymous, and the purpose of the study was briefly explained. Initially, 515 questionnaires were distributed and collected. After the data screening process, questionnaires with missing information, inconsistent responses, or unreliable answers were excluded. Consequently, a total of 409 valid questionnaires were retained for subsequent statistical analysis.

3.2. Sample characteristics

The socio-demographic and mobility-related characteristics of 409 respondents were summarized based the survey data. The proportion of both genders are relatively balanced with 49.88% for male and 50.12% for female. Employed people make up the majority of participants (44.99%), followed by students (33.01%), retirees (6.85%), and others. 58.19% were married and 41.81% were single or divorced. The level of education varied fairly among the participants; the percentage of individuals that have a university degree is the same as those who do not (38.14%) while people with post-graduate degree made up 23.72%. Regarding household income, the largest share of respondents earns more than 30 million VND per month (31.05%), followed by those earning between 10–20 million (29.58%) and 20–30 million (29.1%), while only 10.27% report incomes below 10 million VND.

Most surveyed individuals resided inside Ring Road 1 (48.9%) and Ring Road 2 (40.83%), with only 10.27% of participants reported living outside Ring Road 2. Motorcycles are the predominant mode of travel, accounting for 73.11% of the total, significantly surpassing cars at 13.69%, public transportation at 9.05%, and other modes at 4.16%. Lastly, electric vehicle ownership is reportedly uncommon with 69.19% of surveyed households not owning any, compared to the 30.81% of those that do.

Table 1. Sample characteristics (N=409).

Variables		Frequency	%
Gender	Male	204	49.88%
	Female	205	50.12%
Job	Student	135	33.01%
	Employed	184	44.99%
	Self-employed	41	10.02%
	Retired / homemakers	28	6.85%
	Others	21	5.13%
Marital status	Married	238	58.19%
	Single / divorced	171	41.81%
Education	Under university degree	156	38.14%
	Univeristy degree	156	38.14%
	Postgraduate degree	97	23.72%
Monthly household income	Under 10 million VND	42	10.27%
	10 – under 20 million VND	121	29.58%
	20 – under 30 million VND	119	29.1%
	More than 30 million VND	127	31.05%
Living area	Inside ring road 1	200	48.9%
	Inside ring road 2	167	40.83%
	Outside ring road 2	42	10.27%
Main transportation mode	Motorbike	299	73.11%
	Car	56	13.69%
	Public transportation	37	9.05%
	Others	17	4.16%
Electric vehicle ownership in household	Yes	126	30.81%
	No	283	69.19%

3.3. Exploratory Factor Analysis (EFA) results

Exploratory Factor Analysis (EFA) is a data reduction technique that helps simplify complex data by showing how many observed variables can be explained by a smaller set of hidden factors, using three main pieces of information: factor loadings (links between variables and factors), unique variances (what's left over for each variable), and factor correlations (relationships among the factors). Principal component extraction with oblimin rotation (Kaiser normalization) was applied, and factors were retained based on the eigenvalue-greater-than-one criterion (Table 2).

Table 2. EFA results for perceived risk, environmental concerns and perceived value.

Items	Perceived risk	Environmental concerns	Perceived value
PV_1: When considering the expenses for an electric motorcycle, I feel that they are worthy of the money spent.			0.9127
PV_2: Choosing electric motorcycles is a good deal to me.			0.9155
Cra_R_1: Traveling with an electric vehicle comes with the risk of accidents due to the lack of engine sounds.	0.7643		
Per_R_1: Electric vehicles often encounter charging and battery issues	0.6814		
Emo_R_1: When using an electric vehicle, I feel concerned about finding charging stations when the number of electric vehicles is rapidly increasing while the charging infrastructure remains limited.	0.5287		
Fin_R_1: The battery, maintenance and repair costs of an electric vehicle is a significant burden for the owner.	0.6590		
Soc_R_1: An electric car is not considered a true car by other people.	0.8399		
Pri_R_1: Using an electric vehicle may compromise my personal information (eg. Credit card number, phone number, address, …)	0.8085		
EC_1: I believe people should adjust their behaviour to protect the environment and limit the effects of climate change.		0.7799	
EC_2: I believe environmental problems are growing more severe in recent years.		0.8320	
Model parameters:			
Sample size: 409			
Bartlett's Test of Sphericity: p-value (0.000); H0: variables are not intercorrelated			
Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy: 0.773			
Method: principal-component factors with eigenvalue >1			
Rotation: orthogonal oblimin (Kaiser on)			
Retained factors = 3			
Variance explained by three factors extracted: 0.7508 (~75%)			

The Kaiser-Meyer-Olkin measure of adequacy (KMO = 0.773) demonstrated the sample's validity for analysis. Bartlett's Test of Sphericity (p = 0.000) confirmed that the

intercorrelations between items were sufficient for conducting EFA. About 75% of the data variance was explained by the extracted factors. The 3 retained factors are as follow:

The first factor, Perceived risk consists of 6 items related to potential issues that influence the decision to own an electric vehicle: Cra_R_1 (accident risk due to lack of engine sound), Per_R_1 (charging and battery issues), Emo_R_1 (concerns of proportionately less charging stations), Fin_R_1 (concerns of maintenance costs as financial burden), Soc_R_1 (social acceptance of electric cars), Pri_R_1 (concerns of security breach).

The second factor, Environmental concerns consist of 2 items related to personal opinions about environment conservation: EC_1 (the belief that people should take action to protect the environment), EC_2 (the belief that environmental issues are worsening).

Finally, Perceived value consists of 2 items related to the monetary worthiness of an electric vehicle: PV_1 (related expenses are justified and fair), PV_2 (choosing electric vehicle feels like a bargain).

Table 3. EFA results for intention.

Items	Intention
I_EM_1: For me, the likelihood of using an electric motorcycle in the future is high.	0.9348
I_EM_3: The probability that I become interested in electric motorcycle usage in the future is high.	0.9348
Model parameters:	
Sample size: 409	
Bartlett's Test of Sphericity: p-value (0.000); H0: variables are not intercorrelated	
Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy: 0.500	
Method: principal-component factors with eigenvalue >1	
Rotation: orthogonal oblimin (Kaiser on)	
Retained factors = 1	
Variance explained by factor extracted: 0.8739 (~87%)	

A separate EFA was performed for the intention construct using principal-component extraction with the eigenvalue > 1 criterion, along with orthogonal oblimin rotation under Kaiser normalization. Bartlett's Test of Sphericity was significant ($p = 0.000$) and the KMO value reached the minimum acceptable threshold (KMO = 0.500). This KMO value is considered acceptable given that the intention construct consists of two correlated items with high factor loadings. Around 87% of the total variance was explained (Table 3).

3.4. Results of regression model

A linear regression is a statistical technique used to examine the relationship between the dependent variable and one or more independent variables by establishing their average marginal effects. In this study, linear regression is employed to identify the socio-demographic, residential, mobility-related, and psychological factors associated with individuals' intention to adopt EMs. A positive coefficient indicates that an increase in the explanatory variable is associated with a higher adoption intention, whereas a negative coefficient suggests a lower adoption intention. Statistical significance is evaluated using p-values and confidence intervals to determine whether the observed relationships are unlikely to have occurred by chance.

Regarding socio-demographic characteristics, gender is the only variable that shows a statistically significant association with EM adoption intention (Table 4). Specifically, compared to males, females showed a lower intention to adopt EMs (coef = -0.187, $p < 0.05$). In contrast, other socio-demographic variables including age, employment status, marital status, education level and monthly household income were not statistically significant.

Table 4. Results of factors associated with the intention to adopt EMs.

Independent variables	*Coefficient*	*SE*	*P>|z|*	*95% Conf. Interval*	
Gender (ref=Male)					
Female	-0.187*	0.076	0.014	-0.337	-0.037
Age	-0.005	0.005	0.272	-0.015	0.004
Job (ref=Students)					
Employed	-0.156	0.179	0.383	-0.509	0.196
Self-employed	-0.305	0.205	0.138	-0.709	0.098
Retired / homemaker	-0.313	0.263	0.235	-0.831	0.204
Others	-0.304	0.216	0.161	-0.730	0.121
Marital status (ref=Married)					
Single / divorced	-0.120	0.143	0.401	-0.401	0.161
Education (ref=Under university degree)					
University degree	0.173	0.148	0.244	-0.118	0.465
Postgraduate	0.010	0.162	0.951	-0.309	0.329
Monthly household income (ref= Under 10 million VND)					
10 – under 20 million VND	-0.073	0.133	0.581	-0.335	0.188
20 – under 30 million VND	-0.084	0.139	0.545	-0.358	0.189
More than 30 million VND	-0.111	0.136	0.415	-0.380	0.157
Living area (ref=inside ring road 1)					
Inside ring road 2	-0.099	0.078	0.206	-0.254	0.055
Outside ring road 2	-0.334**	0.125	0.008	-0.581	-0.087
Electric vehicle ownership in household (ref=Yes)					
No	-0.258**	0.084	0.002	-0.424	-0.091
Main transportation mode (ref=Motorcycle)					
Car	0.213	0.121	0.079	-0.025	0.453
Public transportation	0.149	0.128	0.247	-0.103	0.402
Others	-0.068	0.185	0.710	-0.432	0.295
Perceived risk	-0.153***	0.035	0.000	-0.223	-0.082
Environmental concerns	0.287***	0.036	0.000	0.215	0.358
Perceived value	0.531***	0.040	0.000	0.451	0.610
Constant	0.703*	0.251	0.005	0.209	1.198
Number of observations (N)	409				
Pseudo R^2	0.5180				

*Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$*

With respect to residential and mobility-related factors, living area is significantly associated with EM adoption intention. Compared to individuals living inside Ring Road 1, those residing outside Ring Road 2 were less likely to adopt EMs (coef = -0.334, $p < 0.01$). In addition, individuals from households without electric vehicle ownership reacted negatively to EM adoption intention compared to those from households that already owned electric vehicles (coef = -0.258, $p < 0.01$). In contrast, main transportation mode was not significantly associated with adoption intention.

Meanwhile, psychological factors demonstrated strong and statistically significant correlations with EM adoption intention. Perceived risk was negatively associated with adoption intention (coef = –0.153, $p < 0.001$), while environmental concerns were positively associated (coef = 0.287, $p < 0.001$). Moreover, perceived value showed the strongest correlation with EM adoption intention (coef = 0.531, $p < 0.001$).

3.5. Results of ANOVA Test

Analysis of Variance (ANOVA) is a statistical method used to determine whether there are significant differences between the means of three or more groups. It evaluates variability within groups (random noise) and between groups (differences in group means) to assess statistical significance. In this study, ANOVA was applied to compare the mean intention to adopt EMs among residents living inside Ring Road 1, inside Ring Road 2 and outside Ring Road 2 (Table 5).

Table 5. Results of ANOVA test for intention to adopt EMs.

Groups	Number of observations	Mean	Std. Dev.	Min	Max
Inside ring road 1	200	0.102	1.045	-1.970	1.813
Inside ring road 2	167	-0.003	0.968	-1.970	1.813
Outside ring road 2	42	-0.473	0.750	-1.970	0.867
Between groups: Sum of Squares = 11.538; d.f. = 2; Variance = 5.769; F = 5.907; p = 0.003					
Tukey HSD Post-hoc Test.					
Inside ring road 1 vs Inside ring road 2: Diff = -0.1065, 95%CI = -0.3501 to 0.1371, p=0.5596					
Inside ring road 1 vs Outside ring road 2: Diff = -0.5764, 95%CI = -0.9709 to -0.1820, p=0.0018					
Inside ring road 2 vs Outside ring road 2: Diff = -0.4700, 95%CI = -0.8711 to -0.0688, p=0.0168					

The ANOVA results revealed a statistically significant difference in mean adoption intention across the three residential groups (F = 5.907, p = 0.003). Post-hoc Tukey HSD tests indicated no significant difference between residents inside Ring Road 1 and Ring Road 2 (p = 0.5596). However, respondents living outside Ring Road 2 exhibited significantly lower adoption intention compared to those inside Ring Road 1 (Diff = -0.5764, p = 0.0018) and inside Ring Road 2 (Diff = -0.4700, p = 0.0168).

These findings reinforced the regression results by providing additional evidence that residential location, particularly outside Ring Road 2, was linked with lower adoption intention. The consistency between regression and ANOVA outcomes strengthened the empirical findings.

4. DISCUSSION

The findings suggested that psychological factors, besides socio-demographics, played significant roles in shaping individuals' intention to adopt EMs. Among the psychological

factors, perceived value emerged as the strongest driver of adoption intention. This result also suggested that individuals' evaluations of cost-effectiveness and usefulness were critical determinants of EMs adoption.

First, regarding socio-demographic characteristics, most variables did not exhibit a association with EMs adoption intention. However, gender showed a significant association, with females reporting a lower intention to adopt EMs compared to males. This may reflect differences in risk perception and attitudes toward new technologies. In addition, prior studies also indicated that women tend to be more risk-averse [23], thereby displaying lower optimism towards new technology adoption. As electric motorcycles are still in the early stage, associated with concerns related to charging infrastructure, battery performance and long-term reliability, these perceptions may contribute to lower adoption intention among female users.

Second, residential location was also found to be an important factor influencing EM adoption intention. Individuals living outside Ring Road 2 had a negative association with adoption intention compared to those residing inside Ring Road 1. This pattern may be explained by differences in exposure to regulatory and policy pressure. According to Directive No. 20/CT-TTg, the Vietnamese government sets a clear roadmap requiring that by July 1st, 2026, no gasoline motorcycles are allowed to circulate within Ring Road 1 in Hanoi [24]. This policy has sent a strong signal to residents in this area, increasing perceived urgency of transitioning to EMs. In contrast, residents outside Ring Road 2 were not yet directly subject to this restriction. Therefore, they experienced weaker regulatory pressure and continued to use conventional gasoline motorcycles, leading to weaker incentives to shift away from conventional gasoline motorbikes. However, the feasibility of this transition may also depend on the accessibility to charging infrastructure at residential locations. Installing electric vehicle charging facilities is often challenging for renters or residents living in multi-family housing units [25], where private charging installation is limited or not permitted. Moreover, following recent fire-safety concerns, some apartment management boards in Hanoi have imposed restrictions on parking or charging electric motorbikes in basement parking areas, as reported in several residential complexes [26]. Under such conditions, even when residents living within Ring Road 1 face stronger policy pressure to transition away from gasoline motorcycles, the lack of facilitating infrastructure or restrictive residential regulations may constrain their ability to translate intention into actual adoption.

In addition, households without prior electric vehicle ownership exhibited lower adoption intention compared to those already owning at least one electric vehicle. This finding suggested that the absence of prior experience to electric vehicles may increase uncertainty and hesitation toward adopting EMs. In contrast, prior experience with electric vehicles allowed individuals to become familiar with their operational aspects including charging, maintaining and performance, which fostered a sense of reliability and comfort toward this electric mobility [27]. Applied to EMs context, when individuals understand how they function in real-life contexts, they tend to evaluate EMs based on their actual benefits, promoting the adoption of this mobility mode.

Consistent with previous studies, the higher levels of perceived risk, the less intention of individuals to adopt new mobility technologies. Pang et al. and Wang et al. showed that perceived risk was negatively linked with adoption intention, with customers focusing on concerns about vehicle reliability, charging time costs and technological disadvantages compared to conventional vehicles [28, 29]. Applied to EMs context, when they are perceived as less reliable or more inconvenient than conventional gasoline motorbikes, individuals are

more likely to maintain their current travel behavior rather than switching to a new mobility option.

Environmental concern represented individuals' awareness of environmental problems and their consideration of environmental impacts in daily mobility choices. Previous studies indicated that environmental concerns had a significant and positive impact on purchase intention regarding green products, including transportation modes [30]. Therefore, individuals with strong environmental concerns were more likely to perceive EMs as an alternative to gasoline motorcycles as they contributed to lower emissions and reduction of carbon footprint. Furthermore, higher levels of environmental concern motivated individuals to actively search for sustainable alternatives [30]. This search process enhances their knowledge of available green options, reduces uncertainty regarding product performance, and increases their confidence in making environmentally friendly choices.

Finally, perceived value was the most influential determinant of the adoption intention. When individuals perceive EMs financially worthwhile and believe that their benefits outweigh associated costs, they develop more favorable evaluations, which directly translate into stronger adoption intentions. This result was consistent with previous studies indicating that consumers are more willing to adopt EMs when they believe they can bring value to them [31].

The findings serve as a suggestion for future policies, putting emphasis on the most influential factors that affect intention. For instance, financial incentives in the form of discounts, tax reductions, or optimized upfront costs can raise the perceived value of EMs, while public education campaigns and pilot projects highlight the potential benefits of EMs. Measures like free and discounted registration for battery electric vehicles for the first 5 years or special consumption tax cuts are notable examples. At same time, safety standards and reliable service networks are needed to ease concerns about danger and performance. Concerns about electric vehicles caught on fire while charging are the most perceivable safety risks among Vietnamese consumers. It is the responsibility of manufacturers to rigorously test, confirm and improve their products' safety standards to dispel the preconceived negative notions. Campaigns tailored towards female customers, from design, marketing to technical adaptations can help close the observed imbalance in adopt intention.

5. CONCLUSIONS

This study examined the factors influencing individuals' intention to adopt EMs in Hanoi in the context of emerging policies restricting gasoline motorcycles and the implementation of LEZs. Using primary survey data collected from 409 respondents, the study applied EFA, regression analysis, and ANOVA to identify key determinants of EM adoption intention. The results showed that adoption intention is more significantly influenced by psychological factors than by sociodemographic ones. The largest positive influence among these variables was perceived value, followed by environmental concerns. Perceived risk, on the other hand, was the primary discouraging factor that affects intention. Most socio-demographic variables showed no sign of association with the adoption intention, except for gender, as female respondents have shown to be less likely to adopt EM. On the other hand, those who live outside Ring Road 2 have far lower adoption intention than those who live inside Ring Road 1 and 2, indicating that residential location is equally crucial. Furthermore, EM adoption intention was positively correlated with prior experience with electric vehicles.

From a theoretical perspective, the findings reinforce behavioral approaches in transportation research by demonstrating that individuals' cognitive evaluations of benefits and risks play a more decisive role than structural characteristics in shaping the adoption of new mobility technologies. From a practical standpoint, policies aimed at accelerating EM adoption should focus on improving perceived value through financial incentives, strengthening environmental awareness through public communication, and reducing perceived danger by enhancing technical standards and charging infrastructure. In addition, experiential initiatives such as test-ride programs and pilot projects may help increase familiarity with EMs. Together, these measures can complement regulatory policies and contribute to the transition toward more sustainable urban mobility in Hanoi.

A limitation of this study is that the data gathered are not evenly distributed, as only a minority of respondents exhibited certain characteristics compared to other traits of the same group. Future studies are recommended to aim for a relatively balanced group of participants to ensure data integrity. The second limitation is that while the study is conducted in the context of the planned introduction of LEZs in Hanoi, it does not explicitly measure individuals' perceptions of the policy, such as awareness, perceived restriction severity, or perceived inconvenience. These factors may influence behavioral responses once the policy is implemented. Finally, as the study is conducted within Hanoi's specific social and regulatory context, the findings may not be fully generalizable to other urban settings.

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