

PAPER • OPEN ACCESS

Prevalence and influential factors of adopting electric motorcycles: The case of students in Hanoi, Vietnam

To cite this article: Minh Hao Nguyen *et al* 2023 *IOP Conf. Ser.: Mater. Sci. Eng.* **1289** 012046

View the [article online](#) for updates and enhancements.

You may also like

- [Analysing Motorcyclist Characteristics and Parking Behaviours towards Different Parking Schemes](#)
Gusri Yaldi, Imelda M. Nur, Apwiddhal et al.
- [Motorcycling performance and sleepiness during an extended ride on a dynamic simulator: relationship with stress biomarkers](#)
C Bougard, P VanBeers, F Sauvet et al.
- [Understanding the adoption of electric motorcycles among road users in Vietnam](#)
Dinh Minh Tran, Nhat Linh Hoang, Van Bien Nguyen et al.



ECS
The
Electrochemical
Society
Advancing solid state &
electrochemical science & technology

DISCOVER
how sustainability
intersects with
electrochemistry & solid
state science research

Prevalence and influential factors of adopting electric motorcycles: The case of students in Hanoi, Vietnam

Minh Hao Nguyen¹, Sy Sua Tu^{1,*}, Trung Anh Nguyen¹, Hai Binh Nguyen¹, Vu Yen Mai¹, Phuong Mai Nguyen¹, Ngoc Bao Pham¹, Tai Anh Nguyen¹, and Minh Hieu Nguyen¹

¹ Faculty of Transport-Economics, University of Transport and Communications, 03 Cau Giay street, Dong Da district, Hanoi 100000, Vietnam.

* Corresponding author's e-mail: tusysua@utc.edu.vn

Abstract. The development of electric motorcycles depends on the motorcycle usage rate in each country, which is crucial in forming sustainable urban development. In this study, we investigated determinants of using e-motorcycles among students in Hanoi, Vietnam. Students are the research subject due to their critical role in shaping future travel patterns. The used data were collected by surveying 290 students from three universities. We found that the prevalence of adopting electric motorcycles among students is 11%. The results of binary logit regression show that female students in Hanoi living within distances between home and school from 3 to 5 km are more inclined to utilize electric motorcycles. The perception of usefulness and environmental concern are facilitators of the adoption. However, perceived ease of use is not a significant predictor. This study plays a role as an exploratory analysis of the actual use of electric motorcycles. However, in order to have a better understanding of the motives behind the choice of electric vehicles for students and other population segments, more research in different settings is needed.

1. Introduction

Creating a green travel habit for the young generations has attracted a burning attention worldwide. As demonstrated consistently in the academia, the mode choice is affected largely by habit. Therefore, a habit of using environmentally friendly transportation modes at the student period is expected to maintain at adulthood and older stages. In the developed contexts, transport authorities have made efforts to push students to switch from conventional vehicles to electric ones [1,2]. Meanwhile, due to the dominant share of motorcycles in travel patterns, developing countries have encouraged students to commute by electric motorcycles in lieu of conventional ones.

The policy formulation promoting the development of electric motorcycles requires knowledge of the relevant factors affecting the implementation decision. However, previous studies on students' mode use have focused mainly on the utilization of public transport. So far, to the best of our knowledge, there has not been any research on the prevalence of electric motorcycles among students yet.

In this study, we present an investigation of determinants of using e-motorcycles among students in Hanoi, Vietnam. E-motorcycles are defined as a motorcycle using an electric engine rather than an internal combustion one. Different from e-bicycles, e-motorcycles do not have pedals and can run at



higher speeds. The used data were collected by surveying 290 students from three universities. Two specific research questions are as follows:

- (1) What is the prevalence of electric motorcycle use among students?
- (2) What are the influential factors of the prevalence?



Figure 1. Student rides an electric motorcycle to a university in Hanoi (Photo: the authors).

The rest of this paper includes four sections. Section 2 reviews relevant studies of EM use. The following section describes data collection and analysis methods. Results are provided in Section 4 before Section 5 closes this paper.

2. Literature review

2.1. Studies related to electric motorcycles

In contrast to the rich literature on analysing the choice of electric cars [2–4], a few studies have focused on examining factors associated with the use of electric motorcycles. Most research on electric motorcycles has been undertaken in Taiwan because the country has issued various supporting programs to encourage the use of green modes. In addition, Taiwanese are familiar with riding motorcycles for daily travel.

The influential factors of the intention to purchase hydrogen-electric motorcycles is looked at in Taiwan employing the data of 431 respondents collected in January and February of 2021 [5]. Purchase intention are contributed by perceived value and consumption attitude. Surprisingly, perceived risk is found to have no relation with purchase intention.

The authors of [6] have conducted an analysis of determinants of intention to use hydrogen-electric motorcycles in Taiwan. Through a survey conducted between February and March of 2016, the data of 233 participants were collected to empirically test a conceptual framework formulated based on five constructs: product knowledge, perceived risk, perceived quality, perceived value, and purchase intention. The results show that perceived value and product knowledge are important facilitators of the intention while the direct effects of perceived quality and perceived risk are insignificant. Interestingly, product knowledge can decrease perceived risk while perceived quality can increase perceived value.

In another carried out in Taiwan [7], the authors investigate the intention to adopt electric motorcycles using structural equation modelling and fuzzy set qualitative comparative analysis and the data from 305 participants. The findings indicate that purchase intention is positively associated with image, value, and perceived usefulness; however, it is negatively related to risk.

Based on the transaction cost economics theory, the authors of [8] research an intention to switch to electric motorcycles using a sample of 1094 consumers in Taipei. Regression modeling results express

that the switch intention is formed by perceived transaction costs, which were affected by an array of types of uncertainty and dependability.

A recent study based on the responses of 182 Indian persons gathered from May to July of 2021 [9], the application of Structural Equation Modelling yields interesting results. Specifically, attitude towards electric motorcycles is positively influenced by environmental concern, perceived economic benefit, social influence, and charging infrastructure. Attitude is found a strongest contributor to purchase intention.

The abovementioned review emphasizes that existing studies have merely analysed the intention. As such, little is known about factors influencing the practical use of electric motorcycles. In other words, a study on the determinants of the adoption of electric motorcycles (like the current paper) may be valuable to the literature.

2.2. Proposing conceptual framework

Different from previous studies that have been based on extensions of well-established theories with latent variables, this study, as an exploratory analysis, focuses on the roles of socio-demographical variables and some psychological ones. Predictors of students' travel are found to comprise gender, age, living areas, status of internal immigrant, and part-time job [10–13]. Besides, the distance between home and school is demonstrated to be a significant factor of mode choice among students [11]. Therefore, we desire to explore the role of two main variable groups in determining the actual use of electric motorcycles among students.

- Group 1 (observed variables): gender, age, living area, internal immigrant status, part-time job, and home-school distance.
- Group 2 (latent variables): perceived usefulness, perceived ease of use, and environmental concern. The consideration for perceived usefulness and perceived ease of use are in line with earlier studies of intention to use electric motorcycles (as reviewed in sub-section 2.1). Whereas, environmental concern is widely established to be a motivator for performing pro-environmental behaviours, such as choosing green travel modes/services [14].

3. Data and methods

3.1. Research setting

The venue of this study is Hanoi that is situated within the Red River delta in the North of Vietnam. It is the capital and an economic, cultural, political, and tourism centre. Besides, the city is the biggest educational centre of the North in terms of university and post-graduate degree. The resident population of Hanoi is 7,852.6 thousand inhabitants, of which 594.9 thousand are students attending in 75 universities and 3 colleges. Approximately 9.5% of students are studying at 14 non-public educational institutions [11]. Most universities and colleges are located in urban districts where mobility and access are much more convenient and easier.

Daily travel in Hanoi depends largely on motorcycles while cycling is mainly a mode of recreational activity for adults and an access-to-school mode for pupils [15–18]. There has been a worrying increase in car ownership in the capital. Public transport system comprises over 100 subsidized bus routes, one BRT corridor together with one metro line. The ridership of public transport decreased from 2014 to 2017 before recovering in part to reach a share of about 8.5% [19–21]. The uncontrolled proliferation of private vehicle usage and the decrease in public transport exacerbate traffic congestion, pollution, and accidents [22–25].

Travel of Hanoi students are reliant mainly to the bus because it offers a cheap price and the relatively wide coverage; yet, the percentage of bus trips for students decreased over time. Students accounted for about 37% of bus trips in 2016 compared to 45% in 2010 [26]. The role of students' bus use can be seen clearly during the COVID-19 era. The closure of universities in accordance with the national social distancing mandated in April 2020 contributed to a huge fall in patronage from 27.1 million (January 2020) to 0.63 million (April 2020) [11]. When students could re-attend in classes, the ridership made an impressive rise to 19.2 million in May 2020 and 25.3 million in October 2020.

However, as noted in [11], students tend to leave public transport to have their own private motorized vehicles, such as motorcycles. Although there is no official statistics or surveys of students' use of motorcycles, some recent reports of non-governmental organization like GIZ [27] indicate the increasing use of electric motorcycles of the young persons in urban areas. As such, more students are expected to choose the green version(s) of motorcycles.

3.2. Survey and data

To conduct the current research, a questionnaire was designed to gather data. Three parts were included in the questionnaire. In the first section, we explained the objectives of the survey and the policy of data protection were explained to persuade students to continue the survey. The second part respondents' background information, such as gender, age, and internal immigrant status. The third section asked participants about their level with statements about users' attitudes towards electric motorcycles. Three items were adopted to measure perceived usefulness, perceived ease of use, and environmental concern were 'The use of electric motorcycle is useful for my life at that time', 'For me, riding an electric motorcycle is relatively easy', 'I am seriously concerned about environmental challenges due to the emissions of road transport modes'. Responses were measured on a 5-point Likert scale, ranging from 'completely disagree' to 'completely agree'.

To verify the questionnaire, it was tested with 10 students from University of Transport and Communications. Since COVID-19 has been well controlled, in-person interviews were selected to collect data from students. We hired 5 students from University of Transport and Communications and carefully trained them skills and techniques to approach and survey potential participants. The survey was undertaken in three universities, including University of Transport & Communications, University of Foreign Trade, and Thuongmai University. The objective of the survey was to interview 100 students per each university. Interviews were conducted directly with students.



Figure 2. Interview with a student at Thuongmai University (Photo: the authors).

In the end of the survey process, 5 answers were removed because of missing data while 5 others were eliminated due to the lack of reliability of 300 distributed forms. As a result, the final sample included 290 responses.

3.3. Method

Since the present research consider whether a student used electric motorcycles; the dependent variable is a binary one, leading us to choose the method of binary logit regression. The independent variables encompassed two groups of variables mentioned in sub-section 2.2. Attitudinal variables were treated as continuous variables.

Since binary logit regression is very well-known and common method, we do not describe it in more detail here. All of the statistical analyses were estimated using STATA 15.0.

4. Results and discussions

4.1. Descriptive statistics

Table 1 presents the breakdown of the sample. Among 290 participants, 51% were male, while 49% accounted for female. Students in the sample were relatively young with an average age of 19.6 years. Because the surveys were conducted in three universities in urban districts, the vast majority (72%) of respondents were living in urban areas. Students who were not locals in Hanoi accounted for 71%, which was in line with the fact that Hanoi is an educational centre attracting numerous students from different cities and provinces. Only a quarter of the sample had a part-time job. As regards the distance between university and home, the highest rate (32%) of students was related to the distance from 1.5 to 3 km. The numbers of students having the home-university distances of under 1.5 km and 3-5 km were similar while students living the farthest from university (at least 5 km) made up the lowest rate (16%).

The prevalence of using electric motorcycles among students was 11%.

Table 1. Sample description (N=290).

Variable	Frequency	Percent
<i>Gender</i>		
Male	148	51.03
Female	142	48.97
<i>Age</i>	19.617 ^{mean}	1.091 ^{standard deviation}
<i>Living area</i>		
Urban districts	209	72.07
Non-urban districts	81	27.93
<i>Internal immigrant status</i>		
Local citizens in Hanoi	207	71.38
Non-local citizens in Hanoi	83	28.62
<i>Part-time job</i>		
No	215	74.14
Yes	75	25.86
<i>Home-university distance</i>		
Under 1.5 km	81	27.93
1.5 – under 3 km	92	31.72
3 – under 5 km	70	24.14
At least 5 km	47	16.21
<i>Riding an electric motorcycle</i>		
Yes	33	11.38
No	257	88.62

4.2. Factors associated with the use of electric motorcycles

Table 2 provides the results of binary logit regression of whether a student rider an electric motorcycle. The value of Pseudo_R² (0.2295) was of the recommended range (0.2-0.4) [28].

Compared to male students, females (Odds Ratio=2.734) were more likely to travel by electric motorcycle. This can be explained by the fact that male students tend to travel more and longer than female counterparts. One of the obvious drawbacks of electric vehicles compared to conventional ones was (riding) range [3]. As such, males may end up more serious concern about the operation of electric motorcycles. Unlike gender, age and living area were insignificant predictors.

Table 2. Logit regression results.

Variable	Odds Ratio	Std. Err.	P> z
<i>Gender</i>			
Male	Ref.	Ref.	Ref.
Female	2.734*	1.265	0.030
<i>Age</i>	1.281	0.303	0.295
<i>Living area</i>			
Urban districts	Ref.	Ref.	Ref.
Non-urban districts	0.725	0.371	0.531
<i>Internal immigrant status</i>			
Non-local citizens in Hanoi	Ref.	Ref.	Ref.
Local citizens in Hanoi	3.743*	1.766	0.005
<i>Part-time job</i>			
No	Ref.	Ref.	Ref.
Yes	1.050	0.523	0.921
<i>Home-university distance</i>			
Under 1.5 km	Ref.	Ref.	Ref.
1.5 – under 3 km	3.852	2.711	0.055
3 – under 5 km	4.236*	3.034	0.044
At least 5 km	1.154	1.114	0.882
<i>Perceived usefulness</i>	1.965*	0.575	0.021
<i>Perceived ease of use</i>	0.751	0.176	0.223
<i>Environmental concern</i>	1.733*	0.463	0.039
Log likelihood		-79.179822	
Number of obs		290	
LR chi2(11)		47.18	
Prob > chi ²		0.0000	
Pseudo R ²		0.2295	

* refers to $p < 0.05$

The likelihood of choosing electric motorcycles for students who were locals in Hanoi (Odds Ratio=3.743) was higher than that for non-local students. This may reflect the link between the urban lifestyle and the choice of green modes. Students arriving from different provinces may take existing vehicles (e.g., conventional motorcycles or bicycles) from families. In addition, the distances between points of interest in provinces tend to be larger than those in cities, particularly in urban centre. Thus, citizens in provinces may have a more concentration on or a strong culture of using traditional motorcycles.

For Hanoi students, having a part-time job was found to affect the use of public transport [11]; however, it did not influence the choice of electric motorcycles.

In line with previous reports on the significant relationship between mode choice and distance between home and school, we found that electric motorcycles seemed to be more suitable for average-distance trips (3-5 km) (Odds Ratio=4.236) compared to the distance shorter than 1.5 km. This is congruent with the fact that short trips may not need the use of private motorized modes while for very long trips (>5 km), students did not choose electric motorcycles possibly because of the anxiety of range. In addition, males tend to live farther from university [10] therefore, the lower likelihood of adopting electric motorcycles for long distance was consistent with the afore-said result of gender (i.e., lower probability of using electric motorcycles for male students relative to females ones).

As expected, perceived usefulness (Odds Ratio=1.965) was positively related to the higher inclination of riding an electric motorcycle [29–31]. The result validated the findings of prior studies on the intention to adopt electric motorcycles in Taiwan and India [5,7,9].

The difference in the way consumers perceive electric motorcycles and normal motorcycles is not significant. This may be due to the similarity in operating and riding conventional motorcycles and electric ones. In this sense, perceived ease of use was not an advantage to attract students to adopt electric motorcycles.

In agreement with earlier research [14,32], environmental concern was found to encourage the use of electric motorcycles – an option of environmentally friendly transportation modes.

5. Implications and conclusions

In response to the lack of knowledge on the determinants of the actual use of electric motorcycles, we have conducted the present study using the data of Hanoi students. The results of binary logit regression show that female students, locals in Hanoi, living within distances between home and school from 3 to 5 km are more inclined to utilize electric motorcycles. The perception of usefulness and environmental concern are facilitators of the adoption. However, perceived ease of use is not a significant predictor. This study plays a crucial role in an exploratory analysis of the actual use of electric motorcycles. Some policy implications can be suggested to promote the students' use of electric motorcycles as followed. Solutions and strategies should be tailored based on gender and immigrant status. Encouragement of electric motorcycle usage for female and local students tends to lead to more positive results. Besides, practitioners and policymakers may need to think about the ideal distance between home and university for utilizing electric motorcycles when planning locations of dormitories, universities, and other residential areas. An intense demonstration of environmental and utilitarian benefits is necessary to trigger the penetration of the environmentally friendly two-wheelers among students.

This study may have several shortcomings. It only covers students rather than a more diverse sample. Moreover, it would not be sure if the sample is representative of the student population in Hanoi. Our research model is relatively simple. In fact, psychological variables are widely known as influential factors in students' mode choice [11,12]; nevertheless, only several latent factors are included in the current study. Therefore, more research in different settings is needed to better understand the motives behind the choice of electric vehicles for not only students but also other population segments.

CRediT author statement

Minh Hao Nguyen: Conceptualization, Methodology, Software, Writing - Original draft preparation. **Sy Sua Tu:** Data curation, Writing - Original draft preparation, Writing - Reviewing and Editing, Supervision, Project administration. **Trung Anh Nguyen:** Visualization, Investigation. **Hai Binh Nguyen:** Visualization, Investigation. **Vu Yen Mai:** Visualization, Investigation. **Phuong Mai Nguyen:** Visualization, Investigation. **Ngoc Bao Pham:** Visualization, Investigation. **Tai Anh Nguyen:** Visualization, Investigation. **Minh Hieu Nguyen:** Data curation, Writing - Original draft preparation, Writing - Reviewing and Editing.

Acknowledgments

This research is funded by Vietnam National Foundation for Science and Technology Development (NAFOSTED) under grant number 507.04-2021.04.

References

- [1] Lai I K W, Liu Y, Sun X, Zhang H and Xu W 2015 Factors Influencing the Behavioural Intention towards Full Electric Vehicles: An Empirical Study in Macau *Sustainability* **7** 12564–85
- [2] Degirmenci K and Breitner M H 2017 Consumer purchase intentions for electric vehicles: Is green more important than price and range? *Transportation Research Part D: Transport and Environment* **51** 250–60
- [3] Liao F, Molin E and Wee B van 2017 Consumer preferences for electric vehicles: a literature review *Transport Reviews* **37** 252–75
- [4] Ajanovic A and Haas R 2016 Dissemination of electric vehicles in urban areas: Major factors for success *Energy* **115** 1451–8
- [5] Chen Han-S, Chen Chia-Y, Chen Han-K and Hsieh T 2012 A Study of Relationships among Green Consumption Attitude, Perceived Risk, Perceived Value toward Hydrogen-Electric Motorcycle Purchase Intention *AASRI Procedia* **2** 163–8
- [6] Chen H-S, Tsai B-K and Hsieh C-M 2017 Determinants of Consumers' Purchasing Intentions for the Hydrogen-Electric Motorcycle *Sustainability* **9** 1447
- [7] Wu J-H, Wu C-W, Lee C-T and Lee H-J 2015 Green purchase intentions: An exploratory study of the Taiwanese electric motorcycle market *Journal of Business Research* **68** 829–33
- [8] Chang C-W, Chang S-H, Chiu H-J and Liu Y-C 2022 Understanding consumers' intention to switch to electric motorcycles: a transaction cost economics perspective *Australasian Journal of Environmental Management* **29** 7–23
- [9] Jayasingh S, Girija T and Arunkumar S 2021 Factors Influencing Consumers' Purchase Intention towards Electric Two-Wheelers *Sustainability* **13** 12851
- [10] Nguyen-Phuoc D Q, Amoh-Gyimah R, Tran A T P and Phan C T 2018 Mode choice among university students to school in Danang, Vietnam *Travel Behaviour and Society* **13** 1–10
- [11] Nguyen M H and Pojani D 2022 Why are Hanoi students giving up on bus ridership? *Transportation*
- [12] Danaf M, Abou-Zeid M and Kaysi I 2014 Modeling travel choices of students at a private, urban university: Insights and policy implications *Case Studies on Transport Policy* **2** 142–52
- [13] Belgiawan P F, Schmöcker J-D, Abou-Zeid M, Walker J, Lee T-C, Ettema D F and Fujii S 2014 Car ownership motivations among undergraduate students in China, Indonesia, Japan, Lebanon, Netherlands, Taiwan, and USA *Transportation* **41** 1227–44
- [14] Wang Y, Wang S, Wang J, Wei J and Wang C 2020 An empirical study of consumers' intention to use ride-sharing services: using an extended technology acceptance model *Transportation* **47** 397–415
- [15] Nguyen M H and Pojani D 2022 The emergence of recreational cycling in Hanoi during the Covid-19 pandemic *Journal of Transport & Health* **24** 101332
- [16] Nguyen M H, Pojani D, Nguyen T C and Ha T T 2021 The impact of Covid-19 on children's active travel to school in Vietnam *Journal of Transport Geography* 103191
- [17] Nguyen M H and Armoogum J 2020 Hierarchical process of travel mode imputation from GPS data in a motorcycle-dependent area *Travel Behaviour and Society* **21** 109–20
- [18] Hieu N M 2021 Modelling school travel mode choice – the case of Hanoi, Vietnam *Transport and Communications Science Journal* **72** 778–88
- [19] Nguyen M H and Pojani D 2018 Chapter Two - Why Do Some BRT Systems in the Global South Fail to Perform or Expand? *Preparing for the New Era of Transport Policies: Learning from Experience* Advances in Transport Policy and Planning vol 1, ed Y Shiftan and M Kamargianni (Academic Press) pp 35–61

- [20] Nguyen M H, Ha T T, Tu S S and Nguyen T C 2019 Impediments to the bus rapid transit implementation in developing countries – a typical evidence from Hanoi *International Journal of Urban Sciences* **4** 464–83
- [21] Nguyen H N, Tu S S and Nguyen M H 2020 Evaluating the maiden BRT corridors in Vietnam *Transport and Communications Science Journal* **71.4**
- [22] Huynh D T and Gomez-Ibañez J 2017 Vietnam *The Urban Transport Crisis in Emerging Economies* ed D Pojani and D Stead (Cham: Springer International Publishing) pp 267–82
- [23] Nguyen T C, Nguyen M H, Armoogum J and Ha T T 2021 Bus Crash Severity in Hanoi, Vietnam *Safety* **7** 65
- [24] Thanh Chuong N and Minh Hieu N 2022 A review of bus crash severity analyses *Transport and Communications Science Journal* **73** 439–48
- [25] Nguyen M H, Pojani D, Nguyen-Phuoc D Q and Nguyen Thi B 2022 What if delivery riders quit? Challenges to last-mile logistics during the Covid-19 pandemic *Research in Transportation Business & Management* 100941
- [26] Nguyen M H, Ha T T, Le T L and Nguyen T C 2017 Challenges to Development of Bus System Evidence from a Comparative Analysis of Surveys in Hanoi *Transportation for a Better Life: Mobility and Road Safety Managements* Atrans Annual Conference (Bangkok, Thailand) pp 1–10
- [27] Le A T, Nguyen T Y L and Do D T 2021 *Study of electric mobility development in Viet Nam* (Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH)
- [28] Hensher D A, Rose J M and Greene W H 2015 *Applied choice analysis* (Cambridge: Cambridge University Press)
- [29] Nguyen M H, Pojani D and Nguyen-Phuoc D Q 2023 What leads underage teenagers to ride motorcycles without a permit? Utility vs parental permissiveness *Journal of Transport & Health* **29** 101569
- [30] Nguyen Thi B, Tran T L A, Tran T T H, Le T T, Tran P N H and Nguyen M H 2022 Factors influencing continuance intention of online shopping of generation Y and Z during the new normal in Vietnam *Cogent Business & Management* **9** 2143016
- [31] Nguyen M H, Nguyen-Phuoc D Q and Johnson L W 2023 Why do parents intend to permit their children to ride e-bikes? Empirical evidence from Vietnam *Travel Behaviour and Society* **32** 100586
- [32] Nguyen-Phuoc D Q, Su D N, Nguyen M H, Vo N S and Oviedo-Trespalacios O 2022 Factors influencing intention to use on-demand shared ride-hailing services in Vietnam: risk, cost or sustainability? *Journal of Transport Geography* **99** 103302