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Factors Influence Hanoians' Choice of Non-Motorized Transport Mode to Access Bus Stations

Ngo Trung Phuong[1*], Masahiko Kikuchi[2], Aya Kojima[1], Hisashi Kubota[1]

[1]Graduate School of Science and Engineering, Saitama University, Saitama, Japan
[2]Department of Engineering Affairs, City Bureau, Ministry of Land, Infrastructure, Transportation and Tourism, Tokyo, Japan
Email: *ngotrungphuong94@gmail.com, masa.kikuchi28@gmail.com, akojima@mail.saitama-u.ac.jp, hisashi@mail.saitama-u.ac.jp

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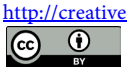

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Abstract

Hanoi's rapid urbanization has led to a surge in private vehicle ownership, particularly motorcycles, amidst inadequate public transportation infrastructure. Despite government efforts, many still prefer motorized transport, citing mobility and safety concerns, exacerbated by insufficient pedestrian infrastructure. This study examines the motivations behind this reliance on motorized vehicles, particularly motorcycles, in Hanoi. Findings reveal safety and convenience as primary factors driving motorized transport use, especially for accessing bus stations. Economic incentives could promote non-motorized travel and public transport adoption. Policy implications highlight the importance of addressing economic factors and improving access infrastructure to manage motorized vehicle reliance and foster sustainable urban mobility in Hanoi.

Keywords

Access Mode Choice, Non-Motorized Vehicles, Motorized Vehicles, Bus User, Urban Transport Behavior

1. Introduction

The rapid urbanization of Hanoi, combined with the absence of comprehensive road network planning, has led to a significant growth in private vehicle ownership. Consequently, motorcycles remain a popular choice, while the public transportation system continues to fall short of meeting the needs of residents. Despite the government's initiatives to enhance infrastructure and promote pub-

lic transportation usage, the number of individuals transitioning from private vehicles remains below expectations. People around the bus station area in Hanoi are expected to choose to walk to access bus stations before using the bus. However, there is still a heavy dependence on motorized transportation. This dependence is largely attributable to widespread private vehicle ownership often leading residents to choose driving even for short distances that could easily be covered on foot or by bicycle. Notably, in Southeast Asian countries, a majority of private motorized vehicles consist of two-wheelers, such as motorcycles and electric bikes [1]. Numerous factors contribute to this reliance on motorized transport for station access, including 1) providing better mobility, safety and accessibility in comparison with poor facilities support walking and inconvenient narrow local roads; 2) the presence of non-continuous sidewalks or sidewalks obstructed by motorcycle parked along them.

In Hanoi, much like in many other bustling cities, motorized vehicles, particularly motorcycles and scooters, play a crucial role in daily life. A significant portion of Hanoi's residents depends on motorcycles and scooters as their main means of transportation for commuting to work, school, or handling daily errands. With the city's vibrant lifestyle comprising a myriad of activities, the reliance on motorbikes is gradually shaping into a cultural characteristic among its residents. While the popularity of motorized vehicles, particularly motorcycles and scooters, in Hanoi offers numerous benefits in terms of mobility and convenience, it also brings several consequences and disadvantages such as traffic congestion, air pollution, noise pollution, safety risks of road accidents, infrastructure strain, urban sprawl, social inequality. Addressing these consequences requires comprehensive transportation planning and sustainable urban development strategies.

In Vietnam, the number of private vehicles witnessed a strong increase. In 2008, there were 2.2 million vehicles in Hanoi (185,000 cars) while there were 6 million vehicles in Hanoi (540,000 cars) in 2017 [2]. Motorcycles were used as normal vehicles. In 2017, the number of vehicles increased by 5.3%, by 2018 it increased by 4.2%, and in 2019 compared to 2018 it increased by 1.5%. Motorcycles are responsible for 86% of the vehicles in Hanoi. In the first 8 months of 2018, the number of registered vehicles in Hanoi is more than 38,000 cars, and 170,000 motorcycles. Moreover, there are about 1.2 million vehicles from the suburbs and other provinces coming to the center area of Hanoi every day [3]. As of May 2018, the network of public passenger transport by bus in Hanoi City includes 111 routes. The bus network now covers 30 districts and towns corresponding to 411 of 584 communes and wards, reaching 70.4% coverage in the city, providing basic connectivity to urban areas and residential clusters, hospitals, schools, and industrial clusters. However, the public transport system only meets 8% - 10% of the travel demand for people in Hanoi [3]. Transport demand now is exceeding the capacity of the road network which makes urban areas have already spread to low density and access to the station is difficult.

The scope of researching all motorcycle users in Hanoi necessitates a vast

amount of data. Within the context of this study, however, the focus is narrowed to bus users who utilize motorized vehicles to access the bus station. Access to bus stations by two-wheel motorized vehicles in Hanoi creates several challenges when accessing bus and train stations compared to non-motorized modes of transportation such as bicycles or walking.

1) Parking problem

Many bus stations may lack designated parking areas for two-wheel motorized vehicles. While bicycles often have dedicated racks or parking spots, the same may not be true for motorcycles and scooters. As shown in Figure 1, this can lead to congestion and haphazard parking (parking on sidewalks), creating inconvenience for both riders and pedestrians. Parking motorcycles on sidewalks can obstruct pedestrian pathways, forcing pedestrians to navigate around them or even walk onto the roadways to bypass the obstruction. This can increase the risk of accidents and collisions between pedestrians and vehicles, especially in areas with high foot traffic or limited visibility. Pedestrians may feel unsafe or uncomfortable sharing the sidewalk with parked motorcycles, particularly if they are forced to walk in close proximity to moving traffic. Parking motorcycles on sidewalks can impede accessibility for individuals with disabilities, including those using mobility aids such as wheelchairs or walkers. Blocked sidewalks create barriers for people with limited mobility, making it difficult or impossible for them to navigate the urban environment safely and independently. The presence of motorcycles parked on sidewalks can detract from the aesthetic appeal of urban spaces, contributing to a cluttered and disorganized appearance. This may negatively impact the overall attractiveness of the area for residents, visitors, and businesses, potentially affecting property values and economic development. Enforcing parking regulations and addressing sidewalk obstruction caused by motorcycles can be challenging for local authorities, particularly in densely populated urban areas. Limited resources, competing priorities, and inadequate infrastructure may hinder effective enforcement efforts, allowing illegal parking practices to persist and exacerbate pedestrian safety concerns. Parking motorcycles on sidewalks can also lead to conflicts between riders, pedestrians, and residents, as well as between different stakeholder groups within the community. Disputes over limited parking space, noise, and safety issues may arise, straining social cohesion and exacerbating tensions between various user groups sharing the urban environment.

Figure 1. Parking motorcycles on sidewalk.

2) Space Constraints

Motorized vehicles, such as motorcycles and scooters, typically require more space than bicycles, both when parked and when maneuvering. In Hanoi, there are a prevalence of narrow streets and small alleys. Narrow streets and small alleys limit the flow of vehicular traffic, leading to congestion, especially during peak hours. As shown in **Figure 2**, the presence of parked vehicles, including motorcycles, along these narrow thoroughfares further restricts available space for moving traffic, exacerbating congestion and delays. Limited space for sidewalks or pedestrian walkways alongside narrow streets and alleys increases the risk of accidents and collisions between pedestrians and vehicles. Pedestrians may be forced to walk in close proximity to moving traffic, exposing them to safety hazards such as speeding motorcycles or encroaching vehicles. Consequently, riding two-wheel motorized on narrow streets leads to accessibility challenges for non-motorized users when choosing to travel to bus stations, reducing the motivation to choose to use buses for groups of people living in narrow neighborhoods.

Figure 2. Riding motorcycle on narrow streets.

This research aims to examine the characteristics and motivations behind the motorized mode of access travel choice to bus stations in Hanoi. By focusing on this specific user group, this study will provide valuable insights into the barriers and facilitators of integrating non-motorized vehicle usage with public transport systems. This research will contribute to the development of targeted transportation planning and sustainable urban development strategies that address the demands of motorized vehicle users, ultimately enhancing the overall efficiency and accessibility of public transportation in Hanoi.

2. Literature Review

Several research studies have identified factors that influence the choice of travel modes. For example, Bolger *et al.* [4], Kwon [5], O'Flaherty [6], and Niblett & Palmer [7] found that saving travel time and costs were important factors when choosing between car or public transport. Moreover, Phuong *et al.* [8] concluded that the availability of parking services at stations played a crucial role in choosing between bus and private vehicles. Many integrated studies have also investi-

gated why people do not use public transport, and the benefits of private vehicles compared to public transport include convenience (quicker and more direct, easier for multiple journeys, and carrying equipment), freedom and control over the travel environment, reliability, access to station/stop issue, travel cost, and physical comfort (air conditioning, comfortable seats, and personal music) [9] [10] [11] [12].

The empirical research conducted in developed countries, particularly in the United States, has focused on understanding the factors influencing residents living in high-density, mixed-use areas to choose walking as a mode of transportation to reach transit stations. For instance, Dill [13] investigated the travel behavior and transit usage of residents in Transit-oriented development (TOD) areas in Portland. His findings revealed that socio-economic characteristics, travel behavior, proximity to transit stations, walking time, walking distance from the main transit station to work or school, and pedestrian-friendly infrastructure significantly influence rail commuters' decision to walk to transit stations in adjacent areas. Pedestrians are vulnerable road users and thus should be prioritized and safeguarded. This can be achieved by providing safer walking access to stations or bus stops which will promote public transportation usage [9]. Walking is a cost-effective and environmentally-friendly mode of transportation that offers numerous benefits. It is recommended by the World Health Organization as a form of moderate-intensity physical activity that can provide significant health benefits to adults [14]. Studies have also shown that walking can promote both health and sustainability [15]. The convenience factor of walking can influence people's choice to use rail or subways by walking to stations [16]. Physical activity can lead to walking for transport behavior [17]. Previous studies have focused on the correlation between the benefits of walking and individuals' willingness to use it as a means of accessing public transportation. However, little research has been conducted on how living areas' differences can impact people's attitudes towards walking to public transportation. Although P. Pongprasert *et al.* concluded that the benefits of walking factors affect people's acceptability to walk to public transport of TOD residents [18], research on the acceptance of walking among TOD residents has made a gap in research on the acceptability of walking to public transport for residents living outside of TOD areas with lower infrastructure levels. Additionally, narrow streets are a prevalent issue in urban areas, not only in Hanoi but also in other megacities across Asia such as Bangkok, Jakarta, and Chinese Taipei [1] [19].

Distance to a rail station is a crucial factor when it comes to choosing a mode of commute. In California, Kitamura *et al.* [20] conducted a study on the impact of land use and attitudinal characteristics on travel behavior and found that residential density, public transit accessibility, mixed land use, and the presence of sidewalks significantly influence travel behavior. Bhat [21] explored work travel mode choice behavior and suggested that socio-economic factors related to individuals and households play a crucial role in travel mode decisions, particularly variables like gender, income, car ownership, and status. Additionally, Van Wee

et al. [22] highlighted that residential location, neighborhood type, and urban form are key determinants of the preferred mode of travel for commute. When it comes to the catchment area and walking distance, previous studies have provided different definitions for the catchment area of rail stations. Typically, it is defined as the maximum or acceptable walking distance based on passengers' preferences for walking between their homes and the station. The acceptable walking distance is influenced by factors like proximity to destinations and social features such as safety or the presence of other pedestrians. Some studies define the pedestrian radius as a one-way walking distance of 500 - 1000 meters to the rail station. For instance, Vuchic [23] and Rood [24] define the catchment area as a circular surface with a radius representing the maximum walking distance achievable within 5 minutes from the center of activities or a 10-minute walk from the rail station. This translates to approximately 400 meters for a 5-minute walk and 800 meters for a 10-minute walk. Different regions may have varying maximum walking distances. In Great Britain, for example, over 70% of one-way walks are shorter than 1600 meters [25]. In Toronto, Canada, Stringham [26] found that the average maximum walking distance of rail passengers is approximately 1200 meters. Rastogi and Rao [27] studied rail passengers in Mumbai, India, and reported that 85% of people are comfortable with a maximum walking distance of 1250 meters. Lee *et al.* [28] examined subway accessibility in new towns across six metropolitan areas of Korea and found that 93.7% of respondents accepted a maximum walking distance of 732 - 762 meters, which equates to a 10-minute walk with an average walking speed of 1.22 - 1.27 meters per second. However, the acceptable walking distance varied depending on geographical conditions, climate, land use characteristics, and individual walking preferences [29].

In Hanoi, sidewalks are the designated area for pedestrians. Unfortunately, these spaces are often taken up by parked motorcycles and cars on Wide Street. On the other hand, Narrow Street is too narrow to accommodate separate spaces for cyclists, pedestrians, and motorcycles. As a result, all these modes of transportation share the same limited space. Mark Stevenson et al concluded that a good urban environment will encourage people walking [30]. Some others research have shown that urban design and transportation features, such as mixed land use, connected streets, and improved access to public transportation are associated to higher rates of walking [31] [32] [33] H. Ozawa *et al.* concluded that the width of roads, and the presence of obstacles had important effects on walkability, or the separation of sidewalks is particularly important to improve walkability in Bangkok [34]. Meanwhile, Hamid Mostofi *et al.* determined that bad condition of environmental attributes, such as pedestrian infrastructure, quality of road network in the neighbourhoods would discourage people from choosing to walk [35]. Bracy *et al.* discovered that perceived safety has an interactive effect on walkability [36]. However, safety is often overlooked in studies concerning walking behaviour in European and American cities. However, prioritizing safety measures could potentially promote physical activity, particularly

through walking [37]. In developing countries, safety in the walking environment is a crucial and complex issue that can affect residents' decision to walk to bus stops. Alejandro Ruiz-Padillo *et al*. had concluded that the two most important attributes identified by residents of Porto Alegre city, Brazil on walkability were public security, with a value of 51.00%, and traffic safety, with a value of 13.78% [38]. Moreover, Carmen Lizarraga *et al*. mentioned that the students will not select walking if they feel that area is not enough security (insecurity) [39].

Despite extensive research on the factors influencing travel mode choices and the benefits of non-motorized vehicles (walking), there remains a significant gap in understanding the specific challenges faced by non-motorized vehicle users in accessing bus stations then understanding the characteristics and motivations behind the motorized mode of travel choice in Hanoi. While previous studies have explored various aspects of public transport usage, socio-economic influences, and pedestrian behavior in high-density urban areas, there is limited research focusing on the distinct experiences and motivations of motorcycle and scooter users who rely on these vehicles to reach public transport hubs. This gap is particularly evident in the context of developing cities like Hanoi, where narrow streets and infrastructure limitations pose unique challenges. This research aims to fill this gap by examining the characteristics and motivations behind the use of two-wheel motorized vehicles for accessing bus stations in Hanoi. By focusing on this specific user group, this study will provide valuable insights into the barriers and facilitators of integrating non-motorized vehicle usage with public transport systems.

3. Methodology

3.1. Questionnaire Design

The survey questionnaire is designed in three main parts to collect information and opinions of the respondents. In the first part, respondents are asked about basic personal information such as: gender, age, occupation, income, and number of motorcycles in the family. In the question about age range, the groups are divided according to groups: 1) less than 19 years old—the target group is still pupils, under the age of being allowed to drive motorcycles (motorcycles, cars, etc.) according to the Law on Road Traffic of the State of Vietnam [40]; 2) the age group 20 - 29 is the age group of students who are studying at universities, colleges or vocational schools, or have just started working and are in the process of improving their income, at this stage, people also tend to prioritize saving on daily living expenses; 3) the age group 30 - 39 years old is the age group that has gradually stabilized their lives both in terms of income and issues of family, children, and housing; 4) the 40 - 60 age group is the middle-aged group with a stable career and place of residence, which tends to prioritize saving time; 5) the last group is the group of over 60 years old, this is the age group that is entitled to the State's subsidy policies in the use of public transport as well as service facilities around public areas [41].

Similar to the age range group, the income group is also divided according to specific groups such as: 1) a monthly income less than 5,000,000 VND based on the per capita income (GDP) of Hanoi city in 2019, people in this group are defined as low-income people; 2) income from 5,000,000 - 7,000,000 VND is the income of a group of people who are working in factories, farms (manual workers, without bachelor) or fresh graduate students with few years of experience, this income has not reached the middle income level and still has to look for cheap rental positions in areas far from the center to save on living costs; 3) the income group from 7,000,000 - 11,000,000 VND is the group of people who have worked for a long time (with bachelor and experience), this group is considered as the middle income group; 4) the income group over 11,000,000 VND is a group of people with high incomes, many years of experience or working in a highly specialized demanding environment, this group of people can afford to pay living expenses to live close to central areas and prefer to save the time for transportation, connected to public transport or can afford to choose other forms of private transport [42].

The second part aims to collect information about the opinions and reasons why they chose to use motorcycles to access to stations. Meanwhile, the last part is designed to collect information about people's travel characteristics such as the frequency of using bus during the week, travel mode to stations, travel time and travel cost.

3.2. Data Collection

As shown in **Figure 3**, an offline interview was conducted at 4 selected stations of Hanoi city in 2019 to find out about the status of the parking areas of the 4 stations and the behavior of choosing the access travel mode to the station between non-motorized and motorized vehicles of bus users.

Figure 3. Map of 4 survey stations.

Out of a total of 300 passengers who used the bus at the bus station randomly asked, the two main target groups of the study were the group that used motorized vehicles or non-motorized vehicles to access to stations, with 226 and 74 respectively, as shown in Table 1.

Table 1. Respondents' characteristics.

	Overall	Motorized	Non-motorized
Number of observations	300	226	74
Share (%)		75.33	24.67
Gender			
Male (%)	49.67	50.88	45.95
Female (%)	50.33	49.12	54.05
Age			
≤19 (%)	23.67	19.91	35.14
20 - 29 (%)	50.33	58.41	25.68
30 - 39 (%)	11.00	13.27	4.05
40 - 60 (%)	12.67	7.96	27.03
>60 (%)	2.33	0.44	8.11
Occupation			
Government staff (%)	21.67	23.45	16.22
Student (%)	49.33	52.65	39.19
Company staff (%)	18.33	13.72	32.43
Other (%)	10.67	10.18	12.16
Income			
≤5,000,000 VND (%)	61.00	67.70	40.54
5,000,000 - 7,000,000 VND (%)	17.67	11.95	35.14
7,000,000 - 11,000,000 VND (%)	15.33	14.60	17.57
>11,000,000VND (%)	6.00	5.75	6.76
No. motorcycle in household			
≤1 (%)	4.67	5.31	2.70
2 (%)	43.67	44.25	41.89
3 (%)	36.00	36.28	35.14
≥4 (%)	15.67	14.16	20.27
Frequency			
<1 time/week (%)	15.33	16.37	12.16
1 - 2 times/week (%)	11.00	11.06	10.81
3 - 4 times/week (%)	13.00	15.04	6.76
≥5 times/week (%)	60.67	57.52	70.27

In 300 valid responses, the similarity in the ratio of gender was shown with 49.67% male and 50.33% female. However, there is a difference between the motorized users' group and non-motorized users' group when comparing the other criteria including age range, occupation, income, number of motorcycles in households and frequency of using bus. Half of the total number of motorized user respondents have an age range from 20 - 29 with 58.41% while group of non-motorized users has a more even distribution among age groups with 26.68% of people from 20 - 29, 27.03% of people from 40 - 60 and 31.14% people lower than 19 years old as shown in Table 1. Most of bus users' respondents are students with 52.65% in motorized user group and 39.19% in non-motorized user group. There are a big number of motorized users who had low income (less than 5,000,000 VND per month) at 67.70% while this number in non-motorized user is 40.54% (also in the highest position). This indicates that people using bus in Hanoi are in the low-income group, which also shows that the public transport system is not attracting users from middle- and high-income groups. Most of bus users have more than 2 motorcycles in their household, with 43.67% of people having 2 motorcycles, 36.0% having 3 motorcycles and 15.67% having more than 4 motorcycles respectively. There are more than 60% of bus users use bus frequencies (more than 4 times per week).

3.3. Data analysis and Tools

According to Section 3.2. about the percentage of choosing the access mode to go to the stations of the passenger between motorized or non-motorized vehicles, this analysis is to find out the factors that affect to the selection of bus users on using access mode choice behavior. This analysis determines the effects of gender, age range, occupation, income, motorcycles ownership, and frequency of using bus. In the analysis, binary logistic regression models are used to determine the factors that influence the behavior of passengers of accessing stations between motorized or non-motorized vehicles; the models are expressed in Equation (1).

$$\ln\left(\frac{p}{1-p}\right) = X\alpha + Y\beta + Z\gamma + \varepsilon \tag{1}$$

where p is the probability with which passengers choose to access station by motorized vehicles; X is the vector of the frequency that passengers use bus system variables; Y is the vector of the number of motorcycles in household variables of the passengers; Z is the vector of personal characteristics (gender, age range, income, occupation) variables of the passengers; ε is the logistically distributed error; α, β, γ are the vectors of the model parameters.

4. Results and Discussion

4.1. Reason Why People Access Station by Motorized Vehicle

Out of a pool of 300 respondents surveyed across four bus stations, 226 respon-

dents accessed stations by motorized vehicles as shown in Table 1. There were 162 people using motorcycles to access station, with 71.68%. Meanwhile, 29 respondents opted for electricity bike, and 30 respondents utilized others mode, with 12.83% and 13.27% respectively. Only 2.21% of total 226 respondents accessed station by car as shown in Figure 4.

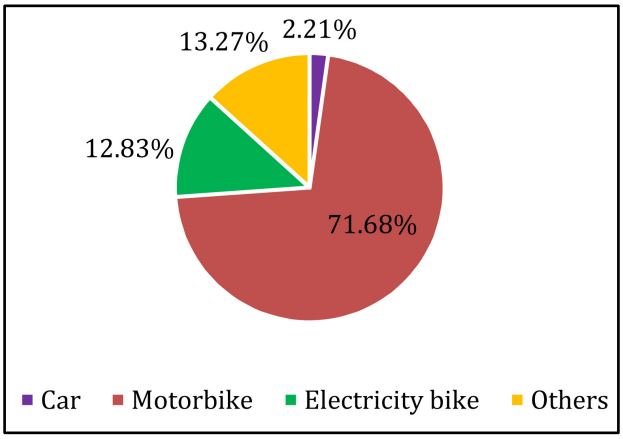

Figure 4. Access to station by motorized vehicle.

In addition, respondents were surveyed regarding their reasons for choosing motorized vehicles to travel to the bus station, assessing five factors: 1) short travel time, 2) low cost, 3) safety, 4) convenience, and 5) the availability of parking facilities at the station. Utilizing a 5-Likert scale with five levels ranging from strongly disagree to strongly agree, participants expressed their personal opinions on selecting motorized vehicles for accessing the bus station, as illustrated in Figure 5.

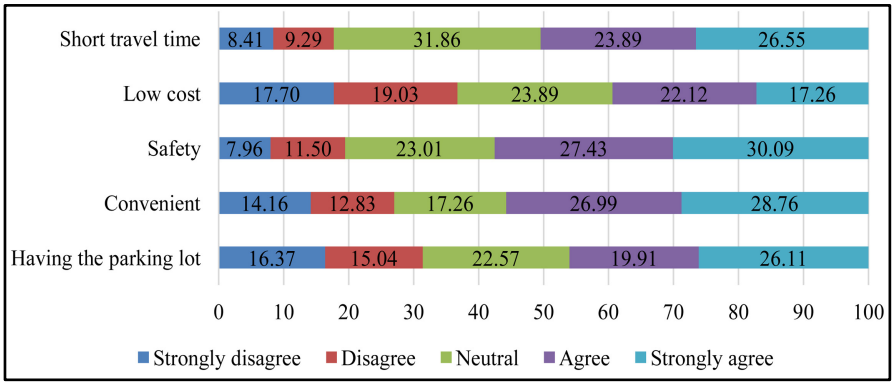

Figure 5. Reason on accessing station by motorized vehicle.

Overall, the highest percentage of strongly agree is observed in the safety factor, at 30.09%, followed by the convenience factor, which garnered 28.76% agreement. Conversely, the lowest level of strongly agree is attributed to the low travel cost factor, at 17.26%. This underscores the paramount importance of safety in influencing the decision to travel to bus stations via motorized vehicles

rather than opting for alternative non-motorized modes such as walking or cycling. This trend is rational, considering that issues like motorcycle parking challenges, the presence of narrow alleys, and inadequate pedestrian facilities in cities like Hanoi often evoke feelings of insecurity among pedestrians [1] [17] [32] [33].

In **Figure 5**, regarding the issue of short travel time, the highest proportion of respondents provided neutral answers, accounting for 31.86%. Meanwhile, the combined rates of strongly agree and agree totaled 26.55% and 23.89%, respectively. This indicates that, from the perspective of individuals, motorized travel may not significantly enhance time savings for reaching the bus station compared to other non-motorized modes of transportation. Concerning the potential cost savings associated with approaching the bus station via motorized vehicles, it is unsurprising that the response rate hovers around 20% in all five levels. Meanwhile, in the category of the availability of parking facilities at the station, 26.11% of respondents strongly agreed, while 19.91% agreed. This suggests that as previous research in Hanoi, the problems of parking services at bus stations for bus users may not yet heavily met people's expectations [6]. In contrast, safety and convenience emerge as the two factors with the highest levels of agreement among respondents, with a combined agreement rate of 57.52% and 55.75%, respectively. This outcome underscores the importance of these factors in shaping people's opinions regarding motorized vehicle usage for accessing bus stations which is the same as the discussed literature highlights key factors influencing travel mode choices, emphasizing the importance of safety and convenience. Studies have shown that the availability of reliable and direct routes, and physical comfort are significant benefits of private vehicle use over public transport [7] [8] [9] [10]. Additionally, pedestrian safety and infrastructure play crucial roles in encouraging walking to transit stations, with well-designed urban environments and secure walking paths being essential for promoting public transport usage [11] [26] [28] [29] [30] [31] [34] [35] [36] [37]. It provides valuable insights for the Hanoi government and policymakers to better manage the motorized vehicle user group and tailor appropriate management policies in alignment with the existing infrastructure conditions.

4.2. Bus Users' Mode Choice to Access Stations and Their Selection on Using Park & Ride Service

Table 2 presents the results of the binary logistic regression analysis examining the likelihood of bus users selecting to access the stations between motorized and non-motorized vehicles. The coefficients associated with explanatory variables such as income and frequency of using bus are statistically significant at $p < 0.05$, while other factors like gender, age range, occupation and motorcycle ownership are not statistically significant. Among the significant factors, the negative coefficients for variables of income and frequency of using bus indicate that, holding other factors constant, lower-income individuals, less using bus than others are more inclined to use motorized vehicles to access stations com-

pared to others. Notably, gender, age range, motorcycle ownership, and occupation variables do not exhibit statistical significance in the model. Moreover, the utilization of motorized vehicles to access stations does not demonstrate any significant association with gender, motorcycle ownership, occupation, or using bus frequency for individual commuters.

Table 2. Binary logistic regression model: Motorized (=1) or Non-motorized vehicles.

Variables	B	S.E.	Sig.	Exp (B)
Gender				
Male = 1	0.213	0.285	0.454	1.238
Age range				
[Age = 1] ≤19 years old				
[Age = 2] 20 - 29 years old				
[Age = 3] 30 - 39 years old	−0.164	0.172	0.340	0.849
[Age = 4] 40 - 60 years old				
[Age = 5] >60 years old				
Income				
[Income = 1] ≤5,000,000 VND/month				
[Income = 2] 5,000,000 - 7,000,000 VND/month	−0.455	0.228	0.046*	0.634
[Income = 3] 7,000,000 - 11,000,000 VND/month				
[Income = 4] >11,000,000 VND/month				
Number of motorcycles in household				
[Motorcycle = 1] ≤1				
[Motorcycle = 2] 2	−0.286	0.175	0.102	0.751
[Motorcycle = 3] 3				
[Motorcycle = 4] ≥4				
Frequency of using bus				
[Frequency = 1] <1 time/week				
[Frequency = 2] 1 - 2 times/week	−0.288	0.140	0.039*	0.749
[Frequency = 3] 3 - 4 times/week				
[Frequency = 4] ≥5 times/week				
Occupation (Government staff = 1)	0.506	0.546	0.354	1.659
Occupation (Student = 2)	−0.428	0.648	0.509	0.652
Occupation (Company staff = 3)	−0.903	0.516	0.080	0.405
Constant	4.179	1.140	0.000	65.294
Number of observations	300			
Chi-square	25.186			
−2 Log Likelihood	310.000			
Cox and Snell R Square	0.081			
Nagelkerke R Square	0.120			
Percentage correct	76.3%			

**Significant at 1% level; *Significant at 5% level.

The observation that individuals with higher incomes are more likely to access station by non-motorized vehicles suggests that as bus users' income levels rise, they are inclined to use non-motorized vehicles to access station. This finding underscores the influence of economic factors on the attractiveness of bus stations to travelers who utilize buses. Building upon this insight, proposed strategies can prioritize economic solutions to encourage more bus users accessing station by non-motorized vehicles, expect more people to switch from private vehicles to public transport and utilize bus stations effectively.

5. Conclusions

The management of motorized vehicles is pressing not only in Hanoi but also in cities across other developing countries. This research highlights that the majority of bus users rely on motorized vehicles, particularly motorcycles, to reach bus stations. Safety and convenience emerge as the primary factors driving this choice, garnering widespread agree among respondents. This underscores the pivotal role of these factors in shaping public perceptions regarding the use of motorized vehicles for accessing bus stations. The findings offer valuable insights for Hanoi authorities and policymakers, enabling them to enhance the management of the motorized vehicle user population and formulate suitable policies tailored to the existing infrastructure conditions.

By using the Binary logistics regression model to analyze data of bus users, this study identified the influencing factors on the behavior of bus users on using motorized vehicle. The result has shown that the Income factor affects the use of motorized or non-motorized as well as the frequency of using bus factors. If other factors are equal, the lower-income individuals, less using bus than others, in same situations, will be more likely to use motorized vehicle to access stations than the others. This result also found that when bus users have higher income, they will tend to use non-motorized vehicle. Because bus users are affected by economic factors, the proposed measures can focus on economic solutions to attract more people to go to stations by non-motorized vehicle and switch to using public transport.

There have been some limitations that should be noted in the present study. The sampling strategy and its geographic limitation to Hanoi may not provide a broad enough basis for generalization to other urban contexts or could be perceived as narrowly focused, potentially overlooking studies on non-motorized transportation incentives in similar urban contexts. Therefore, further research is necessary, in the context of other countries especially those with a substantial number of motorcycle users, such as Vietnam, Indonesia, Malaysia, or Thailand, to evaluate and validate our findings. This comparative approach would offer deeper insights for policy assessments. Additionally, the self-reported data obtaining from the questionnaire survey in this study may be bias due to social desirability although participants were well informed about data confidentiality and anonymity during the survey. Furthermore, this study may not yet suffi-

ciently engage with or challenge existing theoretical frameworks on urban mobility and transport psychology. Future research could explore the effects of other variables using psychology models or theories such as the theory of planned behavior (TPB) or the technology acceptance model (TAM). Addressing these limitations in future research could provide a more comprehensive understanding and enhance the applicability of the findings to broader contexts.

The limitations notwithstanding, based on the results of this research, the accompanying policies related to economic factors and the quality of facilities in access to bus station especially safety level, are very important towards the goal of management motorized vehicles and thereby expecting an overall solution for the sustainable development of traffic in Hanoi.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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