A study on Commuters' Travel Intention in Motorcycle-based Context:

A Case of Ho Chi Minh City, Vietnam

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Abstract:

Motorization is occurring rapidly at the global level. In developing countries, this process is more encouraged by high economic growth and fast urbanization. As an inevitable process, the increasing growth of private vehicles results in pressure on public transport system. Motorcycle also becomes a significant phenomenon in many Asian mega cities. A variety of 'pull' and 'push' strategies focus on reducing private vehicle use and improving service quality of public transport in developing countries. In the last decades, new alternatives of public transport such as Mass Rapid Transit (MRT), Light Rail Transit, and Bus Rapid Transit have been introduced as an effective approach for mitigating urban transport issues in Bangkok (Thailand), Manila (the Philippines), and Jakarta (Indonesia). The study methods of cross analysis and independent sample t-test are used to explore the relationship between attitudinal influences and travel intentions in the context that motorcycle use becomes long-standing habit and public transport accounts for little share of travel demand.

It is found that personal lifestyles and attitudes toward bus access have significant influences on travel intention. Moreover, occupation, household income, private vehicle ownership, parking availability, commuting distance, and trip sharing are important factors classifying commuter groups who have different travel intentions. While it takes time and massive cost for an efficient MRT network integrated to conventional bus system, commuting trips in the long distance should be the target for MRT in the future. Car users become potential of MRT use in term of walking access while motorcycle use can contribute to MRT in term of motorcycle access. In addition, improvement for bus service should be considered to achieve sustainable development of public transport.

Keywords:
    commuter, motorcycle, mass rapid transit, travel intention, Ho Chi Minh City, developing countries

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1. Introduction

Motorization is occurring rapidly at the global level. In developing countries, this process is more encouraged by high economic growth and fast urbanization. The increasing growth of private vehicles seems to continue as an inevitable process. Many megacities are experiencing not only the high growth of car ownership and usage but also a similar trend for motorcycle. It is predicted that car use gradually will substitute motorcycle use to accounts for major share of private modes as income reaches a specific level. It is assumed that high rate of motorcycle growth only happens in the early economic development [19] [22]. However, the case of Taiwan, a developed region with parallel development in cars and motorcycles, has indicated that motorcycle as well as passenger car continues to play a vital role in future urban transport of developing economies. Since motorization has been accelerated at a lower income level, motorcycle-dependent cities have more obstacles in implementing 'pull' and 'push' strategies to control private vehicle use.

In the last decades, mass transit systems have implemented for reducing private vehicle use and improving service quality of public transport. Bus Rapid Transit (BRT) emerged as a popular practice in Latin American cities, and Mass Rapid Transit (MRT) was also introduced as an effective approach for mitigating urban transport issues in many Asian megacities. The advantages of MRT systems have been illustrated with successful examples of Hong Kong, Kuala Lumpur, and Singapore. The introduction of MRT has been examined as a contextual factor influencing on mode choice behavior of motorcyclists in Taiwan- a motorcycle development region [4].

While BRT system has been proved by its feasibility in finance and implementation, the success of MRT systems is still questionable. MRT is considered as an efficient option to meet high travel demand in megacities of developing countries [18]. It keeps major contribution to urban transport improvement [1]. Depending on the level of economic development, MRT investment needs time and massive cost to become an efficient network integrated to conventional bus system. However, heavy cost and insufficient passenger volume were emphasized as obstacles for planning rapid transit as a part of strategic plan [11]. In the case of Bangkok (Thailand), MRT operations fail to meet initial objectives although it was predicted to contribute the reduction of traffic congestion by accounting 41% of the travel demand in 2010 [12]. This issue also occurred for MRT3 of Manila as the MRT ridership was lower than initial forecast [20]. Although high economic growth has resulted in a rapid increase of private vehicles in megacities such as Bangkok, Manila, and Jakarta, it is the fact that conventional bus and para-transit services still keep a significant proportion in urban transport of these cities [13]. This situation is different from that of motorcycle-dependent cities where motorcycle use becomes a long-standing habit and public transport accounts for a little share of travel demand. Asian cities with the high share of two-wheel vehicles have urban traffic distinct from the global trend [16]. It means that there are more challenges for MRT use in the area where motorcycle emerges as a dominant mode. A study of people's travel intention with respect to MRT is recommended for managing private vehicle growth without limiting urban mobility in the motorcycle-based context. This study selects Ho Chi Minh City (HCMC) as a representative of motorcycle dependent cities. The research aims to explore the relationship between commuters' travel intentions and underlying factors that influence behavioral intentions. These targets will be answered through this study. The rest of this paper is organized as follows.

Section 2 reviews existing literature on factors influencing transit use and suggests hypothesis of this research. Section 3 provides local characteristic of the study area. Section 4 describes the methodology (questionnaire design, sampling and survey, and data analysis) while Section 5 presents survey results. Section 6 provides analysis and comparison of commuters' attributes, attitudes, and behavioral intentions. Section 7 summarizes the main findings and discusses the implication of this study, followed by conclusions in Section 8.

2. Research context

According to the Theory of Planned Behavior (TPB), a behavioral intention is based on attitude toward the behavior, subjective norm and perceived behavioral control [2]. A behavioral intention is defined as an important antecedent of future behavior. In term of travel behavior, behavioral intention, namely travel intention, is defined as how people are willing to choose a travel mode [25]. The strength of intention indicates how much people attempt to conduct the behavior. Therefore, understanding behavioral intention results in valuable prediction about a given behavior. The application of TPB has been conducted in previous studies on travel behavior. In developing countries, there are some studies focusing on behavioral intentions [9] [15] [21] [25]. However, such a study of travel intention with respect to MRT has been rarely conducted in a motorcycle-based context.

A range of studies have been conducted to explore the factors that make people likely to have transit use. In term of MRT, it is believed that access to rail stations keeps a vital role in improving MRT ridership. Station characteristics, walking environment, travel patterns (time, cost, and distance), and feeder modes should be considered in connecting traveler to rail station [3] [28]. In addition, commuters' satisfaction on para-transit service (safety, comfort, and convenience) influences positively on mass transit connectivity and transit use intention [24]. The attributes of MRT system such as travel time and service reliability likely affect commuters' choice in using MRT [7]. Socio-economic characteristics are also found as factors affecting MRT choice. Affordable housing should be considered for enhancing the transit habit of low-income people around rail stations [23]. In addition, car ownership is found to be a negative factor for MRT use [28]. The level of rational mobility in car use affects people's auto dependency which influences MRT use intention [10]. Commuters who are car oriented or eco-friendly prefer to use mass transits [25].

In term of bus and para-transit services, auto oriented and transit oriented factors considerably influence on commuters' preference to use public transport [15]. Different lifestyles such as car oriented and service oriented affect the intention of using jeepney service [21]. In the motorcycle dependent region without MRT, it is noted that geography features contribute to the popularity of bus service and motorcycle use [19]. For example, there is less usage of public transport in rural areas than urban areas due to the important role of motorcycles for local economic conditions. Moreover, education level, household income, household size, travel distance, working status, accompanying person, and trip complexity are important variables for using bus [27]. Psychological determinants such as moral concern, perception on bus quality have significant influences on bus use intention [9].

Since MRT system has not been developed in HCMC yet, people lack experience in using this alternative. Motorcycle is utilized as the prime mode for daily trips. Moreover, bus transport accounts for a little share of transport demand. While para-transit service such as motorcycle

taxi keeps a minor role in connecting bus service, attitudes toward bus access might affect people' intention in transit use. Travel intentions might be based on factors different on socio-economic characteristics, modal features, perceptions on trip preferences [25]. Many factors discussed above such as travel patterns and built environments only exist in the context of operating MRT system. Therefore, underlying factors such as lifestyles, personalities, car preferences, auto-oriented, and transit-oriented should be considered to investigate the relationship between current travel behaviors and future MRT choices in motorcycle-based context. These factors are identified by applying attitudinal theories and measured by the social-psychological approaches [21].

Given this background, it is hypothesized that personal lifestyles and attitudes toward bus access are important determinants influencing commuters' travel intentions with respect to MRT in a motorcycle dependent city. A questionnaire survey with state preferences will be conducted to understand commuters' behavioral intentions and future MRT choices.

3. Study area

Ho Chi Minh City is the second largest city in Vietnam. Located in the southern part of Viet Nam, HCMC has an area of 2,095 km^2 and includes 19 urban districts and 5 rural districts. The total population of HCMC is over 9 million that is expected to grow to 13.8 million by 2025 [17].

The re-integration of Vietnam into the world economy and the concomitant shift to market economy affected HCMC much earlier than other parts of the country. Since the market-based economy appeared in Vietnam, the urban transport situation has worsened rapidly, especially in the highly urbanized and emerging urban areas. It is said that HCMC is currently facing challenges from traffic congestion, private vehicle growth, low public transport usage, and inadequate transport infrastructure. Such problems can be found similarly in other cities of developing countries.

Figure 1. Private vehicle growth in Ho Chi Minh City
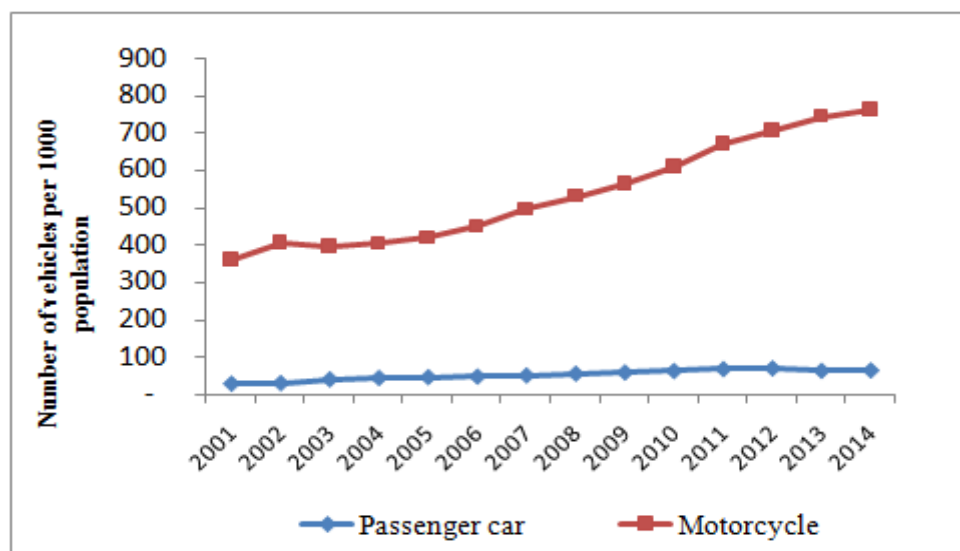
(Source: HCMC Department of Transportation. Compiled by Le Quan Hoang)

The significant change in traffic conditions during the last two decades was characterized by a rapid increase in the number of private vehicles, a reduction in that of bicycles and a

declining trend of bus services. Private vehicles still account for a major share in daily transportation while motorcycle taxi becomes the popular mode of para-transit services. In 2002, the number of cars was only 66,000 while that of motorcycles was more than 2 million [17]. By May 2014, the number of registered private vehicles in HCMC is 6.5 million including 0.5 million cars and 6 million motorcycles (Figure 1). This high rate of motorcycle ownership is extremely different from other cities in Asia. There have not had any effective solutions to control the growth of private vehicles yet. Motorcycle becomes the primary mode of the urban transport.

Since 2002, HCMC's government has focused on public transportation development. Bus transport has been supported through subsidized price policies, investment loans on facilities, and capital and infrastructure. In the period of 2002-2009, the average increasing usage of public transport usage and bus transport are 35.52% and 37.84% respectively [5]. Although public transportation has been developed in recent years, it has not met the travel needs yet. In 1976, HCMC's population was 3 million people and it had about 1,000 buses that met 10% of travel needs. In 2009, HCMC's population was 7.1 million people and it had 3,096 buses that met 5.2% of travel needs. It is estimated that public transport usage accounts for only 7.2 % of travel need while this figure is 5.4% for bus transport.

Moreover, transport infrastructure development does not meet the growth of urbanized areas, and to cope with the existing traffic demand. While the existing basic road network which was built during the French colonial period are still in good condition in the central areas, others in new urbanized areas are narrow. Total length of roads in HCMC is about 3,580 km in which urban roads reach more than half of the total length of the roads (52.4%) and national highways account only for 1.8% [6]. There are not any urban railway systems such as metro, monorail, tramway, etc which share the mode of road transport, and contribute to the capacity of public transport in HCMC yet.

According to the Transport Master Plan toward 2020, there will be 7 metro lines, 2 monorails and 1 tramway with 167 km in length [17]. Since public transport system has only bus and taxi, it fails to compete with private vehicles which account for a major share in daily transportation. Currently, the first two MRT routes, namely MRT 1 and MRT 2, have been launched in HCMC. Their construction will be finished in 2019 and 2020 respectively. Information about new MRT lines has been advertised for local residents. The main station of MRT systems is located in the area where a city bus terminal is being operated as the largest transit hub in the city center.

4. Methodology

4.1. Questionnaire design

Based on the hypothesis, a questionnaire was developed to collect commuters' information and travel behavior. The survey questionnaire consists of following four parts: (1) General information; (2) Travel and trip patterns; (3) Attitudes and opinions; and (4) State scenario.

The first part includes individual and household characteristics such as gender, age, residence location, workplace/school address, occupation, household size、household vehicle ownership, and household income. Residence location and work place/school address are used to identify commuting distance.

The second part consists of current travel and trip patterns such as vehicle use frequency,

commuting mode, travel duration, parking place, parking fee, travel cost, outside trip frequency, possible duration for waiting bus, reasons for using bus, private vehicle use and bus uses. Commuters were required to provide trips in details, then data might be classified for ease of integration For example, vehicle use frequency was categorized into (1) 1-2days/week, (2) 3-5 days/week, (3) 5 days/week and more, (4) At least 1-2 days/month , (5) At least 3-5 days/month, (6) At least 1 day/6 months, (7) At least 1 day/year, and (8) No usage. In descriptive statistics, this categorization might be grouped into fewer levels such as weekly, monthly, occasionally, and none. Since buses are also used for commuting trips, this part includes questions about bus use for private vehicle users and vice versa.

The third part comprises attitudinal items regarding trip preferences, lifestyles, bus access, and behavioral intentions. Respondents indicated to what extent they agree with each statement on an ordinal scale. For the purpose of limiting neutral answers and achieving reliable data, subjective judgments were given on a four-point Likert scale, ranging from "1= Strongly disagree" to "4=Strongly agree". Since respondents might be unfamiliar with the psychological approach of the questionnaire survey, the simplicity of answer choices is necessary to grasp the actual behaviors of commuters. Attitudes toward travel preferences capture commuters' agreements on trip attributes such as travel time, convenience, traffic condition, safety, and travel cost. These items are not requested for answering initial hypothesis, but they supplement for further analysis. In this study, lifestyles are defined as the ways people think of travel modes. Lifestyle items include attitudes toward usage of motorcycle, car, and bus. A part of these items are adapted from relevant prior studies [14] [20] [24] [25]. Statements on attitudes toward bus access show how much commuters accept different modes to access bus service. Statement relating to behavioral intentions measure travel intention with respect to motorcycle, passenger car and bus such as the following items "*For long trip, I might consider transportation modes different from motorcycle*", "*I might use car more than motorcycle in case both are available in my household*" and " *I intend to use bus more if it is possible*".

The last part aims to understand commuters' intentions in using MRT. Commuters were asked to answer the question whether they want to use MRT with different scenarios relating to trip types and access/egress modes such as walking, motorcycle, motorcycle taxi, passenger car, taxi, and bus. The scenario is the combination of access modes and egress modes. For example, the scenario includes an access statement such as "*It takes only 15 minute to walk to station near your origin*", "*You can use motorcycle/motorcycle taxi/car/taxi/ bus to access station*" and an egress statement such as "*It takes only 15 minute to walk from last station to your destination*", "*You can use motorcycle/motorcycle taxi/car/taxi/ bus from last station to your destination*". Further scenarios relate to fare impacts such as "*The fare minimum is decreased to 5,000 VND*", "*The fare minimum is increased to 10,000 VND*". Answers were requested for different distances. In this study, the length of five kilometers is chosen for distinction between long trip and short trip. Since MRT construction has begun in HCMC, information of current MRT projects were also included for providing respondents images of new alternatives. In term of travel duration and cost, a comparison between MRT and other travel modes is also attached for references.

4.2. Sampling and survey

A survey was launched during March 2014. Surveyors are fourth-year students of Ho Chi Minh City University of Transport. The survey was piloted with a group of 20 undergraduate

students. The target respondents are commuters who have regular trips to the city center of HCMC. The survey area is limited around the future MRT terminal and in the radius of five kilometers. Questionnaire sheets were designed for both self-completion and intercept interviews. Questionnaires were randomly distributed at office buildings, schools, and public facilities in the city center. Intercept interviews were undertaken at bus terminal and parking lots around the bus terminal. Since it is difficult to have cooperation from bus passengers in the morning, the intercept survey at bus terminal was conducted in the evening. Respondents completed the questionnaire with the assistance of surveyors. After removing incomplete responses from the initial questionnaires (N=220), 198 usable samples were obtained for further analysis.

4.3. Data analysis

Due to the lack of sufficient data, discrete choice models were not applied for analyzing commuters' mode choice behaviors. Since survey data were obtained in limitation, an aggregation analysis might not represent the characteristics of HCMC's population. Therefore, a cross analysis on data relevance is necessary to explore commuters' behavioral intentions.

A Principal Component Analysis (PCA) with varimax rotation technique was conducted to examine which dimensions could summarize statements about lifestyle. Based on the results of the factor analysis, factor scores were used to identify lifestyle levels. The combination of lifestyle level resulted in different commuter groups. Attributes of respondents such as socio-economic characteristics as well as travel patterns were summarized to describe distinct characteristics of every commuter group. Attitudes toward behavioral intentions, bus access, and MRT choices are compared by different commuter groups.

Accordingly, independent sample t-tests were performed for comparisons between commuter groups based on travel intentions. It aims to find significant differences for attitudes toward bus access and bus use intention by bus-MRT choices.

5. Survey results

5.1. Descriptive statistic

Two-third of respondents (69%) are young people and belong to middle-aged group. About 32% of the respondents are government officials and office staffs. More than half of commuters (53%) are living in households with two to four members. On average, a respondent's household owns 0.23 bicycles, 2.21 motorcycles, 0.26 cars. Motorcycle was owned by most of the households (95%). Approximately one-third of households had monthly income higher than 20 million VND. It simply explained the fact that households with car ownership keep a significant proportion of respondents' household.

Similar to the characteristic of HCMC' population, commuters use motorcycles, car, and bus to and from work/school. Nearly 74% of respondents use motorcycle as the main travel mode for daily commuting. The percentage of commuters selecting bus and car are 17% and 9% respectively. Two-third of respondents (65%) use motorcycle in more than five days a week while this rate is only 8% for car usage or 7% for bus usage. About 70% of the respondents sometimes use bus service or never get on bus. The percentage of respondents using bus 3-5 days per week is 13%. One-fourth of commuters have parking free while almost 60% of respondents only less than 5000 VND per day for parking. It is consistent the fact that HCMC is a motorcycle dependent city. Motorcycle becomes dominant mode while bus transport has little

share in urban transport.

Since the sample size is limited, it is hardly to confirm the sample as the representative of HCMC's population. However, some socio-economic characteristic such as age group, motorcycle ownership, frequency of bus use, distribution of commuting mode, household size could reflect the general characteristic of commuters in HCMC.

5.2 Attitudes toward lifestyles, bus access modes, and behavioral intentions

In general, the results show high acceptance of statements about lifestyles (Figure 2). For short trip i.e. 15-minute walk, only 25 % of commuters refuse to use motorcycle. Almost 68% of respondents think it is normal to drive motorcycle in one hour continuously. A significant proportion of respondents (32%) lack information about bus schedules and bus routes surrounding their households. Almost half of respondents (43%) keep their intention in car purchase despite parking difficulties.

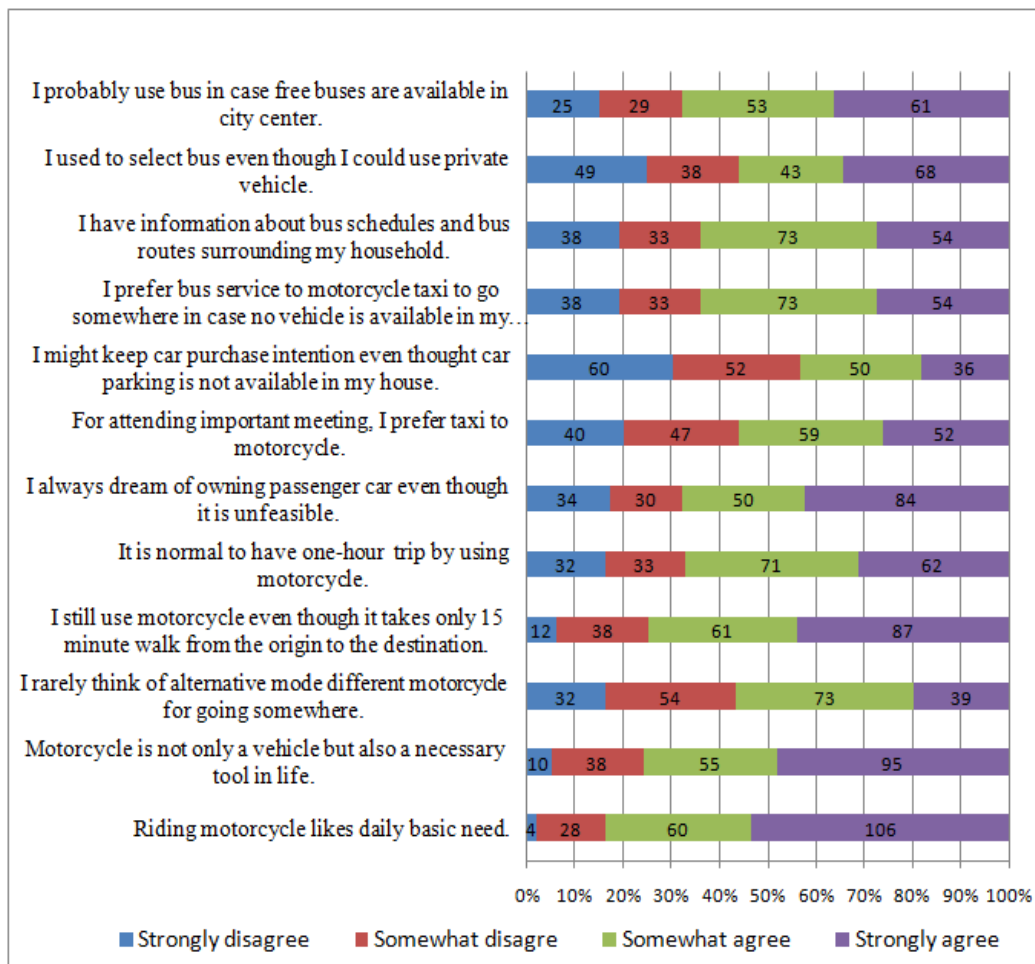**Figure 2.   Distribution of relies to lifestyle items**

Figure 3 presents the distribution of response to bus access. Respondents tend to accept walking, motorcycle use as passenger and bus transfer to access bus service. Only 49% and 42% of commuters agree to use motorcycle or motorcycle taxi as bus access modes. Almost 89% of commuters accept 5-10 minute walk to access bus stops whereas the percentage of respondents using two bus routes to their destination or being motorcycle passenger to bus stop account 73% and 71 % respectively.

Figure 3. Distribution of relies to bus access items
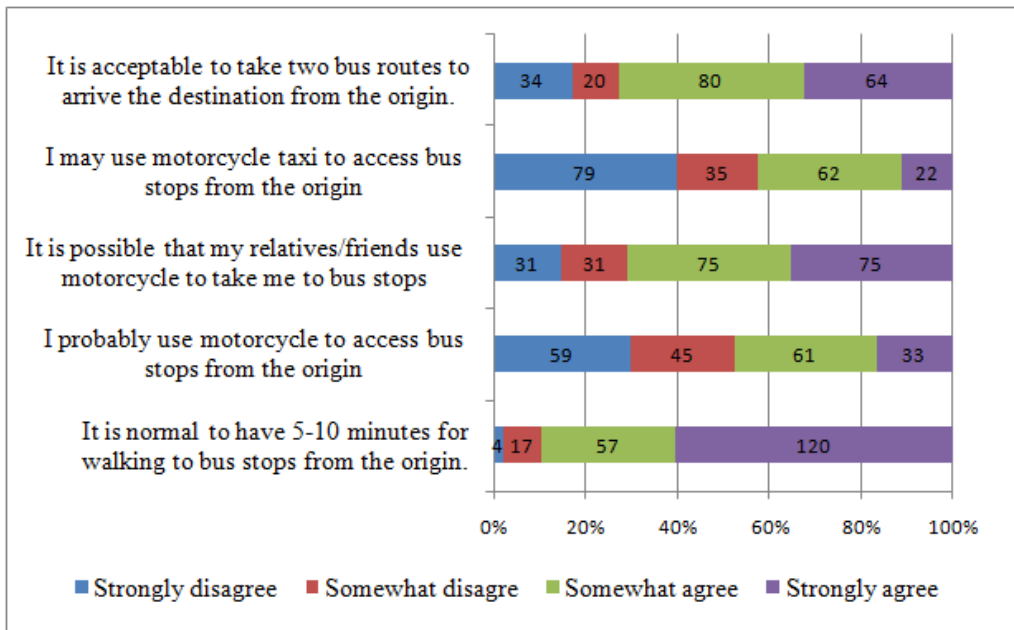
**Figure 4. Distribution of relies to behavioral intention items**
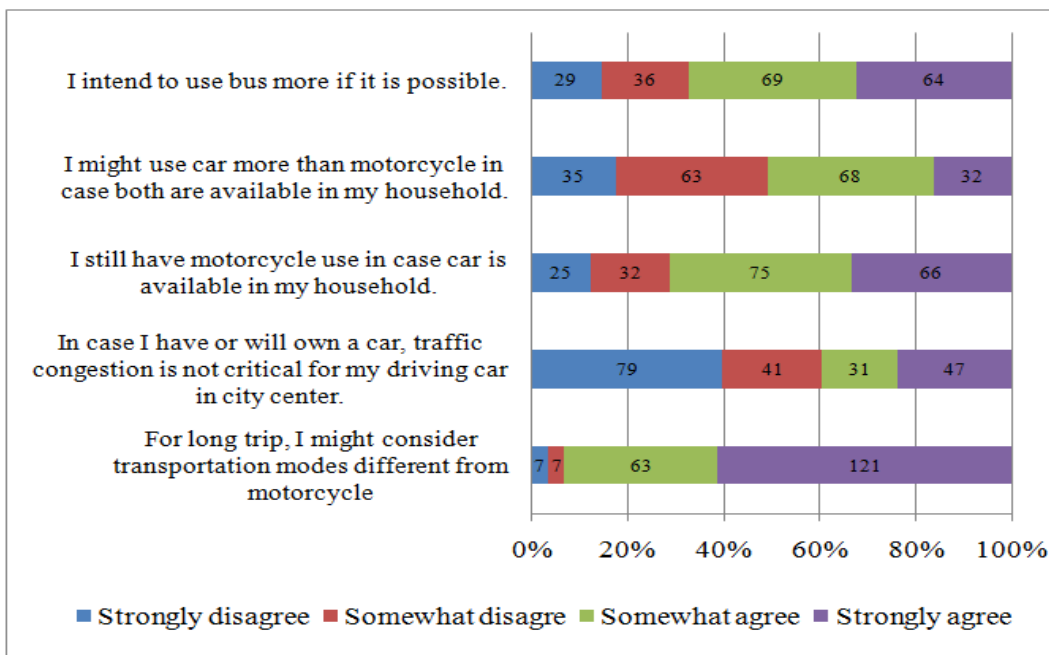
As illustrated by Figure 4, a high percentage of respondents think that they might consider other transport modes different motorcycle for long trips (93%). Over 60 % of the samples think traffic congestion affects little to their driving car habit in the city center if they have or will own cars. More than 71% of respondent agree to keep their motorcycle use in case car is purchased in their household. However, nearly half of commuters (46%) intend to use car more than motorcycle. Two-third of respondents (67%) might have more bus use in the future if it is possible. It means that one-third of commuters will not use bus even though bus service can be accessed. It indicates that there still a significant proportion of commuters want to use private vehicles in case public transport is improved.

5.3. Future MRT choice

As illustrated by the Figure 5, around 75% of commuters consider MRT use for long trips, but this falls to around 59% for short trips. The substantial change indicates that MRT use is regularly chosen for long distance. In addition, commuters who prefer motorized modes for access and egress trips constitute a significant percentage of the sample. Respondents who select motorized modes to access MRT mostly like to use motorized modes for egress trips. There are no differences among commuters' egress modes in case walking is selected for MRT access. It can be seen from Figure 6, walking, motorcycle, and bus are popular modes for MRT access and egress. Motorcycle taxi and taxi are also used for egress trips.

Figure 5. MRT choices by different access/egress modes
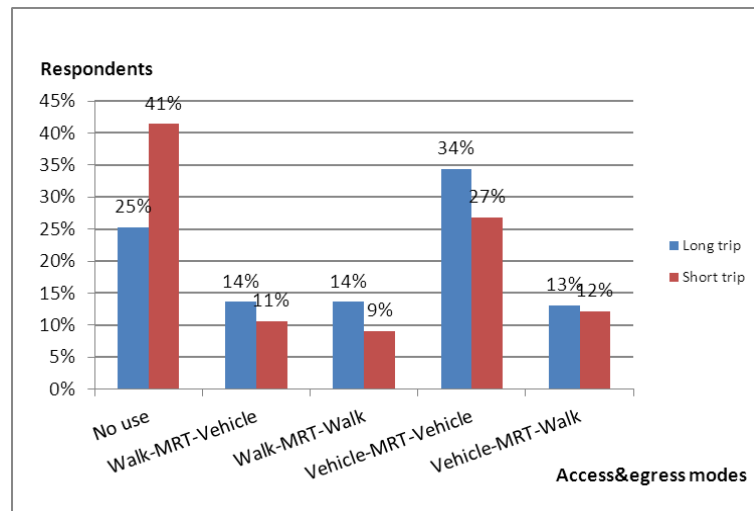
Figure 6. Access/egress modes for MRT use intentions
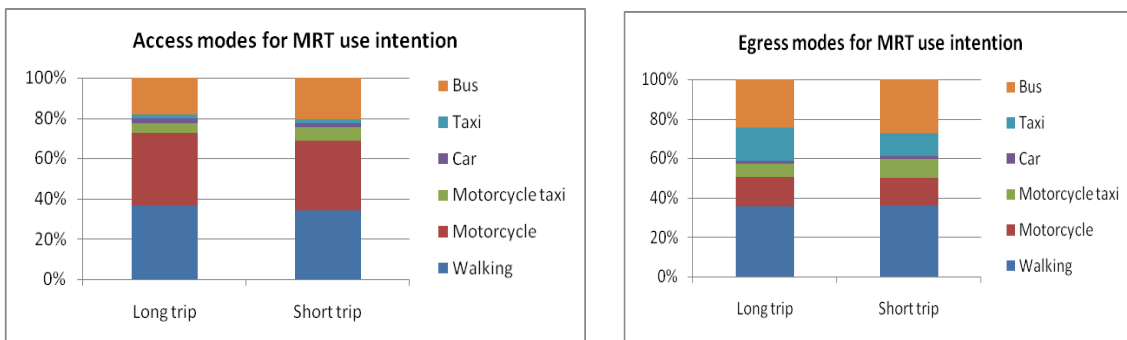
6. Analysis and comparison

Overall analyses and comparisons were conducted to explore the difference between commuter groups in bus access, behavioral intentions, and MRT choices. It is found that every commuter group has its own distinction in travel behaviors. Therefore, it is important to formulate policies and action plans in accordance with attributes of commuter groups.

6.1. Classification of commuters

The reliability analyses were performed on attitudinal items on lifestyles. Some items were deleted until the Cronbach's apha values achieve the minimum requirement >=0.6. It aims to

reduce redundancy, and to ensure sufficient internal consistency. A Principal Component Analysis with rotated component matrix is conducted for identifying main factors of lifestyles. Only attitudinal items having loading factor >=0.5 are noted. The result of PCA identified three factors, namely "bus oriented", "motorcycle oriented", and "car oriented" respectively (Table 1). The factor scores of main factors are calculated by the following factor scoring method [8].

$S= \sum W_i X_i$

In this study, factors of "bus oriented" and "car oriented" were selected for commuter classification. Since motorcycle is popular modes in daily transport, the combination of "bus oriented" and" car oriented" factors are enough to reflect the mutual relationship of motorcycle, car, and bus usage.

Table 1. Factor analysis of lifestyles

`	Lifestyles	Factor loading matrix		
		Factor 1	Factor 2	Factor 3
Bus oriented	I used to select bus even though I could use private vehicle.	.823		
	I probably use bus in case free buses are available in city center.	.749		
	I have information about bus schedules and bus routes surrounding my household.	.656		
	I prefer bus service to motorcycle taxi to go somewhere in case no vehicle is available in my household.	.581		
Motorcycle oriented	Riding motorcycle likes daily basic need.		.812	
	Motorcycle is not only a vehicle but also a necessary tool in life.		.809	
	I rarely think of alternative mode different motorcycle for going somewhere.		.503	
Car oriented	I might keep car purchase intention even though car parking is not available in my house			.804
	I always dream of owning passenger car even though it is unfeasible.			.798
	For attending important meeting, I prefer taxi to motorcycle.			.577

In this equation, the unit weight W_i is derived from factor loading of item i after principal component analysis; X_i is the evaluation score of item i. The comparison between the factor scores and the averages results in different level of bus oriented and car oriented. For bus preference, people with factor scores higher than the average are bus oriented commuters, and the others are non bus oriented commuter. For car preference, the similar procedure is applied for identifying car oriented commuters and non car oriented ones based on their different lifestyles. The combination of two lifestyles results in four commuter groups, namely "rational choice", "bus oriented", "car oriented", and "motorcycle dependent" (Table 2). Rational choice

group includes commuters who are either bus oriented or car oriented, and motorcycle dependent commuters are neither bus oriented nor car oriented.

Table 2. Commuter classification

	Bus oriented	Non bus oriented
Car oriented	*Rational choice group*	*Car oriented group*
Non car oriented	*Bus oriented group*	*Motorcycle dependent group*

6.2. Commuter attributes

Based on socio-economic information and travel pattern, the commuters' profiles are clustered by different lifestyles in Table 3. It is no surprise that men tend to be more motorcycle dependent than women. People who belong to car oriented group are aged mostly between 26 and 40, and almost 56% of motorcycle dependent commuters are aged between 26 and 35. Moreover, those of the other groups are aged between 18 and 30. This result indicates that car oriented commuters are older than the others, and respondents who are car oriented and motorcycle dependent are comprised mainly by the 26-35 year old bracket.

Table 3. Attributes of commuter groups

Category	Group			
	Rational choice	Bus oriented	Car oriented	Motorcycle dependent
Total (persons)	51	53	53	41
Gender (Male)	43%	47%	47%	59%
Age	*18-30 (55%)*	*18-30 (56%)*	*26-40 (66%)*	*26-35 (56%)*
Occupation				
Manager	20%	4%	23%	5%
Official	12%	8%	23%	20%
Officer	24%	23%	32%	20%
Labor	16%	32%	13%	27%
Student	22%	15%	4%	5%
Household income				
4-20 mil. VND	53%	57%		63%
>20 mil. VND			53%	
Car ownership	24%	8%	40%	17%
Commuting mode				
Motorcycle	49%	66%	87%	98%
Passenger car	20%	4%	11%	0%
Bus	31%	30%	2%	2%
Motorcycle use frequency *(>5 days/week)*	39%	57%	81%	85%
Weekly car use	22%	8%	38%	17%
Weekly bus use	49%	51%	6%	10%
Trip distance (<=10 km)	64%	62%	83%	78%
Inside Parking	65%	43%	64%	73%
Outside trip	37%	13%	42%	29%

Regarding occupation, officers account significant proportion of all commuter groups. While students make up 22% of rational choice group and 15% of bus oriented group, managers comprise 23 % of car oriented group and 20% of rational choice group. A large percentage of bus oriented and motorcycle dependent groups are labors. Officials constitute a considerable percentage of car oriented and motorcycle dependent groups. The results indicate that officials favor motorized modes over transit and students always have a trend of being bus oriented than other commuters.

It is found that only approximately 40 % of car oriented commuters have household car ownership. This group also earns more than VN$ 20 million per month while the other groups have monthly household income between VN$ 4 million and VN$ 20 million. It shows that income has a strong effect on car oriented lifestyle.

In terms of commuting mode, the majority of car oriented and motorcycle dependent commuters choose motorcycles. Respondents belong to car oriented and motorcycle dependent groups tend to have commuting distance lower than 10 kilometers. Bus oriented people have average travel distance higher than 10 kilometers in accordance with their lifestyles. Moreover, the ratio of motorcycle dependent commuters who park private vehicles inside office/school and have weekly trip sharing is relatively higher than that figure of the other groups. Respondents who choose bus for commuting trip have the lowest rate of outside trip frequency. Such results suggest that factors such as distance, parking availability, trip sharing, and outside trip frequency might have impacts on commuters' travel modes.

6.3. Attitudes toward lifestyle based on motorcycle use

For statements relative to motorcycle use, car oriented and motorcycle dependent peoples have highest evaluation score (Table 4). These groups are scoring higher than the others for driving motorcycle in one-hour-trip. For the habit of using motorcycle, commuters who are bus oriented have assessment score lower than the average. It indicates that they consider selecting transportation modes different from motorcycle. For driving motorcycle in 15-minute-walking trip, car oriented commuters rate it higher than the others. That these statements are consistent with commuters' lifestyles confirms the reasonable classification.

Table 4. Mean score of motorcycle use items by different commuter groups

Lifestyle (Motorcycle use)	Group			
	Rational choice	Bus oriented	Car oriented	Motorcycle dependent
Riding motorcycle likes daily basic need.	3.06	3.13	3.60	3.68
Motorcycle is not only a vehicle but also a necessary tool in life.	2.94	3.17	3.21	3.49
I rarely think of alternative mode different motorcycle for going somewhere.	2.24	2.45	2.85	2.93
I still use motorcycle even though it takes only 15 minute walk from the origin to the destination.	3.10	3.08	3.23	3.10
It is normal to have one-hour trip by using motorcycle.	2.63	2.55	3.06	3.12

6.4. Attitudes toward bus access

In term of bus access, the average scores of attitudinal items are presented in Table 5. It is found that walking, using motorcycle as passengers or transferring from other bus are highly accepted by commuters, especially bus oriented ones. People who have higher level of bus oriented than the others are likely to choose walking and bus transfer to access bus service. All commuter groups express the low level of driving motorcycle to access bus transport. However, motorcycle dependent people have high probability of using motorcycle as bus access mode. On the statement relating to motorcycle taxi, the respondents, especially bus oriented ones, have mean score lower than the neutral value (2.5). It indicates that commuters do not want to use motorcycle taxi to access bus service. It is the fact that the service cost of motorcycle taxi is usually higher than bus fare. Therefore, motorcycle taxi might not become feeder mode for bus transport although it is sometimes used to access bus service.

**Table 5. Mean score of bus access items by different commuter groups**

Bus access	Group			
	Rational choice	Bus oriented	Car oriented	Motorcycle dependent
It is normal to have 5-10 minutes for walking to bus stops from the origin.	3.41	3.76	3.28	3.42
I probably use motorcycle to access bus stops from the origin	2.34	2.34	2.26	2.46
It is possible that my relatives/friends use motorcycle to take me to bus stops	2.88	3.00	2.56	2.82
I may use motorcycle taxi to access bus stops from the origin	2.23	1.94	2.21	2.15
It is acceptable to take two bus routes to arrive the destination from the origin.	2.95	3.08	2.49	2.88

6.3. Attitudes toward behavioral intentions

The graph on Figures 4 illustrates behavioral intentions by different commuter groups. Most of respondents are less likely to use motorcycle for long trips; however, motorcycle dependent commuters still have higher probability of driving motorcycle than the others. It reveals that travel distance influences little on travel behaviors of motorcycle dependent commuters.

In term of car use, many commuters who are motorcycle dependent or car oriented disagree that traffic congestion is not a problem for driving car in the city center. In case both passenger cars and motorcycles are available in households, car oriented and motorcycle dependent commuters are likely to keep motorcycle use. However, there is no significant difference between people who likely consider more car use than motorcycle and people who do not. This result suggests that car ownership have low effect on private vehicle use of bus oriented people and motorcycle use habit continues exist in case car is purchased.

Figure 4. Behavioral intentions by different commuter groups
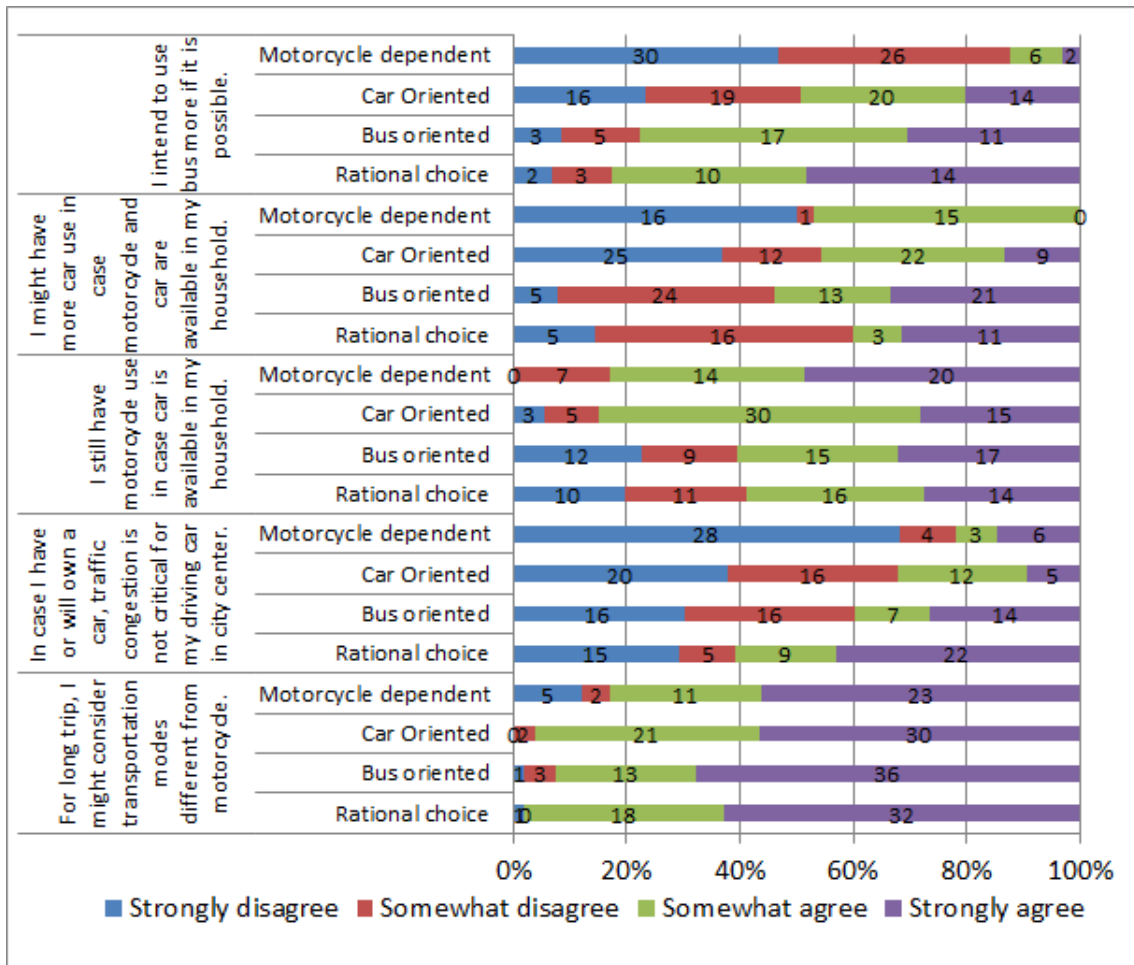
Regarding bus use intention, commuters who state high rate of using bus more in the future concentrate mainly in bus oriented group. Compared to car oriented group, motorcycle dependent group is less likely to access bus service if it is possible. It indicates that there is great difficulty encouraging bus use within motorcycle dependent people. In other words, car oriented commuters will be potential participants for mobility management programs relating to bus use.

6.5. Mass rapid transit choices by different commuter groups

Although there are no differences in MRT choices among commuter groups, there are more car oriented commuters selecting MRT than the others in long trips (Figure 5). It can be explained that car oriented people have high evaluation on punctuality and convenience. Therefore, they might choose MRT with high speed and service quality in comparison with other transport modes. Rational choice group and motorcycle dependent group are less likely to choose MRT than the other groups.

As mentioned in previous results, walking, motorcycle, and bus are selected as main access modes of MRT use. In term of walking, there are different rates between trip types within rational choice and car oriented groups. Table 6 shows that car oriented commuters favor walking to motorcycle and bus trip. Motorcycle is also selected by all commuter groups. It can be explained by the fact that motorcycle use becomes long-standing habit in motorcycle-based context. As a result, people who want to use MRT but still keep motorcycle use might combine

driving motorcycle to access MRT in daily transport. However, car oriented people have lower rate of using motorcycle as access mode than the others. Bus is ranked as the third choice of MRT access, but there is a significant difference between trip types within motorcycle dependent group. This result indicates that the integration of MRT and bus should be considered during MRT operation. Otherwise, the inefficiency of bus service might undermine the success of MRT projects. Commuters, especially motorcycle dependent people, still prefer private vehicle use for short trips in MRT catchment area.

Figure 5. Future MRT choices by different commuter groups
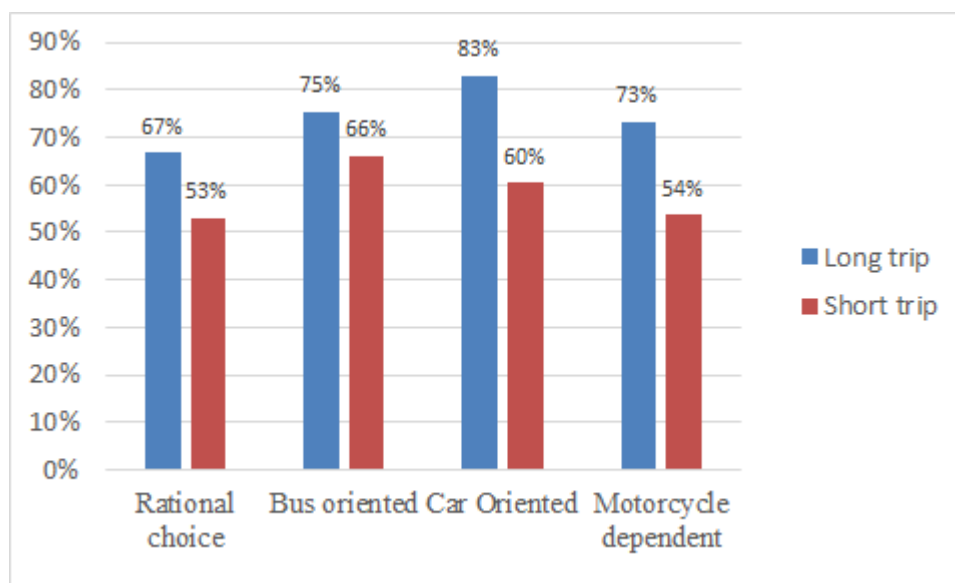
Table 6. MRT access modes by different commuter groups

MRT use	Main access mode	Group			
		Rational choice	Bus oriented	Car Oriented	Motorcycle dependent
Long trip	Walk	25%	26%	32%	24%
	Motorcycle	27%	28%	23%	29%
	Bus	10%	15%	17%	12%
Short trip	Walk	14%	23%	21%	22%
	Motorcycle	20%	23%	17%	22%
	Bus	14%	13%	13%	7%
Total (N=198)		51	53	53	41

6.6. Influence of attitudes toward bus access and bus use intention

An Independent–sample T-test was performed for exploring significant differences in term of travel intentions (Table 7). The categorization of bus choices was based on the value of attitude toward bus use intention. A comparison of bus and MRT choices yielded statistically significant differences for attitudes toward bus access. However, there is no significant difference for attitude toward bus use intention on MRT use intention

Table 7. Mean score (standard deviation) and t-test results of attitudes toward bus access and bus use intention by bus-MRT choices

Variables	Bus choice			MRT choice (Long trip)			MRT choice (Short trip)		
	No	Yes	t-test	No	Yes	t-test	No	Yes	t-test
Bus access									
Walking	3.29 (.81)	3.57 (.69)	.018	3.44 (.73)	3.49 (.74)	.660	3.40 (.75)	3.53 (.73)	.216
Motorcycle (Driver)	2.28 (1.01)	2.38 (1.11)	.545	2.08 (1.07)	2.43 (1.07)	.045	2.13 (1.09)	2.49 (1.05)	.021
Motorcycle (Passenger)	2.69 (1.05)	2.91 (1.03)	.165	2.70 (1.11)	2.89 (1.01)	.275	2.84 (1.06)	2.84 (1.02)	.972
Motorcycle taxi	2.26 (1.05)	2.08 (1.08)	.251	1.70 (1.04)	2.28 (1.04)	.001	1.84 (.97)	2.34 (1.09)	.001
Bus transfer	2.63 (1.05)	3.00 (1.03)	.020	2.64 (1.17)	2.96 (1.00)	.089*	2.56 (1.16)	3.10 (.91)	.001
Bus use intention				2.92 (1.07)	2.82 (1.03)	.574	2.90 (1.00)	2.81 (1.06)	.539

Note : All t-tests were performed at 0.05 probability level.
* t- test was conducted at 0.1 probability level.

For bus choices, there are significant differences at the 0.05 probability level in mean scores of attitudes toward walking and bus transfer. It indicates that commuters who are likely to use bus in the future favor walking or bus transfer to access bus service. Commuters are less likely to combine motorcycle and bus for their daily travel. For MRT choices, no significant differences are found at the score of attitudes toward walking access and motorcycle access as passenger. Commuters who prefer to use motorcycle as driver, motorcycle taxi, and bus to access bus service have more probability of using future MRT. Since the exact probability is higher than 0.05, the t-tests indicate that there are no significant differences in the score of attitude toward bus use intentions. It implies that commuters who do not intend to bus in possible cases might use MRT for other reasons.

7. Finding and discussion

This study has explored commuters' travel intention with respect to MRT and the roles of personal lifestyles and attitudes toward bus access in a motorcycle-based context of developing countries. The results point out that attitudes toward transit access might have important influences on travel behavior while contextual effects encourage little to transit habit. As one obvious limitation of this study, sample size should be increased to enhance data reliability and to reinforce the validity of the findings in the future. Further studies on land use and trip complexity should be included to examine the role of these factors on motorcycle use and travel intention.

In particular, the analysis reveals four commuter groups that differ in lifestyles: "rational choice", "bus oriented", "car oriented", and "motorcycle dependent". Based on commuter classification, comparisons on attitudes toward bus access, behavioral intention, and MRT

choices were conducted. Independent sample t-test was also applied to find the relationship between attitudes toward bus access and travel intentions. Some findings below are summarized for further researches and practices.

It is found that motorcycle dependent commuters have more consideration in long-distance motorcycle ride than other people. It is explained that motorcycle use becomes long-standing habit and public transport accounts little share of travel demand in HCMC. Therefore, people still prefer to drive motorcycle for long trips. It is different from previous studies in which motorcycle is suggested for short distances [4][29]. It indicates that motorcycle use for long distance still exists with regard to the contextual effects of MRT.

Focusing on motorcycle dependent or car oriented groups, it is noted that commuters tend not to use bus in the future even thought they might use bus in the present. It provides useful information for potential market of increasing the patronage of transit use. In HCMC, bus service has many disadvantages such as few bus route and low frequencies in comparison with private vehicles. Unless the quality of bus service is improved remarkably, it is hardly to encourage motorcycle dependent or car oriented commuters to have more bus use. This finding is consistent with the previous evidences that motorcycle users have negative judgment on the quality of bus service in HCMC [9]. On the other hand, the improvement of walking access and the provision of information about bus transfer might increase commuters' intention to use bus more in possible cases.

This research has also shown that MRT might be preferable for long trips in motorcycle-based area. An urban rail network is necessary for a megacity like HCMC. Since access time comprises higher proportion of travel duration in short trip, private vehicles, especially motorcycle, will be more favored than MRT. Furthermore, the inefficient performances of future feeder modes such as bus, motorcycle taxi might become significant barriers for MRT use in long distance. In term of land use, this finding should be considered for urban development along MRT corridors and at the city peripherals.

The findings also highlight challenges for the integration of MRT and bus transport. The analysis shows that bus is ranked as the third mode for MRT access. Although bus users account 30% of bus oriented people, they might not choose future MRT. The t-test results indicate that bus use intention has insignificant effect on future MRT choice. It can be explained that the income per capita of HCMC is still lower than that of other megacities like Bangkok, Jakarta, and Kula Lumpur. Therefore, MRT use might require more travel expense than bus use in HCMC. Until the average income per capita increases to a sufficient level, the future operation of MRT might be undermined by financial difficulties. To encourage more bus use in line with MRT, fare policies should be considered for both bus and MRT service.

For HCMC, car oriented commuters are potential customers of MRT market in term of walking access. In previous researches, car oriented traveler who are also eco-friendly and saving mind one will favor mass transit system to passenger car [24]. In this study, it is forecasted that car oriented people who live in residential areas adjacent the railway will have higher tendency to use MRT. Although car oriented people have more car use than other groups, they also favored MRT in term of walking access. Therefore, the built environment around rail stations keep important role encouraging more MRT use of this group. It also means that the principle of TOD practices might be revised in motorcycle dependent area.

Finally, commuters, especially motorcycle dependent people, would find it is hardly to drive motorcycle to access bus transport, but might use motorcycle frequently to access future

MRT. Since motorcycle continues to keep vital role in a mega city like HCMC, the combination of MRT and motorcycle is reasonable for commuters who intend to use new alternative of public transport and keep their motorcycle habit. Future urban transport of HCMC is similar to what is happening in Taiwan as motorcycle use still exists together with mass transit system. There were successful programs inducing motorcycle to public transit [26]. However, public transportation of HCMC might become worse than that of Taiwan if improvement of bus service comes late.

8. Conclusion

Megacities are growing in accordance with urbanization and motorization. In Asian developing regions, this process is stimulated by high economic development. Consequently, urban transport problems such as traffic congestion, environmental pollution, and private vehicle increase have emerged in many metropolitans. More challenges have been faced in planning ahead for megacities of developing countries. Motorcycle becomes a significant phenomenon which raises questions for sustainable motorization while MRT emerges as effective solution to meet high travel demand in mega cities. The study results show that motorcycle continues to be an important mode in future transport of motorcycle dependent regions. Furthermore, motorcycle might keep a significant role as MRT access mode. Unless there are effective policies to enhance bus service, bus transport continually has low attraction for commuters and contribute little to future MRT market of HCMC.

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