

ROLE OF TWO-WHEELED VEHICLE TRANSPORT IN DEVELOPING CITIES IN ASIA

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Abstract: This paper aims to analyze the characteristics of two-wheeled vehicle transport, particularly of bicycle and motorcycle, and define their sustainability from economic, social, environmental, and management viewpoints. Based on the analysis, possible policy directions on two-wheeled vehicle transport with regard to the development of public transport system were identified. Cities in Vietnam and China were primarily selected for the analysis, while other Asian cities were studied when and where appropriate to deepen the discussion.

Keywords: two-wheeled vehicle (bicycle and motorcycle), urban transport policy, Asian cities, China, and Vietnam

1. INTRODUCTION

Two-wheeled vehicles, particularly bicycles and motorcycles, have been playing a critical role in many developing cities in Asia. The dominant use of bicycle in the cities of China and the rapid shift from using bicycle to motorcycle in the cities of Vietnam are the most significant examples in the region.

With large urban areas suffering from worsening traffic and environmental conditions, policy attention is being given to the development of public transportation such as bus and rail transit systems. However, it is a fact that the expected shift from these two-wheeled vehicles to the planned public transportation is not an easy task but requires vigorous management and social acceptance. Although two-wheeled vehicles in urban areas are often considered transitional modes of transport to the more formal private and public transport modes, many cities lack explicit policy on urban transportation development.

The purposes of this paper are to:

- 1) Analyze the characteristics of two-wheeled vehicle transport. For this, seven Asian cities were selected to know the status of two-wheeled vehicle transport in urban transport. In addition, further analysis was conducted on the three cities of Hanoi and Ho Chi Minh (HCMC) in Vietnam and Chengdu in China where two-wheeled vehicle transport plays a significant role in their urban transport.
- 2) Define sustainability of two-wheeled vehicle based on the above analysis and identify the possible policy directions on two-wheeled vehicle transport with regard to the development of public transport system.

2. CHARACTERISTICS OF TWO-WHEELED VEHICLE TRANSPORT

2.1 Overview of Urban Transport Situation in the Selected Asian Cities

- 1) **Vehicle Ownership:** Table 1 compares the number of registered vehicles and ownership ratio by vehicle type among selected Asian cities. Car ownership in the cities of Vietnam and China, compared to other Asian cities, is still very low. It is interesting to note that motorcycle ownership is extremely high in Hanoi and HCMC and relatively higher in Jakarta and Bangkok, while in Manila motorcycle ownership is very low. Although the exact number of bicycles is not available, it is reported that there are about 2 million bicycles in Chengdu, 0.8 million in Hanoi and 2 million in HCMC.

It is generally understood that private vehicle ownership has a strong relationship with the economic situation of cities. Figure 1 presents the relationship between vehicle ownership and GDP per capita in the selected Asian cities. Most cities are plotted on the designated curve but motorcycle ownership in Hanoi and HCMC shows a different trend from that of other cities in comparison with the economic level.

Table 1. Vehicle Ownership in Selected Asian Cities

City (Country)	Jakarta (Indonesia)	Manila (Philippines)	Bangkok (Thailand)	Singapore	Hanoi (Vietnam)	HCMC (Vietnam)	Chengdu (China)
Year	1994	1996	1993	1993	1995	1996	2000
No. of vehicles ('000)							
- Motorcycle	1,084	73	1,105	120	630	1,400	166
- Car	681	806	1,147 ^{1/}	322	27	38	134
- Other 4 wheel-veh.	487	142	291	142	60	43	
No. per 000 population							
- Motorcycle	118	8	136	41	254	292	54
- Car	74	85	142	110	11	8	43
- Other 4 wheel-veh.	53	15	36	48	24	9	
Population (mil.)	9.2	9.5	8.1	2.9	2.5	4.8	3.1

Source: culled from various reports

Note: 1/ including buses

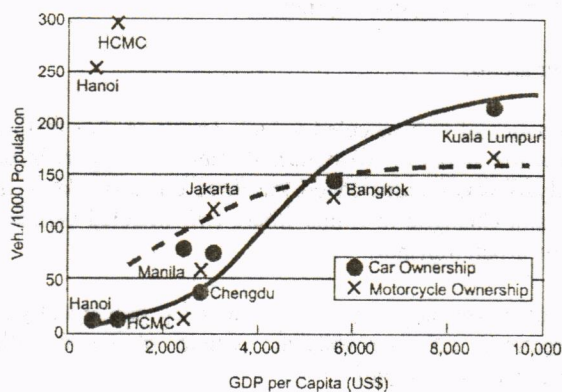


Figure 1. Relationship between Vehicle Ownership and GDP per Capita

- 2) **Modal Split:** Table 2 compares modal shares among the selected Asian cities. Urban transport demand in most of the cities is covered by road transport except Singapore, whose urban railway share accounts for 12%. Bus or paratransit modes, such as jeepney in Manila and *tuktuk* in Bangkok, are the dominant road-based public transport.

The modal share of public transport in Manila and Singapore is remarkably high compared to other cities, a situation desirable to maintain. Meanwhile most of the travel demand in Hanoi, HCMC and Chengdu is met by private transport modes such as two-wheeled vehicle. Among them bicycle is dominant in Hanoi and Chengdu and motorcycle in HCMC.

In Hanoi and HCMC, the share of motorcycles has recently been increasing, while in Chengdu, it is stable because its purchase and usage are controlled.

Table 2. Modal Split in Selected Asian Cities^{1/}

City (Country)	Jakarta (Indonesia)	Manila (Philippines)	Bangkok (Thailand)	Singapore ^{2/}	Hanoi (Vietnam)	HCMC (Vietnam)	Chengdu (China)
Year	1993	1996	1995	1993	1995	1996	2000
Private modes sub-total	46	22	51	34	93	97	77
- Bicycle	-	-	-	-	61	32	63
- Motorcycle	12	1	21	6	31	64	4
- Car	34	19	31	19	1	1	7
- Others	-	2	-	9	-	-	3
Public modes sub-total	54	78	49	66	7	3	22
- Bus	-	17	35	42	6	2	15
- Taxi	-	6	4	-	-	1	7
- Urban Railway	-	2	-	12	-	-	-
- Others	-	53	10	13	1	-	-
Total	100	100	100	100	100	100	100

Source: culled from various reports

Note: 1/ excluding walk trips

2/ to-work trips only

- 3) **Urban Transport Problems:** The problems of traffic congestion, poor public transport, decreased safety, worsening environment, and insufficient transport services for the poor are common to all cities. The causes are attributed to deficiencies in various aspects of policy setting, planning and financing, implementation, and management not only of the transport system but also of the overall urban development.

2.2 Further Analysis of Two-Wheeled Vehicle Transport in the Cities of Vietnam and China

Among the cities analyzed in the previous section, the three cities of Hanoi and HCMC in Vietnam and Chengdu in China, where the dominant mode of urban transport is two-wheeled vehicles, are selected for further analysis.

- 1) **Available Urban Transport Mode and its Services:** The available transport modes in these three cities are almost similar, as shown in Table 3. Only road-based transport modes are available. Bus service is mostly provided by state-owned enterprises, although there is limited private operation.

Compared to other Asian cities, the limited operation of small- to medium-sized public transport such as paratransit service (seating capacity from 10 to 20) is also common to the three cities. As such, its modal share is very low. The level of minibus and ordinary bus services in Vietnam's cities is not sufficient in terms of route coverage and frequency.

Table 3. Available Modes of Transport

Mode		Hanoi	HCMC	Chengdu
Walk		Walk	Walk	Walk
Private	- Personal	Bicycle Motorcycle Car/Van	Bicycle Motorcycle Car/Van	Bicycle Motorcycle Car/Van
	- Shared	Company Bus	Company Bus	Company Bus
Public	- Seating Capacity (1-4)	Cyclo Xe Om Xe Lam Taxi	Cyclo Xe Om Xe Lam Taxi	Tricycle Taxi
	- Seating Capacity (5-25)	Minibus	Minibus	Minibus
	- Seating Capacity (25-100)	Large Bus	Large Bus	Large Bus (AC/non-AC)
	- Rail Transit	None (urban rail transit is being planned)	None (urban rail transit is being planned)	None (subway is being planned)

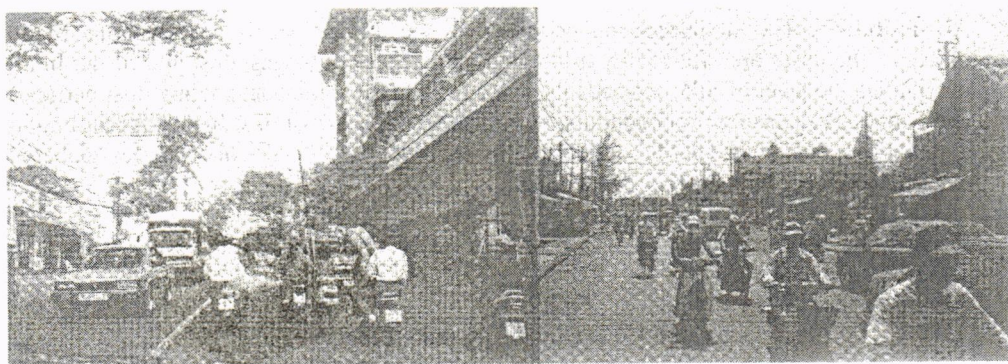
- 2) **Trip Characteristics of Two-wheeled Vehicles:** In the three cities these vehicles serve all kinds of travel purpose. Therefore, the average trip length of two-wheeled vehicles is relatively longer than that in other Asian cities, 4-6 km for motorcycle and 5-7 km for bicycle. The average number of passengers is near to two persons.

The results of an interview survey among bicycle users conducted in Chengdu showed that the major reasons for using the bicycle were shorter travel time (32%), no other available mode (21%), no transfer (16%), lower transport cost (16%), etc. Bicycle users do not use the bus because it entails longer travel time (21%), requires transfer (12%), is crowded inside (12%), etc.

Picture 1. Traffic Situation in Hanoi



Picture 2. Traffic Situation in HCMC



Picture 3. Traffic Situation in Chengdu



- 3) **Road Infrastructure and Parking Facilities:** In Chengdu the carriageway for bicycle traffic is segregated from motorized vehicles on most primary roads, while traffic is still mixed on secondary and tertiary roads. A few intersections are designed to separate bicycles vertically from other motorized vehicles. In Vietnam's cities, segregated lanes for bicycles are very limited.

Parking facilities for bicycles and motorcycles are poor in the three cities. The sidewalk is mostly used as parking space. Parked vehicles thus become a barrier to pedestrians.

- 4) **Regulation for Motorcycle:** In most of the large cities in China, motorcycle use is strictly regulated. There are some regulations such as prohibition of issuing plate number, imposition of tax for entering the urban center and imposition of high registration fee. These measures aim to control the increase in the number of motorcycles in cities.

According to the results of an opinion survey conducted in Chengdu, 75% of residents favor these measures and 81% do not intend to purchase motorcycles. In Vietnam, although the price of motorcycle is still expensive because it includes taxes, there are no regulations for them. Therefore, the number of motorcycles is increasing year by year.

- 5) **Air Pollution:** The environmental condition in the three cities is very serious. Many places of the cities are affected by motorized vehicle's exhaust gas, dust and noise. In all three cities the level of SPM exceeds its standard. The SPM includes mainly dust particles and particles of construction materials, burning coal and exhaust of vehicles. According to a survey conducted in HCMC at 557 points in 1998, 16% of the air samples gathered exceeded the approved level of dust content.

Besides the SPM, the levels of CO are all far beyond its standard and NO₂ exceeds at some places in Chengdu.

Table 4. Level of Major Air Pollutants

Air Pollutants	(Unit: mg/m ³)		
	Hanoi (1995)	HCMC (1994)	Chengdu (2000)
CO (Carbon Monoxide)	4.10 (5.00)	n.a.	6.00-35.00 (4.00)
NO ₂ (Nitrogen Dioxide)	0.02 (0.10)	0.10 (0.10)	0.06-0.15 (0.10)
SO ₂ (Sulfur Dioxide)	0.03 (0.30)	0.21 (0.30)	0.01-0.07 (0.15)
SPM (Suspended Particulated Matter)	0.31 (0.20)	0.53 (0.20)	0.24-1.02 (0.30)

Source: culled from various reports

Note: figures in parenthesis are air quality standards (one hour average value of 24-hour period)

- 6) **Traffic Safety:** Traffic safety is very serious in the three cities. It decreases with the increase in traffic volume. Cities with high mobility have a high degree of accident risk. Mixed traffic flow where four-wheeled vehicles run at different speeds tends to increase the possibility of traffic accidents. People driving motorcycles are also not obliged to wear helmets.

The average number of fatalities per 10,000 motorized vehicles in Chengdu is very high, at 19.5 compared with 4.2 in Hanoi and 7.1 in HCMC. Four-wheeled vehicles cause most of the accidents in Chengdu.

In Vietnam over 21,000 traffic accidents were reported in 1999 and these involved more than 7,000 fatalities. About 80% of road traffic accidents are caused by mistakes of drivers, of which 62% is caused by motorcycle drivers. The number of accidents in the cities of Hanoi and HCMC accounted for 15% of the country total.

Table 5. Number of Traffic Accidents

	Hanoi (1995)	HCMC (2000)	Chengdu (1998)
No. of Traffic Accidents	690	2,300	3,562
- motorcycle- and bicycle-related accidents	370	n.a.	n.a.
No. of Injures	600	2,100	2,801
No. of Fatalities	300	1,050	585
Accident Rate (per 10,000 motorized vehicles ^{1/})	9.6	15.5	118.7
Fatality Rate (per 10,000 motorized vehicles ^{1/})	4.2	7.1	19.5

Source: culled from various reports

Note: including motorcycle

3. SUSTAINABILITY OF TWO-WHEELED VEHICLE TRANSPORT

Based on the analysis in the previous section, the sustainability of two-wheeled vehicle transport is discussed from economic, social, environmental, and management viewpoints.

- 1) **Economic Viewpoint:** It is a fact that two-wheeled vehicles are generally the main modes of transport for the poor because it is cheaper compared to other private vehicles. Therefore, where the poor use these as dominant modes for work trips they have a significant impact on the economic activities of the city.
- 2) **Social Viewpoint:** To maintain mobility for short-distance trips, students and those who cannot own a license should be allowed to use the bicycle.
- 3) **Environmental Viewpoint:** The bicycle does not contribute to air pollution, while the motorcycle does. Hence the latter's role in environmental degradation should be studied. Measures for road traffic safety and safety education and training are also to be considered.
- 4) **Management Viewpoint:** Adequate institutions and organizations should be set under the local government for sustainable usage of two-wheeled vehicles.

4. POSSIBLE POLICY DIRECTIONS

The possible policy directions for two-wheeled vehicle transport with regard to development of public transport are as follows:

- Improve traffic management at road sections and intersections;
- Promote safety education and training;
- Provide adequate infrastructure and facilities such as segregated lanes and public parking spaces for safe traffic and sustainable mobility;

- Define design standard of infrastructure and facilities;
- Integrate two-wheeled vehicle transport into urban and transport planning;
- Prepare national and local plans on two-wheeled vehicle transport;
- Set up adequate institutions and organizations;
- Implement adequate regulations on two-wheeled vehicle transport;
- Provide efficient public transport service such as rail transit and bus;
- Provide various types of public transport service with adequate route coverage and frequency.
- Provide efficient public transport terminals and stations to ease the connection between public and two-wheeled vehicle transport.

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