

DEVELOPMENT AND SUSTAINABILITY OF PUBLIC TRANSPORTATION IN SOUTHEAST ASIAN CITIES

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abstract: The historical development of urban areas and public transportation in Southeast Asian cities are reviewed from which six interactive factors affecting the sustainability of urban public transportation are derived, namely, technology, financial, economic, social, environment and policy. Two focal areas on the sustainability of intermediate public transportation modes and the development of urban rail transit are then discussed.

1. DEVELOPMENT OF SOUTHEAST ASIAN CITIES

1.1 Urbanization Trend

Urbanization in Southeast Asian countries had commenced relatively late, though they vary by country (refer to Table 1). Commonly indicated among the countries is that urbanization has accelerated since 1970 and is expected to continue toward the next century. While urban problems are already serious in many of the urban areas, the urbanization pressure in the southeast Asian countries is not expected to lessen. And the tendency is that the faster the rural-urban inflow of population to the primate city where high natural growth rate still exists, the more the city would grow. This process is not reciprocal though some governments express a desire to reduce the growth of their respective primate city, primarily by curbing rural-to-urban migration. Since it appears that the available agricultural land cannot support the expanding rural population and that accelerating industrialization offers much larger employment opportunities likely at a higher rate, it is concluded that the rural-to-urban migration is essentially beneficial and no attempt should be made to stop it, and that the primate and other larger cities should provide the economies of scale and the advantages of agglomeration which are particularly important for the growth of new enterprises as well as for the efficiency of the industry in general (Lee 1987).

Table 1 Urbanization Trend of Southeast Asian
Countries (% of Urban Population to Total)

Country	1950	1970	1990	2010
Philippines	27.1	33.0	42.6	55.6
Thailand	10.5	13.3	22.6	37.3
Indonesia	12.4	17.1	30.5	47.7
Malaysia	20.4	27.0	43.0	58.4
Japan	50.3	71.2	77.0	78.8
U.K.	84.2	88.5	89.1	91.4
U.S.A.	64.2	73.6	75.0	80.0

Source: UN (1990) World Urbanization Prospects

1.2 Process of Urban Development in Major Southeast Asian Cities

In the beginning of the century, Manila, Bangkok and Singapore were already fairly large cities with populations of about 300,000, while Jakarta and Kuala Lumpur were still small. When they reached a population of one million, it was around 1940 for Metro Manila and Bangkok, around 1950 for Singapore and Jakarta, while Kuala Lumpur still had only about 200 thousand population. The urban areas then were relatively compact with a low level of motorization and a high population density of about 250 persons per ha., with extremely

high density in the central areas reaching often 600 to 700 persons per ha. During the early stage of urbanization, the urban areas then were also relatively well-provided with transport infrastructure. The roads were constructed more or less in a planned manner with a fairly high network density, though not wide enough to accommodate heavy automobile traffic later. All cities, except Kuala Lumpur, had an initial mass transit of electric tramway with good coverage which were supplemented by various non-motorized as well as initial motorized public transportation.

Post-war urbanization was extraordinary for all the cities which had been associated with accelerated motorization and later with fast growing economies. By 1980 Metro Manila has grown to 6 million, Bangkok 5 million, Jakarta 6.5 million, Kuala Lumpur 1 million and Singapore 2.5 million, of which the first three cities are expected to become megacities with populations reaching 10 million at the turn of the century. Urban formation during this extraordinary rapid growth period motivated different urban policies and development practices among the cities. This process varied by city and greatly affected the development and existence of public transportation and, therefore, is briefly reviewed as follows:

Singapore: Singapore was born with modern town planning. The first town planning law was enacted in 1822, followed by a series of planning work and urban development undertakings. Although roads were extensively developed ahead of motorization (the city had about 200 km. of roads in 1920, 570 km. in 1950 and about 2,000 km. in 1970), the people were mostly residing in the central area (even in the early 1970s, 85% of the two million population concentrated in 75 sq.km.), which resulted in a seriously deteriorated living environment. Singapore's dynamic settlement and urban development scheme had commenced under the statutory "master plan" enacted in 1958. Together with the establishment of a number of key agencies such as the Housing and Development Board, Urban Redevelopment Authority, etc., supported with institutionalized financial sources, overall land use plan, CBD development, new town and industrial estate developments and transportation development were strategically planned and implemented. As a result, about 80% of the population were resettled in relatively high density, comprehensively planned new towns provided with varied services and amenities which were effectively linked by high quality arterial transport corridors. The current public transportation system is greatly sustained by this planned urban development. Singapore realized the first urban transportation integrated development model.

Kuala Lumpur: Kuala Lumpur had been developed purely for economic reasons - as a development and trade center of tin mining, though it later became the administrative center. Kuala Lumpur had more or less grown hand in hand with motorization. Scattered activity centers connected by roads made the city structure grow more in a dispersed manner. With abundant state land and estate land available for development, the decentralization policy was formerly adopted by the government where the first successful attempt was the development of the first new town Petaling Jaya, which began in 1952, as well as the Selangor State of Shah Alam functioning as a satellite town in 1966. Supported by high standard arterial roads and expressway network, large-scale residential and industrial developments by the private sector and public corporations contributed greatly to the decentralization as well. As a consequence, Kuala Lumpur metropolitan area forms a conurbation which is known as Klang Valley region with a total population of 2.5 million. Widespread urban area necessitates and encourages a relatively intensive use of private transport.

Metro Manila: Urban formation of Metro Manila is characterized in three phases. The first phase was until the beginning of this century, mostly during the Spanish period when the compact urban area was provided with a well-configured road network though narrow to present standard and a system of canals and horse trams. The second phase was the American period until around 1950 when the expanded urban areas were led by a modern hierarchical road network and extensive electric tramways. With the practice of urban planning and subdivision control, an effective urban system for the area, more or less within EDSA (8-10 lane circumferential road), has been developed which the public and

Table 2 Growth of Major Southeast Asian Cities

Year	Metro Manila	Bangkok	Jakarta	Kuala Lumpur	Singapore	Tokyo	London	New York
Population (000)								
1990	7,930	6,162	-	1,500	2,723	8,164	(91)6,803	7,323
1980	5,926	5,153	6503	977	2,414	8,352	-	7,071
1960	2,462	2,136	2,973	(64) 365	1,634	8,310	(61)8,183	7,782
1950	(48)1,569	(47)1,179	(48)823	(52) 220	1,022	5,385	(51)8,348	7,892
1940	993	(37) 890	(30)435	(47) 176	(31)558	6,779	-	-
1920	(18) 460	(19) 527	-	(21) 80	(11)303	3,358	(21)7,488	5,620
1900	(03) 329	(1832)350	116	30	(06)2,517	(01)6,586	-	3,437
Per Capita GDP at Current Price (US\$)	Philippines	Thailand	Indonesia	Malaysia	Singapore	Japan	U.K.	U.S.A.
1990	623	1,446	574	2,409	13,957	25,569	18,508	22,096
1980	664	683	492	1,751	4,973	10,129	9,813	11,890
1970	179	194	74	380	911	1,967	2,236	4,928
1960	253	94	-	237	428	460	1,366	2,787
1950	170	(55) 83	(30) 41	(55) 234	-	131	715	1,870
Source: MacMillan World Historical Statistics IMF International Financial Statistics				Per Capita GDP at 1990 Price ^v (US\$)	Germany	Japan	U.K.	U.S.A.
^v estimated based on the above sources				1930	1,750	1,100	8,810	7,070
				1900	1,480	730	7,640	4,790
				1880	1,000	510	6,110	3,690
				1860	790	-	4,750	-

private sector equally contributed to. One of the achievements by the private sector which contributed to the present formation is the development of suburban centers such as Makati, Cubao/Ortigas, etc. along EDSA which have later grown to sub-CBDs. The third phase is during the time when urbanization accelerated and the urban area sprawled to all directions followed by insufficient transport infrastructure. These are clearly seen from the present urban structure and has since affected the development of public transportation.

Bangkok: Modernization of the urban system from water transport base to road transport without proper planning of the road network appears to be the root problem of the present urban system of Bangkok. This is further aggravated by a virtual absence of development control. The urban area is characterized by two different natures. One, more or less, within the middle ring road provided with relatively better road network, and the other outside the middle ring road where there is an absolute lack of roads and the network is completely deficient except for high standard intercity arteries. Land use is extremely mixed, and developments undertaken of different scale and nature have been taking place in already congested areas with high plot ratio and along the arteries in the distance, while large-scale pockets of land in the existing urban areas remain untouched mainly due to deficient road network.

Jakarta: Jakarta's urban area is unique. The modern urban area provided with roads, extensive railways and tramways developed during the early part of the century were surrounded by densely inhabited rural settlements called *kampung*. As urbanization progressed, these *kampung*s were swallowed by the urban areas without being reorganized nor resettled, which also cushioned the inflow of population. It was only in the 1960s that the construction of modern roads started, motivated by the transfer of the capital to Jakarta in 1952 and the holding of the Asian Games in 1962 where priority was more on the development of major roads. Owing to the nature of urban areas and the development of roads, Jakarta also suffers from a hierarchical road network, therefore, the urban development basically takes place along the limited arteries though a couple of large-scale developments are practised.

2. DEVELOPMENT OF PUBLIC TRANSPORTATION

2.1 Definition and Classification

It is widely known among transport researchers and planners that varied types of public transportation modes, for which various names given include "paratransit," "intermediate," "unconventional," "informal," "unincorporated," "locally-generated," "low-cost," "simple," "unregulated," etc., and have either disappeared or existed but only in limited importance in developed cities, have been playing often critical roles in many developing cities by filling the gap of the so-called modern and formal transit and even directly meeting the varied needs of people. Cognizant of the missing function of public transportation services of developed cities, a series of research works were started and conferences held on these modes since around 1970. Following initial activities (Kirby R. et. al. 1974, OECD 1977, Fouracre 1977), a considerable number of papers have been contributed to clarify and assess their physical, operating, demand, organizational and management characteristics by different authors (Rimmer, 1980, 1982, 1986, Soegijiko 1988, Ohta 1990, Ocampo 1982, Chujo 1983). An analytical framework was also proposed (Rimmer and Dick 1980). However, while the researches made progress, neither consented general name was given nor proper classification developed which led to confusion in defining their function and comparison between cities. Transportation by type of operation and usage is normally categorized into three: private, for-hire, and public or common carrier. Private transport consists of privately-owned vehicles operated by owners for their own use, usually on publicly provided and operated streets; for-hire urban passenger transport is commonly designated as paratransit - a transportation service provided by an operator and is available to all parties who meet the conditions of a contract for carriage which, however, is adjustable in various degrees to the individual user's desires. Common carrier urban passenger transport is known as transit, mass transit or mass transportation which are operated on fixed routes and their schedules available for use by all persons who pay the established fare. Urban public transportation includes both transit and paratransit categories since both are available for public use (Vuchic 1981). Paratransit is further detailed according to general service characteristics where it is defined as all public transport modes between private auto and conventional transit (Kirby 1974). Although these definitions, in a broader sense, are applicable, their detailed categorization often does not comply with the existing public transport modes in the developing cities.

Previous researches and transportation studies conducted in Southeast Asian cities indicate that the characteristics of these modes can be analyzed with regard to their organization, technology, service and utilization of the service (see Table 3), having intermediate features, and are in this paper collectively called IPT (intermediate public transportation). There is a growing need in urban transportation planning to deal with IPTs for various reasons ranging from elimination and regulation to new introductions, without adequate studies on the experience and lessons of other cities. Taking into account that IPTs cover a broad range of services having varied transport capacities and operating characteristics, they need to be categorized in such a manner that they are more adequately included into traffic survey and transport planning and are comparable among cities (see Table 4 and Table 5).

Table 3 Analytical Framework of Motorized IPT

Organization	Ownership	:	State/Corporation ----- Private
	Scale	:	Large ----- Small
	Management	:	Corporation ---- group ---- Individual
Technology	Local Content	:	Minimum ----- Maximum
	Vehicle Type	:	Modern ----- Traditional
	Transport Capacity	:	Large ----- Small
Service	Carrier Type	:	Common ----- Individual
	Routing	:	Fixed ----- Flexible
	Scheduling	:	Scheduled ----- Unscheduled
Utilization of Services	Method of Getting Services	:	Designated Stop ----- Hail
	Fare	:	Fixed ----- Negotiated
	Seat Availability	:	Not Assured ----- Assured

Source: worked out based on Vuchic (1981), Kirby (1974) and Rimmer and Dick (1980)

Table 4 Classification of IPT

Service Characteristics		Transport Capabilities					
		Motorized			Non-Motorized		
		Seating Capacity (no. of seats)					
		Small (1-9): Micro Bus	Medium: Minibus		Large (50 <); Large Bus	Bicycle-based	Animal-based
(10-19)	(20 <)						
Common	Fixed	Bemo	Microlet	KL minibus Bangkok minibus	Bus	-	-
	Semi-Fixed	Silor	Jeepney Sonteo	Sonteo	-	-	-
Individual	Free/ Flexible	Taxi	-	-	-	-	-
	Area	Soi bike Tricycle, etc.	-	-	-	Pedicab	Calesa
Specific		School bus Work bus				-	-

Table 5 Classification of Urban Public Transportation Modes

		Jakarta	Bangkok	Metro Manila	Kuala Lumpur	Singapore	
Rail-based (Fixed Guideway)	Suburban Railway	PJKA	SRT	PNR	KTM		
	Urban Railway	MRT (underway)	MRT (underway)	LRT	LRT (underway)	MRT	
Road-based	Motorized	1. Large-sized Bus					
		• Double-decker	Double-decker	-	-	Double-decker	
		• Standard Bus	Bus	Bus	Bus	Stage Bus	Bus
		• Premium Bus	Express Bus Aircon Bus	Aircon Bus	Express Bus Aircon Bus	Aircon Bus	Aircon Bus
	2. Medium to Small-sized Bus						
	• Medi-bus (20 <)	Bis Mikro : MetroMini, Kopaja	Minibus, Sonteo	-	Bas Mini	-	
	• Minibus (10-19)	Microlet : Colt, Opelet	Sonteo	Jeepney	-	-	
• Micro-bus (1-9)	Bemo	Silor	Auto Calesa	-	-		
3. Individual Transport							
• Taxi	Taxi	Taxi	Taxi	Taxi	Taxi		
• Mini-Taxi	Helicak, Bajaj Minica, Mebea	Soibike	Tricycle	-	-		
4. Specific Transport (semi- public)							
	School bus	School bus	School bus	School bus	Scheme A and Scheme B		
	Work bus	Work bus	Work bus	Work bus			
Non- Motorized	1. Pedicab	Becak	-	Pedicab	Trishaw	Trishaw	
	2. Ponycart	-	-	Calesa	-	-	
Water-Based		-	Boat	Love Boat	-	-	

Source: worked out from various study reports and papers

2.2 Emergence and Development of Urban Public Transportation in Southeast Asian Cities

1) Historical Background

Public transportation in Southeast Asian cities has been an important element of their respective urban systems. A variety of modes emerged, developed and declined as shown in Table 6. The process is common in certain aspects but is also different among the cities. It is broadly divided into two phases: pre-motorization period and motorization period between which initial mass transit period is overlapped. The characteristics are briefly as follows:

Pre-Motorization Period (- 1920): During the early stages of urbanization, when the cities were compact, the main modes of transportation for the public were walking, local bullock cart and boats, while the horse carriages and sedan chairs were for private use of the officers and wealthy people. Water transport was extensively used both for passenger and goods transport not only in water-born Bangkok but also in Manila and Jakarta, where canals were extensively developed. It was only around the middle of the 19th century when horse carriages were used by the public. Horse carriages became popular particularly in Manila and Jakarta. Manila invented varied types of horse carriages patterned after imported European horse carriages. The "calesa" (localized version of the two-wheeled, canopied horse carriage) became a very popular major public transport mode and has survived for more than a century. In Singapore, Kuala Lumpur and Bangkok, the "jinrikshaw," invented in Japan and soon imported around 1920 via China, became an important public transport mode. Wealthy Manila families never owned jinrikshaws since horse carriages were already extensively used. The first mass transit was the horse tram, which was constructed by the European entrepreneurs during the latter part of the 19th century. Except for Kuala Lumpur, the suburban railway, developed almost at the same time, shared the role to a certain extent. However, the most popular mode was still walking.

Initial Mass Transit Period (1880-1940): The horse tramway was soon replaced by the electric tram which was brought from Europe and the United States without much delay after commercial operation had started in those countries. The first system was in Bangkok (1894), followed by Jakarta (1897), Manila (1905) and Singapore (1905). The electric tramways were extensively developed for the size of urban areas, where Manila had the most extensive network of 85 km. of tracks. They influenced the direction of urban expansion, well-utilized by the public, and survived until they faced financial difficulties due to traffic congestion and competition with buses and taxis. As it was in most of the developed cities, the electric tramways were not supported by effective government policies where the emergence of automobiles and auto-based public transportation attracted the people and future urbanization pressure was underestimated. This period was considered as the time when the first integrated public transportation was realized comprising almost all types of modes existing presently including suburban rail, electric tramway, bus, taxi, horse carriage, jinrikshaw, pedicab, bicycle, etc., which provided frequent services for still compact urban areas with less than a million population.

Motorization Period (1920-): With the abandonment of the electric tramways and with little intention of using suburban railways for urban transport and development, all cities entered into the accelerating motorization stage. During this period, population growth became so rapid that population density intensified and urban areas sprawled outward concurrently. Public transportation needs had increased tremendously, yet infrastructure development and public transport service supply lagged. The demand-supply gaps widened where a variety of intermediate public transport modes sprung up, though types varied according to the local requirements, available technologies and urban environments. Public-transportation-rich cities deteriorated quickly. In the face of seriously compounding urban and transportation problems, the Southeast Asian cities had started to implement policies different from each other which made the existing urban formation and public transportation systems. Development of mass transit commenced initially by amalgamating buses and later by constructing new urban rail transit as well as improving existing suburban rails.

2) Public Transportation Policies

Public transportation policies employed by these cities may have directly or indirectly affected the form of the present urban transportation, depending upon the objectives and effectiveness of enforcement, as shown in the partial list of Table 7.

Singapore, throughout its history, underwent control and regulation of public transport services, starting with the elimination of the tramway and jinrikshaw, and nationalizing urban public transport services which, however, failed owing to social objection, followed by regulation of mosquito buses and taxis. Emphasis was given to the reorganization of overall urban transport including modernization of the bus system and control of private car in the 1970s. New supplemental bus services were also introduced then. In the 1980s, the policy continued and control over private car ownership strengthened. The construction of the 67-km. urban rapid transit was a significant contribution. In the 1990s, the policy is oriented to achieve a fully integrated urban public transport system. Singapore's urban transport policy is characterized by the "integration" not only of public transportation modes but also of other private modes and even urban development.

Kuala Lumpur, which faced a slower urbanization and has relatively small population, also underwent control of public transportation services like Singapore but to a lesser extent. Various auto-based IPT did not emerge, probably due to the government's reluctant policy and the lack of demand pressure. Introduction of the minibus implemented with strong influence of the World Bank is an exception. Although the operation is considered successful, the entry is limited and operation controlled. Kuala Lumpur lacks an effective public transportation although this has been supplemented with extensive use of the school bus and work bus, and relatively heavy reliance on private transport including motorcycles. In spite of the extensive development of quality highways, it is feared that the urban system would not be able to cope with full motorization, thus the construction of the LRT and the improvement of intercity railway (KTM) for commuter services are underway.

Jakarta, Bangkok and Metro Manila, with their large, continuously growing populations, currently face serious public transport problems which are expected to continue into the future. While urban populations in these cities have grown from about a million around 1940-50 to 5 to 6 million by 1980, not much has been done to strengthen public transportation directly.

Jakarta expanded its bus service by nationalizing small operators and by creating PPD which, however, was not able to provide efficient services nor expand the operation as planned, while the number of private bus operators has grown. Modernization policy was applied to a variety of micro buses to increase seating capacity or to improve the safety of the mini taxi. Much effort is taken to revive and modernize the existing intercity railways for the use of urban transport. Especially the expansion and improvement of the existing Jabotabek railway is expected to play a more important role which, however, has had no explicit results yet.

Bangkok eliminated the horse carriages and pedicabs at a much earlier stage compared to other cities. The main, single policy implemented was to strengthen and modernize bus service similarly under state corporation and to introduce extensive bus lanes. The success and effects did not last long and BMTA suffered a financial deficit since the beginning which restricted effective improvement further. To fill the gap, people are now forced to rely on motorcycles and cars. Illegal minibus operation still remains and a new type of service called soibike emerged and has continued to flourish. The development of a number of different urban rail transit projects have been a long standing policy issue of which a part has been started lately.

Metro Manila is provided with relatively better public transport services which, however, cannot be attributed to effective policy. Government intention to expand bus service to replace jeepneys by consolidating numerous bus companies failed and bus operation went back to the previous status. A significant achievement was the construction of the 15-km

Table 7 Partial List of Major Public Transportation Policies Adopted in Southeast Asian Cities

Year	Jakarta	Bangkok	Metro Manila	Kuala Lumpur	Singapore
1940		(13) Prohibit horse carriage	(1889) Regulation of horse-drawn vehicles (1901) Ordinance to regulate use of public transport vehicles (*20-'40) Regulate bus operations (prior operator, protection on investment, territorial responsibility policies)	(37) Consolidate mosquito buses into 7 bus companies (53) Bus operation on fixed routes	(1867) Hackney Carriage Act (1891) Ordinance for regulation and control of Jinrikisha (1902) Tramways Ordinance (1911) Eliminate iron wheel Jinrikisha (1924) Limit no. of Jinrikisha (1935) Consolidate small bus operators into 11 companies
1950	(50's) Nationalize bus and tramway under PPD		(late '50's) Replace jeepney with bus on major thoroughfares (not implemented)		(56) Nationalization policy of urban public transport (not implemented)
1960	(late '60s) Transportation modernization policy (*70s) Movement of Becak elimination/relocation (*72) Eliminate horse carriage (*76) Integrate micro buses under Metro Mini (*79) Enforce minimum no. of buses to 50 units	(59) Bus integration program (62) Eliminate Samlor			(62) Limit no. of taxi and introduce school taxi (*66-'70) Eliminate pirate taxi (*70) Public white paper on automobile reorganization (*70) Consolidate into 3 bus companies (*71) Introduce Scheme A (*73) Consolidate into one bus company (SBS) (*74) Introduce Area Licensing Scheme and car ownership restraint
1970		(75) Establish Metropolitan Transport Company: 51% gov't (*76) Bring MTC to 100% public-owned: BMTA (*76) Limit no. of taxis	(75) Establish public-owned bus company (MMTC)	(75) Introduce minibus	
1980	(*84) Prohibit production of Opelet to convert to Microlet (*80s) Expansion of taxi through government cooperative (*80s) Limit no. of mini taxi to 3000 (*88) Commence JABOTABEK railway project	(80) Introduce extensive bus exclusive lanes (145 km.)	(80) Consolidate bus companies into 14 consortia (*80) Prohibit jeepney operations on selected major roads (*80s) Commence PNR commuter service (*85) Open LRT Line 1	(80s) Privatization policy on urban public transportation	(82) Decision on MRT construction (*84) Introduce new bus company (TIBS)
1990		(90s) Commence urban rail projects	(90) Introduce bus fleet replacement/expansion program	(90's) Start LRT construction	(90) Open MRT network

Source: worked out from various papers and publications

LRT in 1985 along a heavy public transport corridor carrying about 350,000 passengers a day which, however, is operated with considerable government subsidy, and its expansion has been long delayed. In spite of the government's reluctance, jeepneys have been meeting most of the public transport demand which effectively supplement the LRT and are supplemented themselves by the tricycles. Jeepneys, which have been well-accepted by the public, became the core system of integrated public transportation, providing relatively efficient and high level of services, and cultivating stable riding habits due to their extensive network and route choice, high frequency, seat availability, etc. The widespread jeepney system could be a factor to explain why use of the motorcycle hardly developed.

3. SUSTAINABILITY OF URBAN PUBLIC TRANSPORTATION

3.1 Factors Affecting Sustainability

For large urban areas, only a system of public transportation can meet the demands. A review of the historical development of public transportation in the Southeast Asian cities as well as the experience of large developed cities point to the fact that any single mode or line of operation, whatever the mode and no matter the efficiency, would not contribute significantly and effectively to the enormous and varied transportation needs of the urban areas. The system must be sustained over the years complying continuously to the growing and changing demands. Today's public transportation exists on the infrastructure accumulated in the past and tomorrow's system should not be independent from the existing resources and practices.

Singapore demonstrates a model of sustainable urban public transport system by integrating all elements including urban development, private transport, hierarchy of public transport modes under consistent government policy and powerful implementation capabilities. Tokyo, which started under the status of developing economy, managed to develop an urban rail-based public transport system, though the quality of service is yet to be improved, by mobilizing limited resources continuously of both public and private sectors. Metro Manila is also showing a sort of low-cost model of sustainable system though it is not supported by any explicit institutions nor consistent administrative policy; therefore, its future is uncertain.

Sustainability is understood as the state of continuous existence with a certain level of services maintained and with agreeable extent of resource mobilization. The factors which affect sustainability are nothing new but those familiar in the evaluation framework of feasibility studies, except that some redefinition and expansion of the concepts are required. As shown in Figure 1, the key factors are those with regard to technology, social, environment, financial, economic and policy aspects, which are highly interactive, and their degree of interaction may vary in the course of time.

Technology: Availability of technology has been a determinant factor throughout the history of public transportation. Upon invention and commercial testing, it diffuses fairly quickly all over the world where it is further improved, modified and fixed in compliance to the requirements of other factors. Technology covers both "hardware" and "software" for construction/manufacturing, operation and management, and maintenance. Degree of local content or replicability is an important element to adopt the technology.

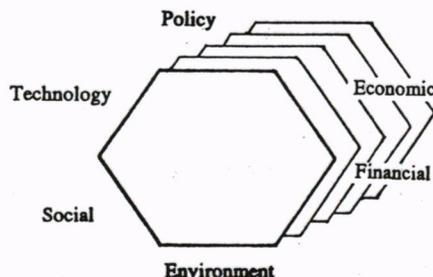


Figure 1 An Analytical Framework: Factors Affecting Sustainability of Urban Public Transportation in Developing Cities

Social: Public transportation involves extensive social implications. How a system is accepted by the public is affected by socio-cultural heritage, technological, environmental, financial factors, as well as the reaction of prior operators. Various organizations of drivers, workers, and operators who seek stable operation and social security are also to be covered. Acceptance of illegal entries and operation is also related to social system though it implicates with political and economic factors.

Environment: The term environment, for the purpose of this paper, is more broadly defined to cover urban structure, land use, management infrastructure, traffic control/ enforcement, impact on pollution, safety and aesthetic elements. Transportation infrastructure and its network developed in the past considerably affect the choice of modes of transportation and their operation, land use, and the demand characteristics. Type and scale of organization and ownership will be affected by management infrastructure which implicate with social and policy factors. Method and level of traffic control and enforcement, directly or indirectly, affect operational characteristics. Impact of public transportation on environmental pollution, safety, and aesthetic aspects has become a growing concern in the developing cities.

Economic: Economic viability, in terms of the optimum allocation of available resources from the national economic viewpoint, is considered a key criterion in justifying a public investment, though the evaluation method, particularly for public transportation in large urban areas involves difficulties in quantifying benefits and stability. Effects on employment, local industries, and the distribution of benefits with particular regard to the urban poor are also elements concerned. Energy savings may become a critical element under certain situations. The economic factor again implicates with other factors greatly.

Financial: This has been a direct determinant factor for IPT drivers and small operators in developing cities. Although to what level of self-financing required largely depends upon policy decision and consent of the society. Heavy reliance on public funding on capital and recurrent costs may restrict further expansion and efficiency of public transportation. Other elements such as the degree of local component of a public transportation and availability of local funding are also important.

Policy: Policy is supposed to be the umbrella factor to determine or guide the provision of adequate transport services by taking all the above factors. However, governments often lack this process and policies are imperfectly or ineffectively formulated and implemented. The state of public transportation will be adversely affected, either directly or indirectly. This factor involves ad hoc policy decision and institutional framework. Consistency among policies as well as over time is also critical.

The time factor needs to be duly considered in view of the fact that public transportation is sustained under the situation where urban areas grow rapidly and are transformed, socio-economic conditions and traffic situation change and available technologies vary constantly.

3.2 Sustainability of IPT

Although IPTs have relatively been discussed extensively in various papers, detailed studies or planning work for more concrete policy formulation and implementation have been scarce. History shows that IPTs are not always transitional modes. Instead, many of them have been in existence over a long period of time and have played their roles with little government support, while the so-called formal transits have been suffering from inefficiency even under government protection.

Technologies applied in IPTs are easily available through the local and international market at reasonable costs. Base hardware comprise truck, van, pick-up, sedan, motorcycle, bicycle, etc., either second-hand or brand new, of which the supply of parts is always assured and adopted technologies for modification, repair and maintenance are also readily available. Technological improvement are also made to meet market needs or to increase productivity either voluntarily or by administrative guidance such as the jeepneys in Manila,

the seating capacity of which has been gradually increased, and the airconditioned minibus in Kuala Lumpur. Management of the IPTs has no difficulties even without any additional fixed facilities, and can be operated individually or by a small group.

IPTs are hated by private car users, are annoying to traffic enforcers but are generally accepted by the public though their negative driving behavior, route deviation, overcharging, etc. are causes of occasional complaints by passengers. Drivers and small operators are organized through associations and cooperatives to facilitate access to formal institutions including entry permit, registration, social security, etc. and to protect their operation against excessive political intervention. Illegal entry is also entertained according to the assessment of operating conditions of relevant routes by the association of jeepneys in Metro Manila. Ownership and management structure comprising driver, operator-driver, and non-driver operator for different sizes and functions of IPT modes contribute to expanding investment and employment opportunities for the lower income group. The transportation business is an important investment area of overseas contract workers or their families in the Philippines

There is little question that IPTs are financially viable for different groups of people at different levels of earning, though they work hard and long.¹ A survey in Metro Manila showed that 36% of drivers, 56% of driver operators and 64% of operators who owned houses were members of government-assisted cooperatives (Balao 1988). Although the IPTs are operated under various uncertainties, financial viability has been maintained through their flexible operations including disorderly loading/unloading, trip cutting, charging extra fare for congested time periods, stormy weather, midnight, etc., which displease the public as well as the government but has some pricing ground. When the operation is strictly regulated in entry and fare, operators may enjoy excess profit or suffer from deficit. When on the other hand it is loosely done, supplies distribute in such a way that profitability among the operators/drivers becomes more equitable. The former applies to the minibus in Kuala Lumpur, while the latter to the jeepneys in Metro Manila.

Sustainability of IPTs is affected by the urban structure, especially road network and density. The relatively well-configured road network of Metro Manila makes it possible for jeepneys to configure a wide selection of routes with high frequencies and short access distance. On the other hand, Bangkok and Jakarta with their lack of secondary roads limit the extension of minibuses of this capacity and invite stronger government regulation, especially as they tend to concentrate onto heavily congested arterial roads.

Inefficient use of limited road space and the diseconomy of IPTs often provoke arguments but these hypotheses have yet to be proven. There is no overwhelming evidence either to support the suppression of paratransit or the abandonment of conventional bus services. Although larger vehicles are better than smaller ones along corridors of heavy demand and smaller vehicles probably have the advantage in less heavily trafficked areas, the boundary line between the two is not easily defined, being subject to local demand and supply conditions (Silcock 1985). On the contrary, even along the corridors with heavy demand optimum bus size will be much smaller than the conventional buses (Walters 1980). Free competition of medium- to small-sized bus services is more economically favorable than ordinary stage bus services (Chujoh 1989). Congestions should not only be attributed to IPTs but also to private cars, of which social costs are higher than the former. When and where congestions are caused by IPTs on the roads, especially at major loading/unloading areas, provision of adequate space/facilities and traffic management should be considered which will improve the situation with a high economic return.

¹In Metro Manila, IPT drivers work 12-14 hours a day for 5 days a week. Jeepney drivers earn more than the average factory workers even after working hours are adjusted, while tricycle drivers' earnings are 30% less and pedicab drivers, about 1/3 of jeepney drivers.

There have been recurring calls for the phase out or restriction of the IPTs. Starting from the elimination of the ponycart and pedicabs, the call is directed towards the mini taxi, microbus then to mini and midi buses, extending the policy to buses to be amalgamated. Singapore and Kuala Lumpur underwent this process, though much later, regulated Scheme A and Scheme B, and minibus services have been introduced. Other cities have also been basically pursuing this process. However, an extraordinarily large public transport demand and the incapacities of planning and policy implementation provide ample areas and opportunities for IPTs to enter and operate.

3.3 Development of Urban Rail Transit

As traffic congestion worsens and public transport service level decreases, many cities have started to develop and construct new urban rail transits and revive the existing intercity railway for urban transport services (see Table 8). However, in the process, fierce arguments take place and a considerable amount of time is spent before they are realized. In Singapore, the rail transit was proposed in the 1971 Concept Plan. Following a series of studies and extensive debate, it was officially committed in 1982 and finally opened only in 1990. Manila took only about 10 years before the LRT Line 1 was completed in 1985 but this was not followed by the second and third lines, which are still in the detailed planning stage.

The underlying reasons for this long process is that while urban rail transit is highly expected as a fundamental solution to urban transportation problems which all major developed cities have, a huge amount of capital costs is required. The reluctant attitude of the World Bank toward urban rail transit, including not only costly subways but also elevated LRTs and existing at-grade railways, and its favoring of more affordable alternatives such as busways and bus priority measures influence the situation (World Bank 1986). Cognizant of the fact that during the 20-year period, between 1960s and middle of 1980, more than 600 km. of urban rail transit were in operation, and 150 km. under construction in at least 21 developing cities, TRRL conducted a Study (Halcrow Fox 1981) which reported findings that in spite of cost overrun and underestimated ridership found in almost all cases, most of the systems generate adequate economic return and are well-utilized, operated and maintained. Many governments expected financial viability of the projects during pre-investment stage which was never realized, and only a few systems can cover part of capital cost; therefore, it is concluded that financial support of the government is unavoidable. Guidelines for introducing urban rail transit are given in the Study in terms of city population size (at least 5 million), corridor traffic demand (approximately 700,000 trips a day with peak hour bus traffic of 15,000 per direction), level of city economy (at least US\$1,000 per capita of national income) and administrative capability for construction and management, which mostly apply to many of the Southeast Asian cities.

Although rail transit is costly, construction of urban roads is also becoming extremely difficult and expensive and even if urban roads are constructed at current pace, transportation studies undertaken in the Southeast Asian cities clearly indicate that demand far exceeds the capacities and congestions worsen quickly. Large cities of developed countries provide projections of future Southeast Asian cities where traffic congestions prevail in spite of that 60% to 70% of demand utilize urban rail transit in Tokyo, London, New York, etc. Even for the size of city like Singapore, traffic congestion is of much concern though it has an effectively constructed MRT and practices strict car restraint policy. Kuala Lumpur is also unable to meet future traffic demand only with road transport. Under the current motorization trend which will further accelerate and that of economic growth in large urban areas such as Bangkok, Metro Manila and Jakarta, urban rail transit should play an important role to share the demand. The issue may not be the choice between bus and rail but of when and how.

London and New York, being large cities already in 1900, constructed extensive subway system more less before motorization was fully accelerated. They already had reached high income levels of 7,600 US\$ and 4,800 US\$ per capita estimated at 1990 prices, respectively (see Table 2). On the other hand, Tokyo, with its large population size, only had low

Table 8 Urban Rail Transit Development in Southeast Asian Cities

Urban Area		System Outline	Status
M E T R O M A N I L A	Existing System (PNR)	(1) Commuter service of Main Line South (40 km).	- Current traffic of 30,000 pass./day; rehabilitation program on-going.
	New System	(1) LRT Line 1 (elevated 15 km.) (2) Capacity expansion of Line No. 1 and construction of Line No. 2 (elevated 10 km.) (3) Construction of Line No. 3.	- In operation since 1985. Current traffic of 400,000 pass./day. - Detailed design on-going. - On-going under BLT.
B A N G K O K	Existing System (SRT)	(1) Elevation of existing tracks (60 km.), and commercial development of the ROW of SRT	- Contract awarded to private investor group on BOT.
	New System	(1) Construction of elevated MRT (25 km.) under BMA. (2) Construction of elevated MRT under MRTA.	- Contract awarded to private investor group on BOT. - Detailed study is underway.
J A K A R T A	Existing System	(1) Rehabilitation/improvement of existing Jobatabek railway system.	- Mostly completed.
	New System	(1) Construction of underground/at-grade MRT.	- Planning work underway.
K U A L A L U M P U R	Existing System (KTM)	(1) Improvement of existing lines for urban commuter services.	- Under construction.
	New System	(1) Construction of elevated/at-grade Line No. 1 (18.5 km.)	- Line No. 1 under construction on BOT, Line No. 2 awarded on BOT.
S I N G A P O R E	Existing System (KTM)	(1) Operation of railbus between Singapore and Johore Bahru, along KTM	- In operation.
	New System	(1) Construction of 67 km. of elevated/underground MRT. (2) Construction of AGT system for two MRT stations.	- In operation. current traffic 800,000 pass./day. Expansion planned. - Feasibility study underway.

Source: worked out from various papers and articles

economic level of 730 US\$ in 1900 and 1,100 US\$ in 1930. Tokyo's success in developing urban transit system is explained as follows (Nakamura 1990, Ieda 1992):

- Subways initially constructed by the private sector was soon publicly owned and operated due to financing incapability. Public sector, however, seek at most efforts to generate non-fare revenue such as operating commercial facilities.
- Prior to the construction of subways, Tokyo had extensive private suburban railways, national railways as well as electric tramways network. Subways replaced the tramway lines and was interconnected with the suburban railways which provided direct inter-line services. This enhanced the ridership tremendously.
- Soon after the construction of initial subways, the high economic growth continued which strengthened public financing.

- Riding habits of the public to rail transit was already cultivated due to suburban rail commuter and tramways.
- Expansion of middle income class enabled to maintain relatively high fare level.
- Feeder transport services were encouraged by providing interchange facilities adjoining the stations as well as networking major buildings in the city center via underground footpaths.

Japan's experience may be generalized as follows:

- In order that urban rail transit is expected to play a major role in urban transportation, an adequate network has to be formulated that also require integration of different operators and effective development of feeder services.
- In order that urban rail transit is continuously expanded in compliance with the development of a city, public financing support is inevitable and proper institution may have to be built to ensure stable financial source as well as to avoid excessive political intervention. Maximization of revenue through adequate fare setting and generating non-fare revenue are to be considered.
- In order to encourage the utilization of the system, improvement of management, operation and passenger services as well as adequate campaign for the public should be constantly undertaken.

It is to be noted that compared to fairly successful development and operation of new urban rail transit, providing urban transport services using existing railways often do not meet the planned target in many cities such as Metro Manila and Jakarta due to various reasons. Among these reasons include the long negligence of the railway turned the area adjacent to the railway unattractive and inaccessible for the railway; the areas are already served by efficient road transport, mix operation with intercity service makes it difficult to provide attractive frequencies, management and staff inheriting inefficiencies of previous operation are not motivated to provide competitive services

4. Concluding Remarks

Review of the historical development of public transportation in Southeast Asian cities shows that various public transportation modes emerged, developed and were phased out which were affected by interacting factors on technology, social, financial, economic, environment and policy aspects. Although Southeast Asian cities had rail-based mass transit supplemented by other indigenous modes soon after the invention and commercial operation in developed cities before motorization accelerated, all abandoned or neglected the system while large developed cities continued to expand the urban rail transit. Southeast Asian cities shifted entirely into road-based public transport where varied types of IPTs emerged. Today, Southeast Asian cities intend to revive urban rail transit for much expanded urban areas under various difficulties. The lessons learned from history as well as from the experience from developed cities indicate that development of sustainable urban rail transit require consistent and comprehensive strategic approach over years and integration with other aspects of urban sector as well as road-based public transportation, particularly IPTs in Southeast Asian cities.

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