

QUT Digital Repository:
<http://eprints.qut.edu.au/>



Rahman, Mamun M. and D'Este, Glen and Bunker, Jonathan M. (2009) *Non-motorized public transport development : present scenario and future approach in developing cities*. In: Proceedings for the 3rd Smart Systems Postgraduate Student Conference, 16 October 2009, Queensland University of Technology, Brisbane, Queensland.

© Copyright 2009 Queensland University of Technology

Non-Motorized Public Transport Development

Present Scenario & Future Approach in Developing Cities

Mamun Muntasir Rahman*, Glen D'Este**, Jonathan Bunker***

*PhD Candidate, School of Urban Development, Faculty of Built Environment & Engineering, QUT, Brisbane 4001, Australia
Corresponding E-mail: mm.rahman@qut.edu.au

**Adjunct Professor, School of Urban Development, Faculty of Built Environment & Engineering, QUT, Brisbane 4001, Australia E-mail: g.deste@qut.edu.au

***Senior Lecturer, School of Urban Development, Faculty of Built Environment & Engineering, QUT, Brisbane 4001, Australia E-mail: j.bunker@qut.edu.au

Abstract: *Over the last few decades, most large cities in the developing world have been experiencing rapid and imbalanced transport sector development resulting in severe congestion and poor levels of service. The most common response at a policy level under this circumstance has been to focus on private and public motorized transport modes, and especially on traffic control measures and mass transit systems. Despite their major role in the overall transport system in many developing cities in Asia & Latin America, relatively little attention is given to non-motorized transport (NMT) modes (walk, bicycle and cycle-rickshaw). In particular, this ideology is applicable to the paid category of non-motorized public transport (NMPT), notably three-wheeler cycle rickshaws that still have an important socio-economic, environmental and trip-making role in many developing cities. Despite, they are often seen as inefficient and backward; an impediment to progress; and inconsistent with modern urban image. Policy measures therefore, to restrict or eliminate non-motorized transport from urban arterials and other feeder networks have been implemented in cities as diverse as Dhaka, Delhi, Karachi, Bangkok, Jakarta, Manila, Surabaya and Beijing. This paper will primarily investigate the key contribution of NMPT in the sustainable transport system and urban fabric of developing cities, with Dhaka as case study. The paper will also highlight in detail the impediments towards NMPT development and provide introductory concept on possible role this mode is expected to play into the future of these cities*

In many such cities In particular, the paid category of non-motorized public transport (NMPT), notably three-wheeler cycle rickshaws that still have an important role in many Asian and Latin American cities, are often seen as inefficient and backward; an impediment to progress; and inconsistent with a modern urban image. So policy measures to restrict or eliminate NMPT have been implemented in many such cities but with mixed success. It is important here to distinguish between cycle-rickshaws (peddle-powered three wheeler) and human-pulled rickshaws (human pulled three wheeler) as depicted in Fig 1. Note that this paper supports the banning of human-pulled rickshaws and specifically excludes them from the category of NMPT.



Figure 1.1: Cycle Rickshaw



Figure 1.2: Human-Pulled Rickshaw

Figure 1 Major Rickshaw Types in the Streets of Developing Cities
Source: [1]

I. INTRODUCTION

Developing countries around the world, especially the major urban centers are experiencing fast but imbalanced transport sector development resulting in poor on-road traffic operability due to congestion, subsequent on and off-road unproductivity attributable to delay. Common response at a policy level under this circumstance has been to focus on upgrading private and public motorized transport modes, improving traffic control measures and particularly emphasizing introduction of mass transit systems. But relatively little attention is given to non-motorized transport (NMT) modes (walk, bicycle and cycle-rickshaw) as a useful option to confront the situation despite its dominant existence.

The major arguments behind NMPT restrictions stem from the criticisms that they are slow-speed, congestion-generator as a vehicle and inhuman as a profession. But such perceptions are relative and arguable considering the key features and potential of NMPT rickshaw. These include short trip-length suitability; lower road space occupancy compared to private vehicles; and capability of operating in narrow streets unsuitable for motorized transport. In addition, the preference and social acceptability of this mode by significant market segments such as women and children; relative cost effectiveness compared to para-transits and private vehicles; social/employment support for substantial population; and the eco-friendliness due to their

fuel-free nature are also worth mentioning. The key role placed by NMPT in different developing cities with similar traffic systems and dominant existing market share is therefore hard to deny. Though the constant inflow of sophisticated private and public motorized transport will take place in the future transport system of these cities, a gap for demand responsive transport mode suitable for short distance trips will always exist. With this backdrop, this paper will primarily investigate the key contribution of NMPT in the sustainable transport system and urban fabric of developing cities, with Dhaka (capital city of Bangladesh) as case study. The paper will also highlight in detail the impediments towards NMPT development and provide introductory guideline on possible role this mode is expected to play into the future of these cities.

II. NMPT DEVELOPMENT: BACKGROUND AND CURRENT TREND IN DHAKA

A. Background of NMPT Development

The original version of the NMPT- ‘rickshaw’ was hand pulled rickshaws first introduced in Japan in 1870. This was then onwards used in countries like China, India, Singapore, the French-Indo-China colonies, South Africa and for brief time in America and Australia. Reference [2] argued that they were, however, never common in Dhaka though some were used in Chittagong and Rangpur.

The NMPT form presently operating in Bangladesh is cycle-rickshaws, a three-wheeler vehicle capable of carrying 2 passengers excluding driver or pay load of 150-200kg [3] (Fig 2).



Figure 2.1: Rickshaw as Passenger Carriage



Figure 2.2: Rickshaw as Freight Carriage

Figure 2 Rickshaw Usage in the Streets of Dhaka
Source: [4]

These vehicles were introduced first in Europe and Asia around 1886, developed from the penny-farthing bicycle concept. The rickshaw was used on a public scale by other countries in Asia including Bangladesh onwards. Reference [2] stated that Singapore was the first city to use cycle-rickshaws on a large scale. Calcutta’s first cycle-rickshaws appeared around 1930 [5] and they soon spread to other towns in the hinterland. They reached what is now Bangladesh in the mid-1930’s, and Dhaka by 1938 [6] as cited in [7]. The cycle rickshaws of Dhaka had their present look by around the 1950’s.

B. Current Trend in Bangladesh and Dhaka

The rickshaw population in Bangladesh has been growing at a high rate in the last few decades. The country wide cycle

rickshaw fleet is predicted to grow from two-thirds of a million in 1988 to over one million by 2000 and more than three-quarters of these would in urban areas [8]. This prediction turned out to be close at the end of the millennium. Almost two-third of these rickshaws ply in urban areas and the growth is mostly reflected in Dhaka. Dhaka City had only 37 rickshaws in 1941 and 181 rickshaws in 1947 [9]. In 1972-73 the total number of rickshaw in Dhaka increased to 14,667 which slowly doubled to 28703 in 1982-83, but thereafter increased rapidly to reach the figure 88,159 at the end of 1986-87 [2]. Reference [2] forecasted the rickshaw numbers in Dhaka to reach the figure of around 300,000 in 2000. This was quite close to the original scenario at that time.

The rapid rickshaw growth is continuing and current fleet number in the country is estimated to be around two million [10], [11,] [12]. The bulk of these rickshaws are growing in Dhaka, an approximate share of 25% as per the latest statistics. According to reference [13] and [8], the **total cycle rickshaw population has continued to grow and is now estimated at around 500,000**. Since there are only a limited number of licenses for many times the number of rickshaws in use, the same license plate numbers are duplicated many times over resulting in the fact that some 80% of the fleet is operating illegally. In addition, there are around 5,000 rickshaw vans that are used exclusively for freight carriage [8].

III. WHY EMPHASIZE NMPT IN DHAKA?

The implications of NMPT rickshaw in the city system of Dhaka are all pervading. More noteworthy is that such impacts exist at different levels of this system – individual micro-level to nationwide macro level. The role contribution of NMPT begins from individual stage (serving rickshaw pullers and passengers); expands to facilitate local functional movement (intra-neighborhood connectivity) and intra-city movement (inter-neighborhood connectivity); and has substantial citywide and nationwide economic effects, both direct and indirect (large scale equity improvement, employment generation, ecology enhancement and financial growth). Key implications of NMPT in the overall urban system of Dhaka are highlighted in the following sections based on facts and findings.

A. Social Preference

- Rickshaws have a key social role to play in Dhaka from individual’s perspective. Reference [14] argues that rickshaws are the preferred travel mode by vulnerable social groups - women, children and the elderly – due to their safety, security and comfort perspective that enhances its social necessity.
- From macro perspective, the cumulative implication on the society is also evident from [8]. The statistics indicate that in Dhaka nearly 40% of the loaded rickshaws are being used by women and children, or people with goods. Another 30% of users are students. In addition, they provide an alternative to the high user cost for taxis and auto rickshaws, and to the poor operating characteristics of motorized public transport. That is the reasons why it is popular among major strata of the society. Reference [8] also emphasizes that

most of the rickshaw passengers come from upper-middle to lower-middle income groups.

Table 1 summarizes the travel characteristics and modal preferences of different segments of the Dhaka population. This directly corresponds to the preferable public transport notion of [15] which suggests that public passenger transports should cater for the range of sub-markets that exist in the community and must be varied, flexible and responsive to the needs of different market niches.

TABLE I. TRAVEL CHARACTERISTICS OF TRANSPORT MARKET SEGMENTS IN DHAKA AND CORRESPONDING MODE PREFERENCES

Market Segments	Modes Type Use	Dominant Mode	Usual Trip Destination	Trip Length
Commuter	●	Train (proposed), Bus, Micro bus	Employment centers/ CBD	Long
Intra-city working population	● ○	Train (proposed), Bus, Micro bus Taxi, Auto rickshaw, Rickshaw Car, Motorbike	Local and regional employment centers/ CBD	variable (short - long)
Student population	● ○	Bus, Micro Bus Rickshaw Car	Educational institutions	variable (medium - long)
Non-working female &/with pre-school children	● ○	Micro bus, Auto rickshaw, Rickshaw Car	local and regional centers & residential areas	short
Elderly Population	● ○	Auto rickshaw, Rickshaw Car	local and regional centers & residential areas	short
Unemployed	●	Bus, Micro bus, Rickshaw	local and regional centers	variable (short - medium)

Source: Developed by Author Based on [8] and Critical Analysis

Legend:

● Public Transport (Metro Train, Bus, Human Hauler, CNG Auto rickshaw, NMPT (Rickshaw) & Taxi)

○ Private transport- (Car, Motorbike)

B. Economic Significance

- Rickshaw is also one of the most important sectors of the Bangladeshi economy. According to reference [2] and [16], rickshaws in Bangladesh contribute 34% of the value added from the transport sector to GDP. Recent research by [10] estimated that 6% of Bangladesh's GDP can be accounted for by rickshaw pulling. In Dhaka alone, around \$300,000 is estimated

to transfer between rickshaw pullers and passengers per day [2], [10]

- Even from a micro-economic perspective the cash flow generated by the rickshaw industry to the individual pullers is significant in maintaining a livelihood which otherwise would have subject to starvation and helplessness. Net earnings of a rickshaw driver/non-owner are estimated to be around Tk 3,800 (\$63) per month while that for a rickshaw van driver are estimated to be about Tk 4,800 (\$80) per month [8]. And it is noteworthy that a study by [11] showed an average income decrease of 15% for a job shift from rickshaw pulling to others.

Such social and economic utility reinforces the concerted need for planned rickshaw incorporation. Realizing such socio-economic role of NMT sectors especially the NMPT like cycle rickshaw as an employment provider, [28] rightly state that rickshaws and pedicabs do generate huge amounts of non-skilled employment. And it is vital in maintaining the incomes of some of the most vulnerable urban dwellers in developing countries.

C. Employment Effect

- Rickshaw is also a substantial contributor to the employment sector of Bangladesh including Dhaka. Reference [2] suggested that directly and indirectly rickshaws in Bangladesh support 5 million people (4.5% of the population of Bangladesh). It is now estimated that there are around two million rickshaw pullers across Bangladesh [10] and that around 19.6 million (14% of the Bangladeshi population) relies indirectly on rickshaw pulling for their livelihoods (their families, manufactures, garage owners, painters, repair men) [17].
- In Dhaka alone, 20% of the population relies on pulling or indirectly, which amounts to about 2.5 million people [17]. It cannot be overstated how crucial the rickshaw is to the individual and gross employment structure of Bangladesh, especially amongst the poorest sections of society. This must be an important consideration in transport planning for the future of Dhaka and cities with similar context.

D. Role as Green Transport

- Reference [18] demonstrated that a reduction in rickshaws led to an increase in the number of mini-buses operating in Dhaka as a stop-and-go service that passengers could request to stop at any point along the NMT corridor. This has added considerably to air pollution. This is in addition to the general gross emission aggregated by the introduction of new motorized vehicles, replacing fuel free NMVs like rickshaw.
- Reference [1] also emphasized that the car is the principal contributor of SO_x, NO_x and CO emission in the city. The contributions from bus and truck are significant in the case of SO_x and NO_x emission. Auto rickshaws contribute significantly in the case of SO_x

and CO emission. By contrast, the NMVs including rickshaw have almost negligible impact on climate change and thereby are most desirable ecologically.

E. Modal Diminane and Transport Functionality

1) *High Volume:* The high rickshaw dominance in the overall traffic volume of Dhaka demonstrates its prominence; especially the presence is highest in Old Dhaka. Reference [8] reveals an average hourly traffic volume of 1,250 on roads in selected sections of Dhaka while that is doubled to around 2,500 in older parts of the city. During the hours of highest volume (peak hour), rickshaw volumes of 2,000 to 4,000 per hour are common. The volume of rickshaws is low only on a number of road segments (Airport Road, Mirpur Road and Elephant Road for example) where non-motorized vehicles (NMT) are now prohibited.

2) *Trip Share Dominance:* Available statistics clearly demonstrate rickshaw as one of the most popular mode of transport in Bangladesh, particularly Dhaka in terms of its trip share and passenger-kilometers of travel. Fig 3 shows the modal shares of NMPT (rickshaw & rickshaw van), public transport (bus) and private motorized transport (car, motorbike) including share for para-transit (taxi, auto-rickshaw & bicycle) in last few decades. The trends are also shown in the Figure.

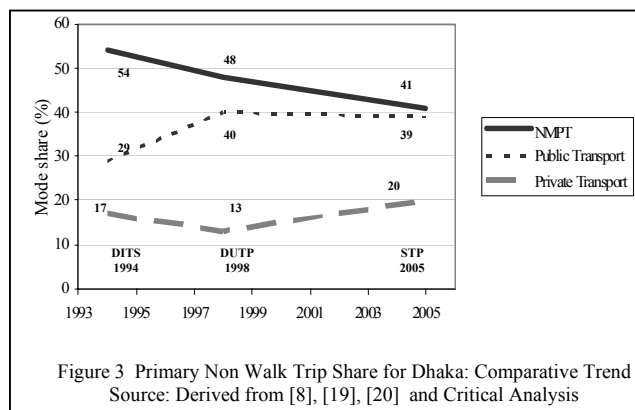


Figure 3 Primary Non Walk Trip Share for Dhaka: Comparative Trend
Source: Derived from [8], [19], [20] and Critical Analysis

The prominent share of rickshaw in NMT based passenger-kilometers of travel is depicted in Table 2.

TABLE II. TABLE 2: COMPARATIVE SCENARIO BETWEEN BUS AND MAJOR NMTs IN DHAKA BASED ON PASSENGER-KILOMETER OF TRAVEL

	Mode Type and Share (in percentage)		
	Public Transport	Non-Motorized Public Transport (excluding walk)	Walk Only
Passenger-kilometer	30.6	21.7	17.7

Source: [20], [21]

These table and figure indicate rickshaw and bus as the two most used modes in Dhaka over last two decades. The trend

also indicates a gradual rise in private transport and motorized public transport. Although the mode share trend is downward for NMPT, it still has the highest mode share and in terms of total volume of trips, is still growing.

3) Demand Responsiveness and Other Operating Utility:

- The demand responsiveness nature of rickshaw in catering the major trip type in Dhaka- short trips which accounts for three-quarter of total trips and ranges 3-4 km [8] alone magnifies its utility and unique gap it fills in the transport spectrum of Dhaka (Fig 4).

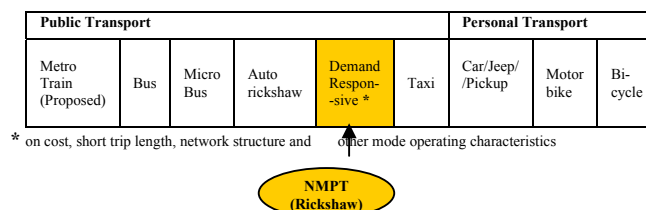


Figure 4: Spectrum of Transport Services and Space for NMPT in Dhaka
Source: Developed by Author Based on [15] and Critical analysis

- Especially, this is crucial as all other available modes (taxi and auto-rickshaw for instance) are more suitable to long distance trip making and too expensive for short trips. In addition, there are a set of other possible operating functionalities of rickshaw compared to available modes in Dhaka. It is a low speed, low capacity mode, but for many trips these factors are not significant. In Dhaka, the majority of trips are short and local, with average trip lengths around 3.8 km [8]; and the number of people traveling together is generally small. For short trips, NMPT is competitive in terms of overall travel time (when walking, waiting and transit time is taken into account) and is cheaper than traveling by auto-rickshaw, taxi or car. Its flexibility (route and time) in providing door to door services, easy access, high service frequency and affordability in short distance trip making further amplifies its functionality as a travel mode.

4) *Road Space Efficiency:* The rise of private vehicle is also significant. But still the non walk mode share of automobiles are less than half (17% [8]) that of NMPT. However, the total road space they occupy almost equals to that of rickshaw (34% road space for automobiles compared to rickshaw's 38%) [12]. This means that the NMPT uses half the road space than that of a car while transporting more people per vehicle than cars across all urban areas in Bangladesh. This highlights the road space efficiency of rickshaw compared to cars which have received policy preference in recent years [17].

These features establish background of rickshaw popularity and scale of its influence in the overall urban transport system of Dhaka.

IV. IMPEDIMENTS TOWARDS NMPT DEVELOPMENT

A. What is Happening in Dhaka?

Given the benefits of NMPT, it might be expected that the general policy environment for NMT in Bangladesh would have been supportive. But, over recent decades NMVs including NMPT have been constantly discouraged compared to motorized transport, through restrictive policy initiatives. This can be defined as the major impediment towards systematic NMPT development.

The active rickshaw restriction initiatives commenced in April 1987 as the government of Dhaka announced plans to completely ban pedicabs from the city on safety grounds, although at the time, they employed more than 100,000 people [22]. This ban did not materialize due to political reasons and public opposition, but has been followed by restricted registration as well as licensing for NMPT in 1989 and high taxation on spare parts. Such restrictive measures continued throughout the 1990s. In line with such trend and with the recommendations of the Dhaka Urban Transport Project (DUTP) (1998) and the National Land Transport Policy (2004), Dhaka City Corporation (the city government), in 2002 adopted plan to phase out cycle-rickshaws from eight major roads of Dhaka (Fig 5), comprising a total of 120 km. The objective being to make space for motorized transport and improve traffic flow, while at the same time, creating some separate routes for NMVs including NMPT rickshaws [23].

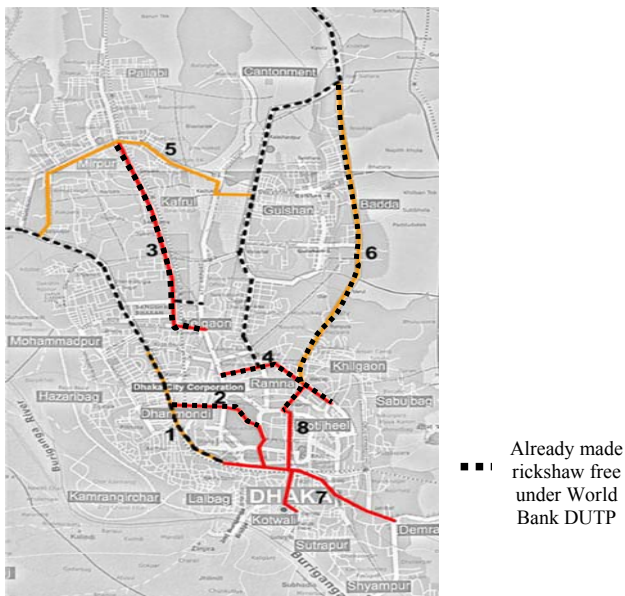


Figure 5 Existing and proposed rickshaw-free corridors in Dhaka
Source: Derived from [8] and [24]

The recent addition to this non-recognition of rickshaw role at policy level came in 2004 in the form of Strategic Transport Plan (STP), the 20 year (2004-2024) transport planning and policy document for Dhaka. STP though recognizes the

integral role rickshaw has been playing in providing eco-friendly mobility and accessibility in the Dhaka transport system, argues for its delimitation on the ground to improve traffic efficiency.

Nullifying this argument, government mandated studies like the Human Development Research Centre (HDRC) report [25] and DUTP Implementation Completion and Result Report [26] depicted the negative socio-economic implications of rickshaw ban in reference to the Mirpur demonstration corridor. Reference [25] indicated a 34% decline in monthly income of the rickshaw pullers and subsequent hardship in livelihood and health. For users, average monthly travel expenditure increased by 10%, travel hardship exaggerated for women and children, frequency reduced for social/recreational trips and inefficiency occurred in making a short trip (one to five kilometers) which is the case for three quarter of the travelers. The other major assessment report [18] demonstrated negative/marginal traffic operating effect of such policy decisions to eliminate rickshaws through a comparative scenario between pre-rickshaw ban (2000) and post-rickshaw ban (2005). In terms of average journey time for MTs, marginal improvement of speed (3.6%) and reduced travel time (5.7%) has been found. But this is not considered as a significant difference statistically due to large variability of travel time data[27]. On the contrary, average travel times for buses have declined by 26.1%.

B. What is Happening Elsewhere?

Such anti-rickshaw policy initiatives are also observed in global perspective, in major developing cities. Manila banned NMV initially in 1950's but some of them re-emerged in 1990's. Bangkok banned them in 1960 and Karachi in 1962. Jakarta followed the trend in 1988, then lifted the ban briefly in 1998 before reversal. New Delhi followed suit during the early 1980's and also put restriction on the number of cycle-rickshaw registrations as well as licensing. The latest addition to this is Ho-Chin-Minh City in 2008.

But transport statistics suggest none of these cities that imposed NMV bans were able to solve their transport problems by doing so. In most cases the situation became even worse. From the modal shares of different vehicles, it becomes clearly evident that NMVs were replaced by higher pollution generating vehicles like motorcycles and motorized three wheelers. The modal share of motorcycles or motorized three-wheeler in these cities accounts for 35-70% of the total vehicles [27]. This is more or less similar to that of rickshaws in Dhaka. The average travel speeds in most NMV free cities are also generally lower than that of Dhaka. Bangkok and Jakarta are notorious for traffic congestion and pollution [28].

These discussions clearly depict that, where total or partial NMV bans have been made over the years in different cities of Asia, the experiences have not been very pleasant. Most of these initiatives have lead to failure and decision reversal in some. And where such bans persist, the sense of dissatisfaction prevails. For example, even long after the ban, about 70% of residents in the low income neighborhoods of New Delhi and Jakarta favor reintroduction of NMT [28]. In this continuation, some cities are observed to have started favoring policies towards NMPT movement- Bogota, Colombia from 2004;

Yogyakarta, Indonesia from 2005 and few cities in India (Delhi, Agra, Chandigarh and Vrindavan) for instance since 2002 [3], [29], [30].

C. Why Such Adversity?

Major justification behind the policy restrictions are though improving traffic operational efficiency, it is often not the output derived as is evident from the case analysis of Dhaka. This is mostly because NMPT is only a part of a set of reasoning behind transport system inefficiency in developing cities. So why such adversities on NMPT alone rather addressing the issue more in a holistic manner?

Improving city image is thought to be the key driving force behind such anti-NMPT policy initiatives, coupled with lack of vision by the decision level in these cities, as can be assumed through above analysis and different literature review. Though the more specific reasons are arguable, but some obvious arguments can be summarized below-

- Developing a better city image to outside world?
- Insufficient understanding of the needs and demands of the city people?
- Inappropriate assessment of the present condition and future expectations, rational to resources, opportunities and constraints?
- Aggregation of all these?

Irrespective of the reasons, the common implications has been-

- Reduced equity in access to transport for major part of the society including the vulnerable groups- women, children and elderly population
- Increased sufferings of the common people through unemployment
- Environmental degradation
- Above all, neglecting common people's needs and requirements.

So, the key question that is evident from these discourse is, what should be the plan for future transport system of cities like Dhaka?

V. THE WAY FORWARD

The above discussion clearly establishes the present role significance of NMPT for Dhaka in particular and similar NMPT dominated developing cities like Delhi, Calcutta or Santiago. But it is also clear that the allowance to grow rickshaw without incorporating them in the overall transport system in a planned manner has also created a chaotic traffic situation in these places. *Therefore rather than simply pursuing policies to eliminate NMPT, a better approach should be to integrate motorized and non-motorized vehicles as complementary rather than competitive forces in meeting the comprehensive transport demand of these cities.*

A. Existing Initiatives

Some ideal instances of integration in the form of technical improvement can be observed in a number of cities of India including major cities like Delhi, Agra, Chandigarh and in Yogyakarta, Indonesia. Preliminary initiatives towards physical incorporation are observed in Bogota, Colombia.

B. Future Focus

But no initiatives have so far been undertaken to develop comprehensive integration of NMPT with MT. The primary focus will therefore be on developing effective approach towards realizing the integration process for developing cities. This paper depicts some preliminary progress as a part-effort of the on-going research conducted by the author towards such system development. Dhaka would be the case application due to its substantial NMPT dominance and role-significance. The primary focus in such development will be two fold.

1) MT-NMPT Integration Method Development:

- Develop an MT-NMPT integration method that is sustainable in meeting local transport demand while maintaining quadruple bottom line ideology of social equity, economic growth and traffic efficiency, eco-sustainability and policy support.
- A method that can consider alternative MT-NMPT integration scenarios, incorporate quantitative and qualitative attributes in option evaluation and consider the view points of all potential stakeholders (decision makers, rickshaw operators, drivers, and users) in deriving to best option selection.
- The method (which is currently in the process of development) will consider, for instance, the future issues like comparative implication of each alternative on - user mobility, accessibility, network congestion and stakeholder preferences of the scenarios before prescribing a definite solution.
- Network modeling (VISUM) & Multi-criteria analysis (Analytical Hierarchy Process) will be used as tools in logical and systematic derivation to the best option.

2) Planning Tools Formulation:

- Formulate comprehensive planning guidelines and management strategies for NMPT, as an implementation mechanism for the developed method.
- Micro-simulation tool (VISSIM/AIMSUN), for instance will be considered for possible sample testing of the planning strategies (if required) and to comprehend their functionality.
- The endeavor is to build up towards a general planning tool that
 - balances the transport needs of different users and associated social/cultural issues against the needs for overall urban transport efficiency and integration; and
 - is applicable beyond the case study city of Dhaka.

VI. CONCLUDING REMARKS

This paper has provided a brief preliminary analysis of the exiting condition of NMPT sector throughout the developing world, especially those with dominant NMPT market, using Dhaka as a case application. The discourse through facts and figures clearly delineates the pivotal and unique role cycle-rickshaw plays in meeting the transport needs of the people in these cities. The obvious multi-dimensional non-transport contribution (social, economic and environmental) of the NMPT industry is also established through analysis which admits its significance as an integral part of the overall urban system of these cities. The major adversities towards systematic NMPT development and the reasoning behind such initiatives have been determined to clarify the existing condition and to identify the places for improvement.

These lead to the conclusion of having a comprehensive integration framework for smooth NMPT operation with the motorized transport. Some preliminary guidelines have therefore been provided on the future activities in achieving the integration effort. The future endeavor would be to have a comprehensive planning effort that can maximize the obvious opportunities of NMPT facilities and its formal acceptability as a complementary force to motorized transports in Dhaka. It is also expected that while the planning guidelines will be developed on the basis of Dhaka case study, they will also be applicable to other developing cities facing similar problems.

REFERENCES

- [1] M. M. Hoque, and B. Khondokar, "Urban transport issues and improvement options in Bangladesh", Proceedings of the 40th Annual Canadian Transport Research Forum (CTRF) Conference, Hamilton, Canada, 2005. Retrieved August 5, 2009, from www.buet.ac.bd/ari/UrbanTransport.pdf
- [2] R. Gallagher, "The Rickshaws of Bangladesh", University Press Ltd., Dhaka, Bangladesh, 1992.
- [3] S. Gadepalli, "Rickshaws in the new millennium", The Daily Star, June 30 2006. Retrieved March 11, 2009, from <http://www.thedailystar.net/2006/06/30/d606300901105.htm>
- [4] <http://www.fotosearch.com> Retrieved September 6, 2007
- [5] World Car Free Network, (2005) "Campaigners achieve a victory in effort to save Dhaka's rickshaws", 2005. Retrieved May 29, 2008, from <http://www.worldcarfree.net>
- [6] S. Rashid, "The rickshaw industry of Dhaka: Preliminary findings", Bangladesh Institute of Development Studies, research report no.51. Dhaka, Bangladesh, 1978 as cited in Begum and Sen, 2005.
- [7] S. Begum and B. Sen, "Pulling rickshaws in the city of Dhaka: A way out of poverty?", Environment and Urbanization, vol. 17, pp. 11-25, 2005. Retrieved July 23, 2009, from [http://eau.sagepub.com/cgi/content/abstract/17/2/11D?Este et al \(1994\)](http://eau.sagepub.com/cgi/content/abstract/17/2/11D?Este%20et%20al%20(1994))
- [8] Strategic Transport Plan, "Strategic Transport Plan for Dhaka- Final Report", Dhaka Transport Co-ordination Board, Dhaka, Bangladesh, 2005.
- [9] Banglapedia, retrieved April 15, 2009, from http://banglapedia.search.com.bd/HT/R_0201.htm
- [10] M. Ali and R. Islam, "Livelihood status of the rickshaw pullers", The Good Earth, Dhaka, 2005.
- [11] S. Begum and B. Sen, "Unsustainable livelihoods, health shocks and urban chronic poverty: Rickshaw pullers as a case study", Chronic Poverty Research Centre, Working Paper 46, 2004. Retrieved May 12, 2009, from http://www.chronicpoverty.org/pubfiles/46Begum_Sen.pdf
- [12] M. Hoque, M. A. Ahsan, and M. A. Salam, and M. A. Hossain, "Rickshaw eviction from the main roads of Dhaka city: Impact on livelihood of the rickshaw drivers and remedial investigation, Niti Gobeshona Kendro (Policy Research Centre), 2006. Retrieved January 23, 2009, from <http://www.neetigob.org/Reports/Report%20on%20Rickshwa%20Puller.pdf>
- [13] Institute for Transportation and Development Policy, "World Bank says Dhaka Rickshaw ban should not go ahead", Sustainable Transport e-update, no. 16, 2005. Retrieved July 5, 2009, from <http://www.itdp.org>.
- [14] S. Rahman, "Future mass rapid transit in Dhaka city: Options, issues and realities", Jahangirnagar Planning Review, vol. 6, pp. 69-81, 2008.
- [15] G. D'este, M. P. Taylor, and L.G. Radbone, "Demand responsive public transport for Australia: The trade-offs", Proceedings of the 19th Australasian Transport Research Forum (ATRF), pp 207-222, Transport Research Centre, University of Melbourne, Australia, 1994. Retrieved October 7, 2008.
- [16] J. Whitelegg, and N. Williams, "Non-motorized transport and sustainable development: Evidence from Calcutta", 2005. Retrieved July 28, 2009, from <http://www.eco-logica.co.uk/pdf/Calcutta2.pdf>
- [17] T. Wipperman, and T. Sowula, (2007) "The rationalization of non-motorized public transport in Bangladesh", 2007. Retrieved August 10, 2009, from <http://www.drishtipat.org/blog/wpcontent/uploads/2007/08/rickshaw-development-proposal.pdf>
- [18] Dhaka Urban Transport Project, "Project performance assessment report", Government of Bangladesh and World Bank, Dhaka, Bangladesh, 2007. Retrieved February 24, 2009 from http://www.wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2007/05/15/000020953_20070515132917/Rendered/PDF/39323.pdf
- [19] Dhaka Integrated Transport Study, "Greater Dhaka Metropolitan Area Integrated Transport Study Final Report: Volume 1, Database and Immediate Actions", BGD/88/011, Government of Bangladesh Planning Commission, United Nations Development Program and Department of Development Support and Management Services, Dhaka, Bangladesh, 1994.
- [20] Dhaka Urban Transport Project, "Dhaka Urban Transport Project-phase II. volume 1: Technical proposal", Government of Bangladesh and World Bank, Dhaka, Bangladesh, 1998.
- [21] Dhaka Transport Coordination Board, "Dhaka Urban Transport Project 1998-2004", Government of Bangladesh and World Bank, Dhaka, Bangladesh, 2004. Retrieved March 22, 2008, from http://www.dtcg.gov.bd/dutp_backgroundmain.htm
- [22] M. Replogle, "Non-motorized vehicles in Asian cities", World Bank Technical Paper 162, Environmental Defence Fund and World Bank, Washington DC, USA, 1992. Retrieved March 8, 2008, from http://www.wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/1999/10/23/000178830_98101904141662/Rendered/PDF/multi_page.pdf
- [23] P. Menchetti, "Cycle rickshaws in Dhaka, Bangladesh", Social Movements and Collective Action, Rosanne Ruitten, Universiteit van Amsterdam Collegekaartnummer, The Netherlands, 2005. Retrieved January 27, 2009 from http://www.pedalinginbikcity.org/diary/text/Dhaka_Rickshaws.pdf
- [24] The Daily Star, "DMP bans non-motorized vehicles at nine places", Star Publications, Dhaka, Bangladesh, July 2, 2009. Retrieved July 14, 2009 from <http://www.thedailystar.net/newDesign/news-details.php?nid=95132>
- [25] HDRC report, "After study on the impact of Mirpur demonstration corridor project (Gabtoli-Russel Square)", Funded by Dhaka Transport Coordination Board (DTCB), Government of Bangladesh, 2004.
- [26] Dhaka Urban Transport Project, "Implementation completion and result report", Government of Bangladesh and World Bank, Dhaka, Bangladesh, 2005. Retrieved August 18, 2008 from http://www.wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2005/12/21/000160016_20051221180517/Rendered/PDF/34544.pdf
- [27] M Bari and D. Efrogmson, "Knowledge-based transport planning and more rickshaw bans in Dhaka city", Road for People, Working for Better Bangladesh Trust, Dhaka, Bangladesh, 2007.

- [28] GTZ, "Sustainable transportation: A sourcebook for policy-makers in developing countries", Sustainable Urban Transport Project – Asia and Deutsche Gesellschaft für Technische Zusammenarbeit, GTZ Press, Eschborn, Germany, 2003 Retrieved June 12, 2009, from <http://www.sutp-asia.org> and <http://www.gtz.de>
- [29] D. Hidalgo, "Structural change in Bogota's transportation systems: Public and non-motorized transportation priority and private car restrictions", Proceedings of the 2nd International Conference on Urban Public Transportation Systems, pp.26-36, American Society of Civil Engineers, Virginia, USA, 2004.
- [30] H. H. Zudianto, and D. Parikesit, "Implementing blue-sky program: The role of non-motorized transport in improving air quality in Yogyakarta, Indonesia". BAQ 2006 International Workshop Presentation, 2006. Retrieved March 6, 2009, from <http://www.cleanairnet.org/baq2006/1757/>