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Identifying public preferences using multi-criteria decision making for assessing the shift of urban commuters from private to public transport: A case study of Delhi

Suresh Jain [a,*], Preeti Aggarwal [a], Prashant Kumar [b,c], Shaleen Singhal [d], Prateek Sharma [a]

[a] Department of Natural Resources, TERI University, 10, Institutional Area, Vasant Kunj, New Delhi 110070, India
[b] Department of Civil and Environmental Engineering, Faculty of Engineering and Physical Sciences (FEPS), University of Surrey, Guildford GU2 7XH, United Kingdom
[c] Environmental Flow (EnFlo) Research Centre, FEPS, University of Surrey, Guildford GU2 7XH, United Kingdom
[d] Department of Policy Studies, TERI University, 10, Institutional Area, Vasant Kunj, New Delhi 110070, India

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ABSTRACT

Shifting urban commuters to public transport can be an effective strategy to deal with the energy and environmental problems associated with the transport sector. In order to enhance public transport the mode of choice for urban commuters, public expectations and requirements should be at the centre of the policy-making process. This study uses pair-wise weighing method (i.e. Analytical Hierarchy Process) to derive priorities for different criteria for shifting urban commuters to the public transport system based on their opinion. The primary survey has been conducted to collect the data for identifying public preferences for public transport characteristics under four parent criteria: reliability, comfort, safety and cost, identified based on literature review and expert opinion. This information was collected using questionnaire based surveys between January 2013 and July 2013 from nearly 50 locations using a stratified random sampling technique from nine districts of Delhi. Our results suggest safety as the most important criteria (36% of total) for encouraging the urban commuters to shift from private vehicles to public transport and then reliability (27%), cost (21%) and comfort (16%). Based on above four criteria, commuters were found to be happy with Delhi metro services compared to buses and other mode of public transport due to more frequency, adherence to schedule, less travel time, comfort and safety. Commuters were willing to pay more for better public transport service since the travel cost was not considered to be one of the important criteria. The results also showed that 96% commuters are willing to shift to public transport if above criteria or services are considered for providing an efficient public transport system. These results can assist transport planners to integrate public preferences with the available technical alternatives for the wise allocation of the available resources.

1. Introduction

Urban centres all over the world are plagued with unsustainable trends in the transport sector due to increased energy use, air pollution, traffic accidents, congestion and noise pollution (Jain & Khare, 2010). Mitigating transport externalities is a

* Corresponding author. Tel.: +91 11 2612 2222; fax: +91 11 2612 2874.
E-mail addresses: sureshjain_in@yahoo.com, sureshj@teri.res.in (S. Jain).

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major challenge faced by the governments all over the world. These problems are even more pronounced for developing cities where the rate of vehicle growth is far greater than the rate of growth of transport infrastructure (Santos, Beherndt, Maconi, Shirvani, & Teytelboym, 2010). Like many other urban regions in Asia, Delhi is experiencing considerable growth due to migration and growth in population. Due to strategic location in context to political, economic and commercial centre, Delhi attracts an enormous influx of people, promoting faster growth, resulting in massive demand for passenger transport (Ahmad, Balaban, Doll, & Dreyfus, 2013; Khanna, Jain, Sharma, & Mishra, 2011). It is expected that the distance travelled by people within and outside the city is expected to increase further in Delhi due to demographic marginalization and urban sprawl, resulting in higher reliance on personal vehicles (Economic Survey of Delhi, 2013).

The vehicle fleet of Delhi has increased from 3.16 million in 1999–2000 (4.72% growth rate) to ~7.69 million by the year 2011–12 (7.27% growth rate), with nearly 299 two-wheeler and 162 cars for every 1000 people (MoRTH, 2011). The increasing shift in motorised mode of transport in megacities of the developing countries is contributing to increased levels of air pollutants, attributed to vehicular sources (Jain & Khare, 2008; Kumar et al., 2013). This tremendous rise in the number of vehicles is due to the poor quality of public transport system provided in the city. Under the current democratic setup, policy makers and transport managers are faced with pressures of keeping the fares at the existing levels. Such a measure is also desirable to ensure social equity. Since the revenue collected by fares is inadequate, public transport authorities are often unable to recover their operational costs, let alone the investments to improve its services (Singh, 2005). Consequently the poor quality services encourage users to steer away from the public transport.

Whilst the share of public transport in Delhi was 60% in 2001, this decreased to less than 45% in 2008 (Sahai & Bishop, 2009). In fact, buses found to constitute less than 1% of the vehicle fleet in Delhi, but meet almost half of the travel demand leading to overcrowding and poor quality of transport services (Asian Development Bank, 2008). Personal vehicles such as two wheelers and cars or jeeps constitute more than 90% of Delhi's vehicles. This category of personal vehicles is also responsible for deteriorating the air quality in Delhi (Jain & Khare, 2010; Kumar, Gurjar, Nagpure, & Harrison, 2011). The vehicular stock has consequently grown beyond the carrying capacity of roads. This has led to congestion and a decrease in average travel speed leading to further problems related to energy use and emissions (RITES, 2010). Due to the lower average speeds and increasing sprawl, average travel time has therefore increased to 2 or 3 h per day for their work trip (Pucher, Korattyswaropama, Mittal, & Ittyerah, 2005).

Delhi Government has taken many policy initiatives to curb vehicular pollution since 1998, as shown in Table 1. Major policy interventions in Delhi included ordinary technological interventions that did not return the desired results, calling for a need to promote a shift of Delhi commuters from private to public transport. New policies should consider encouragement and strengthening of public transport system. Recognising this need, the Government of Delhi has proposed introduction of an Integrated Mass Rapid Transit System (IMRTS), which would cater 70–80% of the total travel demand of the city by 2021. The proposed system has corridors for Bus Rapid Transits (BRT), Light Rail Transits (LRT), Delhi Metro and Monorail. The Delhi Metro started operation in 2002 and now has completed Phase-I and II as on January 2013 covering distance of ~190 km. In order to make bus transit more reliable and faster, the Delhi Government has proposed BRT as a part of IMRTS. The pilot BRT corridor in Delhi stretches from Dr. Ambedkar Nagar to Moolchand, and is under trial run since 20 April 2008. The pilot project saw some resentment among private vehicle users due to priority given to buses at traffic signals, leading to longer stoppage time for non-bus users.

According to a survey by RITES (2010), Delhi Metro has been successfully able to make commuter shift from privatised modes. About ~46% of metro users were private vehicle users. This success can be attributed to the high quality service provided as compared to the existing bus system in Delhi. On the other hand, BRT has not been able to replicate Delhi Metro's success in terms of public acceptance. Other cities in the world have also shown a similar trend where even after the introduction of IMRTS, the share of private motorised transport has not decreased. For example, the study conducted by Poudenx (2008) in twelve major cities from Singapore, Hong Kong, Europe showed that IMRTS was only successful in drawing the users of non-motorised transport. A study conducted by Wener, Evans, Phillips, and Nadler (2003) on public transport system in New York suggests that the major reason for not shifting private vehicle users to public transport is the quality of service and the stress associated with frequent transfers among different modes. The local commuters could be satisfied with public transport system if their expectations are met by them. These aspects like service quality and stress associated with frequency transfers among different modes have not been comprehensively dealt with in transport research (Fellesson & Friman, 2008) and, research is conquered by choice modelling and stated preference approaches (Cantwell, Caulfield, & O'Mahony, 2009). However, satisfaction is an important aspect which may attract more commuters to shift from private vehicle to public transport. Hence it is very important to understand the commuter perceptions and their behaviour about public transport characteristics.

The relevant past studies showed that travel time, cost, frequency of service, seat availability, staff behaviour, reliability, availability of information about transport services, comfort, safety, and cleanliness are factors that constitute perceived service quality in public transport services (Bhat & Sardesai, 2006; Friman, Edvardsson, & Gärling, 2001; Friman & Gärling, 2001; Gatersleben & Uzzel, 2007; Hensher, Stopher, & Bullock, 2003; Nolan, 2007; Redman, Friman, Gärlingb, & Hartig, 2013; Rietveld, Bruinsma, & Vuuren, 2001; Sherestha, 2013). Another study conducted by Fellesson and Friman (2008) for nine European cities confirmed these results by highlighting the impact of safety, security, frequency, service reliability, comfort, and the quality of staff behaviour on the level of satisfaction with public transport. Poudenx (2008) suggests that the quality and service of transit modes will have to be raised to encourage a shift from private vehicles to public transport. This is because people would only be willing to shift to modes with greater comfort and reliability irrespective of energy use