TRAVELLING TOGETHER BUT DIFFERENTLY: COMPARING VARIATIONS IN PUBLIC TRANSIT USER MODE CHOICE ATTRIBUTES ACROSS NEW DELHI AND NEW YORK

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Abstract
Over the years, use of public transport has been the preferred mode of commuting for millions of people across the globe – both for developing and well as developed countries. While using public transport, commuters are often vested with a plethora of attributes that ultimately result in their final decision making regarding the public transportation mode choice. The purpose of this paper is to identify and prioritize a set of critical attributes that users consider while deciding their mode choice for urban public transport. The multi criteria decision analysis (MCDA) tool of Analytic Hierarchy Process (AHP) is used to prioritize the identified attributes. A survey among daily commuters in New York (USA) and Delhi (India) revealed that while the commuters from a developed country (USA) preferred safety and reliability, the counterparts from a developing country (India) weighed price / fare over other attributes. The findings of the current study might aid the policy makers in designing better public transport infrastructure as well as developing sustainable transport policy initiatives that aim to persuade people to use more public transport.
Keywords: Public Transit, Mode Choice, Urban Mobility, User Perception, Analytical Hierarchical Process (AHP)

1. INTRODUCTION

User mode choice in an urban scenario is a function of mode choice from a finite set. The user optimization of costs and benefits for a certain trip are usually based on frequency, distance and other utilities (Borndörfer et al. 2012; de Grange et al. 2013; Oum et al. 1992). Mode choice works within the monopolistic market of government's public transport policy (Borndörfer et al. 2012) and influences the conventional wisdom (Goodwin et al. 1992; Oum et al. 1992). The conventional wisdom termed as perceived utility-based attraction within the available alternatives can be categorized within probability

Theoretical and Empirical Researches in Urban Management
Volume 13 Issue 3 / August 2018

based multiple attributes (Barff et al. 1982). A generic categorization could be from the operator's perspective, defined as level of service and user's perspective, which can be defined as service quality (Wilson et al. 2013). User attitudes like personal norms, habits and intentions have been studied from the mode choice perspective (Bamberg et al. 2003; Lind et al. 2015; Şimşekoğlu et al. 2015). Study of user attitudes towards public transport in six Asian countries by Van et al. (2014) found that attitudes varied across countries, with Philippines showing higher attraction towards use of cars. Most of the respondents across six countries valued comfort, social image e.g. prestige value ahead of attributes like convenience, simplicity and speed, among others. An analysis of attributes performed using AHP by Das & Pandit (2015) for level of service of bus service in Kolkata, India, found that user valued low levels of waiting time and had high tolerance for crowding. de Luca (2014) has attempted to introduce public perception in strategic transport planning through developing an AHP model. Additionally, while the study by Cedar (2009) focussed on developing new stepwise multi-criteria and multi-strategy concepts for optimal design of public transit shuttle service, Altieri et al. (2017) have identified the best public transit mode from the user perceived transport quality. Chowdhury et al. (2018) have attempted to align the policy formulation practices for integrated urban transport along with user perception in Auckland, New Zealand. Hernandez & Monzon (2016) have studied user perception to identify the attributed which affect the efficiency of transport interchange. Hamid et al. (2015) have identified the user perception regarding safety and security need for commuter rail. Fan, Guthrie, & Levinson (2016) have tried to understand the varied nature of user perception for waiting time and environment from gender, basic amenities and security perspective. Iseki & Smart (2012) have used user perception to understand out-of-vehicle experience at transit station for walking, waiting and interchange experiences. Eboli & Mazzulla (2011) have classified subjective and objective user perception measures. Subjective measures were attributes like comfort, reliability and objective measures were attributes like frequency, fare, time and delays etc. Using demand theory, FitzRoy & Smith (1998) stated that user perception and actual fare and service quality are the main attributes towards patronage in German cities. Román et al. (2014) have used stated preference to analyse what results in disutility for the travellers. Hu and Jen (2006) have user consumer research literature to understand the user perceived quality of city transit system for Taipei and went for a two-stage scale development process. Tirachini et al. (2013) focus upon crowding aspect of user experience and it's affect upon transit demand. They state that recent discrete choice models have provided good understanding of various qualitative measures that enhance or harm the user experience. Vij et al. (2013) sum up user preferences as an effect of overall lifestyle comprising of attitudes, values and social networks etc. affecting the mobility style in terms of vehicle ownership, cycle ownership or transit pass possession affecting mode choice.

However, most of the research work for understanding user perception is city transit system specific, transit mode specific, or to understand the effect of socio-economic variables on mode choice. Understanding mode choice attributes from the geographic perspective has been limited to cities or regions. Bugheanu (2018) has done a comparative study of two European capitals - Bucharest and Berlin and identifies higher share of non-motorised share of trips for Berlin (26%), while 50% of the Bucharest uses public transport as against 26% in Berlin.

Differences between urban areas of developed and developing countries have not been measured within one research work using common technique for both the countries or regions. In this paper, we have investigated the relative importance of determinants of user's mode choice in New York (USA) and Delhi (India). The paper postulates that public transit users of urban areas in developing and developed countries with multiple mode availability will give different weights to specific attributes or determinants, not only based on the overall quality of service of the public transit system, but also due to assimilated cultural differences (Das & Pandit, 2015). The study attempts to capture this difference between public transit users from urban areas in India and USA using AHP.

The paper is organized as follows: the first section of the paper establishes the need for the study and identifies the various attributes influencing the user mode choice. The second section discusses the approach for quantification of attributes and substantiates it through literature review. The third section provides the details about the urban areas and user group surveyed through descriptive statistics. The fourth section provides the analysis and findings. Discussing the findings are presented in the fifth section and the final section draws conclusions from the findings and discusses the limitations of the study along with providing directions towards and further research activities.

2. LITERATURE REVIEW AND IDENTIFYING THE ATTRIBUTES

Traditionally, public transit system quality has been analyzed through two approaches. One approach relies on technical (supply side) and the other on perceptional (demand side) grounds (Fellesson & Friman 2012). The technical grounds are mostly covered through total passenger-kilometers, frequency, network access time, safety and reliability etc. (Román et al. 2014; Souche 2010). Perceptional grounds have been studied through the user's review of the system with attributes like comfort, delay, safety and security (Table 1). The second approach considers user as the customer and deploys customer satisfaction theories for benchmarking service delivery (Cirillo et al. 2011; Eboli & Mazzulla 2012b; Oliver et al. 1997; Parasuraman et al. 1988). Significant amount of research work has been designed to measure attributes for systems managed in an integrated manner i.e. either a Rail based transit system

(light/heavy) or bus transit system and sometimes for radio or GPS based taxi system (Eboli & Mazzulla 2012b). However, there have been debates regarding heterogeneous nature of user perception and system specific models against models that are generic (Cirillo et al. 2011; Fellesson & Friman 2012). Román et al. (2014) argue this as failure of system specific internal assessment in addressing overall user welfare within the public transit system. However, for both the approaches user perception has been one of the most important tool to analyze the service levels of public transit system. Further, research works have focused upon perceived quality based on existing experience and desired quality of service (Bordagaray et al. 2014; Fellesson & Friman 2012; Filipović et al. 2009). An analysis of user and service provider's perception limited to bus transit system for current and potential users found fare and operations for current users and ease of access and park and ride facilities as important attributes for current and prospective users respectively (Mahmoud & Hine 2013). Vij et al. (2013) discuss these as latent choices made in long-term for everyday or one-off trips. Das & Pandit (2015) analyze the mode choice behavior of urban areas of developing countries for bus transit system. Barff et al. (1982) provide the most simplistic definition of mode choice or utility as probability-based sum of perceived deterministic and random component.

Research works also emphasize upon the user perception differences based on geography (developed v/s developing countries) and demography like income and age etc. (Das & Pandit 2015; Rajamani et al. 2003). However, often public transport system involves transfers across modes and hence, single mode utility models might not capture the user perception for the city's public transit system. Therefore, first city-based user perception of public transit systems should be analyzed, a second and third tier classification can be done based on mode choice and socio-economic characteristics (Bordagaray et al. 2014; Cirillo et al. 2011; Kumar et al. 2015). However, with increase in number of respondents, consistency of the analysis becomes a major issue.

Traditionally, major parameters for mode choice with urban public transit systems have been cost (compared against modes for the same trip), time or duration (comparison of travel time / delays across modes for the same trip), comfort (measured through relative ease of access of the primary mode, number of transfers, ease of boarding/de-boarding, micro-environment and crowding parameters across modes for the same trip), safety and security and inertia due to routine etc. (Aarts et al. 1997; Betsch et al. 2001; Das & Pandit 2015; Vij et al. 2013). Recent research works have also considered reliability as an attribute where minimization of variance in terms of frequency, time and increased safety and security are the contributing attributes (Eboli & Mazzulla 2012a). Similarly, environmental sensitivity or sustainable mobility (Le Pira et al. 2015) of a certain mode has also been considered as a parameter for

mode choice, however, significant differences have been limited only for private modes v/s public modes (Hyad 2012).

A frequency analysis of five attributes (Table 1) show that out of 13 studies done between 2006 and 2018 covering USA, Europe, UK, and East and South-east Asia, fare has been researched as an attribute some 9 out of 12 times. Similarly, travel time, travel comfort, safety and reliability have been studied 10, 11, 8 and 11 times respectively. This research work, performs existing user perception analysis on the basis of these five attributes for users in different cities, using public transit systems have been analyzed. Based on these descriptive statistics, we have further elaborated upon the definition and selection of these five attributes in the following sections.

TABLE 1 - SOME PRIOR STUDIES ON USER MODE CHOICE ATTRIBUTE SELECTION

Sl. No.	Research Work	City or Mode Specific	Attributes				
			Fare	Travel Time	Travel Comfort	Safety	Reliability
1	Hu & Jen 2006	Bus Transit System - Taipei				✓	✓
2	Bordagaray et al. 2014	Bus Transit System – Santander, Spain	✓	✓	✓	✓	✓
3	Das & Pandit 2015	Bus Transit System, Kolkata		✓	✓		✓
4	Vij et al. 2013	Travel Diaries - Karlsruhe and Halle, Germany		✓			
5	Mahmoud & Hine 2013		✓	✓	✓	✓	✓
6	Souche 2010	Car v/s Public Transit – San Francisco Bay	✓	✓			
7	Tirachini, et al. 2013	Train and Bus – Sydney, Australia	✓	✓	✓		✓
8	Filipović et al. 2009	Public Transit System – Belgrade	✓		✓	✓	✓
9	Cirillo et al. 2011	Southern Italy	✓	✓	✓	✓	✓
10	Paulley et al. 2006	Bus and Train, UK	✓	✓	✓		✓
11	Fellesson & Friman 2012	Benchmarking in European Service of Public Transport		✓	✓	✓	✓
12	Eboli & Mazzulla 2012	Railways, Italy	✓		✓	✓	✓
13	Román, et al. 2014	Public Transit, Gran Canaria, Spain	✓	✓	✓		✓
		Total	**9**	**10**	**11**	**8**	**11**

2.1. Fare

Fare of public transit system has been researched from two perspectives, first from the perspective of relative attraction of private mode v/s public mode (Steg 2005) and then second from the overall subsidization of public transit from the target group income (Paulley et al. 2006) and the urban

Theoretical and Empirical Researches in Urban Management
Volume 13 Issue 3 / August 2018

environment management perspective (Hyard 2013; Le Pira et al. 2015). Paulley et al. (2006) study of metropolitan area of London found that, fare and patronage for public transport are inversely related with upward fare revision resulting in low ridership. They further state that fare elasticity with ridership is different for short-term, medium term and long-term time periods. As user perception as well as mode availability changes over a period of time, fare elasticity for different trip purposes in long term also shift. Changes in fare with respect to income variations are also a significant measure to analyze mode choice. A model developed by Bordagaray et al. (2014) to analyze user perception for Santander bus system and specific routes found that lack of availability of private mode reduces fare sensitivity for low income group. Borndörfer et al. (2012) state that fare decisions by public transit systems are based on the demand for public transport, profit and welfare of users. However, fare remains one of the most important factor affecting travel choice. Study done from the financial sustainability perspective of public transport by Buehler & Pucher (2011) found that synchronized policies for fare, services and schedules have resulted in increased ridership in addition to relatively low levels of fare revision as compared to gasoline price increase in Germany. Chakour & Eluru (2014) while analyzing access mode's effect on mode choice found that fare becomes important not just for the mode choice, but sometimes fare from different boarding points also influences mode choice. Study done by FitzRoy & Smith (1998) to understand the increase in demand for public transport over two decades in a German city (1980-98) found that changes in fare against service quality are the two most important variables in deciding user mode choice. Souche (2010) analyzed travel cost from the quantity, quality and spatial effect perspective. The model interrelates use of private mode or public mode vis-à-vis urban density and cost, the results find a significant relationship between urban density, travel cost and the demand for public transport. For public transit in developing countries with high information availability and reliability e.g. rail based urban transit, recent experiences of fare rise have led towards sharp drop in ridership (Business Today Online, 2017), substantiating research work done for developed countries in the last three decades (de Grange et al. 2013; Goodwin 1992). Cirillo et al. (2011) vary the fare between 0% and 25% and found asymmetric correlation between willingness to pay and service reliability with nearly half of the respondents having no willingness and 30% somewhat willing to pay for reliable services and 20% with high propensity to pay for on-time reliability. The response varies with varied geography and hence, predictable differences would remain between fare sensitive behavior of users in developed and developing countries (Das & Pandit 2015). FitzRoy & Smith (1998) consider fare and service reliability as two of the most important factors for user patronage. To capture the simplified understanding of the respondents 'fare' for this study is defined as 'relative fare or cost of available modes e.g. metro, bus or private vehicle for trips having same origin and destination as well as purpose.'

2.2. Travel Time

Paulley et al. (2006) discuss time dimension of urban trips as part of service quality, discussing elasticity of access time, journey time and egress time for the main mode. They discuss the complexity as the actual time against perception of journey time, waiting time and the comfort during journey. They find that for all such work trips have lesser elasticity as compared to leisure or weekend trips. Naess (2003) compares travel time in public transit as against personal modes and plots 'probability of using a car' against time ratio of using public transit and personal mode. He found that an increase of travel time ratio of car is to public mode from 0.5 to 1.5, the car use probability reduces from 1.0 to 0.1. Das & Pandit (2015) have approached the travel behavior in developing world through vehicular level of service model and find that service levels and time are related in a complex manner. Cirillo et al. (2011) discuss various research work done on travel time, access time, variability and perception. Bordagaray et al., (2014) discuss journey time and waiting time and find higher coefficients for both of them for users within their log-likelihood function. Filipović et al. (2009) have studied the expected travel time as part of reliability with 80% of users in Belgrade choosing reliability as one of the most important measure. Fellesson & Friman (2012) found factor loading of 8% to 17% for travel time for studies done for nine European cities. For this study the 'travel time' has been defined as 'sum of access time, waiting time, journey time and delays of the primary mode for trips having similar origin and destination and purpose' e.g. for metro – travel time would be sum of time take to reach the station, waiting time at station, journey time, time taken to exit the metro system and reaching the destination or other mode's access point in case of transfer.

2.3. Travel Comfort

Comfort is traditionally defined through level of service provided by a certain mode under different demand conditions (Schwanen et al. 2004; UITP, Metro Committee 2011). User perceives comfort through the quality of the microenvironment which might include safety and security aspects, this perception is also pitted against the fare of the said mode. Tirachini et al. (2013) discuss the crowding aspect of comfort and find that demand forecasting without considering disutility due to overcrowding will result towards demand overestimation. Cirillo et al. (2011) and Eboli & Mazzulla (2008) define comfort in terms of environment control, cleanliness and seat availability and found that users were ready to pay 0.14 Euros more for clean buses and 0.20 Euros for higher frequency, where daily travel card is valued at 1.55 Euros. Mahmoud & Hine (2013) consider comfort, cleanliness and crowding of the bus as part of service design and find a weight of 3.6% within their AHP model for bus users. A study of city bus service of Taipei by Hu & Jen (2006) defines comfort in terms of tangible services as bus

Theoretical and Empirical Researches in Urban Management
Volume 13 Issue 3 / August 2018

quality, cleanliness, noise levels and air conditioning, they find these as positively correlated with the travel behavior with confirmatory factor analysis giving composite reliability of 0.79. Comfort appears as one of the top three attributes studied in seven out of nine European cities (Fellesson & Friman 2012). For this study we have defined 'Travel Comfort' as 'perception related to crowding, seat availability, cleanliness of the system and other infrastructure like universal accessibility etc.'

2.4. Safety

Paulley et al. (2006) discuss safety and security as part of the waiting environment, however, limit it to safety from weather conditions. Safety and security was considered as one of the most important factors by more than three-quarters of the respondents (749) in a study by (Iseki & Taylor 2010). Eboli & Mazzulla (2011) discuss safety and security from the vehicle reliability, driver's competence and safety at the bus stop perspective. Extremely high value for weightages for safety and security was also found by Cirillo et al. (2011).

For a public transit system safety and security are termed as normative exception arising out of system's as well as user group's cooperative behavior (Anable 2005). Safety and security also overlap with the attribute comfort of the mode, as safe and secure modes are also considered comfortable. However, some amount of safety and security functions alongside what time of the day the trip is being made and how much of it could be sacrificed against other attributes. Iseki & Smart (2012) have discussed safety and security among one of the five important factors in their analysis. Mahmoud & Hine (2013) discuss factors like lighting, CCTV monitoring and absence of offensives as part of safety and security among the six attributes studied. Some of the recent research work have tried to identify relationship between gender, safety and security and waiting environment and attitudes and risk-taking behavior from the public transit use perspective (Chowdhury & O'Sullivan 2018; Fan et al. 2016; Lois et al. 2017). For this study we have defined 'safety' as 'sense of security and low probability of being at risk of harm by and external or internal agents' e.g. human attack or system dysfunction etc.

2.5. Reliability

Nielsen & Lange (2008) state that reliability is a perception built through information availability. Reliability of a system is about maintaining headways and consistent frequency (Reddy et al. 2014). However, sometimes reliability is defined through the utilitarian perspective of fare paid against average travel time and travel time variance and performance of the system for the intended function within the given time window (OECD 2010). The definition of service reliability has been further been constricted to management of peak hour traffic volume without major disruptions fulfilling consumer satisfaction (Barron et al. 2013; Transport Research Board 2013). Barron et al. (2013) further state that economic

quantification of passenger hours lost can be used to measure reliability. Furthermore, OECD (2010) provides an alternate definition of reliability as predictability of the system. To improve reliability UITP (International Association of Public Transport) provides five major operational indicators - Service Regularity, Passenger Density, Service Availability, Service Punctuality and Service Reliability, with first three perceived by commuters (UITP, Metro Committee 2011). Other measures to gauge reliability of the system are number of transfers or wait time, a wait time between 2 - 4 minutes makes the system reliable from user's perspective (Cervero 1998; Mees, 2000, 2000; Vuchic 2005). Comparative analysis of the basic features of the expected and perceived quality of mass passenger public transport service in Belgrade found that service reliability is one of the important factors in building user perception among current and potential users (Filipović et al. 2009). van Oort (2016) and Van Oort et al. (2015) have developed the model to identify the economic loss of service unreliability of a public transit system. Hence, reliability is one of the major attributes which needs to be analyzed from the user's perspective for varied geographies. Soza-Parra et al. (2018) found that improved service reliability results in more time spent per user within the public transit system. Thereby reliability of a system as per the user perception becomes an important part of the decision choice model. For this study we have defined 'reliability' as 'service related information availability, variance in travel time or frequency of the primary mode, number of transfers and waiting time' e.g. journey time informed against actual journey time including delays and its variance.

3. OVERVIEW OF THE METHODOLOGY

In order to analyze decision making problems that are not only complex in nature, but also involve trade-offs between attributes of almost similar importance, decision makers often use multiple criteria, which often clarify the advantages as well as the disadvantages of various policy options under the condition of risk and uncertainty (Saaty 1994). One of the common approaches in this regard has been Analytic Hierarchy Process (AHP) developed by Thomas L. Saaty (Saaty 1980). AHP can be stated as "*an approach to decision making that involves structuring multiple choice criteria into a hierarchy, assessing the relative importance of these criteria, comparing alternatives for each criterion, and determining an overall ranking of the alternatives*" (Decision Support Systems Resources Glossary). AHP has emerged to be a common technique that can be used to determine the relative importance of a set of attributes critical to achieving a desired objective, for example, in the context of the current study, user perceptions of public transport mode choices in developed and developing countries.

The process of AHP starts with the construction of a hierarchy that describes the multi criteria problems that is to be tackled. The overall objective (which Saaty calls "the focus") of the project is always placed

right at the top of the hierarchical tree and the main attributes a level below it. The sub attributes are placed on the subsequent levels of hierarchy and the final level of the hierarchical tree consists of the alternatives among which the selection is to be made. In certain cases (for example, the current study) where the final decision-making objective involves (and is restricted to) prioritizing a set of attributes only, the final level of hierarchy, which are the alternatives, are often omitted and the last level of attributes (or sub attributes) forms the final level of the AHP hierarchical tree. After constructing the hierarchy, the next step in developing an AHP model is to derive the weights of the lowest level of attributes through a series of pair wise comparisons where each attribute of that particular hierarchical level is compared with its sibling with respect to their relative importance to each other. The pair wise comparisons are made relative to the importance, likelihood, desirability and so on and are based either on a numerical scale or on a verbal or graphic format (Ganguly and Merino 2015). The pair wise comparisons are denoted in terms of the relative importance of an attribute with respect to the final alternative decisions being compared. After the comparisons are made, they are converted into a numeric scale and are entered into a matrix. The resulting data is normalized in order to make them add up to one. After all the comparisons have been completed, the results are combined into a composite score which denotes how well each of the alternatives to be chosen fits the overall objective (focus) of the decision-making process. After the final composite score has been calculated and the final overall value of the alternatives has been deduced, the last step of the AHP process is to make the actual decision based on the overall values of the alternatives in question. However, at this point it would be worthwhile to mention that since AHP is used to rank the attributes associated with user perception of public transportation in the context of the present research, the final stage of determining the preferred alternative was beyond the scope of this research and is therefore not presented in the study.

AHP has been used extensively to understand latent choices (Altieri et al. 2017; de Oña & de Oña 2014). Chowdhury et al. (2018) have used AHP to understand the perception towards integrated transport system for the users and policy makers. Altieri et al. (2017) have used AHP to understand the user perception towards selecting the best transportation mode. de Luca (2014) has used AHP to analyze public participation in strategic transport planning and ot gauge user desires and expectations from the system. de Rocha et al. (2016) have used AHP to analyze the operational performance of Brazilian Airport Terminals. Das & Pandit (2015) and Mahmoud & Hine (2013) have used AHP to analyze the user perception of current and potential public transport users for bus transit systems. Guirao et al. (2016) have used AHP to analyze service quality while keep the need of practitioners in mind. AHP has been used to evaluate the public transit system of Tehran by Nassereddine & Eskandari (2017). All these studies provide us a sound grounding to use AHP to analyze the user perception for

public transit mode choice and draw a comparative study between users of developed and developing countries.

4. DATA COLLECTION AND FINDINGS OF THE STUDY

A meta-analysis done by de Oña & de Oña (2014) found that user perception for public transit has been analysed mostly through aggregated or disaggregated performance-expectations model, the prominent tools and relative importance of attributes have been identified through techniques like factor analysis, bivariate correlation, regression analysis and structural equation modelling. Additionally, it was also observed from reviewing the extant literature that multi criteria decision making models have also been used, although sparsely, in analysing public transportation, and that too not from the perspective of the public transportation users (Celik et al. 2013; Liu et al. 2013; Zak 2011). The current study, through using the MCDM model of AHP, tries to bridge this gap in the extant literature. Additionally, it also tries to draw a comparative analysis of the user perception in public transportation from a developed (USA) vis-à-vis a developing (India) country. Therefore, to understand the user perception of public transit mode choice respondents were selected from developing and developed country i.e. USA and India. The respondents were identified from cities having multiple easily accessible public transit options e.g. Rail based urban transit system, bus transit system, para transits and taxis. Respondents were chosen from Million plus cities so that transit mode choices become important as commuters spend more time in transit in these cities as compared to smaller cities, giving emphasis upon the mode choice. Although the optimum sample size for an AHP analysis is completely dependent on the nature of the problem and the number of alternatives, smaller sample sizes are more useful for alternatives that were almost equally important to one another. As a result, since five attributes were finalized for the AHP analysis, a minimum benchmarking of 25 respondents from both USA and India were sought. A total of 35 responses were collected from USA and 40 from India. It was cautiously ensured that respondents have the financial and income-based flexibility to opt between public or private mode. The final set of respondents who were chosen to be a part of the study comprised of daily commuters who have been availing public transport over a considerable period of time – which in this case was more than 5 years. The initial number of responses based on the AHP survey were subsequently narrowed down, in the process separating the 'vital few' from the 'trivial many', which came out to be 25 for each of the countries and were subsequently analyzed for the study. The AHP questionnaire distributed to the respondents included the five major attributes associated with user perception of public transport and the evaluators were requested to perform a pair wise comparison among the attributes. As there were five attributes that were selected, the total number of pair wise comparisons that each of the evaluators

had to make were (n*(n-1) / 2) = 10. The feedback received from the evaluators was then combined and normalized in order to obtain the global priority weights for each of the attributes, which formed the crux of the study. Tables 2 and 3 exhibits to the readers the prioritized weights among the five attributes along with their mean normalized weights as provided by one of the respondents in USA and India.

TABLE 2 - PAIRWISE COMPARISON AMONG THE ATTRIBUTES AND THEIR NORMALIZED WEIGHTS FROM ONE OF THE RESPONDENTS IN USA

Attributes	Fare	Time	Comfort	Safety	Reliability	Mean Normalized Values
Fare	1	0.167	0.200	0.111	0.111	***0.029***
Time	6	1	4	0.167	0.143	***0.119***
Comfort	5	0.250	1	0.143	0.125	***0.069***
Safety	9	6	7	1	1	***0.379***
Reliability	9	7	8	1	1	***0.403***
					CR	***0.132***

TABLE 3 - PAIRWISE COMPARISON AMONG THE RISKS AND THEIR NORMALIZED WEIGHTS FROM ONE OF THE SURVEYS IN INDIA

Attributes	Fare	Time	Comfort	Safety	Reliability	Mean Normalized Values
Fare	1	0.250	0.333	0.052	0.058	***0.038***
Time	4	1	4	0.069	0.058	***0.115***
Comfort	3	0.250	1	0.052	0.068	***0.064***
Safety	8	6	8	1	1	***0.399***
Reliability	7	7	6	1	1	***0.384***
					CR	***0.101***

The authors' want to reiterate here that the results exhibited in tables 2 and 3 reflects the pair wise comparison among the attributes as provided by one of the respondent and is not a composite mean of all the survey feedback. The responses received from the other respondents were analyzed in a similar fashion and all the results obtained were used as a part of the final research result. Table 4 and 5 provides the reader with the final 'overall rakings' of the identified attributes based on a composite analysis of the responses provided by all the respondents both in USA and India along with their mean and standard deviations.

TABLE 4 - FINAL AHP VALUES OF THE USER PERCEPTION ATTRIBUTES AND THEIR RANKINGS IN THE CONTEXT OF USA

	Fare	Time	Comfort	Safety	Reliability
Mean Value	**0.04**	**0.14**	**0.07**	**0.39**	**0.37**
Std. Dev	**0.005**	**0.029**	**0.011**	**0.079**	**0.006**
RANK	***5***	***3***	***4***	***1***	***2***

N = 25, Consistency Ratio = 0.14

TABLE 5 - FINAL AHP VALUES OF THE USER PERCEPTION ATTRIBUTES AND THEIR RANKINGS IN THE CONTEXT OF INDIA

	Fare	Time	Comfort	Safety	Reliability
Mean Value	**0.29**	**0.11**	**0.17**	**0.25**	**0.18**
Std. Dev	**0.237**	**0.041**	**0.127**	**0.140**	**0.155**
RANK	***1***	***5***	***4***	***2***	***3***

N = 25, Consistency Ratio = 0.12

TABLE 6 - CONSISTENCY RATIO – MEAN AND STANDARD DEVIATION

	USA	India
Mean Value	0.14	0.12
Std. Dev	0.030	0.061

N = 25

Tables 4 and 5 provides the readers with prioritized rankings of the user perception in public transport mode choices both from the lens of a developed vis-à-vis a developing country. As observed from tables 4 and 5, the user perceptions were different in the two situations. While the commuters from a developed country primarily based their perceptions on safety and reliability, it was the fare (price of tickets, overall travel cost, etc.) that dominated the other factors in the case of a developing country. Additionally, table 6 provides the readers with the mean and standard deviation of the consistency ratio of the survey respondents, both from USA and India. It is also observed that the consistency ration in both the cases were marginally higher that the acceptable value (≤ 0.10). The primary reason for this was assumed to be the fact that pair-wise comparison among the attributes selected was not transitive. For example, the relative importance of fare being higher than travel time and the relative importance of travel time being greater than the travel comfort does not necessarily denote that fare will hold a position of more importance than travel comfort. As a result, the final AHP judgment values were not revised with the objective of lowering the consistency ratio to within the permissible range (Ganguly & Merino 2015). As mentioned by Saaty (2001), evaluators often make tradeoffs that violate transitivity but, overall, are accurate in their judgment since they take into account the relative importance of the criteria themselves. Also, Tam et al. (2006) states that the root of this problem stems from the 9-point scale of AHP, which assumes that the decision-makers understand well the relationship and the magnitude of differences among various decisions under consideration. However, in practice, using such a complicated scale makes it extremely difficult to achieve an absolute consistency in the evaluation process (Tam et al. 2006), thereby resulting in a marginally higher consistency ratio. Finally, it should be worthwhile to mention that the low degree of standard deviation among the consistency ratio indicated that the respondents, in spite of being surveyed separately, were fairly in agreement with each other regarding their user choice attributes. The following section of the paper will be devoted towards discussing the findings, comparing it with the extant literature and providing insights based on the findings.

5. DISCUSSIONS THE FINDINGS

The differences between prioritized rankings of the user perception across are a reflection of socio-economic differences, mode choice availability and user expectations. While, users in developing countries are more sensitive and less elastic to fare, considering low income levels giving it the top ranking, users in developed part of the world have given it the lowest ranking. This is consistent with the findings of Das & Pandit (2015) for bus services in the city of Kolkata, India and Mahmoud & Hine (2013) for UK. Both safety and reliability are among the top three attributes for developed and developing country. Considering that the mode choice is for daily trips, where, on-time performance of the system allows routinization (Aarts et al. 1997; Verplanken et al. 1997) and reduces daily variance, thereby increasing reliability, the results are consistent with the findings of other studies. Also, since daily trips increases chances of accidents, safety becomes of utmost importance for the commuter irrespective of the region they belong to. However, there is significant difference in overall attribute weight allocation. While for New York the top two attributes i.e. safety and reliability dominate 77% (0.77) of the user mode choice decision, the same for developing country stands at 49% (0.49) for fare and safety. This is a typical case of 'survival issues' or subsistence versus 'life issues' or security (Costanza et al. 2007). The stark difference is a clear reflection of socio-economic difference, and capacity and quality of service provided by public transit in developed world as against in developing countries. Considering that services in developing countries like India (New Delhi) are marred with capacity constraints and low levels of reliability, the user with low income levels and low elasticity towards shifting to somewhat expensive personal mode will stick to services with expectation of deriving maximum utility and future betterment (Mahmoud & Hine 2013; Pucher et al. 2005; Verma et al. 2011). However, in the developed country, high levels of per capita infrastructure availability and high elasticity towards modal shift takes care of attributes like comfort and time. High income levels also take care of fare to some extent; hence user perception and mode choice decision making is heavily influenced by safety and reliability. This a scenario where, user values his / her high quality of life and hence, will like a system which is very safe and reliable, a case which has been described as 'forget-the-timetable' by Nielsen & Lange (2008) and with very high level of normative behavior like trust and cooperation by the society and other users in terms of social safety and security (Parks et al. 2013; van Vugt et al. 1996). Overall, we find that the differences in user perception across developed and developing country are latent reflection (Vij et al. 2013) of the socio-economic conditions reflecting flexibility or elasticity towards modal shift for everyday commuter trips, the condition of public transport reflected through capacity constraints, level of service, comfort and availability. Therefore, fare takes precedence over any other attribute in developing countries. However, as fare, capacity, comfort and availability are no more a

concern and are nearly taken for granted in decision making in developed countries, safety and reliability of the public transport become important for user mode choice. The study therefore puts forward, the need for increasing ridership in developed countries by making public transit systems more safe and reliable, which should be the concern considering the current geo-political situation and lack of social trust in public spaces and public systems. However, for the developing countries the user mode choice and overall ridership in public transport becomes trickier considering that fares need to be kept moderate, while the system should also focus towards increasing safety, reliability and comfort.

6. CONCLUSIONS AND FUTURE RESEARCH

In the highly complex decision-making environment prevailing currently, users and policy makers are finding it more and more difficult to arrive at an optimal decision for their objective. The complexity in decision making has also adversely affected human consistency in judgment. In many such decision-making settings, the theory of MCDM can aid in resolving this complexity in the value systems and improve the consistency in judgment. The current study expects to achieve this through using the MCDM technique of AHP. Additionally, over the years, public transportation has been the preferred mode of commuting for a large percentage of daily trips, both in developed as well as developing countries. The current study focused on investigating the role of user perception in availing public transportation. A set of important attributes were identified using a comprehensive review of the extant literature and were subsequently used in the current study. The identified attributes, which were both tangible and intangible in nature, were subsequently prioritized using the MCDM technique of AHP. Review of the extant literature revealed the existence of five major attributes - fare, safety, reliability, travel comfort and travel time – which were subsequently analyzed. The findings of the study exhibited that while the users in a developed country preferred safety and reliability, their commuter counterparts from a developing country weighed fare over anything else. This serve as a key takeaway for the policy makers in the developing country, where, in spite of laying emphasis on the other factors, the fare can still prove to be the determining factors between the use and avoidance of public transport.

The future research path should be directed towards using other MCDM techniques like Fuzzy AHP, TOPSIS and DEA, among other, to validate the findings from the AHP study and comparison of the results. This will not only increase the validity of the study, but also will increase its robustness. Additionally, using a diverse sample size spread across multiple developed and developing countries will also aid in increasing the generalizability of the findings, thereby further improving the robustness of the study. Finally, breaking down the identified attributes into a set of sub-attributes, in the process forming a second level of hierarchy that might also serve as a useful direction towards future research.

In conclusion, the limitations of this study are presented. First, the focus of the paper is primarily on urban transportation and therefore rural sector, is not considered as a part of the research. Secondly, the sample size used in this study was 25, which although in the context of AHP can be considered acceptable, is still relatively small. This study is based on the experiences of a limited number of commuters, both in the developed and the developing countries and the authors would suggest caution be exercised with regards to generalizability of the findings, particularly beyond the current context.

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