

Intentions of Car and Motorcycle Oriented Groups towards Public Transport In Lahore

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Abstract-The rapid increase in private vehicle usage tends to increase the demand for the road infrastructure and related facilities. Like other cities in the world, Lahore city is also facing with the dilemma of auto-dependency and transit insufficiency. It is very important for local government to develop and promote state-of-art public transport. To develop such polices, it is essential to explore the potential factors at the planning stage that can affect the intended use of improved transit facilities. Therefore, this study attempts to explore the significant influencing factors on the use of public transport using results of a questionnaire survey. In this study, a questionnaire was designed which included socio-demographics and trip characteristics of respondents, statements on travel attitudes and intentions to use public transport under specific conditions. This survey was conducted in Lahore city and 428 usable samples were obtained. An exploratory factor analysis was conducted and two factors were extracted i.e. auto-oriented and transit-oriented. Structural equation modeling technique was used to evaluate the influence of extracted factors on people's intentions to use public transport. The results depict that the intentions to use public transportation are affected negatively by auto-oriented attitudes whereas positively by transit-oriented attitudes. The study findings implicate that auto-oriented attitude of travelers need to address properly in planning and designing public transport improvement policies for Lahore city. The findings would be helpful for local planners and policy makers in developing a transport system for Lahore system that should be sustainable, equitable and affordable for the community.

Keywords-Public Transport, Travel Behavior, Attitudes, Intentions, Car, Motorcycle

I. INTRODUCTION

The rapid increase in private vehicle usage tends to increase the demand for the road infrastructure and related facilities. Actually the growth of urban population, increase in vehicle ownership and its usage as well as the pace of globalization have affected the travel demand in most of the countries and

subsequently have altered the travel pattern in different ways [i]. The lack of good quality and efficient public transport system generates more travel demand for private vehicle and people especially in middle-high income class become auto-dependent. In addition to insufficient and/or inefficient public transport system, availability of cheaper parking facilities is another major contributing factor in promoting the use of private vehicle. The increased traffic jams tend to increase social costs in-terms of increase in energy consumption, travel time and cost, environmental pollution and traffic accidents. To ensure the sustainable development of the cities, it is very important for local governments in developing world to develop and promote state-of-art public transport facilities. To develop polices for public transport improvement, it is very essential to explore the potential factors at the planning stage that can affect the intended use of improved public transport facilities.

The important features need to be considered in policymaking concerning transport is the current and changing nature of society and lifestyle patterns that generate diversified travel demand [ii]. Other instrumental factors seem to play an important role such as feelings of power, freedom, status and superiority [iii]. Commuters in developing regions are mainly dependent on affordable transportation options like walking, cycling, and transit. This implies that travel demand management (TDM) measures that facilitate cheaper travel options will be more effective for a major portion of residents in developing countries [iv]. It is believed that lifestyles, social status traits and travel attitudes are important elements in changing travel behavior and travel pattern [ii, iii, v-vii]. Cao and Mokhtarian [viii-ix] stated that travel related measures are likely to be affected by individual's travel attitudes, personality, and lifestyles. As many Asian people tend to believe that owning an automobile is a social status symbol, and drive not only for mobility needs but also as a status symbol. Therefore, it has been hypothesized that travel attitudes and lifestyle preferences are likely to affect individual's behavioral intentions to TDM measures such as improvements in public transport system. However, different lifestyles and attitudes may affect the consideration of each strategy differently [vi,

x]. Javid *et al.* [xi] believe that public transport improvements strategies are affected by individual travel pattern, mobility restrictions and incentives on use of public transport. Some recent studies report the different factors that influence the user's intentions towards public transport such as access and accessibility, negative experience by others, individual socio-demographic, attitudes towards travelling, and service quality attributes of public transport [xii-xv]. Most of the previous studies on evaluation of specific TDM measures in relation to user's attitudes and intentions are related to the context of developed countries. Only few studies in the developing world provide the evidence of significant factors influencing the consideration of specific TDM policy [ii, vi, viii-x, xi]. These studies mainly include the factors related to socio-demographic aspects of the travelers. There is still need to explore the relationship of lifestyles and attitudes of specific users with the improvement of public transport facilities. In addition, consideration of local social and cultural factors of a particular region is very important in order to ensure the success of developed transportation policies. Therefore, this study attempts to explore the significant influencing factors on the use of public transportation considering the results of a questionnaire survey. In this study, only attitudes and intentions of private vehicle users are considered. It is supposed that to make significant modal shift from private vehicle to public transportation it is vital to understand attitudes of private vehicle users i.e. car and motorcycle users. This paper is organized in the following manner. Section 2 describes the characteristics of study area and section 3 elaborates the data collection methods. Section 4 presents the results of questionnaire survey and analysis. Last section summarizes the key findings and their implications.

II. STUDY AREA CHARACTERISTICS

Lahore is the capital and most advance district of Punjab province and almost 81.7% of its population is urban [xvi]. Current population of Lahore is almost 8.65 million and increasing at a growth rate of almost 3% per annum. The vehicle growth rate has reached to 17% per year between 2004 and 2008 [xvii]. Now a days, Lahore citizens are showing a high trend of motorcycle ownership and usage, which has tremendously increased by 483% during the last decade. Motorcycle almost accounts 45 % of road traffic [xviii] and 22.4 % of modal share [xvii]. The share of motorcycle is almost two times of public transport in modal share and even sometime uses as a family mode. Rapid increase in motorcycle usage has also threatened the safety of pedestrians and bicycle users. The main reasons of increase in automobile ownership and its usage are the banking leasing policy of government to own a car and the absence of an

efficient public transport system.

Currently, public transport is under-developed, highly fragmented, and inefficient. More than 800,000 passengers are using public transport in Lahore where only 800 high occupancy buses are operating along with Para-transit service [xvii]. Public transport modes include high occupancy bus, wagon or minibus, motorcycle rickshaw, auto-rickshaw and taxi. There are almost 53 planned routes for buses and 48 routes for wagons along with concentration of motorcycle rickshaws on some routes. The public transport modes constitute almost 20.1% of modal share (bus and wagon: 12.5%; rickshaws, taxi, etc. 7.6%) [xvii]. High occupancy bus routes operate by many private operators such as Daewoo, Niazi, Malik, Baloch, etc. Auto-rickshaw and taxi are on demand modes, their schedule and routes are not fixed. Motorcycle rickshaws have fixed routes but some of rickshaws are running on un-authorized routes due to lack of enforcement and monitoring. Motorcycle rickshaw is very common in high density and low profile areas. Initially, provincial government was responsible to own and operate public transport. However, from last decade government has encouraged private operators to enter in market and run buses. Therefore, a large number of small private operators permitted to fill gap between passenger demand and capacity in a fragmented way. The incomplete routes, high fares, fewer buses, gender discrimination, and even absence of buses on some routes are common. Efficiency is acceptable on certain routes but reliability is poor, because there is no schedule at all. Public transport has now become the privilege of private sector in the absence of human resources, and financial capacity of public sector. Recently, local government has established Lahore Transport Company (LTC) to regulate public transportation system. Government of Punjab has taken various steps at different occasions to provide efficient and affordable public transport for the public. In 1991, JICA proposed rail mass transit including the construction of light rail transit. This project has four lines i.e. green line, blue line, orange and purple line [xix]. So far, this project did not implement due to financial and political issues. In last 2-3 years, various private operators started operation on different designated routes with CNG buses. In February 2013, operation of 27.8 km BRT track was started. Despite of all these public transport improvement efforts there is still big gap between demand and supply. It is required to explore the public transport improvement potential under the influence of attitudes and intentions of different modes users especially non-users. Therefore, this study selects only car and motorcycle users and evaluates their intentions towards public transport.

III. DATA COLLECTION METHODS

This study finding derived from the results of a questionnaire survey and structural equation modelling. Fig. 1 presents a schematic flow diagram of research methods used in this study. A questionnaire was designed consisting of following three parts: (1) personal information; (2) trip information; and (3) attitudes and intentions. The questionnaire was designed to know attitudes and intentions of car and motorcycle users only. The questionnaire survey was conducted in Lahore city with the help of university undergraduate students. Thirteen locations were selected in Lahore city. The selected students were trained for the purpose and methods of survey in order to ensure the reliability of data. Initially, one-day pilot survey was conducted to check the concreteness of questionnaire items. After pilot survey, questionnaire was revised for better understanding and easiness of the respondents. Self-completion and interview approaches were used to conduct this survey. It was assured to interview those respondents whose literacy level was low in order to ensure the reliability of data.

A total of 428 usable samples were obtained. Sample strata represent a good mix of different occupations. The female respondents are less because they do not drive motorcycle, and do not work in commercial sectors (business, shops, etc.). Table I

shows that 64.6% respondents have education bachelor or above, which is higher from actual literacy rate in Lahore. This is because majority of car and motorcycle users belong to medium and high-income category in this study and education level increases with the increase of income in Lahore. The distribution of other SEDs is given in Table I.

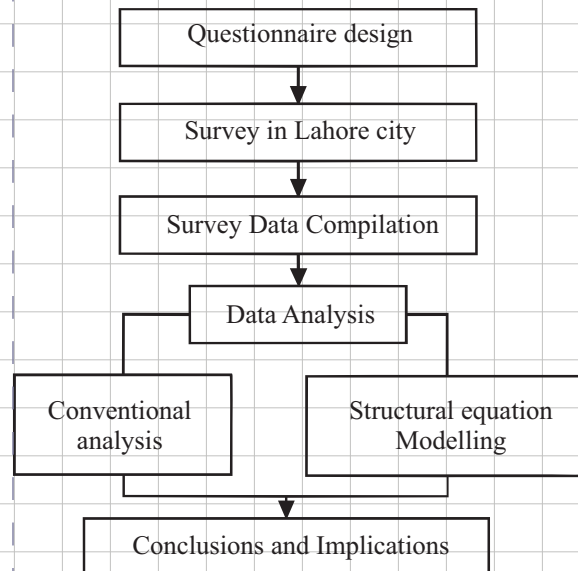


Fig. 1. Research methodology framework

TABLE I
DESCRIPTIVE STATISTIC OF RESPONDENT'S SOCIO-ECONOMIC CHARACTERISTICS

Characteristics	Distribution (%)
Gender	male (70.6), female (29.4)
Marital status	single (62.7), married (37.3)
Age (years)	< 20 (14.4), 21-30 (56.3), 31-40 (20), 41-50 (6.97), above 50 (2.36)
Education	below high school (8.9), high school (8.9), higher secondary (11.9), diploma (5.7), bachelor and above (64.6)
Occupation	students (23.6), government employees (20.8), private employees (29), business (15.7), others (11.0)
Personal income per month (PKR)	< 10,000 (37.3), 10,000-20,000 (23.1), 21,000-30,000 (16), 31,000-40,000 (10.9), 41,000-70,000 (7.3), > 70,000 (5.4)

IV. RESULTS AND ANALYSIS

A. Average Response on Attitudes and Intentions

In Table II, average response of respondents is presented on attitudes and intentions. They place a high score on attitude of 'using car or motorcycle increases their work efficiency'. It is, because they can reach timely at work place and these modes provide more flexibility in travelling and accessibility to different destinations. The intentions to use public transport are little lower for short trips and destinations with limited

parking space. It means that some people prefer to use their private vehicle to destinations with short distance and limited parking facilities. Similarly, high parking charges may not have any impact on less usage of private vehicles. This might be true for auto-dependent people. Similarly, situational constraints and climatic condition have some impact on people intentions to use public transport or private vehicle. Most of the respondents have willingness to use better mode of public transport such as rapid rail mass transit or bus rapid transit as indicated from question 11 in Table II.

TABLE II
AVERAGE RESPONDENT'S RESPONSE

Sr. #	Description of statements	Average
1.	Using car/motorcycle increases my work efficiency	3.36
2.	I do not mind to share my personal vehicle with friends or colleagues going to work/study/business trip	3.00
3.	It is acceptable for me to use public transport for short trips like 3-5 km	2.57
4.	It is acceptable for me to use public transport, if parking facility is not available at destination or work place	2.72
5.	It is preferable for me to use public transport, if parking charges are very high	2.58
6.	I prefer to use air-conditioned bus whenever I need to use public transport	3.08
7.	It is not possible for me to use public transport during rain or hot weather	2.85
8.	I will prefer to use personal vehicle even if other modes offer shorter travel time	2.66
9.	It is not possible for me to use public transport when I have trip other than work/study	2.89
10.	In any case, I try to avoid to use public transport	2.58
11.	I would use public transport if there is better mode like rapid rail mass transit/ bus lanes	3.20
12.	Even if I have or will own a car, I do/would use public transport sometimes	2.60

B. Factor Analysis of Attitudes and Intentions

For analysis purpose, an exploratory factor analysis was conducted to categorize the attitudes and intentions into appropriate groups. Two factors were extracted for overall sample size. These two extracted factors were named considering the nature of their related indicators or observed variables i.e. auto-oriented and transit oriented. Auto-oriented factor mainly includes user's attitudes having concern with travel using private car or auto. Transit oriented factor consists of observed attitudes having nature of public transport travel.

Sample was classified into two groups i.e. car users and motorcycle users considering most frequent travel mode. The sample size for car users and motorcycle users was 204 and 224, respectively. Factor loadings were estimated for the indicators of extracted factors for both groups. Structural equation modeling (SEM) technique was used to evaluate the influence of extracted factors on people's intentions towards public transport.

C. Structural Equation Modeling of Respondent's Intentions toward Public Transport

The results of structural equation modeling (SEM) in Fig. 1 depict that extracted auto-oriented and transit oriented attitudes have significant relationship with users intentions towards a better mode of public transport in the form of rail mass transit or rapid bus transit. Overall structural model in Fig. 1(a) shows that the user's intentions to use public transport are affected negatively by auto-oriented attitudes whereas positively by transit-oriented attitudes. These results imply that people who have strong belief on auto-oriented attitudes would have less potential to use improved public transport. The users with

strongtransit-oriented attitudes have more potential to use public transport modes in the future. The structural relationships were also estimated for car users and motorcycle users groups separately. The modeling results of car user's model in Fig. 1(b) are same as overall model i.e. both structural relationships are significant and have it signs as overall model. The results of motorcycle users model are little different from overall and car users model. The auto-oriented attitudes of motorcycle users have insignificant relationship; however, transit-oriented attitudes have positive and significant relationship with the intentions to use public transport. The other factors presented in previous studies affecting the traveler's intentions towards public transport include specific situational constraints, attitudes towards auto and transit modes, individual's lifestyle pattern, and social and personal constraints of the people [ii, vii-ix, xi-xiii]. Okamura *et al.* study revealed similar factors that influence user's intentions towards public transport modes [xx]. This comparison implicates that motorcycle users have more potential to be attracted by a better mode of public transport in comparison to car users. The motorcycle users usually belong to low and middle income category and would have more propensity to use a public transport mode that can provide a better service with reasonable cost in comparison to motorcycle. It would be difficult to attract car users towards public transport as they generally belong to high-income category and feel comfortable, freedom and flexibility in travelling with car. They also own different lifestyles, social status and attitudes, and use of car is the status symbol for them in the society.

Various parameters are used to assess the reliability of structural model such as chi-sq/DF, CFI, GFI, AGFI, RMR and RMSEA. Researchers in the

field of statistics have suggested critical values of these parameters. For example, χ^2/DF less than 5 indicates a reasonable fit of model [xxi], GFI, AGFI, and CFI greater than 0.90 indicate good fit [xxii-xxiii], RMSEA less than 0.08 shows a good fit [xxiv], RMR less than .08 is acceptable [xxv]. The indices of goodness-of-fit parameters for all models show that these developed models have good estimation of respondent's intentions towards public transport under the actions of their

attitudes. These results imply that we need to encourage or promote positive transit oriented attitudes among private vehicle users in order to reduce use of private vehicle and promote use of public transport with the introduction of a better quality transit mode. However, public transport facilities first need to develop and improve considering the specific attitudes, intentions and preferences of targeted groups.

TABLE III
ROTATED FACTOR LOADINGS FOR ATTITUDES AND INTENTIONS

Attitudes and intentions	Overall (N: 428)		Car users (N: 204)		Motorcycle users (N:224)	
	Auto Oriented	Transit Oriented	Auto Oriented	Transit Oriented	Auto Oriented	Transit Oriented
It is not possible for me to use public transport when I have trip other than work/study	0.771		0.696		0.713	
In any case, I try to avoid to use public transport	0.706		0.474		0.556	
I will prefer to use personal vehicle even if other modes offer shorter travel time	0.698		0.513		0.482	
Using car/motorcycle increases my work efficiency	0.655		0.520		0.293	
It is not possible for me to use public transport during rain or hot weather	0.645		0.653		0.405	
It is acceptable for me to use public transport, if parking facility is not available at destination or work place		0.778		0.714		0.531
It is preferable for me to use public transport, if parking charges are very high		0.753		0.644		0.654
It is acceptable for me to use public transport for short trips like 3-5 km		0.716		0.692		0.630
I do not mind to share my personal vehicle with friends or colleagues going to work/study/business trip		0.561		0.372		0.371

Note: 'N' number of samples for each group

TABLE IV
INDICES OF GOODNESS-OF-FIT PARAMETERS OF EACH MODEL

Model	Chi-sq/ DF	CFI	GFI	AGFI	RMR	RMSEA
Overall	2.413	0.919	0.964	0.940	0.065	0.058
Car users	1.706	0.932	0.951	0.919	0.077	0.059
Motorcycle users	1.608	0.913	0.954	0.924	0.068	0.052

Note: Chi-sq/degree of freedom, CFI: Comparative fit index, GFI: goodness of fit index, AGFI: adjusted goodness of fit index, RMR: root mean square residual, and RMSEA: root mean square error adjusted.

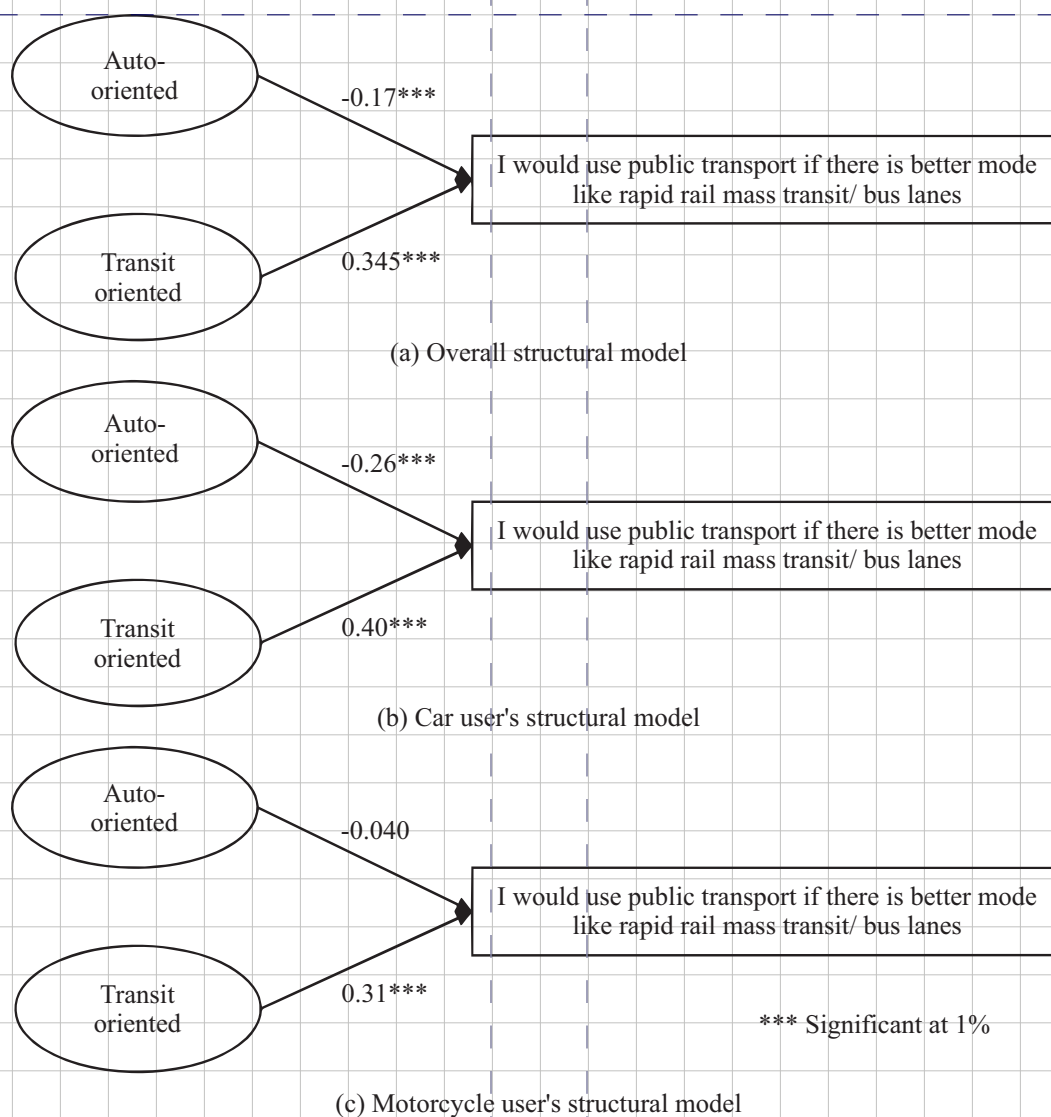


Fig. 2. Structural models of user's intentions toward public transport

V. CONCLUSIONS AND SUGGESTIONS

The survey and analysis results reveal that auto- and transit specific attitudes are significant factors in defining the user's intentions towards public transport. The findings implicate that auto-oriented attitude of travelers need to address appropriately in planning and designing public transport improvement policies for Lahore city. It means that proper attention should be given to provide convenient, reliable, time saving and comfortable transport service. Concurrently, transit-oriented attitudes need to develop and promote among users of all private modes especially motorcycle users for proper modal shift. For this purpose, some physical polices need to adopt that should make sure the development of positive attitudes among people towards public transport. These physical polices should include improvement in service quality attributes of existing public transport modes and

development of new mass transit modes. These measures would help to meet the increased travel demand and needs of existing users as well as to handle traffic congestions by making proper modal shift from private transport to transit modes. Soft policies should be considered for the promotion of developed facilities and change of public attitudes towards public transport. Moreover, public transport improvement polices need to be integrated with hard TDM measures concerning use of private vehicle. These policies may include restriction on parking facilities and imposition of parking fee in areas served by public transportation modes. Implementation of such hard policies would help in making transit improvement efforts successful. The findings of this study would be helpful for local planners and policy makers in developing a transport system for Lahore system that should be sustainable, equitable and affordable for the community.

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