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PASSENGERS' ATTITUDES AND PREFERENCE TOWARDS METRO-BUS SERVICE IN LAHORE

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Abstract: The existence of a good quality public transport system is considered as the backbone of transportation infrastructure in densely populated cities. The people's intentions to use a public transport system are influenced by how they perceive the service quality dimensions. Metro-bus service in Lahore was started in 2013 in order to provide state of the art public transport system to the people. To ensure its success and sustainability it is essential to make improvements in its service quality seeking the perceptions of its current users and potential users. Therefore, this study aims to assess the passenger's attitudes towards service quality attributes of metro-bus using results of a questionnaire survey and make suggestions for its future potential. An objective oriented questionnaire was designed and conducted at selected locations and total collected samples were 328. Analysis of results revealed that users have positive attitudes with most of the service quality attributes. Reliability, friendliness and instrumental dimensions of service quality are significant in determining the passenger's preference towards metro-bus service. Gender, vehicle ownership and characteristics of access mode are also having significant influence in this aspect. These findings would be helpful in making appropriate policies regarding improvements in service quality of metro-bus.

Keywords: Public transport; attitudes; perception survey; structural equation modeling; Lahore

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INTRODUCTION

Rapid growth in urban population is causing increase in the demand of transportation infrastructure. Public transport system is an important entity of this infrastructure. The economic activity, citizen's mobility and efficiency of densely urbanized cities heavily depend on performance of public transport system. Pamplona and Oliveira (2016) state that the use of economic indicators in forecasting the needs of passenger's urban transport demand identify the needs of required infrastructure in better way. Wright and Fjellstrom (2003) believe that choices on transit systems are choices about a city's future. Public transport system is usually constituted of mass transit systems (e.g. bus rapid transit and rail mass transit), conventional bus system and Para-transit modes. The efficiency and economic viability of mass transit systems are dependent on quality of its feeder service such as conventional bus and Para-transit modes.

Radnovic *et al.* (2015) report the significant correlation between gender, age, employment, and satisfaction with driver behavior and attitude in public transport of the city of Belgrade and comfort is the most significant factor in choosing a service. Susilo *et al.* (2010) believe that attitudes and preferences of individuals towards public transport policies are governed by their socio-demographic aspects and it is a learning process over time. The user satisfaction with the bus service is governed by five important aspects of service quality that include line reliability, bus stop location adequacy, bus lighting and service punctuality (Del Castillo and Benitez, 2012). Shaaban and Khalil (2013) state that passenger's satisfaction with station facilities, bus service conditions and drivers behavior have strong relationship with the satisfaction and usage of people belonging to different socio-economic groups. The quality of a public transport system is influenced by comfort and safety within the vehicle, the time taken to cover the routes and the convenience, incurred cost, symbolic, soft and functional dimensions of service quality and existence of supporting infrastructure (Anna et al, 2014, Javid *et al.*, 2013, Javid *et al.*, 2015a, Budiono, 2009, Le-Klähn *et al.*, 2014).

According to different studies, the important service attributes are safety, security, span of service, on-time performance, travel speed, comfort level at stop, punctuality, frequency, reliability, bus comfort, provision of relevant information, driver behavior, cleanliness of vehicle and accessibility for disabled persons (Ngoc *et al.*, 2017, Mouwen, 2015, Vilakazi & Govender, 2014, Das *et al.*, 2013). Similarly, other study findings show that accessibility to various surrounding destinations by transit modes is significant for existing user's satisfaction with the transit system (Chowdhury *et al.*, 2016). Studies also reveal that the behavioral intentions of using the public transport are positively influenced by perceived service quality, environmental aspects, situational constraints, awareness about available transit modes, attitudes and lifestyles (Javid *et al.*, 2016, Borhan *et al.*, 2014, Steg, 2003, Beirao & Cabral, 2007, Anwar, 2009, Belwal, 2013). A study in nine European cities revealed four service quality dimensions of user satisfaction with transit facilities that include system, comfort, staff and safety and identified that there are differences in how public transport is perceived by its users (Fellesson & Friman, 2008).

Users of different modes perceive the service quality of transit modes differently and their satisfaction with the service is influenced accordingly (Javid *et al.*, 2015a, Imam, 2014). Local, social, cultural and environmental issues play important role while marketing the transit modes (Belwal & Belwal, 2010). In order to suggest improvements in the existing transit, it is important to investigate the attitudes and satisfaction of its users through their perceptions survey. The outcomes of such perception studies direct the concerned authorities in considering the necessary improvements in the transit facilities. According to earlier cited literature there are many local, cultural and service quality factors that influence the user's satisfaction and attitudes with transit modes. However, still there is need to explore the attitudes and preferences of local people with public transport mode in the context of socio-economic aspects of each city. Moreover, transit improvement policies for a specific region need to be developed considering their local problems and development. Therefore, this study aims to diagnose the passenger's attitudes and preference towards existing metro-bus service in Lahore. This paper is organized in the following manner. Section 2 presents the characteristics of study area. Research methods are discussed in section 3. Survey and analysis results are presented in section 4 and last section summarizes the key findings.

CHARACTERISTICS OF STUDY AREA AND METRO-BUS SERVICE

The Lahore is the second largest city of Pakistan after Karachi with population of almost 8.65 million and area about 1792 km^2 (JICA, 2012). It is concentrated with many educational, medical, and recreational facilities and surrounded by industrial zones, which generate huge travel demand. Some of the areas are densely populated and in some areas, the population density is very low that increases the travel time and cost of commuting. In densely populated regions of the city the demand of transit use is more as compared to outskirt

areas. Rapid growth in transportation took place in the last 15 years with the construction of underpasses, overhead bridges and most importantly Metro bus service. The private vehicle ownership is increasing at a rate of almost 17 % per annum (JICA, 2012) that result in more traffic on road infrastructure. This high trend of private vehicle ownership and its usage among citizens may shape this mega city as an auto-dependent city and create social problems in the city. The current public transport system consists of conventional bus system, para-transit modes and 28 km metro bus route, whereas orange line train is under construction. Conventional bus service is the most dominant form of public transport in Lahore and most of the people are not satisfied with it due to inconvenience and uncomfortable nature. But with the start of metro-bus service this trend is changing and people now prefer to use public transport. Para-transit modes consist of minibus, wagons, Qingqi rickshaw and auto rickshaw. The capacity of these modes varies from 4-20 passengers. These modes also serve as feeder routes to the metro-bus service. Public transport modes almost account 20 % of the modal share (JICA, 2012). Private modes have major contribution in modal share that results in increase in traffic congestion and related social costs.

Metro bus service has 28 km long route and 29 bus stations between Gajumata and Shahadra. It was opened in February 2013, and route was selected along one of the main arteries of Lahore. Route map of metro bus service with stations details, typical bus-stop and articulated bus are presented in **Fig. 1** (Government of Punjab). Almost 8 km section of metro bus is elevated. The system uses e-ticketing and smart card for fare collection and ITS (intelligent transport system) technology for operational management. The bus service is operated at different headways during peak and off-peak hours i.e. 2.25 – 3 minute's headway. The bus operation starts at 6:15 AM and ends at 10:00 PM (Government of Punjab). A flat fare of 20 PKR per trip is charged to the passengers regardless of their origin and destination. For the use of feeder routes, the passengers need to pay separately. This system uses articulated buses. The buses provide with separate compartments for male and female travelers in order to ensure the security and privacy of female passengers. To ensure the convenience of passengers the stations are equipped with escalators, and station and bus floor level was kept at the same level. Different feeder services are available for the passengers to access the metro-bus e.g. conventional bus, wagon, minibus, and auto and Qingqi rickshaw. Some new feeder routes were also started for people who do not live close to track. Some of these routes are on narrow roads that cannot take buses so wagons are mainly used on these routes. Metro bus route has the capacity to carry around 112,000 people per day (Government of Punjab).

RESEARCH METHODS

The required data was collected with the help of a questionnaire survey. This survey was conducted at suitable stations of metro-bus service in Lahore city. Collected data was analyzed using factor analysis and structural equation modelling (SEM) technique.

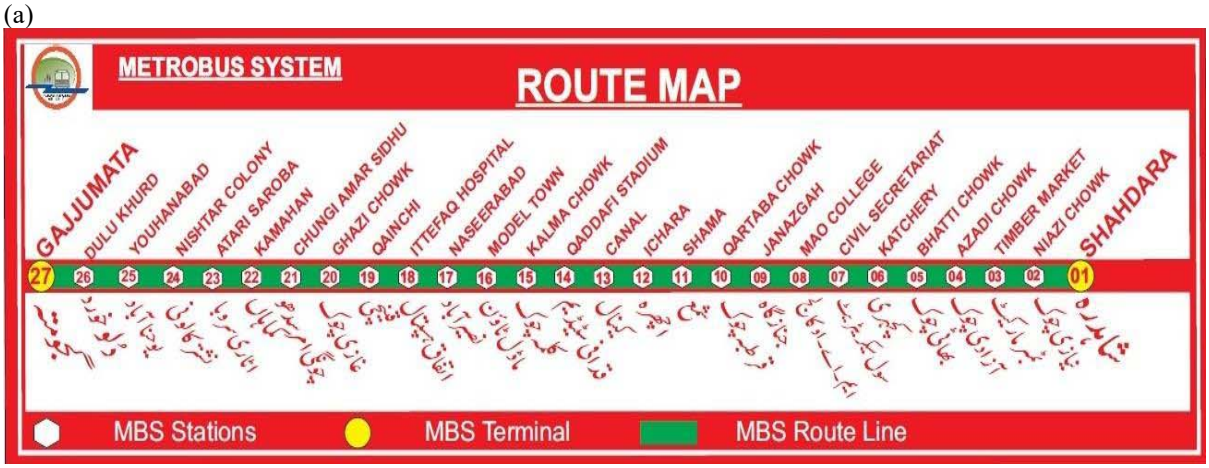
Questionnaire Design

A detailed questionnaire was designed in this study considering the stated objectives and target population. The target population of this survey was the regular and potential users of metro bus service. The potential users are those people who occasionally use metro-bus service and may shift completely on metro bus if some improvements are made. First part of the questionnaire was comprised of personal and trip information of the respondents e.g. gender, age, income, car ownership, access mode to metro bus and trip frequency with metro-bus, etc.

Second part of questionnaire was consisted of attitudinal aspects of metro-bus service. Various service quality attributes were selected seeking their opposite-adjectives. These opposite adjectives included: late-punctual, slow-fast, unsecure-secure, unreliable-reliable, expansive-cheap, noisy-quiet, uncomfortable-comfortable, environmental damaging-environmental friendly, inconvenience–convenience, unattractive-attractive, unhealthy-healthy, depressing-relaxing, unfriendly-friendly, public-private and uncertain-certain.

These attributes were selected considering the service nature of transport mode and convenience in conducting the questionnaire survey. All these attitudinal attributes were evaluated using a five point semantic differential scale (i.e. strongly, somewhat, neutral, somewhat, and strongly). This scale was selected for evaluation because it has consistency with attitudes and easy to construct. This scale can be used in coordination with Likert scale data for analysis purpose. Last part was consisted of few questions on people intentions to prefer metro-bus service over private vehicle in future in case improvements are made in its service quality and feeder routes. These questions were evaluated on five-point scale (i.e. never (1), almost never (2), sometimes (3), almost every time (4), and always (5)). All the questionnaire items were designed in such a way that they should be easily understandable for all kind of respondents as literacy level of some people was low in target population.

(a)



(b) (c)

Fig. 1 Typical components of metro-bus system: (a) metro bus route map Lahore (Retrieved from http://www.pma.punjab.gov.pk/brts_map), (b) a typical articulated bus, and (c) a typical bus station.

Survey and Sampling

Intercept survey technique was used in this study. It is usually done on street, and commercial areas near the metro route with the people who use this service. The purpose of intercept survey is to gather more and deeper information from the respondents. One benefit of intercept survey is a high response rate of people, as people are more likely to answer live questions. Moreover, people actual behavior and attitude can be observed. Major disadvantage of intercept survey is that usually take longer time. This survey was conducted at four stations along metro bus route where different feeder services are available and has potential for improvements in future.

The selected stations for survey include i.e. Azadi chowk, Kalma chowk, Qartaba chowk, and Qainchi Chowk. Here, Chowk is a local term that means intersection. At these locations, survey was conducted during morning and evening peak hours. Respondents at each location were approached randomly and interviewed individually. To ensure the reliability of data, the respondents were initially instructed regarding the objectives and contents of questionnaire. Despite a huge population size, a low response rate was observed and only 328 usable samples were obtained.

Data Analysis Methods

In this paper a structural model was developed using structural equation modelling (SEM) method. The SEM is a multi-variate statistical analysis tool that has been used by many researchers in transportation research (Javid *et al.*, 2016, Beirao & Cabral, 2007, Steg, 2005). It takes a hypothesis-testing approach to the analysis of structural theory bearing on some phenomenon. Typically, this theory represents "causal" processes that generate observations on multiple variables (Bentler, 1988). It has several advantages on conventional regression analysis. Using this technique it is possible to include more number of observed variables and their corresponding latent variables. Direct and indirect effects between variables can be elicited. It also allows the researchers to interpret the results even in the occurrence of multicollinearity. Initially, measurements models are developed using respondents response on observed variables. For this purpose factor analysis technique is generally deployed. Two kinds of factor

analysis are available i.e. exploratory factor analysis and confirmatory factor analysis. The choice of particular method depends on the questionnaire design hypothesis and available data. Once measurement models confirmed can be used to construct the structural model. In this study, an exploratory factor analysis was conducted on the collected user's response. Results of factor analysis were used to construct a structure of passenger's attitudes and preference towards metro-bus service. In developing the structural model it was hypothesized that the passenger's demographic aspects and perceived attitudes on service quality attributes influence their preference to use metro-bus in the future under some improvements.

RESULTS AND ANALYSIS

The collected data was analyzed using factor analysis and structural equation modelling approach. The details are given in subsections.

Distribution of Respondent's Personal and Travel Characteristics

Table 1 shows the distribution of respondents personal and travel characteristics. Most of the respondents are male and fall in different age groups. This gender distribution is consistent with the share of working women in the city. They also travel less in comparison to male. Most of the respondents are students and work in private organizations. Around 38 % of the respondents did not own any vehicle. All the respondents were regular and/or occasional users of metro-bus service. Descriptive statistics shows that people use different modes to access metro bus service. Some people use car/motorcycle to access the metro-bus as park-n-ride facility is available at selected bus stations. Also some passengers are drop-off/pick up by their family members on car or motorcycle. This distribution also showed that most of the target respondents belong to low-middle income category and almost 35 % used wagon as access mode to metro bus.

Table 1. Distribution of respondent's socio-demographic features

Characteristic	Distribution (%)
Gender	Male (73), female (27)
Age (years)	Under 20 (22), 21-30 (33), 31-40 (25), 41-50 (10), 51-60 (8), more than 60 (2)
Occupation	Student (32), Private Employee (34), Government Employee (10), Others (24)
Education	Below high school (2), High school (17), College (31), Bachelor (36), Master or higher (14)
Personal income (PKR)	Non income (22), Below 10,000 (20), 10,000-20,000 (25), 21,000-30,000 (14), 31,000-40,000 (8), 41,000-70,000 (8), more than 71,000 (3)
Household vehicle ownership	Motorcycle (28), car (33), None (38)
Trip purpose	Work (45), Study (30), Shopping (8), Recreational (6), other (11)
Frequent access mode to metro bus station	Walk (15), Bicycle (2), Wagon (35), auto-rickshaw (10), motorcycle rickshaw (12), bus (3), motorcycle (11), car (12)

Distribution of Response on Attitudinal Aspects of Metro-Bus

Figure 2 shows the respondents response on attitudinal dimensions of metro-bus service quality. It is shown that respondents have positive attitudes with most of the service quality attributes. The attributes with poor attitudes included crowded-vacant and public-private. It means people feel that metro-buses are crowded and they do not feel any privacy when they use it. Respondents placed high positive attitudes on environmental friendly nature, fast, and punctuality attributes of service quality. These results imply that some service improvements are required to make this service un-crowded and comfortable e.g. increase in frequency.

Factor Analysis on Attitudinal Attributes of Bus

An exploratory factor analysis was conducted on respondent's attitudes with metro-bus service quality and three factors were extracted using maximum likelihood method and varimax rotation. These three factors were named considering the associated altitudinal aspects from user's perspective. These factors included (1) service attributes (SA), instrumental attributes (IA) and reliability and friendliness attributes (RFA) of metro-bus service quality. Cronbach's alpha values were also calculated for each factor and these values show high internal consistency among respondents in evaluating the observed variables of each factor, as values are more than 0.7. Observed variables or indicators with higher factor loadings in each factor have more influence in explaining the corresponding extracted factor. Factor loading for most of the indicators are more than 0.5, which means there is significant mutual consistency among respondents in rating the attitudes. Average response is also presented in **Table 2** for observed variables of each factor on a five-point bipolar semantic differential scale (-2,-1, 0, 1, 2). Average results depict that passengers have positive attitudes with all attributes service quality. First factor of service attributes depict that passengers consider

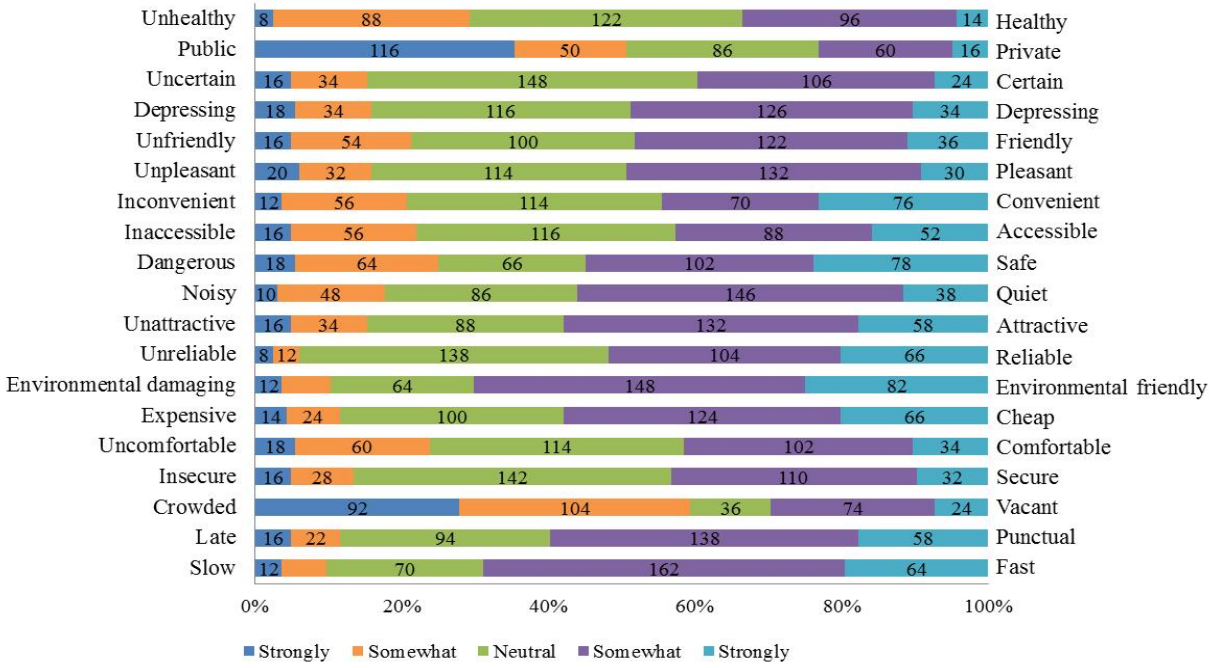


Fig. 2 Distribution of response on attitudinal aspects of metro-bus.

Table 2. Rotated factor loadings for altitudinal attributes of metro-bus service

Description of observed variables	Mean	SA	IA	RFA
Unattractive - attractive	0.593	0.797		
Inconvenient – convenient	0.521	0.744		
Uncertain – certain	0.294	0.704		
Late – punctual	0.666	0.614		
Inaccessible – accessible	0.331	0.610		
Unpleasant – pleasant	0.513	0.550		
Insecure - secure	0.371		0.763	
Unhealthy – healthy	0.072		0.697	
Uncomfortable – comfortable	0.244		0.678	
Noisy - quiet	0.556		0.608	
Slow - Fast	0.991		0.582	
Depressing – relaxing	0.394		0.540	
Unreliable – reliable	0.667			0.827
Environmental damaging – environmental friendly	1.075			0.747
Unfriendly – friendly	0.333			0.625
Factor average (mean)		0.483	0.435	0.687
Cronbach's Alpha		0.815	0.781	0.731

Note: SA: service attributes, IA: instrumental attributes, and RFA: reliability and friendliness attributes

metro service attractive, convenient and punctual. Factor loadings and average rating of instrumental attributes show that passengers are highly satisfied with the security, hygienic, and comfort aspects of service quality. Passenger's attitudes are highly positive with service reliability and environmental-friendly service as indicated from results of third factor.

Structural Equation Modeling (SEM) for Attitudes and Preference with Metro-Bus

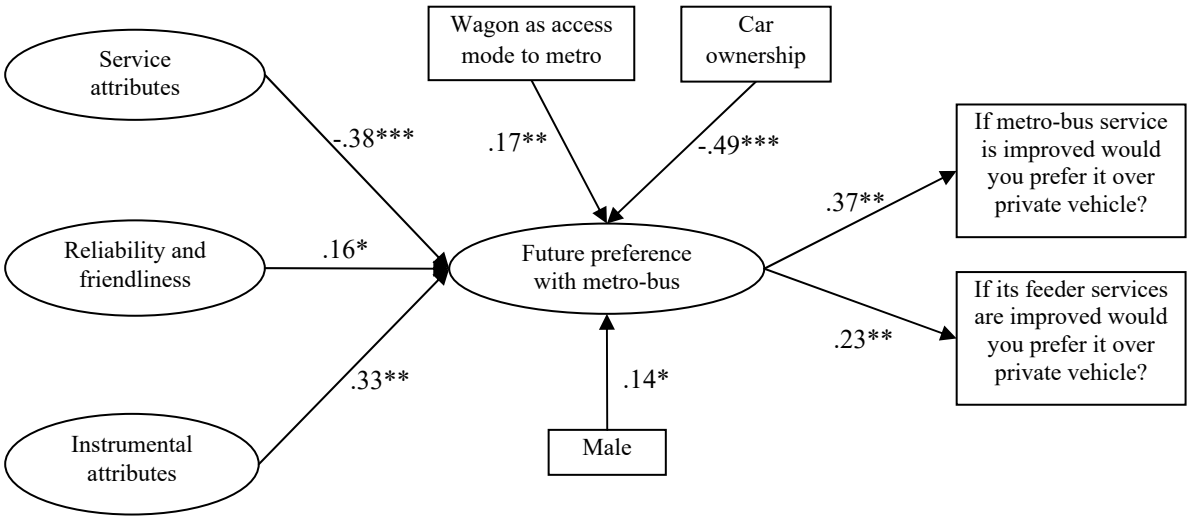
Using results of factor analysis a structural model was developed for user's attitudes and preferences to use improved metro-bus service in future. For this purpose a latent variable was defined comprising of two observed variables on passenger's preference with metro-bus service in case improvements are made in its service quality and existing feeder routes as shown in **Fig. 3**. The standard estimates of these observed variables with latent variable are significant and positive which depict positive propensity of the commuters towards metro-bus service. To construct the structure few observed variable on passengers demographics were defined as dummy variable (i.e. 1, 0) and included in the model. Only significant variables are reported in the model of **Fig. 3**. These defined variables include gender (1 for male, otherwise 0), access mode to metro-bus (1 if access mode is wagon, otherwise 0), and car ownership (1 if owns a car, otherwise 0).

Results of structural modeling in **Fig. 3** depict that people who have positive attitudes on instrumental attributes (IA) of service quality would prefer to use it if

improvements are made in its service and relevant access modes. The positive and significant relationship of reliability and friendliness attributes (RFA) factor with stated endogenous latent variable shows that passengers having positive attitudes and beliefs on RFA would have more tendencies to use. The significant and negative relationship of service attributes (SA) shows that the improvement in such dimensions will not influence people preference to use metro-bus service despite possessing positive attitudes on these dimensions. These results imply that improvements in instrumental, reliability and friendliness dimensions of service quality are vital in enhancing it use in the future. The negative relationship of car ownership with preference variable depicts that people who own a car in household have low propensity to use this service in future. This is, because private vehicle provides more freedom and flexibility in travelling and its use has become status symbol for the people in the society (Javid *et al.,* 2015b, Steg, 2005, Bin and Dowlatabadi, 2005, Beirao and Cabral, 2007). It indicates that the current and future private vehicle ownership trend among vehicle may decline the use of metro-bus if significant improvements are not made in its service and concerned feeder routes. Male passengers have more potential to use metro-bus in the future as the structural relationship is positive. This gender specific finding is very much relevant with the local and social aspects of the Lahore city as it is difficult for women to travel alone on metro-bus and its feeder service due to privacy, security and social issues (Javid *et al.,* 2016). In addition, people who travel with families prefer to use other means of travelling instead of using public transport. Passengers who use wagon as a feeder mode have high propensity to use metro-bus. It depict that passengers consider it a reasonable access mode, therefore; improvements are required in the service quality of wagon service, as it would help in enhancing the ridership of metro-bus. The indices of goodness of fit parameters depict reasonable fit of the model in explaining the attitudes of passengers towards metro-bus under extracted factors.

CONCLUSIONS

The analysis of survey results concludes that passengers possess positive attitudes with most of the service quality attributes of metro-bus service. The extracted factors of service attributes, reliability and friendliness and instrumental attributes are significant factors in determining the user's preferences towards metro-bus under scenario of improvements in its service quality and concerned feeder routes. Other significant and influencing factors include passenger's access mode to metro, car ownership and gender (male). These findings imply that improvements in instrumental and reliability and friendliness dimensions would help in promoting the use of metro-bus. Due to local cultural and religious issues, the male have more potential to use metro-bus in comparison to their female family members. The people who own or have potential to own a car in future would not prefer to travel on improved metro-bus. They may or may have become auto-dependent and do not want to leave it for shifting to other modes as car offers more flexibility and freedom in travelling. However, the target of improvements in metro-bus service quality should be to keep the existing users and attract potential users such as low-middle income people who are captive riders and have less potential to own a car.



Chi-sq/DF = 4.171, RMR = 0.102, GFI = 0.778, CFI = 0.784

Fig. 3 Structure of passenger's attitudes and preferences with metro-bus service.

The improvements in wagon service as an access mode would help in enhancing the use of metro bus service as it helps to make it a viable and successful transit service in the city from user's convenience, operational and economic perspectives. Proper integration between mass transit service and its feeder routes is essential from schedule, routing and transfer station aspects as it will help in making them efficient and successful. The findings of this study are based on a small sample size and its implications may have some limitations. However, these findings would be helpful for local transit planners and decision makers in making appropriate improvements in metro-bus and its feeder modes. The future studies should focus on different segments of metro-travelers with large sample size. It would help in making specific improvements in the metro-bus service considering the attitudes and intentions of specific travel market segments.

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