ATTRIBUTES INVOLVING BUS SERVICE QUALITY IN DHAKA CITY BY DISCRETE CHOICE MODEL

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Abstract: Bus service quality is remarkably important that influence user travel choices having significant dominance in the improvement of living condition of the urban residents. Passengers' perceptions of service performance and the role of these perceptions in travel decisions are necessary to improve the bus service quality. The aim of this study is to measure overall customer satisfaction and to investigate the related service quality attributes that influence the most. Accomplishing the research objective, a questionnaire survey was conducted on five major locations of Dhaka City to achieve passengers' perception. 1000 regular city bus users of different profession participated in the survey in March, 2015. The result investigates that important service aspects such as mode of transport, reliability, travel time, availability of seat, cost, availability of female/disable/elderly people seat, cleanliness, overcrowding condition and safety are the important attributes that effect the bus service quality most. Binary logit model was developed to explore the important attributes and their effect on overall bus service quality. The findings of this study can help bus operators and authorities to establish more attractive measures to improve bus service quality.

Index Terms— Bus Service Quality, Passenger Perception, Binary logistic regression model.

I. INTRODUCTION

Bus service performs a significant function for movement of considerable number of people in developing cities where the mobility needs are increasing due to rapid urbanization. Although buses play the crucial role in any urban areas, their services as a main mode of mass transport are commonly inadequate to meet up demand. The services that are provided are commonly unsatisfactory (Ali, 2010). Users are obliged to meet up their mobility needs by public buses with associated challenges in delay and discomposure (Davidson and Knowles, 2006) leading to dissatisfaction (Aidoo et al, 2013).

Dhaka is known as one of the most overcrowded capital city in the world, with density of 115,000 people per square mile (Demographia, 2016). However, the insufficient transportation facilities for the mass numbers of the people is also affecting the quality and services of this road transports. The majority of trips in Dhaka are dependent on public transport since a significant numbers of people can't afford personal vehicle. As the fare of non-motorized transport (NMT) or other Para-transits are higher than the bus fares (Rahman, 2009), most of the people are heavily dependent on public transport for their travel (Hossain 2006). By improving the quality of the mass transport service will not only facilitate the passengers but also the government and owners of the transport services.

Mannan and Karim (2001) stated that the level of service of the present bus system is inadequate to meet the public demand. Hasnine, (2011) found that bus service in Dhaka City is insufficient in terms of security, capacity, comfort and convenience. Also, buses are considered as unreliable and time consuming to reach the destination (Hoque et al., 2012). Besides, insufficient light and air, entry and exit problem, lack of discipline and technical difficulties like inadequate terminals and bus stops, absence of separate lanes for buses or even accident of the bus become every day incident in Dhaka city. Excessive delay in roads due to congestion makes the situation worse and consequently passengers suffer greatly on peak periods. The reserved seats for the females are remarkably insufficient as stated by Islam et al. (2016). It is evident that the existing bus service is not sufficient to keep pace with the growing demand of passengers.

Service quality assessment by the user is based on the gap between the users' expectations of service quality and observed experiences. In order to improve the services in a way that user hopes and wants may be met; service quality analysis is vital. Public transport system of Dhaka city necessitates significant improvement of service quality, which can be accomplished by a clear understanding of travel behavior and its user needs and expectations to elucidating the factors that affect the overall bus service quality. Thus the objective of this research is to evaluate overall customer satisfaction and to investigate the associated service quality attributes that influence the most. Addressing these attributes will help service providers' gain competitive advantages by implementing specific strategies to increase their service quality offer.

II. LITERATURE REVIEW

Passenger satisfaction in transport perspective may result by the judgment of expectations previous to travel and experiences followed by the travel. Satisfaction is accomplished if a feeling of contentment results comparing users experience to their expectation. The expected service quality can be achieved by giving priorities to the most important

variables those affect the users to make a decision about to use or not to use the public transport services. Service quality is perceived as an important determinant of users' demand (Prioni & Hensher, 2000) to identify importance of service quality for user's satisfaction. The feelings of satisfaction may incorporate several factors like service quality, product quality, price, status and individual attributes as stated by Parasuraman et al. (1988).

Various factors like security, consistency, attitude, completeness, condition, availability, and training of service providers are necessary to determine the service quality (Sasser et al. 1978). Several researches have shown that reliability (arrival of bus on time) is an influential factor (Hensher et al. 2003; König, 2002, Edvardsson, 1998; Bates et al. 2001; Disney, 1999) whereas convenience and comfort such as cleanliness of bus service, availability of seat, fan, air condition, light, seat condition, are well known arguments (Anable, 2005). Other important and major aspect of service quality is safety (Eboli & Mazzulla 2007; Fellesson & Friman 2008; dell'Olio et al. 2010; de Oña et al. 2012; Eboli & Mazzulla 2012). Tyrinopoulos & Antoniou (2008) indicated that the key satisfaction indicators were the service frequency, transfer distance, ticketing system, and vehicle cleanliness. Paulley et al. (2006) determined that the interchange between modes is one of the important attributes of service quality for public transport.

Although a large number of passengers are dependent on public buses (Karim et al. 1999) of Dhaka city, very few studies have been done regarding their service quality. Rohani et al. (2013) suggests that bus service reliability, safety, comfort and cleanliness are the major factor. Rahman and Nahrin (2012) found that most of the respondents are satisfied with the cost of ticket but very unsatisfied with the waiting time as they have to wait for the bus sometimes for about an hour. Hasnine (2011) examined the public transportation system in the Dhaka city in terms of service quality and found traffic congestion and delays, inadequate traffic management, unaffordable and inaccessible public transport for majority of the people, high accident rates and increasing air pollution problem are directly affecting the consumer. Mannan & Karim (2001) stated that long waiting time, delay on regular schedule, overloading, discomfort, long walking distance from the residence and work place to bus stop and struggle for acquiring seats are some of the major problems faced by the users. According to Alam et al., (2013), cheapest mode available as mass transit, are constrained by poor service conditions for example long waiting, delay on plying, overloading and long walking distance from the residence/work place to bus stoppages.

Hossain et al. (2012) pointed out that the excessive travel time, waiting time and dreadful services in terms of comfort, regularity and on-time performance hindered the prospect of the public bus service. The study of Andaleeb et al. (2007) suggests that the factors of comfort, behavior of the staff, condition of bus and government supervisions are significant but quality of the ride, co-passengers' behavior, and feelings of insecurity are not significant in predicting passenger satisfaction about bus service in Dhaka city. The remaining part of this paper is organized as follows: section 3 describes the methodology employed in this research, data analysis is presented in section 4 and section 5 provides concluding remarks of this research.

III. METHODOLOGY

Accomplishing the research objective, a questionnaire survey was conducted to the city bus service users of Dhaka City. A sample of thousands and eight (1008) passengers was randomly interviewed at designated bus stations to obtain their perceptions of bus services. Five important locations (Science Lab, New Market, Farmgate, Mirpur-10, and Malibagh) were chosen for conducting the survey. The survey was conducted off-board at the above mentioned bus stops. Some respondents were found not enthusiastic to fill up the forms as they were in hurry. The interviews of bus passengers were conducted in March 2015 during office days and weekends between 8:00 a.m to 6:00 p.m. Out of the 1008 questionnaire administered, eight (8) were discarded for incompleteness; hence the total usable sample size was 1000 for model development.

A. Questionnaire

The questionnaire was divided into five parts: First part is about demographics information of passengers. This part consisted questions regarding to respondents gender, age, occupation and availability of car/motorcycle. Second part is about trip characteristic. This part consisted questions regarding to respondents purpose of trip, in vehicle travel time, and main mode of transport. Third part named quality of bus service. This part comprised questions regarding to respondents waiting time, reliability, cleanliness, availability of seat, seat condition and crowding condition in peak hours. Fourth part is about other services. This part consisted questions regarding to respondents major reason for using bus, availability of ac/fan/light/glass, and availability of female/elderly/disable seat. Last part is about assessment of bus services. This part consisted questions regarding to respondents distance of bus stoppage from home, route information, availability of bus stoppage, safety, major problem while using bus service and users opinion about the service.

B. Binary Logistic Regression

The Binary Logistic Regression (BLR) model is one of the most commonly used statistical techniques to analyze the binary categorical response variables (McCullagh et al., 1972; Agresti, 2007). The model is generalized linear model with a binomial response and link logit. If binary values 1 and 0 are used to represent passengers overall good and not-good respectively, then the binary logistic regression model which is

commonly known as binary logit model is defined as (Agresti, 2007):

$$\log it(y) = \ln\left[\frac{P(Y=1)}{1-P(Y=1)}\right] = \alpha + X\beta$$

Here,

P(Y=1) = the probability of passenger rating the overall service as being good

[1-P(Y=1)] = the probability of a passenger rating the overall service as not-good given the satisfaction level of the individual service components

α = intercept

β = a vector of slope coefficients respectively

X = a vector of explanatory variables representing the satisfaction level for individual service components

The probability falls between 0 and 1 ($0 \leq \pi \leq 1$) for all possible independent variables. The parameters in the model can be estimated by using maximum likelihood estimation method. The estimated model can be evaluated as done in any other generalized linear model. That is, by testing the significant difference between the null model (restricted model) and the fitted model (unrestricted model) for the data. In addition, the fitted model can be checked for the problem of over dispersion. The estimated value of the parameter β describes the effect of the explanatory variable X on the log odds of response Y=1 (Agresti,2007). STATA software was employed to develop model in this research.

C. *General Characteristics*

From the analysis, it has been found that about half (47 %) of the passengers travel by public transport for work related purposes. Aside passengers use public transport for school (20%), business (18%), shopping (11%), and other purposes (4%) like social visits. Table 1 represents the socioeconomic characteristics of the respondents along with their perceptions for the overall bus service quality. In terms of overall bus service quality, higher proportion of both male and female passengers (65% and 66% respectively) rated SQ to be neutral while very few of them rated service quality as good (male 1.26% and female 2.43% respectively). Passengers who are within the age ranges from 21-30 years form the majority group (about 50%) of whom 75% rated the overall service quality to be neutral and 23% rated as bad. Result shows that service holders use bus service mostly (41%) of whom 58% passengers rated service quality as neutral. Result demonstrated that most of the respondents (47%) use bus for work related purposes.

Table 1 Sample characteristics of the respondents

Variable	Overall Service Quality Ratings (%)				P-value
	Good	Neutral	Bad	Sample total	
Gender					0.7
Male	1	65	35	715	
Female	2	66	32	287	
Age (years)					0.319
<20	8	17	75	12	
21-30	1	75	23	496	
31-40	2	48	50	396	
41-50	2	77	21	92	
50-60	0	0	100	4	
Occupation					0.00
Student	3	71	26	192	
Service holder	2	58	41	416	
Businessman	0	77	23	184	
Garments worker	3	66	31	64	
Others	2	57	41	144	
Purpose of Trip					0.038
Work related	2	53	45	467	
School	1	76	24	200	
Business	0	81	19	180	
Shopping	2	74	24	113	
Others	8	38	55	40	

D. *Result Analysis*

To evaluate the influences of attributes to the overall SQ based on users' perception, the binary logistic regression model was developed. Due to low frequencies recorded for some categories, we merged them with other categories in a significant way. Table 2 shows the maximum likelihood estimates of the fitted binary logit model. Table 2 shows that travel time (21- 40 minute) negatively influence the overall service quality. With the increase of travel time there is probability that overall service quality may decrease. People use bus and paratransit for their main mode of transport and the analysis shows that bus and paratransit positively (coefficient 1.5, 0.58 respectively; table 2) influences the overall SQ.

Reliability is significant consideration to measure bus service quality. Cleanliness level and available seats are crucial attributes related to the bus service quality. Passengers who use bus describes these two attribute as poor. Table 2 shows that with the increase of cleanliness and seat comfort level, there is a probability that overall SQ will increase. Result reveals that overcrowd of the bus

Table 2: Parameters estimates for binary logit model

Variable	Coefficient	P- value
Travel Time		
21-40 minute	-1.66	0.00
Main mode		
Bus	1.5	0.00
Paratransit	.58	0.00
Waiting time		
10-15 minute	0.38	0.1
15-20 minute	0.35	0.00
Reliability		
Always	0.38	0.002
Cleanliness		
Poor	0.49	0.005
Available of Seat		
Poor	1.42	0.00
Seat condition		
Good	-1.64	0.004
Over Crowding		
Always	4.2	0.00
Sometimes	3.7	0.00
Major reasons for using bus		
Cost	1.11	0.00
Time required	0.51	0.00
Availability of AC/fan/light		
Sometimes	-1.2	0.001
Availability of female seat		
Never	1.38	0.004
Distance of bus stoppage (meter)		
1 to 100	-2.72	0.00
101-200	-3.52	0.00
201-300	-4.25	0.00
301-400	-3.56	0.00
Safety from pickpocket		
No	0.88	0.002
Major Problems		
Traffic	-1.3	0.00
Schedule	-1.83	0.00
Safety	-2.18	0.00
Comfortable	-2.2	0.00

service has significant impact on service quality. Cost and time required to get a bus are two notable reasons for which people use bus service. Female passengers hardly get
any seat in the bus; hence it is evident that with the increase of female seat availability, there may be increase in overall bus service quality. Distance of bus stops influences the overall bus service quality negatively. Passengers reveal that they are not safe from pickpocket. Major problems of the bus service are mainly traffic, schedule, safety and comfort.

CONCLUSION

This paper investigates passengers' satisfaction level on various service features of public transports particularly the major problems the passengers are facing, based on their experience on existing service quality. There is no significant difference between the ratings of male and female passengers for service quality. Majority of the passengers are not satisfied with the service provided by the public bus transport though bus is the main mode of transport for most of the people in Dhaka city. The estimated logit model indicates that passengers rating for overall service quality of transport significantly increases when they are satisfied with the services such as travel time, cleanliness, seat availability, seat condition, overcrowding, safety, traffic, and fare of the bus transport. A quality service is necessary to retain the users and to attract new user for using public transport more, rather than the individual transport to reduce traffic congestion.

The results presented in this research offer, significant comprehensions for improving knowledge about user perception of bus service currently being provided and the aspects on which the greater attention may be provided. Although findings of this research offers instigating direction in evaluating service quality of bus, some limitations is also acknowledged. The sample had a gender bias. This could be due to the fact that female were less enthusiastic in answering the questionnaire. Further variation in samples as adding more survey locations may help to obtain more accurate conclusion of bust service quality.

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