SERVICE QUALITY OF INTERCITY BUS AND RAIL TRANSPORTATION IN BANGLADESH: TWO DISTINCTIVE POPULATION STUDY

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Abstract- **The study of the commuters' perception about service quality of road and rail transports revealed that buses need to discourage their drivers from speeding and reckless driving. Restroom facilities in stoppages and clean surrounding are ways to improve the bus services. Unaccounted passenger pickups, illegal goods trafficking should be stopped and security should be ensured for the passengers. Bus companies need to maintain timely departure and arrival. Proper carriage of delicate goods and seats for disadvantaged can improve the bus service. However, the buses are found better in pre-purchase of tickets, tickets availability, service providers' accessibility, information about vehicle time and short waiting time for ticket purchase. On the other hand, areas of improvement in trains are controlling travel of un-ticketed passengers, preventing carriage of smuggled goods, stopping black market of tickets, stopping hijacking/mugging and arranging seats for disadvantaged. Improving environment, restroom facilities, toilet cleanliness need to be improved for better service delivery. Lack of courtesy and cordial greeting of the passengers are causes of concern for passengers. Maintaining scheduled arrival and departure should be closely monitored. However, the trains are found better in careful driving, information availability, less vehicle breakdown, good ventilation, less accidents, better cooling facility and good lighting.**

Key phrases: Courtesy, Environment, Illegal activity, Operational efficiency, Physical facilities

I. INTRODUCTION

A. *Issue*

Transportation is an inevitable part for keeping Bangladesh moving. With the development and industrialization of the country, the number of commuters travelling for work, personal interest, or education is increasing day by day [1]. Road, river, rail and air are the different means of transportation in Bangladesh. In many cases they substitute and/or complement one another[2]. Often the choice of the public transport varies vastly depending on the demographic uniqueness of the commuters [2],[3]. The country being a flat plain, mainly road, rail and river transports are widely used in carrying passengers and cargo.

Road transport is a major mode of transport in Bangladesh. Road transport is mainly a private sector affair operating predominantly in domestic routes. Rates are among the cheapest in the world[1]. Express and non-stop services are available to majorplaces from three bus terminals in the capital Dhaka. The government-run Bangladesh Road Transport Corporation (BRTC) also maintains a countrywide network of bus services. In addition, a good number of premium quality intercity bus services are transporting substantial number of commuters. It is estimated that mechanized road transport carries about 70% of the country's total passenger and cargo [3], [4].Apart from

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quick movement of goods and passenger traffic, the road network is facilitating transmission of electricity and natural gas and has integrated the telecommunication links.

Bangladesh Railway (BR) provides an efficient and cheap rate service throughout the country. The BR provides services to places of interest to and from Dhaka [5]. The intercity express service is available to and from important cities, if in all. It covers about one-third of Bangladesh effectively [6]. BR operates a track of 2,855 km, employs about 60,000 people, owns a fleet of 307 locomotives, 1240 coaching vehicles & 643 freight wagons, and provides passenger and cargo services through 502 stations. TodayBR operating 90 inter-city trains, 52 mail/ express trains, 64 commuter trains, 135 shuttle/ local trains and 2 international services [7]. BR often take seasonal initiatives to ensure hassle-free journey of holidaymakers. About two-thirds of Bangladesh is a wetland laced with a dense network of rivers, canals and creeks. The alluvial flood plain formed by these rivers covers most of the country. Water transport is the only means available in nearly 10% of the total Bangladesh[8].

Fueled by robust economic growth of around seven plus (7^+)% in recent years, the demand for freight and passenger transport are on the rise. Accordingly, Bangladesh observed drastic change in its transportation infrastructure since its independence. The overall annual growth rate has been nearly 8.2% for freight transport and 8.4% for passenger transport [9] [10]. However, there was never much explicit focus on the future requirements of the transportation development of Bangladesh and the means of meeting these requirements on a competitive, as well as, sustainable basis. So, a well-articulated transport policy is definitely needed for the development of transport sector by understanding the needs of the customers.

The transportation sector in Bangladesh is often considered dire [11]. The service providers regularly take advantage of situation providing substandard service, ignoring safety and comfort, and carrying beyond capacity to make big profits. Such problems are exacerbated during long holidays and festival times. Of all the different transport networks, road and rail are the two major transportation modes in Bangladesh as they carry major share of goods and people [3]. Their network is also spread throughout the country. However, the service quality of these two public transports has its own merit and demerit [3], [12].

As bus and train are two major means of intercity public transport, it is important to know the perception of the commuters regarding their service quality. Customer satisfaction plays a key role in the choice of medium of transport, underscoring the need to determine the nature and impact of such factors that leads to customer satisfaction [13]. Thus, an in-depth study of the level of customer satisfaction can serve as both a qualitative and quantitative compass for improving the quality of transport services in Bangladesh.

B.   Objectives

The broad objective of this study is to find commuters' perception of the service quality of intercity road and rail transport in Bangladesh. Specifically, this research looked into i) the commuters' perception of the service quality of road and rail transport, ii) the commuters' perception of the service quality of road and rail transport focusing different demographic features, iii) the commuters' perceptional difference between road and rail service quality, iv) factor analysis of the service quality variables for both bus and train, and v) some policy recommendations for the improvement of the service quality of road and rail transport.

II. METHODOLOGY

The study made use of both primary and secondary data and pertinent literature review. Primary data was collectedby questionnaire survey. The secondary data includes books, journal articles, reports, etc. The study addressed 34 service quality items (simple variable) grouped in nine categories (complex variables) by reviewing literature and consulting the knowledgeable persons. Only those service qualities common for both Bus and Rail are considered to make the comparison consistent. The questionnaire includesall the 34 simple variables in statement form. The questionnaire was pre-tested with 20 train and 20 bus commuters. The target population of the study consists of two different clusters: i) regular commuters of bus, and ii) regular commuters of train. A 5-point likert scale (1: strongly agree, 5: strongly disagree) is used to analyze the commuters' responses regarding the service quality.

Due to accessibility and convenience, and non-response issues the total sample size of the questionnaire survey ended up in 269 (137 were bus commuters, and 132 were rail commuters). Due to absence of sampling frame, sampling was done through non-probabilistic convenience sampling method. Highcronbach's alpha ofthe responses (0.918 for bus and0.876 for train) showed strong reliability and internal consistency of the responses. The study used face validity tochoose the items logically related to the parameter. The study made use of mean index analysis, standard deviation, variance, t-test, ANOVA, one-population t-test, two-population t-test, correlation analysis, regression analysis, Chi-square test, F-test, etc.

III. DATA ANALYSIS

The primary data of the study collected through questionnaire survey is divided into twodistinct groups: a) commuters travelling mainly in buses, b)commuters travelling mainly in trains. In this section, analysis and comparison is made of the responses of the commuters travelling in buses and trains. The detailed data analysis follows.

A.   Profile of Respondents

Bus
        The study received responses of 137 bus commuters. Of the 137 commuters 81 (59.1%) are male and 56 (40.9%) are female. The average age of the respondents is 27.77 years (st. dev. 12.7 years). The age range is 17~75 years. The education of the respondents showed that 14 (10.2%) has SSC or equivalent degree, 55 (40.1%) has HSC or equivalent degree, 43 (31.4%) has Bachelor or equivalent degree, and 25 (18.2%) has master or equivalent degree. Occupation wise 90 (65.7%) of the respondents are students and the rest 47 (34.3%) are service holders. Some of the students are working also (23). The modal range of income of the service holders (n=70) are Tk. 0-50,000 (25, 18.2%) and Tk. 50,001-1,00,000 (26, 19%). Another 7 (5.1%) earn between Tk. 1,00,001-1,50,000, 5 (3.6%) earn between Tk. 1,50,001-2,00,000 and 7 (5.1%) earn above Tk. 2,00,000. The average income of the respondents is Tk. 84,286.

Train
        The study is conducted among 132 rail commuters. Of the 132 commuters 78 (59.1%) is male and 54 (40.9%) is female. The average age of the respondents is 28.97 years with a (st. dev. 11.9 years). The age range is 17~75 years. The education of the respondents showed that 3 (2.3%) has SSC or equivalent degree, 44 (33.3%) has HSC or equivalent degree, 43 (32.6%) has Bachelor or equivalent degree, 31 (23.5%) has Master or equivalent degree and 11 (8.3%) has other degrees. Occupation wise 71 (53.8%) of the respondents are students and the rest 61 (46.2%) are service holders. Some of the students are working also (22). The modal income range of the service holders (n=83) is Tk. 50,001-1,00,000 (31, 23.5%); but a significant number (24, 18.2%) earn between Tk. 0-50,000. Another 15 (11.4%) earn between Tk. 1,00,001-2,00,000, but a quite a few (13, 9.6%) earn above Tk. 2,00,000. The average income of the train commuters is Tk. 97,891.

Comparative Bus and Rail profile
        The comparison of the demographic profile of the bus and rail respondentsnoted a lot of similarity. The male-female ratio (1.45 vs. 1.44) and age distribution (average age 27.77 years vs. 28.97 years) seemed to be almost same for both the samples. The education distribution showed that there are more SSC/HSC level bus commuters, whereas there is more educated rail commuters (Masters). Occupation wise, there are more student bus respondents; whereas, there are more employed rail respondents. The average income of train commuters is found to be a little more than the bus commuters (Tk. 97,891 vs Tk. 84, 286). Overall, the two populations are not much different.

B.   Index Analysis for Bus and Train Responses
        In the study, thirty-four variables in statement form are considered for service quality evaluation of bus and train transports. All the statements are narrated in a positive service quality tone. A 5-point likert scale (1: strongly agree, 2: agree, 3: Indifferent, 4: disagree, 5: strongly disagree) is used to analyze the commuters' responses regarding the bus (n=137) and train (n=132) service quality. The mean indices along with the standard deviationand significance level ($\mu\neq3$) for each of thevariablestatements for bus and train commuters are shown in Tables 1 and 2.As noted, in 5 cases for bus and 5 cases for train the mean indices are not significantly different from 3 (indifferent). The findings for bus and train commuters' responses are described below.

Bus commutersresponses
        It is noted from bus commuters' responses (Table 1) that, except four cases, the mean index values of the variables are above 3(i.e., disagreement);but these four mean values are also not significantly different from 3at α=5%. As the most of the mean responses (30) are*significantly*above 3 (except one), signifies that the bus respondents tend to disagree or stay with the positive quality statements. The overall mean index of the 34 variables found to be 3.65. Hence,it can be concluded that overall the bus commuters are not happy with the specific service

quality dimensions. Even with such a gloomy view, the study tried to identify the most agreed and least agreedservice qualities based on their mean indices.

The most agreed quality dimensions (none of them is significantly different from 3 at α=5%) are i) pre-purchase of tickets is an easy process for buses (2.84), ii) tickets are easily available for buses (2.93), iii) bus service providers are accessible via telephone (2.95), and iv) information regarding time and vehicle is available for buses (2.95). The five least agreed quality dimensions are i) bus drivers do not drive recklessly (4.56), ii) bus are not prone to road accidents (4.56), iii) restroom facilities are good in stoppages (4.32), iv) delay in starting a vehicle does not happen in buses (4.12) and v) bus drivers do not pick passengers illegally (4.11).

Table -1 Mean and Standard Deviation for Bus Commuters

	Variables	Mean (μ)	St. dev. (σ)		Variables	Mean (μ)	St. dev. (σ)
1)	Environment of bus station is decent.	3.73	1.095	18)	Cooling facility is good in buses.	3.47	1.270
2)	Tickets are easily available for buses.*	2.93	1.097	19)	Ventilation facility is good in buses.	3.24	1.181
3)	Queuing time is short during purchasing a bus ticket.*	3.08	1.131	20)	Luggage management is easy in buses.	3.45	1.188
4)	Pre-purchase of bus tickets is very convenient.*	2.84	1.128	21)	It is easy to carry delicate goods in buses.	3.98	0.992
5)	Ticket return facility is available in buses.	3.30	1.223	22)	Refreshment facility is satisfactory in buses.	3.94	1.063
6)	Bus tickets do not go to black markets.	3.58	1.204	23)	Delay in departure does not occur in buses.	4.12	1.082
7)	Bus counter service providers are apt at clarifying queries.	3.38	1.190	24)	Buses do not extend stipulated time in stoppages.	3.69	1.241
8)	Bus counter service providers are accessible via telephone.*	2.95	1.150	25)	Buses reach destination timely.	3.75	1.174
9)	Bus service providers handle problems effectively.	3.67	1.071	26)	Bus drivers are careful & do not drive recklessly.	4.56	0.728
10)	Information regarding vehicle time is available for buses.*	2.95	1.169	27)	Buses are not prone to road accidents.	4.56	0.779
11)	Commuters are greeted cordially in buses.	3.53	1.182	28)	Chances of vehicle break-down are low for buses.	4.01	1.051
12)	Employees/conductors in buses are helpful.	3.23	1.086	29)	Getting mugged/hijacked is rare in buses.	3.79	1.045
13)	Buses are quite clean.	3.75	1.136	30)	Smuggled goodscarriageis low for buses.	4.01	0.934
14)	Female/children seats are readily available in buses.	3.66	1.108	31)	Maintenance of buses is good& regular.	3.94	1.073
15)	Buses have reserved seats for the disabled/handicap.	3.56	1.254	32)	Buses maintain consistent quality of service.	3.87	1.065
16)	Bus seats are comfortable.	3.41	1.125	33)	Restroom facilities are good in stations/stoppages.	4.32	1.008
17)	Condition of lights is good in buses.	3.29	1.164	34)	Buses do not pick up un- ticketed passengers.	4.11	1.093
* not significantly different from 3 (Indifferent) at 5% level of significance (α=5%)							

Train commutersresponses

It is noted from train commuters' responses that, except seven cases, the mean index values of the variables are above 3 (Indifferent); five of these seven mean values are found significantly different from 3 at α=5% (Table 2). As the majority of the mean responses areabove 3, signifies that the respondents tend to disagree or stay with the positive quality statements. The overall mean index of the 34 variables found to be 3.40. Hence, we can also conclude that the train commuters are not happy with the service quality dimensions. Even with such a gloomy view, the study tried to identify the most agreed and least agreed service qualities based on their mean values.

The most agreed quality dimensions are i) Train drivers do not drive recklessly (2.27), ii) Information regarding time and vehicles is available for trains (2.53), iii) Chances of vehicle breakdown are low for trains (2.60), iv) Ventilation facility is good for trains (2.70), Trains are not prone to road accidents (2.70), vi) Cooling facility is good in trains (2.85) and vii) Condition of lights is good in trains (2.87). The five least agreed quality dimensions are i) Train tickets do not go to black markets (4.33), ii) Delay in departure does not happen in trains (4.18), iii) Restroom facilities are good in railway stations (4.07), iv) Drivers do not take passengers illegally (4.06) and v) Chances of carrying smuggled goods are low in trains (3.91).

Table -2 Mean and Standard Deviation for Train Commuters

Variables	Mean (μ)	St. dev. (σ)	Variables	Mean (μ)	St. dev. (σ)
1) Environment of train station is decent.	3.45	1.107	18) Cooling facility is good in trains.*	2.85	1.066
2) Tickets are easily available for trains.	3.62	1.102	19) Ventilation facility is good in trains.	2.70	1.093
3) Queuing time is short during purchasing a train ticket	3.80	1.022	20) Luggage management is easy in trains.	3.26	1.001
4) Pre-purchase of tickets is an easy process for trains.*	3.10	1.195	21) It is easy to carry delicate goods in trains.	3.42	1.140
5) Ticket return facility is available in trains.	3.35	1.139	22) Refreshment facility is satisfactory in trains.	3.45	1.065
6) Train tickets do not go to black markets.	4.33	0.826	23) Delay in starting a vehicle does not happen in trains.	4.18	1.034
7) Train service providers are apt at clarifying queries.	3.48	1.108	24) Trains do not spend much time in stoppages.*	3.14	1.224
8) Train service providers are accessible via telephone.	3.54	1.136	25) Trains are regular in case of reaching destination timely.	3.51	1.142
9) Train service providers handle problems effectively.	3.67	1.003	26) Train drivers do not drive recklessly.	2.27	1.014
10) Information regarding vehicle time is available for trains.	2.53	1.204	27) Trains are not prone to road accidents.	2.70	1.104
11) Commuters are greeted cordially in trains.	3.73	1.067	28) Chances of vehicle break-down are low for trains.	2.60	1.019
12) Employees/conductors in trains are helpful.	3.22	1.056	29) Getting hijacked is not a possibility in trains.	3.47	1.084
13) Trains are quite clean.	3.70	1.100	30) Smuggled goods carriage is low for trains.	3.91	1.023
14) Female/children seats are readily available in trains.	3.80	1.117	31) Maintenance of trains is regular and proper.	3.57	0.985
15) Trains have reserved seats for the disabled/handicap.	3.72	1.172	32) Trains maintain consistent quality of service.	3.42	1.081
16) Train seats are comfortable.*	3.11	1.144	33) Restroom facilities are good in stations/stoppages.	4.07	1.047
17) Condition of lights is good in trains.*	2.87	1.073	34) trains do not pick up un-ticketed passengers.	4.06	1.038

* not significantly different from 3 (Indifferent) at 5% level of significance (α=5%)

C. Comparison of mean values of Bus and Train quality variables

The comparison between the responses of the bus and train commuters regarding the 34 service quality variablesnoted that in 20 out of 34 cases the mean values are found dissimilar at a significance level of 5% (Table 3). Of these 20 cases in only four cases the bus commuters' responses are less dissatisfied than the train commuters. These are: i) Tickets are easily available, ii) Waiting time in is short during buying a ticket, iii) Tickets do not go to black market, and iv) Counter service provider available online. But in rest 16 cases the bus commuters are more skeptical. Hence, we can conclude that the train commuters are less dissatisfied than the bus commuters regarding the services.

Table -3Variables where Commuters Responses Are Different (α=5%)

Simple Variables	Mode	Mean	Simple Variables	Mode	Mean
1) Environment is decent	Bus	3.73	11) Ease of carrying delicate goods	Bus	3.98
	Rail	3.45		Rail	3.42
2) Tickets are easily available	Bus	2.93	12) Refreshment facility is satisfactory	Bus	3.94
	Rail	3.62		Rail	3.45
3) Waiting time in is short during buying a ticket	Bus	3.08	13) Maintain schedule time in stoppages	Bus	3.69
	Rail	3.80		Rail	3.14
4) Tickets do not go to black market	Bus	3.58	14) Drivers are careful	Bus	4.56
	Rail	4.33		Rail	2.27
5) Counter service provider available online	Bus	2.95	15) Accident proneness is less	Bus	4.56
	Rail	3.54		Rail	2.70
6) Information is available	Bus	2.95	16) Vehicle breakdown is low	Bus	4.01
	Rail	2.53		Rail	2.60

7) Seats are comfortable	Bus	3.41	17) Chance of getting hijacked/mugged is low	Bus	3.79
	Rail	3.11		Rail	3.47
8) Good condition of lights	Bus	3.29	18) Maintenance is good	Bus	3.94
	Rail	2.87		Rail	3.57
9) Better cooling facility	Bus	3.47	19) Quality of service is consistent	Bus	3.87
	Rail	2.85		Rail	3.42
10) Good ventilation facility	Bus	3.24	20) Restroom facilities are good	Bus	4.32
	Rail	2.70		Rail	4.07

D.   Complex Variable Wise Analysis

The study has grouped the 34 simple variables into nine complex variables (broad groups)(Table 4). The group means showed that bus service is better for ticketing, accessibility & convenience (3.02 vs. 3.48), service for disadvantaged (3.61 vs 3.76), and illegal activity & security (3.87 vs. 3.94); on the other hand, train service is better for physical facility (3.45 vs 2.88), environment & ambience (3.94 vs. 3.67), time & timeliness (3.63 vs. 3.34), luggage management (3.72 vs 3.34), and operational efficiency (4.27 vs. 2.79).The courtesy, consistency & responsiveness found to be almost same for both the groups (3.54 vs. 3.50).Overall, it can be said that both bus and train failed to satisfy the respective commuters (3.40 vs 3.65).

As noted overall the bus service is better than train for the complex variable ticketing, accessibility & convenience (3.02 vs. 3.48). In all cases of the ticketing, accessibility & convenience, the bus mean values are less than train mean values indicating buses are comparatively better in ticket availability, less queuing time for tickets, easier telephone accessibility of service providers, relaxed pre-purchase of tickets and better ticket return facility. Regarding the complex variable service for disadvantaged (two variables under this), it is observed that overall the bus mean values are a little less than train mean values (3.61 vs. 3.76). This indicates that seats availability for females & children, and handicaps are better in buses than trains but are not significantly.

Like previous two cases, bus is doing a little better (but not significantly) than the train (3.87 vs. 3.94) regardingthe complex variable illegal activity & security. This complex variable has four items for evaluation. It is noted that in one of the four variables the bus is more positive than the train, but in rest of the three cases it is otherwise, but not very different. The commuters perceive that the chances for train tickets going to black market are *significantly high*; but the chance of getting hijacked/mugged in bus is *significantly higher*. The mean value for chance of carrying smuggled goods and carrying un-ticketed passengers in buses is more than the trains but they are *not significantly different*, i.e., the chances of carrying smuggled goods and illegal passengers exist both in bus and train.

Under the complex variable physical facility, environment & ambience, there are four service quality variables. In all four cases the bus mean values are significantly greater than train mean values demonstratingsitting, lighting, cooling, and ventilation in train are better than buses. Overall, the physical facility for train is better than bus (3.45 vs 2.88). Similarly, in all four items of the complex variable environment & ambiencethe bus mean values are greater than train mean values implicating environment, cleanliness, restroom &refreshment facilities in train are better than buses. Overall, the environment & ambiencefor train is better than bus (3.94 vs. 3.67). Under the complex variable time & timeliness, there are four quality variables. On time departure of bus is found more positive than the train, but in rest of the three cases it is otherwise, i.e., the train has less unscheduled delay in stoppages, more detailed time schedule, and better on time arrival/departure Overall time and timeliness is better in trainthan bus (3.63 vs. 3.34).

The study indicated that the complex variable luggage managementis better in train than bus (3.72 vs. 3.34), i.e., handling of luggage, and carriage of delicate goods is comparatively easier in trains than buses, but none of them is up to the mark. Further it is noted that, in all the four variables under complex variable operational efficiency, the rail is doing significantly better than the bus. Specifically, the rail commuters perceive less reckless driving, less prone to accidents, less breakdown on the way, and better maintenance of the vehicles. Overall the operational efficiency of train is found much better than bus (2.79 vs. 4.27). This signifies that the railway perceived to be a safer mode.

The complex variable courtesy & consistency has five quality variables. As noted, except consistent service, the mean values for the rest four cases are not significantly different. Specifically, it is found that query clarification,

problem handling, customer greeting, and helpfulness of bus and train employees are very similar and not up to the mark. But service consistency is found better in trains than buses, indicating that train employees treat the commuters more or less in similar fashion. Overall, the study found courtesy & consistency a little better in trains than buses (3.54 vs. 3.50) but not significantly.

Table -4Complex Variable Wise Comparison between Bus & Train Service Quality

Parameters	Complex Variables	Simple Variables	Bus	Train
Commuters Perception of Service Quality of Bus and Train Bus: 3.65 Train: 3.40	**1. Physical facility** Bus : 3.45 Train: 2.88	1) **Comfortable seats (16)** 2) **Good lighting (17)** 3) **Better cooling facility (18)** 4) **Well ventilation (19)**	3.41 3.29 3.87 3.24	3.11 2.87 2.85 2.70
	2. Environment& ambience Bus : 3.94 Train: 3.67	1) **Station environment is decent (1)** 2) **Clean surrounding (13) *** 3) **Good restroom facilities (33)** 4) **Satisfactory refreshment facility (22)**	3.73 3.75 4.32 3.94	3.45 3.70 4.07 3.45
	3. Time &timeliness Bus : 3.63 Train: 3.34	1) **Time and vehicle schedule is available (10)** 2) **On time departure (23) *** 3) **No unscheduled delay in stoppages (24)** 4) **On time arrival (25) ***	2.95 4.12 3.69 3.75	2.53 4.18 3.14 3.51
	4. Ticketing, accessibility & convenience Bus : 3.02 Train : 3.48	1) **Easy availability of tickets (2)** 2) **Easy ticket pre-purchase facility (4) *** 3) **Easy ticket return facility (5) *** 4) **Telephone accessibility to service providers (8)** 5) **Short waiting time in queue for ticket purchase(3)**	2.93 2.84 3.30 2.95 3.08	3.62 3.10 3.35 3.54 3.80
	5. Courtesy, consistency & responsiveness Bus : 3.54 Train : 3.50	1) **Apt at clarifying queries by staffs (7) *** 2) **Effective problem handling by staffs (9) *** 3) **Cordial greeting (11) *** 4) **Helpful employees (12) *** 5) **Consistent service (32)**	3.38 3.67 3.53 3.23 3.87	3.48 3.67 3.73 3.22 3.42
	6. Service for disadvantaged Bus : 3.61 Train: 3.76	1) **Seats available for female/children (14) *** 2) **Seats available for handicap (15) ***	3.66 3.56	3.80 3.72
	7. Luggage management Bus : 3.72 Train: 3.34	1) **Easy handling of luggage (20) *** 2) **Easy to carry delicate goods (21)**	3.45 3.98	3.26 3.42
	8. Illegalactivity& security Bus : 3.87 Train: 3.94	1) **Tickets do not go to black-market (6)** 2) **Low chances of mugging/hijacking (29)** 3) **No carrying of Smuggled goods (30) *** 4) **No illegal pick-up of passengers (34) ***	3.58 3.79 4.01 4.11	4.33 3.47 3.91 4.06
	9. Operational efficiency Bus : 4.27 Train: 2.79	1) **No reckless driving (26)** 2) **Not prone to accidents (27)** 3) **Low vehicle breakdown (28)** 4) **Good maintenance (31)**	4.56 4.56 4.01 3.94	2.27 2.70 2.60 3.57

E.   Demography Wise Perceptional Difference of Bus and Rail Commuters

Gender-wise difference

The study tried to find out gender wise perceptional differences of the bus and train commuters with respect to 34 service quality dimensions. The study interviewed 81 male and 56 female bus commuters. On the other hand, 78 male and 54 female rail commuters are interviewed in the study. As noted, gender wise there is no significant difference of the perception of the bus commuters at 5% level of significance. But for train commuters,only in three quality-dimensions gender-wise perceptional difference is observed at 5% level of significance (Table 5). These are: i) Environment of station (3.69 vs 3.09), ii) Counter service staffs' aptness in query clarification (3.46 vs 3.52) and iii) No illegal carriage of passengers on the way (4.24 vs 3.81). Overall, there is no gender wise perceptional difference of the bus and train commuters.

Table -5Gender Wise Perceptional Differences of the Bus and Train Commuters

Simple Variables	Gender	Bus			Train		
		Mean	St. Dev.	Sig.	Mean	St. Dev.	Sig.
1) Environment of station	Male				3.69	0.997	0.002
	Female				3.09	1.17	
2) Query clarification of counter service provider	Male				3.46	1.064	0.004
	Female				3.52	1.177	
3) Illegal carriage of passengers	Male				4.24	0.918	0.023
	Female				**3.81**	**1.144**	

Occupationwise difference

Occupation wise the research has divided the respondents into two groups: Students and service holders. This research had a total of 137 respondents for the bus survey, out of which 90 were students and 47 were service holders. Similarly, there are 131 respondents for train survey, out of which 71 were students and 60 were service holders. As noted, occupation wise there is no significant difference of the perception of the bus commuters at 5% level of significance except five cases: i) Counter service provider availability, ii) Availability of seats for female/children, iii) Luggage management, iv) Ease of carrying delicate goods, and v) Departure delay (Table 8). But for train commuters only in two quality-dimensions occupation wise perceptional difference is observed at 5% level of significance. These are: i) Departure delay (3.69 vs 3.09), ii) Chance of getting hijacked/mugged (4.24 vs 3.81) (Table 6). Overall, there is no occupation-wise perceptional difference of the bus and train commuters.

Table 6: OccupationWise Perceptional Differences of the Bus and Train Commuters

Simple Variables	Gender	Bus			Train		
		Mean	St. Dev.	Sig.	Mean	St. Dev.	Sig.
1) Counter service provider availability	Student	2.81	1.170	0.046			
	Service	3.22	1.073				
2) Availability of seats for female/children	Student	3.50	1.202	0.010			
	Service	3.96	0.833				
3) Luggage management	Student	3.66	1.123	0.007			
	Service	3.06	1.223				
4) Ease of carrying delicate goods	Student	4.17	0.927	0.002			
	Service	3.59	1.019				
5) Departure delay	Student	4.30	1.033	0.007	4.32	1.025	0.049
	Service	3.76	1.099		3.97	1.025	
6) Chance of getting hijacked/mugged					3.69	1.036	0.023
					3.27	1.056	

<u>Education wise difference</u>

An ANOVA test was conducted to see the difference of means for four groups of respondents based oneducation: i) SSC & below (14), ii) HSC (55), iii) Undergraduate (43) and iv) Graduate (25). The results show that in 9 of the 34 cases the mean responses are different (Table 7).

Table -7ANOVA for Mean Difference of Education Groups

Variables		Sum of Squares	df	Mean Square	F	Sig.
1) **Waiting time in queue for tickets**	Between Groups	11.512	3	3.837	3.146	.027
	Within Groups	158.585	130	1.220		
	Total	170.097	133			
2) **Query clarification of counter service provider**	Between Groups	12.367	3	4.122	3.045	.031
	Within Groups	177.367	131	1.354		
	Total	189.733	134			
3) **Information availability**	Between Groups	15.119	3	5.040	3.924	.010
	Within Groups	169.521	132	1.284		
	Total	184.640	135			
4) **Cordial greeting**	Between Groups	13.898	3	4.633	3.497	.017
	Within Groups	176.204	133	1.325		
	Total	190.102	136			
5) **Helpfulness of conductors**	Between Groups	12.924	3	4.308	3.882	.011
	Within Groups	147.602	133	1.110		
	Total	160.526	136			
6) **Seat comfort**	Between Groups	10.761	3	3.587	2.956	.035
	Within Groups	160.180	132	1.213		
	Total	170.941	135			
7) **Condition of lights**	Between Groups	13.929	3	4.643	3.624	.015
	Within Groups	170.392	133	1.281		
	Total	184.321	136			
8) **Luggage management**	Between Groups	20.617	3	6.872	5.335	.002
	Within Groups	171.325	133	1.288		
	Total	191.942	136			
9) **Ease of carrying delicate goods**	Between Groups	13.115	3	4.372	4.824	.003
	Within Groups	117.817	130	.906		
	Total	130.933	133			

The descriptive statistics for the nine variables are shown in table 8. As noted, in these cases the less educated are more critical than the more educated ones.

Table 8: Descriptive Statistics for the Nine Variables where Mean Responses areDifferent

Education	Statistics	Waiting time for tickets	Query clarification	Information availability	Cordial greeting	Helpfulness of conductors	Seat comfort	lights Condition	Luggage management	Ease of carrying delicate goods
SSC/Equivalent	μ	3.86	4.07	3.86	4.36	4.14	4.00	4.00	4.21	4.43
	n	14	14	14	14	14	14	14	14	14
	σ	1.292	1.328	1.351	1.008	0.949	.877	1.038	.802	.756
HSC/Equivalent	μ	2.93	3.16	2.82	3.49	3.13	3.20	3.24	3.40	4.07
	n	54	55	55	55	55	55	55	55	55
	σ	1.163	1.085	1.140	1.169	1.019	1.061	1.186	1.241	.900
Under Graduate	μ	3.17	3.57	3.00	3.56	3.12	3.63	3.42	3.65	4.05
	n	42	42	43	43	43	43	43	43	43

	σ	1.034	1.233	1.175	1.221	1.159	1.254	1.139	1.110	1.045
Graduate	μ	2.83	3.13	2.63	3.12	3.16	3.17	2.80	2.80	3.32
	n	24	24	24	25	25	24	25	25	22
	σ	0.963	1.116	.875	1.054	.987	1.007	1.041	1.080	.995
Total	μ	3.08	3.38	2.95	3.53	3.23	3.41	3.29	3.45	3.98
	n	134	135	136	137	137	136	137	137	134
	σ	1.131	1.190	1.169	1.182	1.086	1.125	1.164	1.188	.992

F.   CorrelationBetween Service Variables and Age/Income

Bus

The study noted that afewvariables have significant weak correlation with age and income (Table 9).The variables which have significant correlation with age are i) Condition of lights (-0.187), ii) Luggage management (-0.219), iii) Ease of carrying delicate goods (-0.367), iv) Departure delay (-0.277), v) Carefulness of drivers (-0.207), vi) Chance of carrying smuggled goods (-0.276), and vii) Quality consistency (-0.195). As noted each of the variables has negative weak correlation indicating that with increase in age the perception regarding different services becomes more positive. In four cases significant correlation with income is observed. These are i) Bus counter service providers are apt at clarifying queries (-0.25), ii) Buses do not extend stipulated time in stoppages (-0.271), iii) Chances of vehicle breakdown are low for buses (-0.318), and iv) Chances of carrying smuggled goods are low for buses (-0.254). As can be seen each of the variables also has negative weak correlation indicating that with increase in income the perception regarding different services becomes more positive. Overall it can be said that the bus service quality variables are independent of age and income.

Table -9 Significant Correlations of Bus Variables with Age and Income

Simple Variables	Statistics	Age	Income
1) Bus counter service providers are apt at clarifying queries.	Pearson Correlation		-.250*
	Sig. (2-tailed)		0.040
2) Condition of lights is good in buses.	Pearson Correlation	-0.187*	
	Sig. (2-tailed)	0.028	
3) Luggage management is easy in buses.	Pearson Correlation	-0.219*	
	Sig. (2-tailed)	0.010	
4) It is easy to carry delicate goods in buses.	Pearson Correlation	-0.367**	
	Sig. (2-tailed)	0.000	
5) Delay in departure does not happen in buses.	Pearson Correlation	-0.277**	
	Sig. (2-tailed)	0.001	
6) Buses do not extend stipulated time in stoppages.	Pearson Correlation		-0.271*
	Sig. (2-tailed)		0.023
7) Bus drivers are careful and do not drive recklessly.	Pearson Correlation	-0.207*	
	Sig. (2-tailed)	0.015	
8) Chances of vehicle breakdown are low for buses.	Pearson Correlation		-0.318**
	Sig. (2-tailed)		0.008
9) Chances of carrying smuggled goods are low for buses.	Pearson Correlation	-0.276**	-0.254*
	Sig. (2-tailed)	0.001	0.038
10) Buses are consistent in maintaining quality of service.	Pearson Correlation	-0.195*	
	Sig. (2-tailed)	0.024	
** Significant at 0.01 level (2-tailed), * Significant at the 0.05 level (2-tailed).			

Train

Very few train service variables have significant correlation with age and income (Table 10). The variables which have significant correlation with age are i) Train tickets do not go to black markets (-0.227), ii) Information regarding time and vehicles is available for Trains (0.241)and iii) Train drivers are careful and do not drive recklessly (0.203). Similarly, in only two cases significant correlation with income is observed. These are i) Refreshment facility is satisfactory in Trains (0.256), and ii) Trains are not prone to road accidents (0.237). As noted each of the variables has weak and positive correlation indicating that the train commuters become more skeptical

regarding few services with increase in age and income. Overall it can be said that the rail service quality variables are also independent of age and income.

Table - 10 Significant Correlations of Train Service Variables with Age and Income

Simple Variables		Statistics	Age	Income
1)	Train tickets do not go to black markets.	Pearson Correlation	-0.227**	
		Sig. (2-tailed)	0.009	
2)	Information regarding time and vehicles is available for Trains.	Pearson Correlation	0.241**	
		Sig. (2-tailed)	0.005	
3)	Refreshment facility is satisfactory in Trains.	Pearson Correlation		0.256*
		Sig. (2-tailed)		0.020
4)	Train drivers are careful and do not drive recklessly.	Pearson Correlation	0.203*	
		Sig. (2-tailed)	0.020	
5)	Trains are not prone to road accidents.	Pearson Correlation		0.237*
		Sig. (2-tailed)		0.031
** Significant at 0.01 level (2-tailed), * Significant at the 0.05 level (2-tailed).				

IV. Factor Analysis

A. Factor Analysis for Bus

The factor analysis[1] reduced the 34 survey variables into eight factors[2] with eigenvalue greater than one (Table 11). The factors are found quite like the complex variables the study has identified. The factor analysis of 34 variables with 137 sample is found adequate (KMO test result = 0.838 ≥ 0.5) and valid (significance level of 0.000)[3] and explain 63.3% of the variability. It can be noted that the first factor (**Physical facilities and consistency**) appears to be the most important as it explains 29.63% variability. Some of the other factors include **Time, timeliness and convenience** (σ^2=8.13%), **Illegal activity, security & efficiency** (σ^2=5.63%) and **Counter service & responsiveness** (σ^2=5.04%). The communalities[4] of the variables that constituted the factors are found very strong, which indicates strong relationships among the group variables. The following sections describe and analyze these factors in detail.

Table -11Factors for Bus Commuters and their Variability

Factors	Eigen value	Variance (σ^2) (%)	Cumulative Variance (%)
1. Physical facilities and consistency	10.074	29.63	29.63
2. Time, timeliness and convenience	2.765	8.13	37.76
3. Illegal activity, security& efficiency	1.913	5.63	43.39
4. Counter service& responsiveness	1.714	5.04	48.43
5. Ticketing convenience	1.483	4.38	52.81
6. Service for physically disadvantaged	1.488	3.90	56.71
7. Restroom	1.328	3.43	60.14
8. Pre-purchase of ticket	1.075	3.16	63.30

Factor 1: Physical facilities and consistency(σ^2=29.63%)

The first factor "physical facilities and consistency"contains nine variables (Table 12).It appears that physical facilities and consistency isa very important factor in the eyes of the respondentsas it explains 29.63% of the variability. Based on their responses, it may be deduced that the respondents believe that different physical facilities are important for buses. Mostly, all the variables have factor loadings[5] of 0.5 or greater. This clearly shows the relative strengths of these individual variables. Therefore, Physical facilities and consistencyis a very important factor for two reasons. Firstly, it is the factor that comprises the maximum number of the variables. Secondly, the variables have high factor loadings.

Table - 12Physical facilities and consistency

Variable Code	Variable Name (Code)	Factor Loading
18	Cooling facility is good in buses	0.693
19	Ventilation facility is good in buses	0.687
16	Bus seats are comfortable	0.664
17	Condition of lights is good in buses	0.658
13	Buses are clean	0.592
31	Maintenance of buses is good	0.577
32	Buses are consistent in maintaining quality of service	0.525
12	Employees/conductors in buses are helpful	0.519
34	Driver/Conductors do not pick up passengers illegally for unfair earnings	0.495

Factor 2:Time, timeliness and convenience (σ^2=8.13%)

The second factor "Time, timeliness and convenience"contains nine variables and explains only 8.13% of the variability (Table 13). It appears that this factor isalso an important factor in the eyes of the respondents. Based on their responses, it may be deduced that the respondents believe that time, timeliness and luggage management are important for buses. Mostly, all the variables have high factor loadings andshow the relative strengths of these individual variables.

Table - 13Time, Timeliness and Convenience

Variable Code	Variable Name	Factor Loading
23	Delay in starting a vehicle does not happen in buses	0.761
21	It is easy to carry delicate goods in buses	0.718
20	Luggage management is easy in buses	0.618
22	Refreshment facility is satisfactory in buses	0.605
11	Commuters are greeted cordially in buses	0.559
9	Problems are effectively handled by bus service providers	0.492
25	Buses are timely in reaching destination	0.486
24	Buses do not spend much time in stoppages	0.448
1	Environment of bus station is decent	0.385

Factor 3: Illegal activity, security &operational efficiency(σ^2=5.63%)

The third activity"Illegal activity, security& efficiency"contains five variables and explains only 5.63% of the variability (Table 14). It appears that this factor is also an important factor in the eyes of the respondents. Based on their responses, it may be deduced that the respondents believe that illegal activity, security& efficiency are important for buses. Mostly, all the variables have high factor loadings and show the relative strengths of these individual variables.

Table - 14Illegal Activity, Security and Operational Efficiency

Variable Code	Variable Name	Factor Loading
30	Chances of carrying smuggled goods are low for buses	0.765
29	Getting hijacked/mugged is not a possibility in buses	0.717
27	Buses are not prone to road accidents	0.707
26	Bus drivers do not drive recklessly	0.608
28	Chances of vehicle breakdown are low for buses	0.559

Factor 4: Counter service & responsiveness(σ^2=5.04%)

The fourthfactor "Counter service& responsiveness"contains four variables and explains only 5.04% of the variability (Table 15). It appears that this factor is also an important factor in the eyes of the respondents. Based on their responses, it may be deduced that the respondents believe that counter service& responsiveness are important for buses. Mostly, first three variables here have high factor loadings and show the relative strengths of these individual variables.

Table - 15Counter service and responsiveness

Variable Code	Variable Name	Factor Loading
8	Bus service providers are accessible via telephone	0.669
10	Information regarding time and vehicles is available for buses	0.611
5	Ticket return facility is available in buses	0.561
7	Bus counter service providers are apt at clarifying queries	0.395

Factors 5-8: Other factors

The other four factors (Ticketing, Service for Women, children and handicap, Restroom, Pre-purchase of ticket)explain only 4.38%, 3.90%, 3.43%, 3.16%variability respectively (Table 16). It can be noted that the variables in each of the factors have high factor loadings indicating the importance of the variable in measuring each factor and their strong correlation with the corresponding factors.

Table - 16Other Factors

Variable Code	Variable Name	Factor Loading
	Factor 5: Ticketing convenience	
3	**Waiting time in a queue is short during buying a bus ticket**	**0.709**
2	**Tickets are easily available for buses**	**0.661**
	Factor 6: Service for physically disadvantaged	
15	**Buses have reserved seats for the disabled/handicap**	**0.833**
14	**Female/children seats are readily available in buses**	**0.766**
	Factor 7: Restroom	
33	**Restroom facilities are good in stations/stoppages**	**0.691**
6	**Bus tickets do not go to black markets**	**-0.451**
	Factor 8: Pre-purchase of ticket	
4	**Pre-purchase of tickets is an easy process for buses**	**0.787**

B.   Factor Analysis for Trains

The factor analysis reduced the 34 survey variables into 10 factors with eigenvalue greater than one (Table 17). The factor analysis of 34 variables with 132 sample is found adequate (KMO test result = 0.739 ≥ 0.5) and valid (Bartlett's test of sphericity indicates a significance level of 0.000) and explain 66.92% of the variability. The factors are found quite like the complex variables the study has chosen. Also, it can be noted that the first factor (Physical facilities) appears to be the most important as they explain 29.63% variability. Some of the other factors include Counter service and accessibility (σ^2=8.84%), Service for Women, children and disabled(σ^2=6.59%), Security, smuggling and consistency (σ^2=5.50%) andTicketing facility (5.09%). The communalities[5] of the variables that constituted the factors are found very strong (all above 0.5 except one), which indicates strong relationships among the variables. The following sections describe and analyze these factors in detail.

Table -17 Factors for Train Variables and their Variability

Factors	Eigen value	Variance (σ^2) (%)	Cumulative Variance (%)
1. Physical facilities	**7.367**	**21.669**	**21.669**
2. Counter service and accessibility	**3.004**	**8.835**	**30.509**
3. Service for physically disadvantaged	**2.239**	**6.585**	**37.089**
4. Security, smuggling and consistency	**1.869**	**5.498**	**42.587**
5. Ticketing facility	**1.729**	**5.085**	**47.672**

6. Operational efficiency	1.637	4.813	52.485
7. Time and timeliness	1.482	4.359	56.844
8. Luggage management	1.310	3.852	60.696
9.Physical ambience	1.071	3.150	63.846
10.Courtesy	1.045	3.073	66.919

Factor 1: Physical facilities(σ^2=21.67%)

The first factor "physical facilities and consistency"containingfour variables appears to be the most important factor in the eyes of the respondents as it explains 21.67% of the variability (Table 18). Based on their responses, it may be deduced that the respondents believe that different physical facilities are important for buses. Mostly, all the variables have high factor loadings. This clearly shows the relative strengths of these individual variables.

Table -18Physical Facilities

Variable Code	Variable Name	Factor Loading
18	Cooling facility is good in trains	0.809
17	Condition of lights is good in trains	0.776
19	Ventilation facility is good in trains	0.734
16	train seats are comfortable	0.597

Factor 2: Counter service and accessibility(σ^2=8.84%)

The second factor "counter service and accessibility"contains four variables and explains only 8.84% of the variability (Table 19). It appears that variables of this factor are also important in the eyes of the respondents. Based on their responses, it may be deduced that the respondents believe that counter service and accessibility to information are important for buses. Mostly, the first three variables have high factor loadings and show their relative strengths.

Table -19Counter Service and Accessibility

Variable Code	Variable Name	Factor Loading
7	Train counter service providers are apt at clarifying queries	0.798
8	Train service providers are accessible via telephone	0.704
9	Problems are effectively handled by Train service providers	0.649
10	Information regarding time and vehicles is available for Trains	0.408

Factor 3: Service for physically disadvantaged(σ^2=6.59%)

The third factor "Service for physically disadvantaged"contains three variables and explains only 6.59% of the variability (Table 20). It appears that variables of this factor are also important in the eyes of the respondents. Based on their responses, it may be deduced that the respondents believe that special servicesfor physically handicapped are important for buses. Mostly, the first twovariables have high factor loadings and show their relative strengths.

Table - 20Service for Physically Disadvantaged

Variable Code	Variable Name	Factor Loading
15	trains have reserved seats for the disabled/handicap	0.846
14	Female/children seats are readily available in trains	0.838
13	Trains are clean	0.582

Factor 4: Security, smuggling and consistency(σ^2=5.50%)

The fourthfactor "security, smuggling and consistency"contains four variables and explains only 5.5% of the variability (Table 21). It appears that this factor is also an important factor in the eyes of the respondents. Based on their responses, it may be deduced that the respondents believe that security, illegal activity,&consistency are important for buses. Mostly, all the variables (especially the first one) have high factor loadings and show their relative strengths.

Table - 21Security, Smuggling and Consistency

Variable Code	Variable Name	Factor Loading
29	Getting hijacked/mugged is not a possibility in trains	0.805
30	Chances of carrying smuggled goods are low for trains	0.650
32	Trains are consistent in maintaining quality of service	0.585
5	Ticket return facility is available in trains	0.520

Factor 5: Ticketing facility(σ^2=5.09%)

The fifthfactor "Ticketing facility"is another important factor. It contains three variables and explains only 5.09% of the variability (Table 22). Based on their responses, it may be deduced that the respondents believe that easy access and convenient ticketing are important for buses. Mostly, all the variables have high factor loadings and show their relative strengths.

Table - 22Ticketing Facility

Variable Code	Variable Name	Factor Loading
2	Tickets are easily available for trains	0.827
3	Waiting time in a queue is short during buying a train ticket	0.738
4	Pre-purchase of tickets is an easy process for buses	0.594

Factors 6-10: Other factors

The other four factors (Operational efficiency, Time and timeliness,Luggage management, Physical ambience, Courtesy) explains only 4.81%, 4.36%, 3.85%, 3.15%, 3.07% variability respectively (Table 23). It can be noted that the variables in each of the factors have high factor loadings indicating the importance of the variable in measuring each factor and their strong correlation with the corresponding factors.

Table - 23Other Factors (6-10)

Variable Code	Variable Name	Factor Loading
	Factor 6: Operational efficiency (σ^2=4.81%)	
28	Chances of vehicle breakdown are low for trains	0.798
27	Trains are not prone to road accidents	0.762
26	Trains drivers do not drive recklessly	0.561
6	Train tickets do not go to black markets	-0.451
	Factor 7: Time and timeliness (σ^2=4.36%)	
24	Trains do not spend much time in stoppages	0.853
25	Trains are timely in reaching destination	0.734
23	Delay in starting a vehicle does not happen in Trains	0.594
	Factor 8: Luggage management (σ^2=3.85%)	
20	Luggage management is easy in trains	0.611
21	It is easy to carry delicate goods in trains	0.581
31	Maintenance of trains is good	0.478
	Factor 9: Physical ambience (σ^2=3.15%)	
1	Environment of train station is decent	0.719
22	Refreshment facility is satisfactory in trains	0.532
33	Restroom facilities are good in stations/stoppages	0.484
	Factor 10: Courtesy (σ^2=3.07%)	
34	Driver/Conductors do not pick up passengers illegally for unfair earnings	0.617
11	Commuters are greeted cordially in trains	0.604
12	Employees/conductors in trains are helpful	0.600

C.   Comparison of Factors and Complex Variables

An analysis of the complex variables developed and the factors identified shows good commonality among them. As noted, the 34 simple variables are grouped into nine complex variables; also the 34 simple variables are

reduced to eight factors for bus and 10 factors for train. Of these three groups, a lot of commonality is observed (Table 24). For example, the parameter physical facilities appear to be the most common and important issue. Other common activities found are: Time &Timeliness, Illegalactivity and security, Ticketing convenience, Service for physically disadvantaged.

Table- 24Factors for Bus and Train and Complex Variables

Complex Variables	Factors (Bus)	Factors (Train)
1. **Physical facilities (Bus 3.45, Train 2.88) 16/17/18/19**	1. **Physical facilities & consistency (σ^2=29.63%) 12/13/16/17/18/19/31/32/34**	1. **Physical facilities (σ^2=21.67%) 16/17/18/19**
2. **Environment & Ambience (Bus 3.94, Train 3.67) 1/13/22/33**	2. **Time, timeliness & convenience (σ^2=8.13%) 1/9/11/20/21/22/23/24/25**	2. **Counter service &accessibility (σ^2=8.84%) 7/8/9/10**
3. **Time &Timeliness (Bus 3.94, Train 3.67) 10/23/24/25**	3. **Illegal activity, security & operational efficiency (σ^2=5.63%) 26/27/28/29/30**	4. **Service for physically disadvantaged (σ^2=6.59%) 13/14/15**
4. **Ticketing, Accessibility & Convenience (Bus 3.02, Train 3.48) 2/3/4/5/8**	4. **Counter service & responsiveness (σ^2=5.04%) 5/7/8/10**	5. **Security, smuggling & consistency (σ^2=5.49%) 5/29/30/32**
5. **Courtesy, Consistency & responsiveness (Bus 3.54, Train 3.50) 7/9/11/12/32**	5. **Ticketing convenience (σ^2=4.38%) 2/3**	5. **Ticketing facility (σ^2=5.09%) 2/3/4**
6. **Service for physically disadvantaged (Bus 3.61, Train 3.76) 14/15**	6. **Service for physically disadvantaged (σ^2=3.9%) 14/15**	6. **Operational efficiency (σ^2=4.81%) 6/26/27/28**
7. **Luggage management (Bus 3.72, Train 3.34) 20/21**	7. **Restroom (σ^2=3.43%) 6/33**	7. **Time & timeliness (σ^2=4.36%) 23/24/25**
8. **Illegal activity& security (Bus 3.87, Train 3.94) 6/29/30/34**	8. **Pre-purchase of ticket (σ^2=3.16%) 4**	8. **Luggage management (σ^2=3.85%) 20/21/31**
9. **Operational Efficiency (Bus 4.27, Train 2.79)26/27/28/31**		9. **Physical ambience (σ^2=3.15%) 1/22/33**
		10. **Courtesy (σ^2=3.07%) 11/12/34**

V. SUMMARY, CONCLUSION AND RECOMMENDATION

Of all the different transport networks in Bangladesh, road and rail are the two major transportation modes in Bangladesh. Customer satisfaction plays a key role in the choice of medium of transport, underscoring the need to determine the nature and impact of such factors that lead to customer approval. Thus, an in-depth study is made to find customers' perception towards the rail and road transport service qualitiesin Bangladesh. In this regard, the study addressed 34 simple service quality items grouped into nine broad groups. The study made use of questionnairesurveyto get responses from bus and rail commuters. The questionnaireincluded all the service quality items for commuters' responses. The bus and rail commuters (137 and132 respectively) gave their satisfaction level regarding different service qualities in the modes they mainly travel.

The bus commuters' responses, regarding the 34 service dimensions, reveal that they are not happy with most of the quality dimensions (30). However, the five most agreed quality dimensions are found to be a) pre-purchase of tickets is an easy process for buses, b) tickets are easily available for buses, c) bus service providers are accessible via telephone, d) information regarding time and vehicle is available for buses, and e) waiting time in a queue is short during buying a bus ticket. The five least agreed quality dimensions are a) bus drivers do not drive recklessly, b) bus are not prone to road accidents, c) restroom facilities are good in stoppages, d) delay in starting a vehicle does not happen in buses, and e) bus drivers do not pick passengers illegally.

Similar responses are observed for train commuters. In 27 out of the 34 service dimensions, they are not happy. However, the most agreed quality dimensions are found to be a) train drivers do not drive recklessly, b) information regarding time and vehicles is available for trains, c) chances of vehicle breakdown are low for trains, d) ventilation facility is good for trains, e) Trains are not prone to road accidents, f) cooling facility is good in trains and g) condition of lights is good in trains. The least agreed quality dimensions are a) train tickets do not go to black-markets, b) delay in departure does not happen in trains, c) restroom facilities are good in railway stations, d) drivers do not take passengers illegally, and e) chances of carrying smuggled goods are low in trains.

A comparison between the responses of the bus and train commuters regarding the 34 service quality variables showed that in 20 out of 34 cases the mean values are found significantly dissimilar. Of these 20 cases in only four cases the bus commuters' responses are more favorable than the train commuters. These are: i) Tickets are easily available, ii) Waiting time in is short during buying a ticket, iii) Tickets do not go to black market, and iv) Counter service provider available online. But in rest 16 cases the bus commuters are more skeptical. Hence, we can conclude that overall the train commuters are less dissatisfied than the bus commuters regarding the services.

The 34 quality variables are grouped into nine broad groups: i) physical facilities, ii) environment & ambience, iii) time & timeliness, iv) ticketing, accessibility & convenience, v) courtesy, consistency & responsiveness, vi) service for disadvantaged, vii) luggage management, viii) illegal activity & security, and ix) operational efficiency. The groups mean indices showed that bus service quality is better for ticketing, accessibility & convenience, accessibility & convenience, service for disadvantaged and illegal activity & security; on the other hand, train service quality is better for physical facility, environment & ambience, time & timeliness, luggage management, and operational efficiency. The courtesy, consistency & responsiveness found to be almost same for both the groups. Overall, it can be said that the train is giving a little better service than the bus.

The study tried to find out demography wise perceptional differences of the bus and train commuters regarding different quality dimensions. As noted, gender wise there is no significant difference of the perception of the bus commuters; but for train commuters in three cases gender-wise perceptional difference is observed. These are: i) environment of station, ii) counter service staffs' aptness in query clarification, and iii) no illegal carriage of passengers on the way. Occupation wise (Students and service holders)the study noted no significant difference in the perception of the bus commuters except five cases: i) counter service provider availability, ii) availability of seats for female/children, iii) luggage management, iv) ease of carrying delicate goods, and v) departure delay. But for train commuters only in two cases occupation wise perceptional difference is observed. These are: i) departure delay, ii) chance of getting hijacked/ mugged.

Education-wisethe results show that in only nine of the 34 cases the mean responses are different. Overallit is noted that the less educated are more critical than the more educated ones. The study observed a few variables with significant, but weak and positive, correlation with age and income. For bus commuters, only seven variables have relationship with age and three variables have relationship with income. For train commuters, only three variables have relationship with age and two variables have relationship with income. This indicates that the train commuters become more skeptical regarding few services with increase in age and income. Overall it can be said that there is not much demography wise difference in responses of the bus and train commuters.

The factor analysis for bus commuters reduced the 34 survey variables into eight factors. The first factor (Physical facilities and consistency) appears to be the most important as they explain maximum variability. Some other factors aretime, timeliness and convenience,illegal activity, security &efficiency andcounter service & responsiveness. The factor analysis for train commuters reduced the 34 survey variables into 10 factors. The first factor (Physical facilities) appears to be the most important as it explainsmaximum variability. Some other factors arecounter service and accessibility, service for women, children and disabled, security, smuggling and consistency and ticketing facility. Further analysis of cohesion for bus and train factors and complex variables shows good commonality. The complex variable physical facilities appear to be the most important factor for bus and train. Other common activities are time &timeliness, illegal activity and security, ticketing convenience, courtesy, service for physically disadvantaged.

Luggage scanners can reduce the chances of illegal goods smuggling and can also reduce the possibility of trafficking prohibited goods. Policing and appropriate identification of passengers can go a long way in improving the safety concerns like hijacking, theft, mugging, robbery, etc. Penalties in accordance to updated company policies may be imposed in extreme cases. To improve staff behavior a complaint box may be installed to track offenders and take effective action against them. Consideration may also be given to training and certifying transportation workers placed in public service. Such training and certification are actually needed across the board in all service sectors and may even be introduced in school curriculums to sensitize young citizens to the needs of society. A visible and vigorous supervision in the overall service is likely to give greater confidence and satisfaction to the passengers.

NOTES

1   Factor Analysis is a type of analysis used to discern the underlying dimensions or regularity in phenomenon. Its general purpose is to summarize the information contained in many variables into a smaller number of factors. It is an interdependence technique in which all variables are simultaneously considered.

2   Factor is a linear combination of the original variables. Factors also represent the underlying dimensions (constructs) that summarize or account for the original set of observed variables.

3   Ideally the sample size should be at least 150 (subject to variable ratio greater than 5). But we have to limit our responses to 269 (137 for bus and 132 for train) which is less than preferred one (150). The factor analysis of 34 variables,in both the cases, are found adequate (KMO test result $\geq$ 0.5) and valid (Bartlett's test of sphericity indicates a significance level of 0.000).

4   Communality refers to a measure of the percentage of a variable's variation that is explained by the factors. It is the amount of variance original variables share with all other variables included in the analysis. A relatively higher communality indicates that a variable has much in common with the other variables taken as a group.

5   'Factor loading' is a measure of the importance of the variable in measuring each factor. It is used for interpreting and labeling a factor. It is the correlation between the original variables and the factors, and key to understanding the nature of a factor.

REFERENCES

[1]   Rahman, F., Chowdhury, T. D., Haque, T., Rahman, R., Islam. A., Rahman, F. (2017). Identifying Existing Bus Service Condition and Analyzing Customer Satisfaction of Bus Service in Dhaka City, April 2017, *Journal of Transportation Technologies, 7*(7), 107-122.

[2]   Mahmud, S. M. S.; Rahman, Mohammad W. &Hasanat-E-Rabbi, Shahnewaz. (2006). Transport System in Bangladesh: Issues and Options for Sustainable Development, Paper 5 a-1. Accident Research Center (ARC), BUET, Dhaka, Bangladesh.

[3]   Islam, M. A.&Hoque, M. S. (2020). Mode of Transportation Choices in Bangladesh: An Application of Multinomial Logistic Model, *International Journal of Probability and Statistics*, *9(3)*, 45-53, doi: 10.5923/j.ijps.20200903.01.

[4]   Ahsan, H. M., Rahman, F. & Hayder, T. (2016). Rail Connectivity in Bangladesh: Present and Future. *Proceedings of 3rd International Conference on Advances in Civil Engineering,*21-23 December 2016, CUET, Chittagong, Bangladesh.

[5]   Uddin, M. Kamal. (2014). Service quality of the Bangladesh Railway as perceived by the passengers. *Bangladesh Journal of Psychology, 20,* 137-152.

[6]   Rahaman, K. R., &Rahaman, M. A. (2009). Service quality attributes affecting the satisfaction of railway passengers of selective route in southwestern part of Bangladesh. *Theoretical and Empirical Researches in Urban Management, 4.3* (12), 115-125.

[7]   BRIB (2016). Bangladesh Railway Information Book 2016. Bangladesh Railway, Ministry of Railway, Government of Bangladesh.

[8]   Valentine, Harry(2020). The Bangladesh Commercial River Transport Industry, The Maritime Executive, May 2020.

[9]   Jahan, Sarwar (2016). *Sustainable and Inclusive Transport Development in Bangladesh*, Bangladesh Country Report, Habitat III, UN.

[10]   Mallik, Nahid S. (2015), *Connectivity and Transport Infrastructure Development*, a paper Presented by Deputy Secretary, Economic Relations Division, Ministry of Finance, Government of Bangladesh.

[11]   Islam, M. R., Hadiuzzaman, M., Banik, R., Hasnat, M. M., Musabbir, S. R., & Hossain, S. (2016). Bus service quality prediction and attribute ranking: a neural network approach. *Public Transport, 8*(2), 295-313.

[12]   Hasan, M. R. (2009). Problems and Prospects of a railway: A case study of Bangladesh Railway. *Journal of Service Marketing*, *4*, 124-136.

[13]   Balakrishnan, K. P. (2012). A study on service quality perception of railway passengers of southern railway. *International Journal of Management Research*, *2(2)*, 105-110.

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