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SERVICE QUALITY RENDERED BY PUBLIC BUS TRANSPORT IN WEST BENGAL: A PERCEPTION STUDY ON PASSENGER SATISFACTION

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ABSTRACT

As part of a larger study on public transport, - particularly bus transport in the state of West Bengal, a primary survey is undertaken on 502 bus passengers to investigate the most significant factors and their influence on passengers' satisfaction with respect to bus service quality parameters against the fare paid by them; and to compare the preference and willingness to pay for more facilities such as CCTV, GPS, Wi-Fi, catering facilities and toilet facilities according to the age group, gender, monthly income level and educational qualifications. This study lays the foundation for future investigation on service quality in a very promising but highly complex public transport by expanding the target area through including more transport systems to evaluate on one hand and benchmark and enhance the passenger service quality rendered through Scenario and Causal analysis using Bayesian Probabilistic Network for appropriate policy implementation.

KEYWORDS: Service Quality, Scenario and Causal Analysis

INTRODUCTION

Background of the Study

The 21st century has been considered as the service industry century. Service can be core or supplementary. Whatever it may be, all the service organisations are solely depending upon their customer service quality as in today's competitive world understanding and meeting customer needs is the focal points and so transport sector. That's why thrust has been given measuring the passenger service quality provided by public and private bus operating in West Bengal so that they can initiate the necessary steps on the basis of their passengers' perception.

In this regard present study adapts and applies a modified SERVQUAL approach on service quality in West Bengal Bus Transport. The **OBJECTIVES** of the study are:

- To investigate the most significant factors and their influence on passengers' satisfaction with respect to bus service quality parameters against the fare paid by them
- To compare the preference and willingness to pay for more facilities such as CCTV, GPS, Wi-Fi, catering facilities and toilet facilities according to the age group, gender, monthly income level and educational qualifications.
- To recommend some suggestions to improve the service quality, if required

Theoretical Framework

Wide-ranging literatures have been accentuated in the field of **service quality**. Out of which Parasuraman et al.

(Parasuraman, Berry, & Zeithaml, 1991; Parasuraman, Zeithaml, & Berry, 1985, 1988) constructed a service quality measure, called SERVQUAL, which are mostly used as the customer's assessment tool of overall service quality determined by the degree and direction of the gap between customers' expectations and perceptions of actual performance levels. This model has also put emphasis on the five main parameters of service quality. They are as follows:

- *Tangibles* involve the appearance of physical facilities, including the equipment, personnel, and communication materials.
- *Reliability* involves the ability to perform the promised service dependably and accurately.
- *Responsiveness* involves the willingness to help customers.
- *Assurance* involves the knowledge and courtesy of employees and their ability to convey trust and confidence. This assurance includes competence, courtesy, credibility and security.
- *Empathy* involves the provision of caring, individualized attention to customers. This empathy includes access, communication, and understanding the customer.

Several findings of the effectiveness of public transport have been identified through passengers' perception surveys. Iseki et al (2007) opined that accessibility and reliability are the top two key factors in evaluating the effectiveness of the services at the bus stop and bus terminal followed closely by the security factor. The findings pointed out that the physical factor of bus stops and bus terminals is not a priority. Eboli and Mazzulla (2007) considered the passengers' satisfaction perception in the context of bus services and found many factors that influence the effectiveness of public transport. The main factors are the physical condition, convenience, comfort and safety of the bus. On the other hand, Abreha (2007) established that accessibility and reliability are key factors that contribute towards the ineffectiveness of public transport. From passenger perception, Veliou (2010) found that the number of passengers increased by increasing the effectiveness of the transportation. Lau, C.Y. et al (2003), defined accessibility and mobility as the main factor of satisfaction in usage of public transport.

RESEARCH METHODOLOGY

Primary Data Collection

Sample

The passengers have been selected by random sampling method.

- **Number of Respondents:** 502 bus passengers

Demographic Details

- **Age:** 13 years to 60 years and above
- **Gender:** Both male and Female
- **Monthly Income:** Less than Rs. 5000 to Rs. 40000 and above
- **Educational Qualifications:** School standard to PhD and above

TOOLS

- **Personal interview**
- **Questionnaire survey**

Variable Measurement

- A total of 23 questions are used to measure the service quality of bus services in West Bengal based on five dimension defined by Parasuraman et al. (1985). All questions were designed as closed ended questions using 5-point Likert scale varying from strongly disagree (1) to strongly agree (5).
- Another 10 questions were asked to measure the preference and acceptance level for enhanced service quality of bus services in West Bengal

Statistical Techniques

- **Factor Analysis**
- **Multiple Regression Analysis**
- **Cluster Analysis**
- **Bayesian Probabilistic Network**

DATA ANALYSIS

Frequency Distribution: Demographic Details

AGE –

Out of the 502 total surveyed respondents, for two respondents the age data are missing. Therefore, the age wise distribution of the respondents is as per following

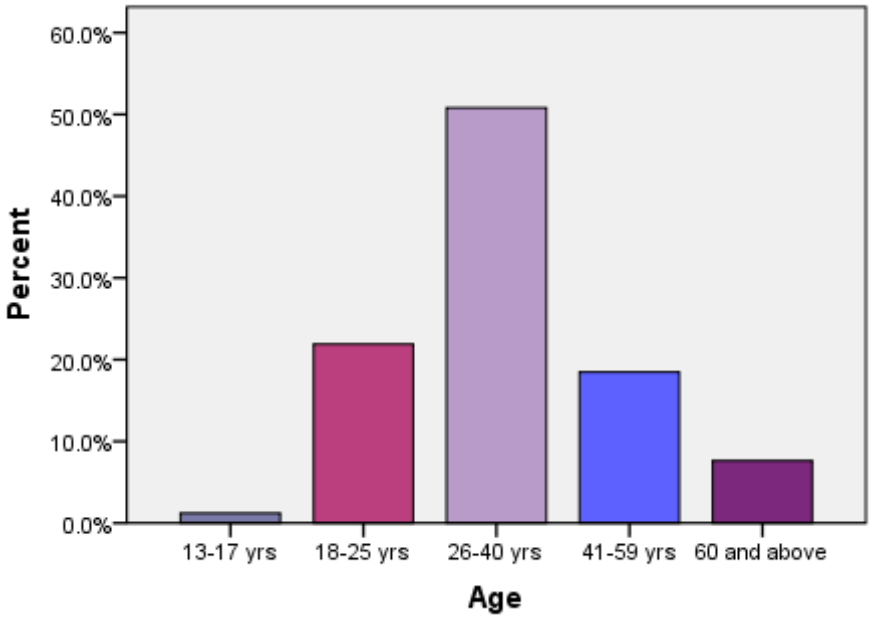

Figure 1

Figure 1 shows that 1.2% of the respondents belongs to the 13-17 years' age group. Majority i.e., about 50.8% of the respondents belong to the 26-40 years' age group. About 21.9% and 18.5% of the respondents belong to the 18-25 years' and 41-59 years' group respectively and only about 7.6% of the respondents belong to the 60 years' and above group.

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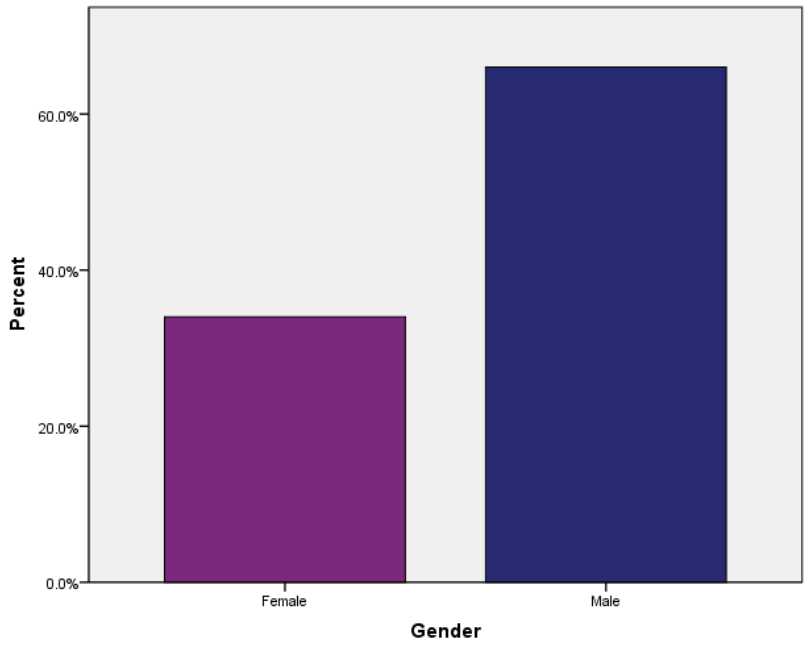

Figure 2

Figure 2 interprets out of 502 respondents, 66% is male and the remaining 34% is female.

MONTHLY INCOME002D

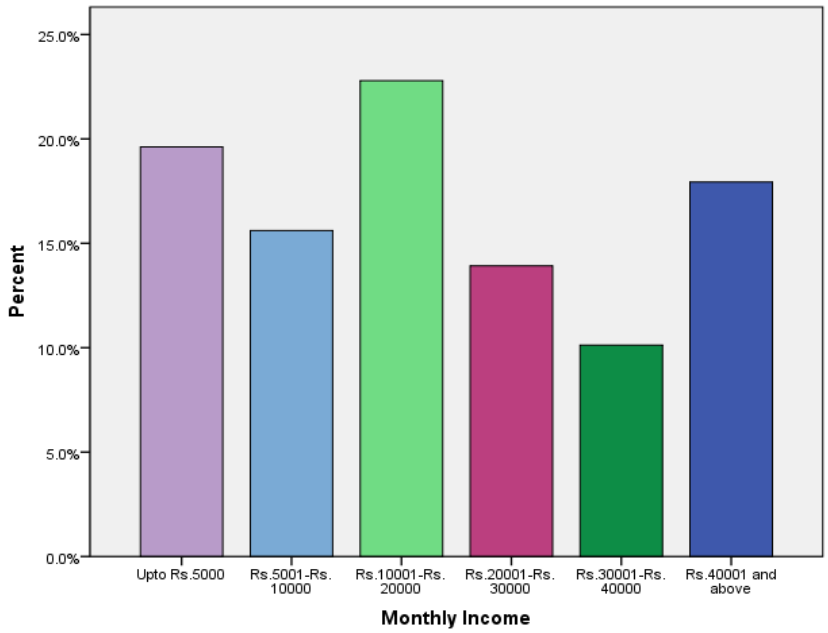

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Figure 3

Figure 3 shows that out of 500 respondents, for 26 respondents the income details are missing. From the above figure it is observed that majority or 22.8% of the respondents belong to the Rs.10001-Rs.20000 income group followed by 19.6% and 17.9% belonging to the lowest and highest segment respectively. About 15.6% and 13.9% of the respondents belong to the Rs.5001-10000 and Rs.20001-Rs.30000 income group. Only about 10.1% of the respondents belong to the Rs.30001-Rs.40000 income bracket

Educational Qualification

The educational qualification details of only 487 respondents were available. The distribution is shown in the following table:

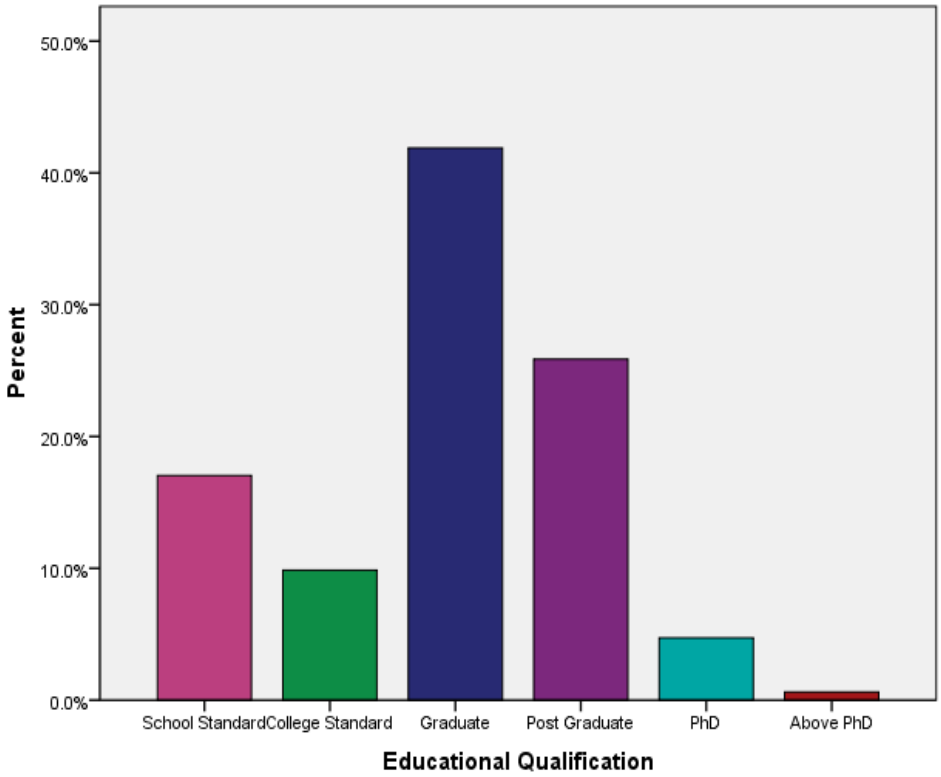

Figure 4

It is observed from the Figure 4 that the majority or 41.9% of the respondents are graduate followed by 25.9% post graduates. A significant 17% has only school level education followed by 9.9% college students and 4.7% Ph.D.'s. Only about 0.6% has above Ph.D. level education.

IDENTIFYING THE MOST SIGNIFICANT FACTOR IN BUS SERVICE QUALITY AFFECTING PASSENGER SATISFACTION LEVEL

Interpretation of Factor Analysis

Table 1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.812
Bartlett's Test of Sphericity	Approx. Chi-Square	2433.740
	df	253
	Sig.	.000

Here, Barlett's test of spericity is significant, as p value is .000 which is less than .05. Thus from the perspective of Bartlett's test, factor analysis is feasible. As Bartlett's test is significant, a more discriminating index of factor analyzability is the KMO. High values (between 0.5 and 1.0) indicate factor analysis is appropriate. Values below 0.5 imply that factor analysis may not be appropriate. For this data set, Table 1 shows that it is .812 (very close to 1.0), which is very large, so the KMO also supports factor analysis.

Table 2

Item Labels	Factor Loading	Cumulative Variance Explained	Cronbach Alfa	Number of Items
FACTOR 1: RELIABILITY		27.075	.8897	1
Availability of bus	.862			
FACTOR 2: EMPATHY		48.495	.8362	2
Conductors flexible behaviour in complaint handling	.833			
Conductors proper care in critical situation handling	.831			
FACTOR 3: RESPONSIVENESS		66.128	.8033	2
Response time in complaint handling	.811			
Readiness to help passengers	.766			
FACTOR 4: ASSURANCE		77.224	.7809	2
Trained driver and safety	.785			
FACTOR 5: TANGIBLES		85.060	.7612	1
Leg space	.673			
Seat condition	.627			

Total variance explained 85.06%

Factor analysis was carried on all the statements found in the questionnaire in order to test the dimensionality of the survey instrument. A principal component analysis with Varimax rotation was conducted on 23 items. Only factors with eigenvalue 1 were considered significant and chosen for interpretation.

Reliability Coefficients

N of Cases =500.0 N of Items = 23 Alpha = .8142

In this reliability analysis, 500 cases are used on 23 items in the calculation of Cronbach's alpha. The obtained alpha score is 0.8142, which indicates that the scale has high internal consistency (reliability).

Table 2 interprets that as factor 1 is treated as principal component, or the most determining factor, in bus service quality, *availability of buses* termed as RELIABILITY is the most important factor related to passengers service quality followed by factor 2, *Conductors flexible behaviour in complaint handling and Conductors proper care in critical situation handling* named as EMPATHY**.** Next important factor i.e. factor 3 is *Response time in complaint handling and Readiness to help passengers* called as RESPONSIVENESS**.** *Trained Driver and Safety Measures* termed as ASSURANCE (factor 4) whereas the physical factors like *Leg Space and Seat condition* TANGIBLES detected as factor 5 is also given high preference in terms of passenger satisfaction with respect to bus service quality.

Interpretation of Multiple Regression Analysis

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	**.715**[a]	**.511**	**.495**	.79064	.170	20.142	5	492	.000

a. Predictors: (Constant), Tangibles Average, Reliability Average, Empathy Average, Assurance Average, Responsiveness Average

The Table 3 represents the value of R, the multiple correlation coefficient. Here the value of "R" .615 indicates a low level of prediction. From the R square value of 0.511 it can be depicted that our independent variables explain 51.1% of the variability of our dependent variable. Here our dependent variable is overall satisfaction of service quality of bus and the 5 independent variables are categorized under 5 parameters, namely – Reliability, Responsiveness, Assurance, Empathy and Tangibles.

The F-ratio in the ANOVA table (Table 4) tests whether the overall regression model is a good fit for the entire data. This table shows that the independent variables statistically significantly predict the dependent variable, F (5, 492) = 20.142, p < .005.

Table 4: ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	62.956	**5**	12.591	**20.142**	**.000**[a]
	Residual	307.556	**492**	.625		
	Total	370.512	497			

a. Predictors: (Constant), Tangibles, Reliability, Empathy, Assurance, Responsiveness

b. Dependent Variable: Overall Satisfaction Score

Table 5

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.198	167		7.163	000
	Reliability	326	051	315	4.433	000
	Empathy	246	057	235	2.580	010
	Responsiveness	183	059	160	2.259	024
	Assurance	072	046	075	1.547	123
	Tangibles	041	027	035	1.082	280

Unstandardized coefficients, in Table 5, indicate how much the dependent variable varies with an independent variable when all other independent variables are held constant. Consider the effect of Reliability on Overall satisfaction, the unstandardized coefficient, B, for Reliability score is equal to 0.326. This means that for each one scale increase in the Average value of Reliability, there is an increase in Overall satisfaction of 0.326. Similarly, for each one scale increase in the score of Empathy, there is an increase in Overall satisfaction of 0.246, for each one scale increase in the score of Responsiveness, there is an increase in Overall satisfaction of 0.133 and for each one scale increase in the Average value of Assurance, there is an increase in Overall satisfaction of 0.072 whereas for each one scale increase in the Average value of Tangibles, there is a increase in Overall satisfaction of 0.041.

From the "t" value and the "Sig." value we tests whether the coefficients are statistically significantly different to

0 (zero). Here for all the 5 independent variables $p < .05$, so this explained that all the coefficients are statistically significantly different to 0 (zero).

So, for Bus Service Quality, the equation from the regression output is

OVERALL SATISFACTION

= 1.198 + (.326 ×RELIABILITY) +(.246 ×EMPATHY)+

(.183 ×RESPONSIVENESS) + (.072 ×ASSURANCE) + (.041 × TANGIBLES)

Figure 5 (below) presents the pictorial form of the above equation.

BUS SERVICE QUALITY PARAMETERS INFLUENCING PASSENGERS' OVERALL SATISFACTION

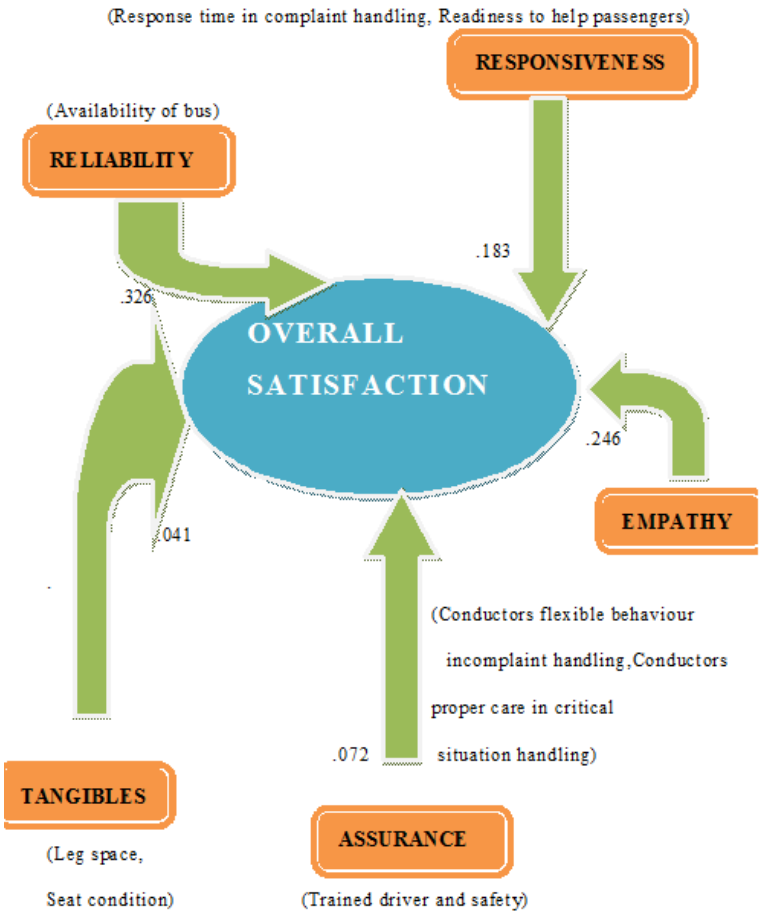

Figure 5

PREFERENCE AND WILLINGNESS TO PAY EXTRA AMOUNT TO ENHANCE SERVICE QUALITY

This section discusses about the respondent's preferential level and that of the willingness to pay extra amount for availing five facilities, viz. – CCTV, GPS, Wi-Fi, Catering facility and the toilet facility in long distance busesas responded as a whole by all 502 passengers and then with respect to the their demographic profile, namely – age, gender, income and qualification.

PASSENGERS' PREFERENCE FOR EXTRA FACILITIES

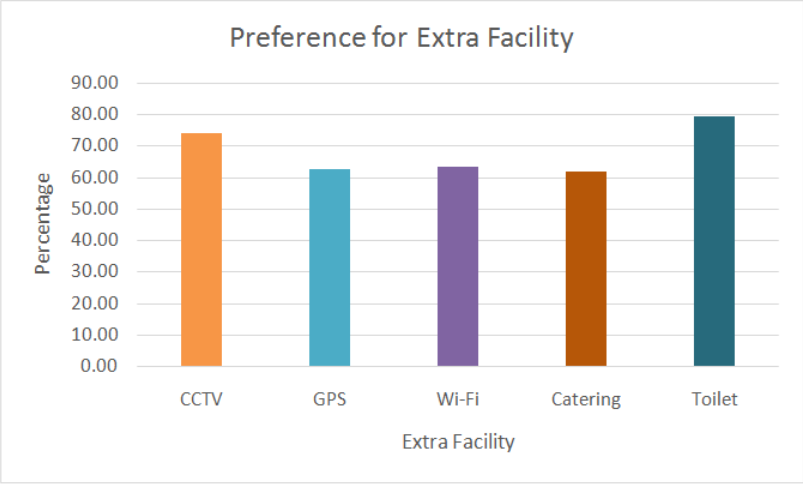

Figure 6

It is observed from Figure 6 that the respondents express as an average of 73.86% preference for CCTV, 62.73% for GPS, 63.29% for Wi-Fi, 61.64% preference for catering services and 79.2% for introduction of toilet facility in long distance buses.

PASSENGERS' WILLINGNESS TO PAY EXTRA AMOUNT FOR EXTRA FACILITIES

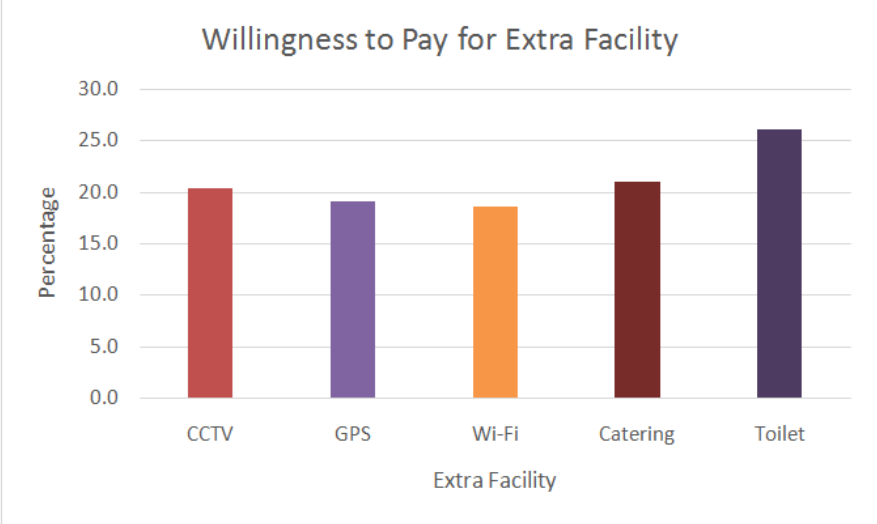

Figure 7

It is observed from Figure 7 that respondents show willingness to pay extra amount as an average of 20 % for CCTV, 19.1% for GPS, 18.6% for Wi-Fi, 20.9% for catering services and 26% for toilet facility in long distance buses.

PREFERENCE AND WILLINGNESS WITH RESPECT TO DEMOGRAPHIC DETAILS:

Interpretation of Cluster Analysis

For each demographic detail preferential level and willingness to pay extra amount for all 5 extra facilities are reflected simultaneously as follows:

AGE

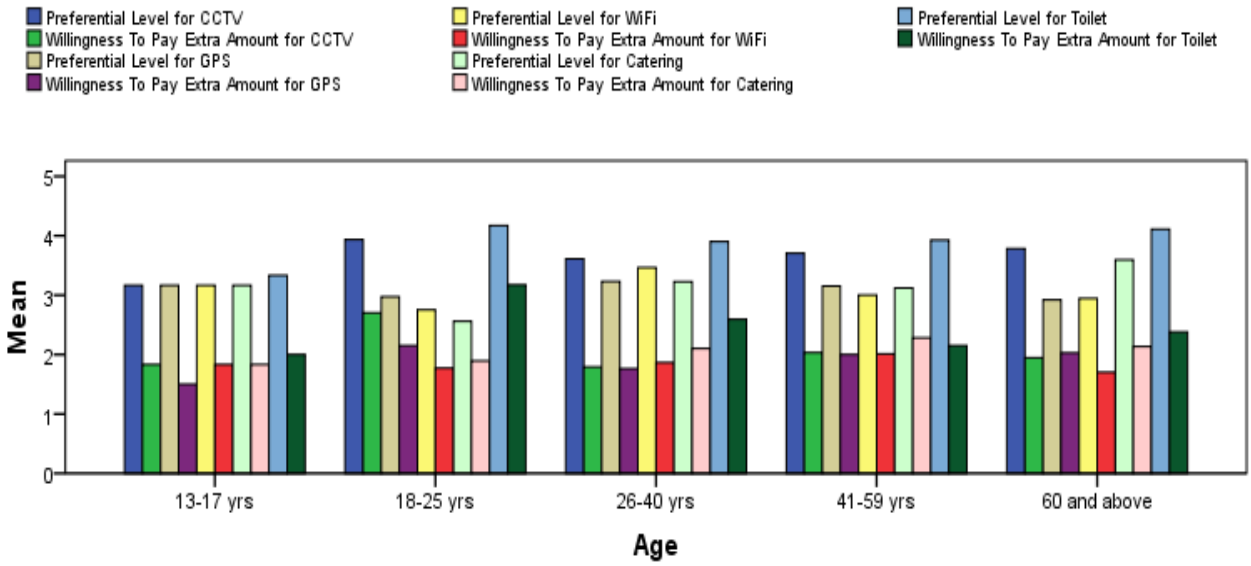

Figure 8

Figure 8 shows that from Age wise distribution of preferential level and that of the willingness to pay extra amount for availing five facilities, viz. – CCTV, GPS, Wi-Fi, Catering facility and the toilet facility, it can be depicted that irrespective of the age group toilet facility is highly required for long distance journey. And for this the respondents are also willing to pay extra amount in respect to the rest four facilities. In case of CCTV, in comparison to the 5 age groups, the age group belonging to 18-25 years showed their high preference (an average of 80%) as well as the willingness to pay extra amount (an average of 28%) for installation of CCTV. Wi-Fi is preferred most (an average of 60%) by the 25-40 years but their willingness to pay extra amount is as low as other 3 age groups (an average of 18%); aged people are least willing to pay extra amount (an average of 15%) for this facility.

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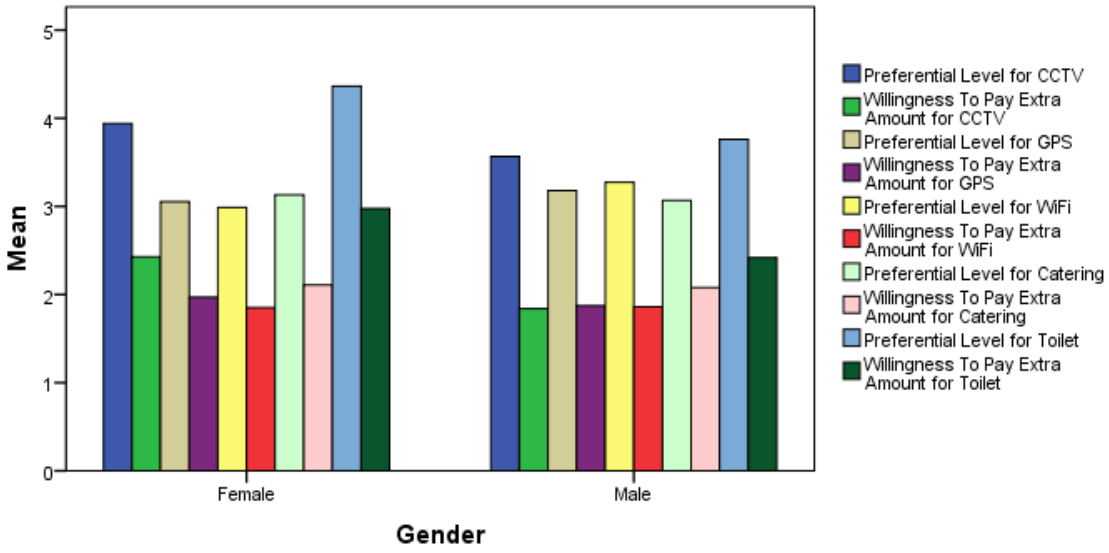

Figure 9

Gender wise distribution of preferential level and that of the willingness to pay extra amount for availing five facilities are explained here from Figure 9:

In case of installation of CCTV in buses it is observed that female respondents are more inclined to this facility (an average of 78%) and also willing to pay extra amount (an average of 24%) for this in comparison with their male counterpart.

For GPS and Catering facility in long distance buses, there is more or less same kind of preference and willingness to pay extra amount to avail these facilities.

In case of toilet facility in long distance buses female respondents' preference (an average of 83%) as well as willingness to pay extra amount (an average of 28%) for this facility is higher in comparison with the male respondents. But for Wi-Fi facility in buses the scenario is just reversed. Here male respondents preferred slightly more(an average of 63%) to avail Wi-Fi facility in buses.

Monthly Income

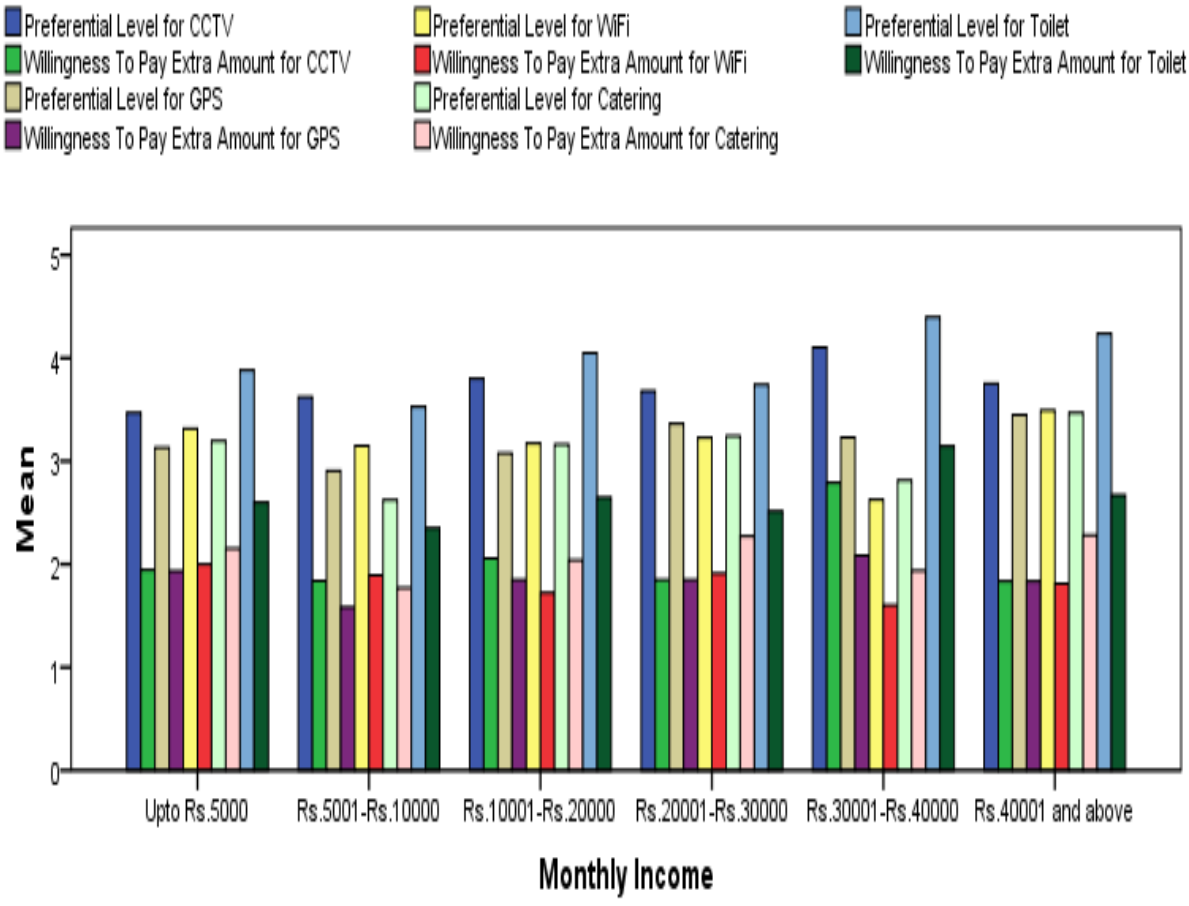

Figure 10

Bar chart of Figure 10 regarding monthly income group wise respondent's preferential level and that of the willingness to pay extra amount for availing five facilities describe that irrespective of income groups, there is highly preference for CCTV (an average of more than 75%) and toilet facilities in long distance buses (an average of more than 70%); but surprisingly with increase in monthly income level, there is no increase in willingness to pay extra amount for

availing these facilities. In case of all income groups it is noticed that though the preference level differs, but their willingness to pay extra amount for availing Wi-Fi facilities in buses is almost equally low. The facilities where most of the income groups are willing to pay comparatively higher amount are toilet facility followed by catering facility in comparison with the rest three facilities.

Educational Qualification

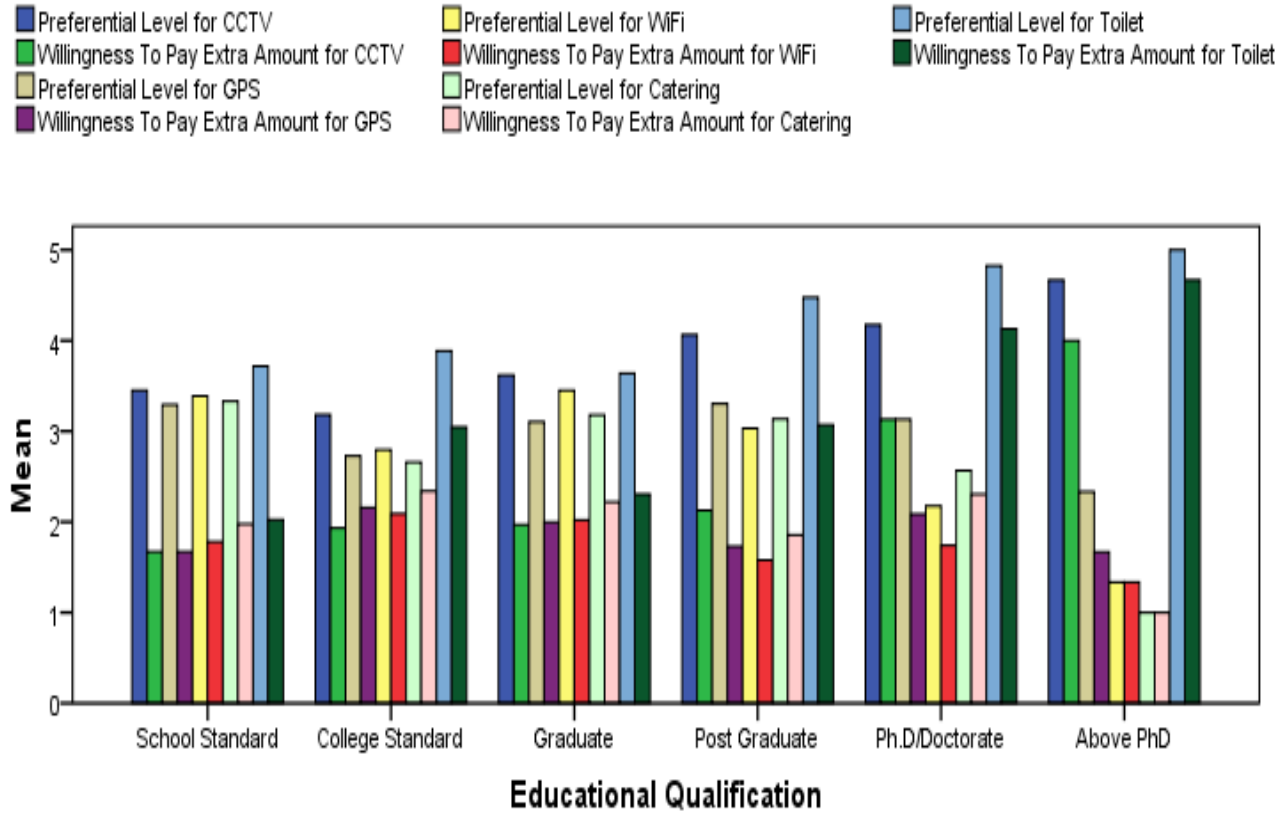

Figure 11

In Figure 11, Educational qualification wise group for respondents' preferential level and their willingness to pay extra amount for availing five facilities showed an increasing trend for preference level of and willingness to pay extra amount for CCTV facility (an average of 83%) as well as toilet facility (an average of 87%). So it is observed that higher is the education level higher is the preference for toilet facility in long distance buses and simultaneously higher is the education level higher is the willingness to pay extra amount for CCTV and toilet facility in buses. For the respondents with highest level of education only toilet (an average of 80%) and CCTV facilities are required most, the mean value of both the preference and willingness to pay extra amount for the GPS, Wi-Fi and Catering facilities surprisingly lie between 2.5 to 1. i.e. (an average of 10% to 20.5%). School students highly preferred all 5 facilities unlike other groups, but they don't want to pay extra amount to avail the same.

Findings

From Factor analysis it is found that in bus service quality, *availability of buses*is the most important bus service quality aspect related to bus passengers' satisfaction followed by *Conductors flexible behaviour in complaint handling and Conductors proper care in critical situation handling***.**

So it is revealed that most focus should be given on the **Reliability** of bus service and **Empathetic** behaviour of the conductors in case of critical situation and complaint handling.

Next, area of concerns is *Response time in complaint handling and Readiness to help passengers*, so **Responsiveness** is another major issue in bus service quality.

Trained Driver and Safety Measures i.e. **Assurance** has come out as the next key factor whereas the physical factors like *Leg Space and Seat condition termed as* **tangible** is also playing vital role in bus service quality.

From Multiple Regression Analysis, it is observed that the above mentioned service quality parameters influencing overall passenger satisfaction as follows: *availability of buses i.e.* **Reliability**, **Empathetic** behaviour of the conductors in case of critical situation and complaint handling are influencing 32.6% and 24.6% respectively followed by *Response time in complaint handling and Readiness to help i.e.* **Responsiveness** which is influencing 18.3%. Assurance and tangibles are having negligible impact of 7.2% and 4.1% respectively.

The results of factor and regression analysis corroborate each other in terms of 3 most important factors in bus service quality i.e. **Reliability, Empathy** and **Responsiveness.**

Further, from the next portion of the study, the preference and willingness to pay extra amount for the extra facilities such as CCTV, GPS, WI-FI, Catering and Toilet facilities are investigated from the cluster analysis with respect to the demographic details of the respondents.

In case of CCTV, in comparison to the 5 age groups, the age group belonging to 18-25 years showed their high preference (an average of 80%) as well as the willingness to pay extra amount (an average of 28%) for installation of CCTV. Wi-Fi is preferred most (an average of 60%) by the 25-40 years but their willingness to pay extra amount is as low as other 3 age groups (an average of 18%); aged people are least willing to pay extra amount (an average of 15%) for this facility.

It is noticed that in case of installation of CCTV, in comparison to the 5 age groups, the age group belonging to 18-25 years showed their high preference as well as the willingness to pay extra amount for installation of CCTV. Wi-Fi is preferred most by the 25-40 years but their willingness to pay extra amount is as low as other 3 age groups; aged people are least willing to pay extra amount for this facility.

In case of CCTV and toilet facility in long distance buses it is observed that female respondents are more inclined to this facility and also willing to pay extra amount for this in comparison with their male counterpart. But for Wi-Fi facility in buses the scenario is just reversed. Here male respondents both preferred and agreed pay extra amount to avail Wi-Fi facility in buses.

There is highly preference for CCTV and toilet facilities in long distance buses, but surprisingly with increase in monthly income level, there is no increase in willingness to pay extra amount for availing these facilities. The facilities where most of the income groups are willing to pay comparatively higher amount are toilet facility followed by catering facility in comparison with the rest three facilities.

Educational qualification wise group for respondents' preferential level and their willingness to pay extra amount for availing five facilities showed an increasing trend for preference level of and willingness to pay extra amount for CCTV facility as well as toilet facility, both the preference and willingness to pay extra amount for the GPS, Wi-Fi and

Catering facilities surprisingly very low.

Passengers' Suggestions for Further Improvement in Service Quality

Respondents expressed their opinion on introducing new equipments to enhance service quality. Most of the respondents expressed that Toilet facility is crucially essential for long and short distance bus journey; They also suggested that installation of CCTV is immediately required for both long and short distance bus journey for safety purpose. Some of them showed their eagerness in introducing route map in each route through GPS facility to have an adequate idea about stoppages and timing for next bus in that route. They talked about Catering facility which they feel necessary for long distance journey. Few of them said Wi-Fi facility should be provided to entertain the passengers or to incline people's interest to ride in buses.

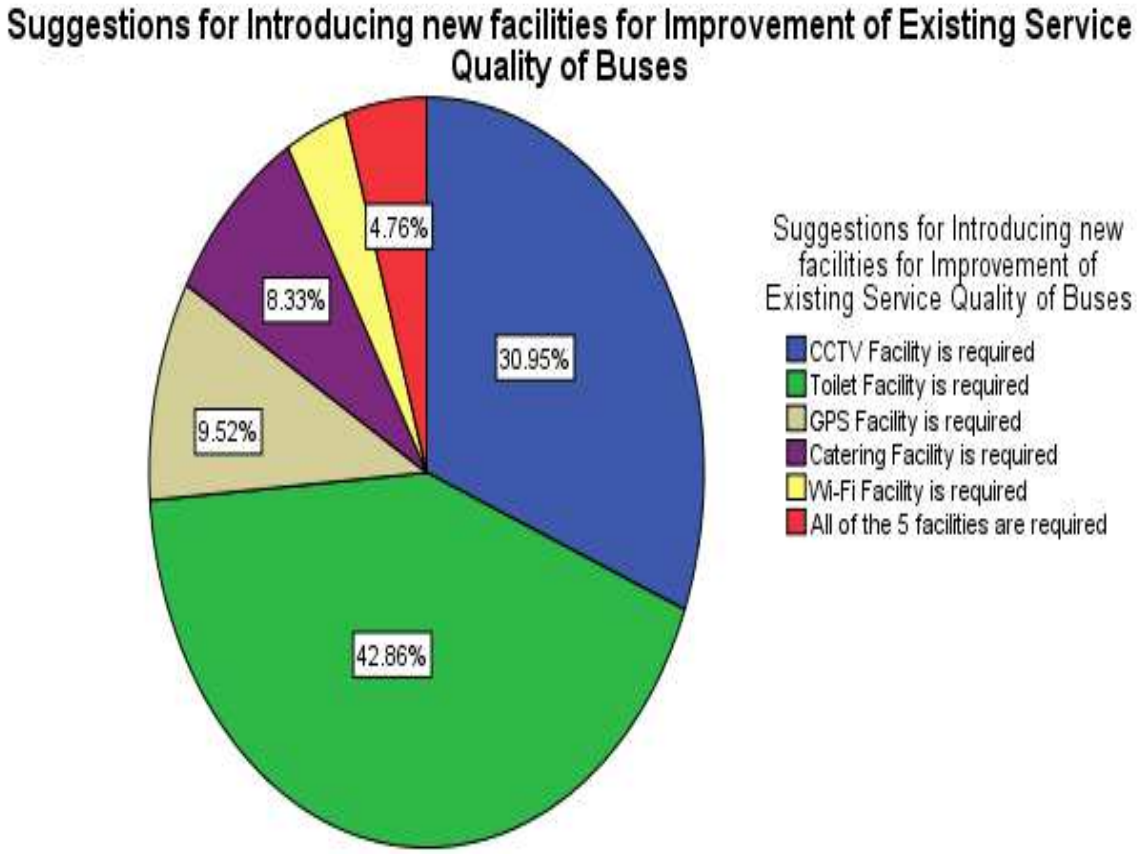

Figure 12

Above pie diagram in Figure 12 shows the respondents' propositions for five extra facilities that would be incorporated with the existing facilities of buses for overall improvement of bus service quality. Majority (42.86%) of the respondents are longing their preferences for the toilet facility for long distance buses, followed by the CCTV facility. Only 3.58% of the respondents showed their willingness for Wi-Fi facility. 9.52% of the respondents required GPS facility in the buses followed by the catering facility (8.33%).

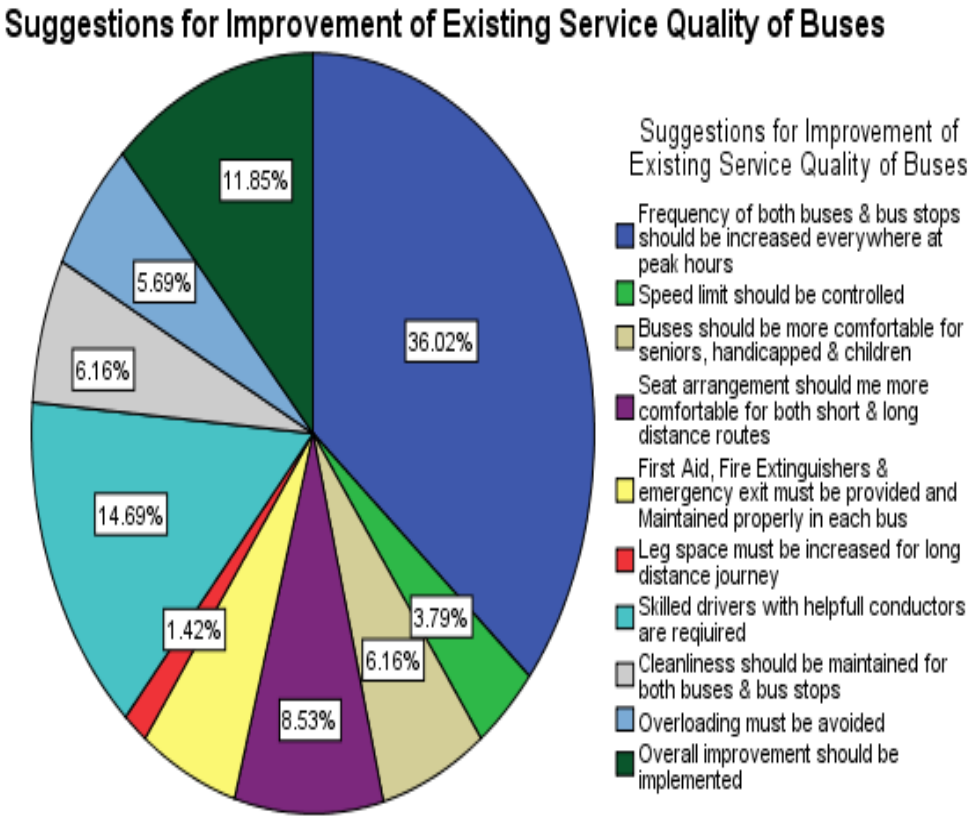

Figure 13

Figure 13 interprets that when respondents are asked for recommendations to improve existing service quality, they opined number of suggestions as follows:

- Frequency of buses must be increased during peak hours
- Number of bus stops should be increased in everywhere / all areas
- Speed limit should be controlled on busy roads
- Buses should be more comfortable for senior citizens, handicapped and children's journey
- Seat arrangement should be more relaxed with well maintenance of both buses and bus stops
- First aid, fire extinguishers and emergency exits must be provided and properly maintained in every buses
- Leg space between seats should be increased for both short and long distance journey
- Irrespective of seniors, handicapped and children seats should be more comfortable for long distance journey
- Skilled drivers with helpful conductors are required to resolve any critical situation quickly
- Each bus and bus stop both should be clean and well maintained appropriately
- For improvement in service quality overloading should be checked or avoided
- For overall improvement in service quality of buses each of the above mentioned points must be fulfilled accurately

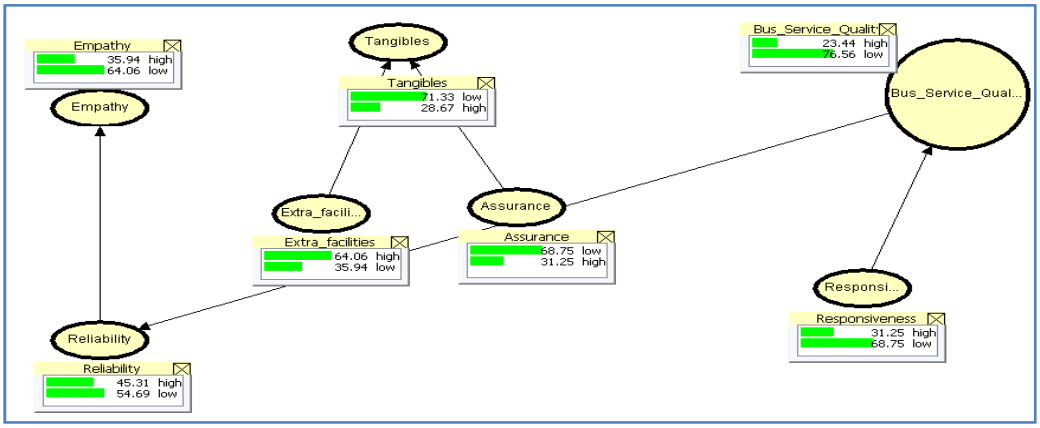

Figure 14: Bayesian Probability Network

Scenario and Causal Analysis

Keeping the significant factors of bus service quality in mind, further research may be undertaken to develop a measure that works using Bayesian Probability Network as follows:

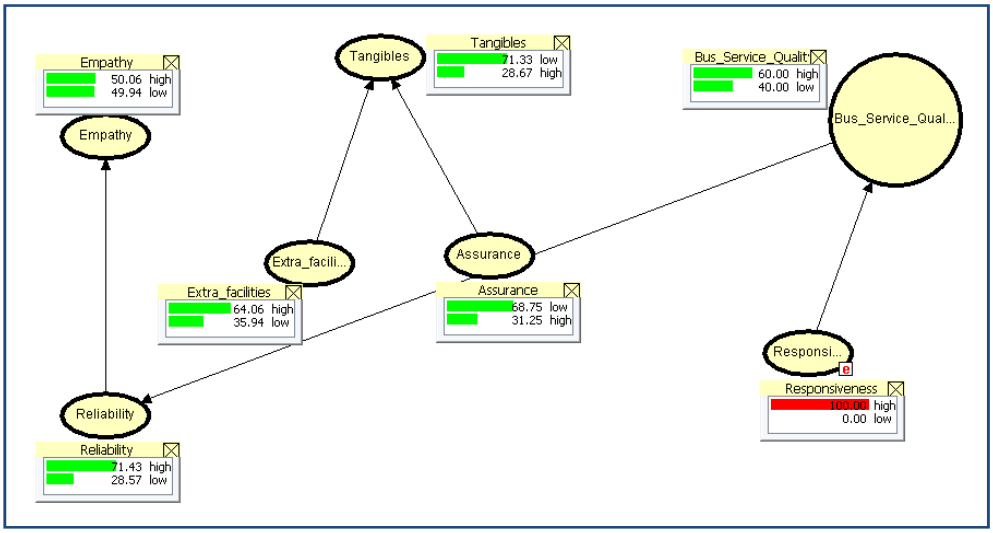

Figure 15: Scenario Analysis 1

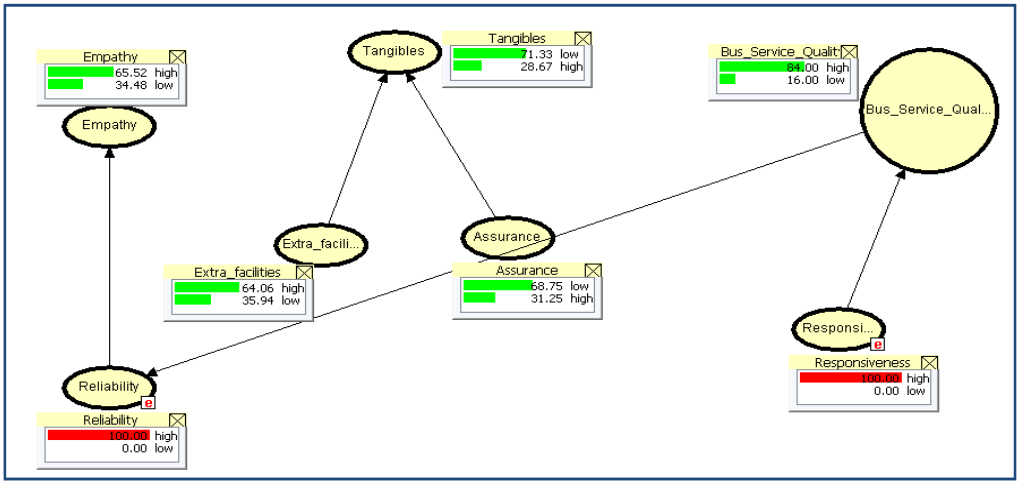

Figure 16: Scenario Analysis 2

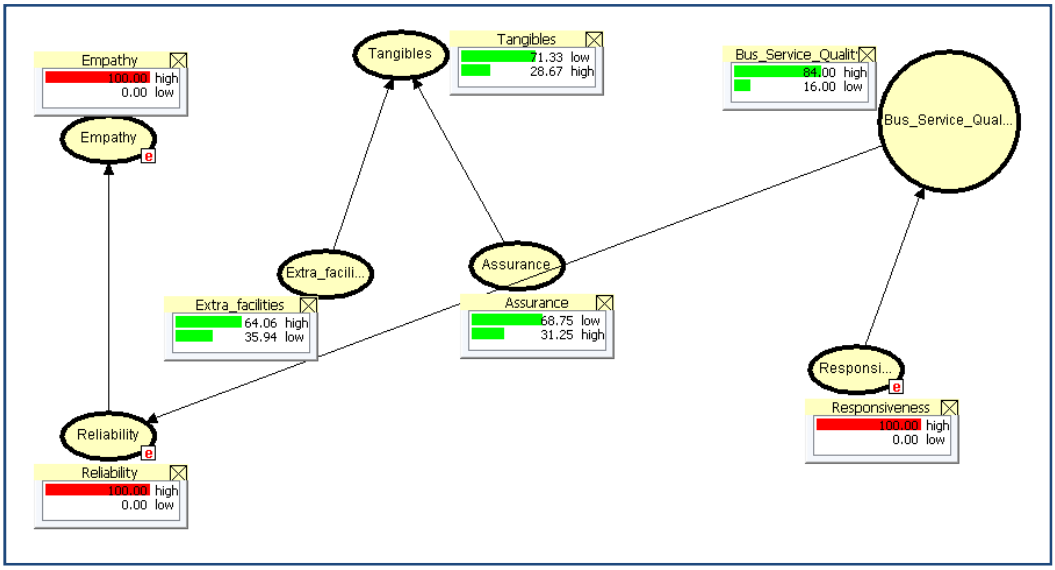

Figure 17: Scenario Analysis 3

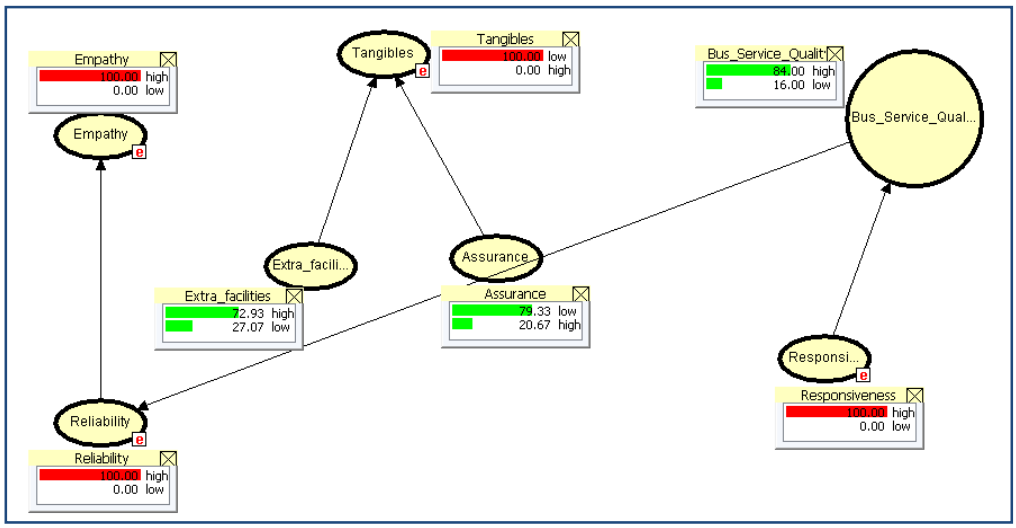

Figure 18: Scenario Analysis 4

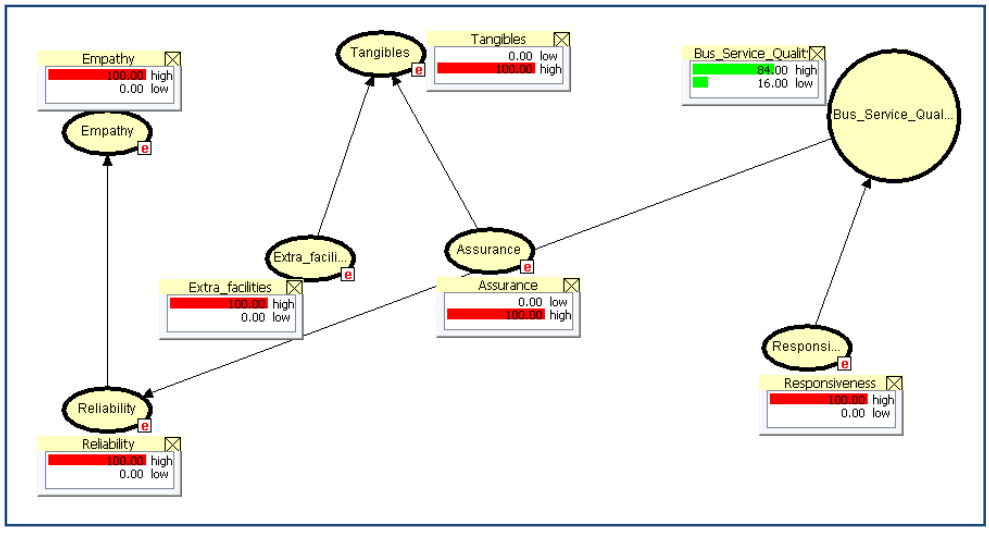

Figure 19: scenario Analysis 5

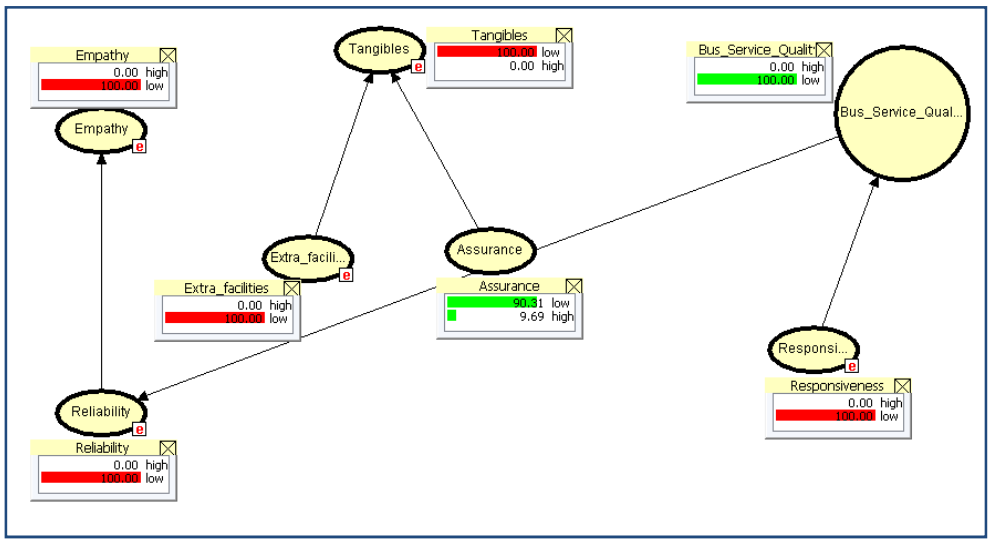

Figure 20: Scenario Analysis 6

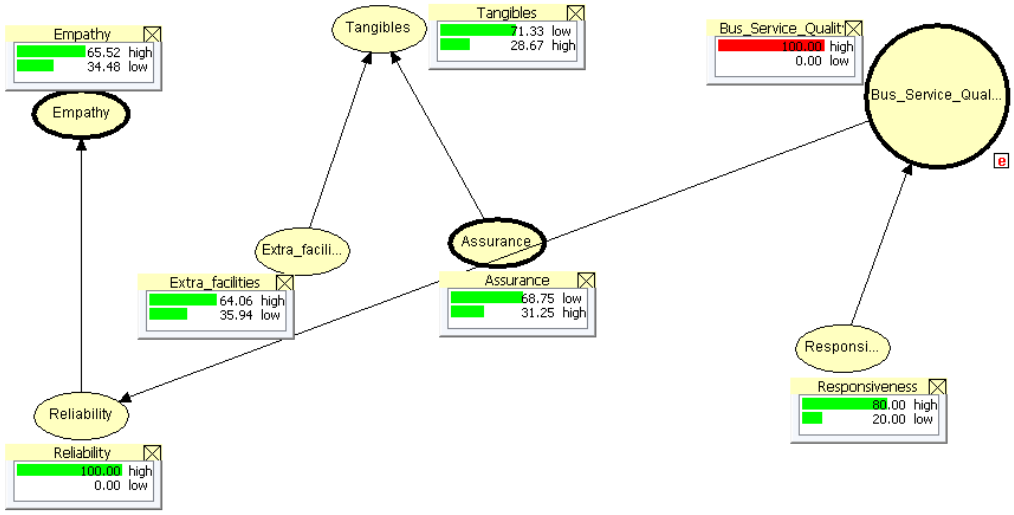

Figure 21: Causal Analysis 1

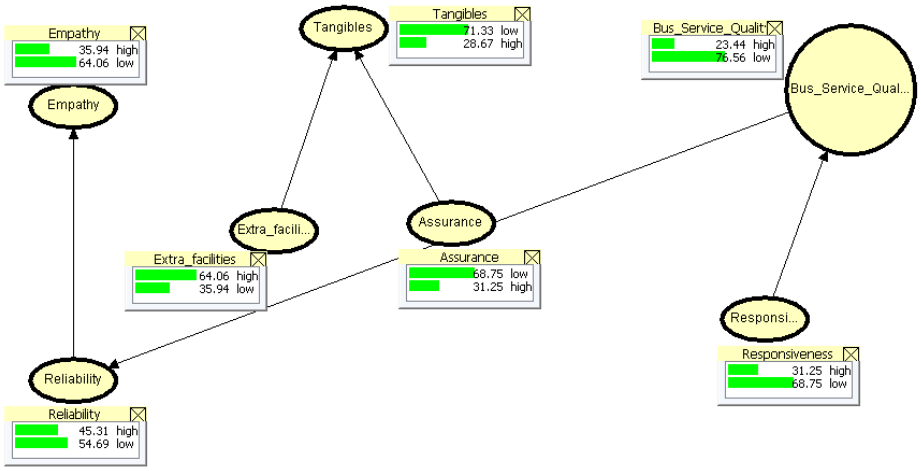

Figure 22: Causal Analysis 2

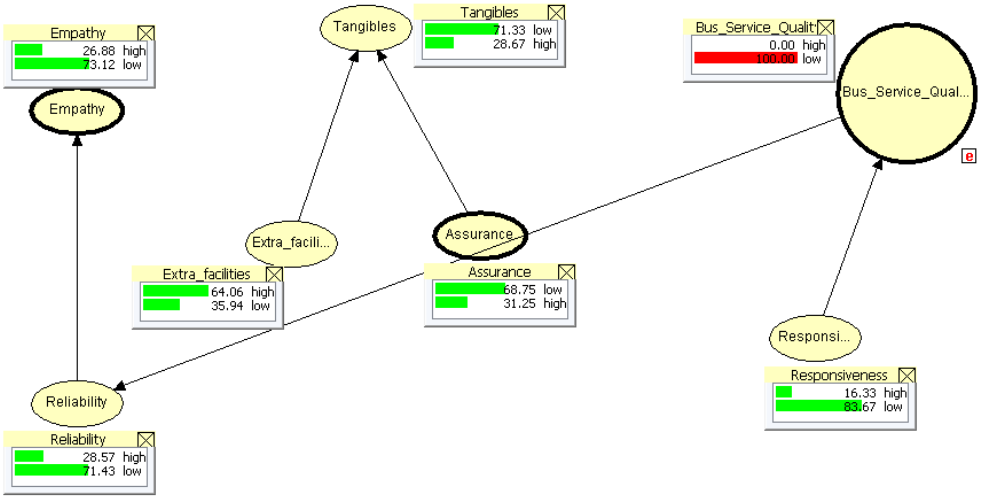

Figure 23

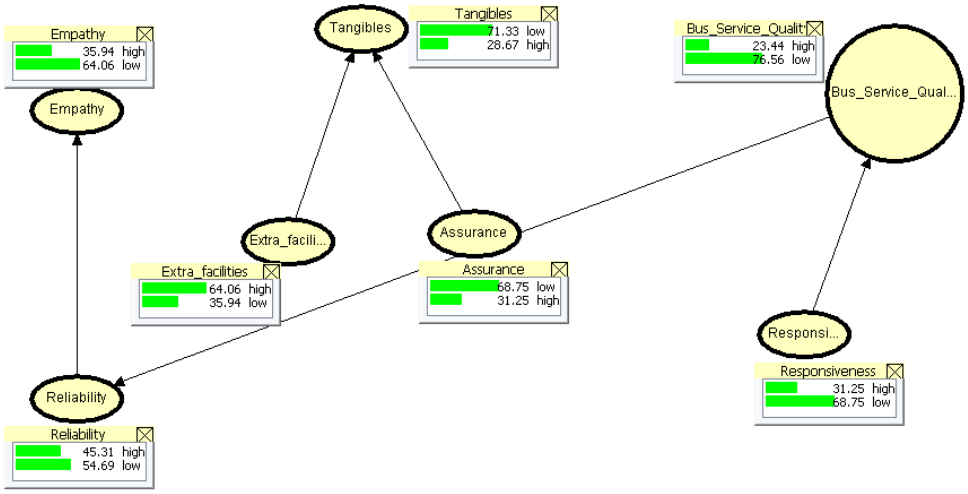

Figure 24

With **Scenario Analysis**, one can calibrate one or more causal or independent factors in the network and analyze its impact on the likely performance estimate. For example, one might be interested in estimating overall bus service quality under different sets of different sets of service quality parameters, (other conditions remaining unchanged).

Under **Causal Analysis,** new evidence of overall bus service quality is used to calculate updated probabilities (also referred to as posterior probabilities) of all the causal/ independent factors. In other words, additional service quality information is propagated to all the nodes in the network. This technique of evidence (new performance data) propagation is extremely useful for analyzing the causes that impact service quality parameters.

The Bayesian process of statistical estimation is one of continuously revising and refining the probable influences of the independent service quality parameters about the state of the outcomes regarding overall bus service quality as more data become available.

So this research lays the foundation of *bus service quality* model for the West Bengal public bus transports; most significant factors and their influencing levels have been identified by principal component analysis and multiple

regression. Bayesian analysis lays down different scenarios are available to them where they can find out how the highest or lowest value of the most significant factors like reliability, *empathy, assurance, tangibles and other facilities affect on* the lowest and highest level of *bus service quality; on the contrary,* a Causal analysis at the end clearly discerns what levels of the significant factors would obtain for the West Bengal public bus transports desired values of service quality. Present study is significant as this kind of model may help all other state transports operating in India to improve their public bus service quality and is useful for their policy implementation in this context.

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