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SOCIO-ECONOMIC STATUS AND TRAVEL BEHAVIOUR OF INTER-CITY BUS PASSENGERS: BANGLADESH PERSPECTIVE

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ABSTRACT: Nobody travels for the sake of transportation, rather it is a derived demand. The travel behaviour of a traveler is governed by a number of factors. The socio-economic condition of a traveler is the key factor among them. The value of travel time plays a major role in traveler's mode choice behaviour and varies significantly with varying socio-economic conditions. A detailed questionnaire survey was carried out to determine the socio-economic status, travel behaviour and value of travel time for inter-city bus passengers traveling from Dhaka, the capital city, towards some major cities of Bangladesh. The findings of the survey clearly indicates that the pattern of travel and the value of travel time for the surveyed passengers depend on the purpose of travel, family size, monthly income, travel expenses, age and gender. The results further show that the average monthly income of inter-city bus passengers (Taka 4573) are much higher than the average monthly income in Bangladesh (Taka 1493) and their average monthly travel expense is about 11% of their average monthly income. Moreover, information collected using stated preference technique in the survey reveals that these passengers valued their travel time savings as 1.4 times higher than their hourly income. Findings of the study are expected to help in developing sustainable inter-city bus services and to maximize passengers' service satisfaction.

KEYWORDS: Inter-city bus passenger, Socio-economic status, Travel behaviour, Value of travel time.

INTRODUCTION

Economic analysis has now established itself as an important factor in making rational decisions on expenditure of public funds. In Bangladesh, due to overall scarcity of resources in conjunction with the presence of competing demands from alternative schemes, planners need to carry out rational economic appraisal of various alternative plans in order to facilitate and formulate the correct investment decision. For economic evaluation of any transport project, the socio-economic analysis of the beneficiaries (for example: passengers, transport operators and owners, freight consignors) should be an integral part, because the socio-economic status of the users directs the share (mode choice) of the users for the sustainability of the project. Moreover, the mode choice of the passengers largely depends on the monetary value attached to their travel time saving. From existing socio-economic status and value of travel time of the desired users, a

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planner can get necessary input information for the successful planning of the transport project.

In this context, furthermore, the time spent in traveling has an opportunity cost, which is a well- known concept in economics (Haney, 1981). Major issues that often arises in the concept of evaluating passenger time saving are minor time saving (CRRI, 1977), manner of treatment for working time and leisure time (Harison, 1977) and relevance of travel time saving in the developing countries (Winfery, 1969; Howe, 1976). The answer probably is that since time saving is a distinct category of benefit it cannot be ignored totally, but should be evaluated very carefully considering the compositions of the persons traveling (ARRB 1973; Stubbs et al., 1980).

A detailed questionnaire survey was conducted to collect the socio-economic status of inter-city bus passengers traveling from Dhaka to other major cities. The values of travel time for different socio-economic groups of these passengers were also estimated using a logit model based on stated preference technique included in the questionnaire survey. This paper presents some major findings of the questionnaire survey and attempts to unveil the influence of these important factors on passengers' choice of travel mode.

THE QUESTIONNAIRE SURVEY

The questionnaire survey (Rahman, 2000) was carried out at all the three major bus terminals in Dhaka city, namely Mohakhali, Gabtoli and Sayedabad. Inter-city buses are planned to operate from these terminals for various destination cities of the country. However, a few roadside private bus stoppages exist at different places, such as Kalabagan, Sukrabad and Asadgate for some inter-city bus services.

The interview sessions of the bus passengers were conducted for twenty days extended over a period of 13 hours from 9 A.M. to 10 P.M. every day. Twelve hired interviewers at a time, who were extensively trained for the purpose before the actual interview took place, performed interviews. A total of 1050 questionnaires were completed during the sessions, which is approximately estimated to be around 1% of the total inter-city bus passengers using these terminals every day. The destination cities covered in the survey are Chittagong, Khulna, Jessore, Barisal, Sylhet, Rajshahi and Rangpur.

The format of the questionnaire was designed based on the available literature and then a pilot survey was conducted to make the questionnaire as realistic as possible to reflect the socio-economic condition of the passengers and nature of inter-city bus services in Bangladesh. The major items included in the questionnaire are:

- Trip and mode choice information: origin, destination, mode, trip distance, travel time, fare, purpose of trip, travel cost bearer, route choice, quality of service, available alternatives, etc.
- Socio-economic information: gender, age, occupation, monthly income, monthly travel expense, working days per week, working hours per day, family size, etc.

- The stated preference approach for alternative trip options: passengers were asked to evaluate the fare they would be willing to pay for changes in the travel situations, such as comfort, travel time, etc. Passengers stated their preferences on the basis of provided information that is under the control of the analyst. Thus it tends to determine passengers' taste in terms of trade-off ratio for time, comfort and fare.

The information contained in the questionnaires were then coded and the coded information were processed and analysed using computer packages. The results, thus developed are presented in the following sections.

SOCIO-ECONOMIC AND TRAVEL CHARACTERISTICS

Among the interviewed inter-city bus passengers the male to female ratio was 4 to 1 representing people from different occupation categories such as service (43%), business (22%), student (17%), and others (18%) including unemployed and housewife. The majority of the passengers were below 45 years of age (96%) and the average age was 34 years.

Average monthly family income of all passengers was determined as Taka 4573. For air-conditioned (28% of all passengers) and non-air-conditioned (72% of all passengers) bus passengers this value was around Taka 6498 and Taka 3826, respectively. Among the passengers a major group (almost 30%) represents the students and unemployed people, who do not have any direct monthly income.

Travel expense, as a percentage of monthly income is a major socio-economic factor that governs the travel characteristics of a traveller. Figure 1 presents this factor for the passengers interviewed. It shows that passengers having travel expense less than 10% of monthly income are in the highest (63%) group. However, the average travel expenses for all the passengers were found to be about 11% of their monthly income.

Majority of the passengers (55%, see Fig. 2) work for more than five working days. This segment of passengers perhaps represents the people employed in the private sectors, where it is not mandatory to follow the five working days system practiced in government offices.

Furthermore, Fig. 3 shows that around 34% of passengers engage themselves in work for eight hours per day, which is the normal labor law in Bangladesh. Beyond this, around 32% are engaged in more than eight hours per day of working time, which may represent the private sector employment including some government employed people working overtime. The remaining 34% have variable working hours per day, which perhaps represents part-time private employment.

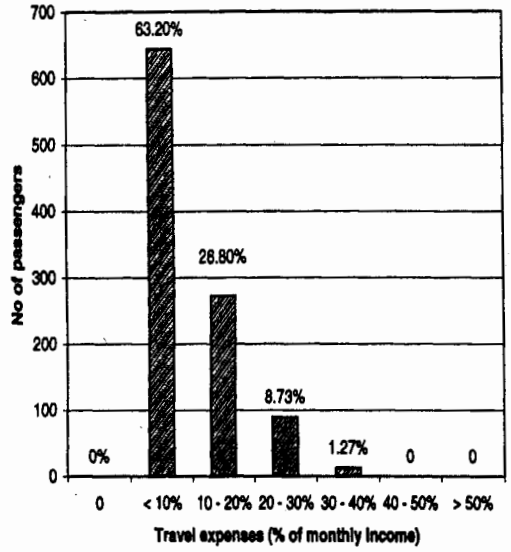

Fig 1. Distribution of Passengers by Travel Expenses

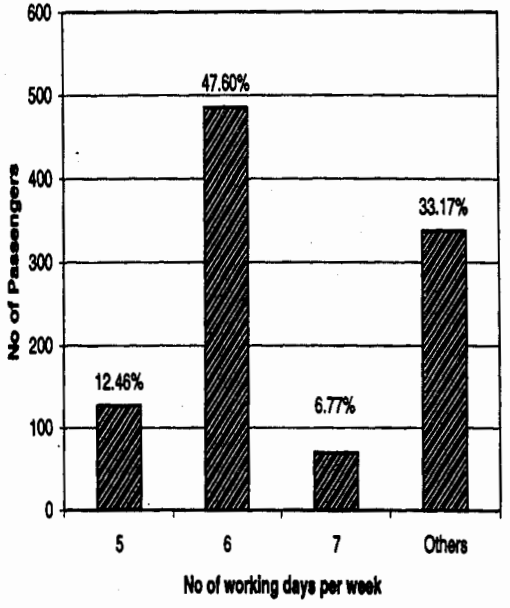

Fig 2. Distribution of Passengers by Working Days

Family sizes against the number of passengers are shown in Fig. 4. It shows that the highest portion of passengers (28%) have five members in their families. Passengers having family members of four and six are in second (22%) and third (19%) positions, respectively. This pattern again represents that the majority of the passengers belong to the middle economic class of the society. According to demographic patterns of the people of Bangladesh, despite rigorous population control campaign and incentives, middle economic class people are always inclined to take more than two children.

Purpose of trip is the key representative attribute of travel characteristics. Fig. 5 shows that among the inter-city bus passengers interviewed, around 40% travelled for social purpose, around 30% travelled for work purpose, 22% for recreation purpose, 3% for medical purpose and the remaining passengers travelled for different other purposes. Further analysis revealed that most of these passengers travelled with self-expense (90%) and only in 10% cases passenger's employer bore the expense.

Regarding the choice of route, it was observed that the majority (40%) of the passengers chose the current route, because fare is less as compared to other modes of travel. Some passengers chose the current route because they believed this requires less time (27%) and is more comfortable (19%). The remaining of the passengers (13%) chose the current route, because there were no other alternatives. Moreover, 7% passengers rated the bus service as very good, 76% as good, 15% as poor and remaining 2% rated the service as very poor.

VALUE OF TRAVEL TIME

For deriving behavioral values of different travel attributes by analysing the stated preference data, the choice proportion of passengers for an alternative is represented by a logit model (Ben-Akiva and Lerman, 1985) of the following type:

$$P_r(i) = \frac{\exp(\mu V_i)}{\sum_{k=1}^{m} \exp(\mu V_k)}$$

where, i = selected alternative
m = number of alternatives available
μ = scale parameter
= 1 (this assumption does not change the relative importance of the parameters of the utility function)
V_i = the indirect utility function for alternative i
$= pc_i + qt_i + r_{ac}AC$
where, c_i = fare of alternative i, excess cost
t_i = time of travel for alternative i, excess time
AC = dummy variable for existence of air-conditioning
= 1, if air-conditioning facility exits, otherwise it is 0
p,q,r = scale parameters

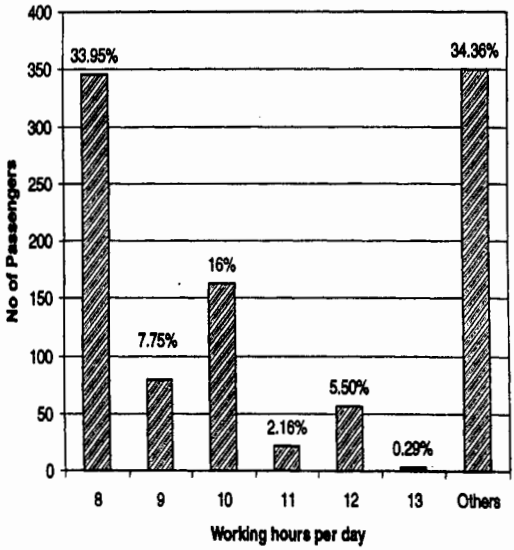

Fig 3. Distribution of Passengers by Working Hours

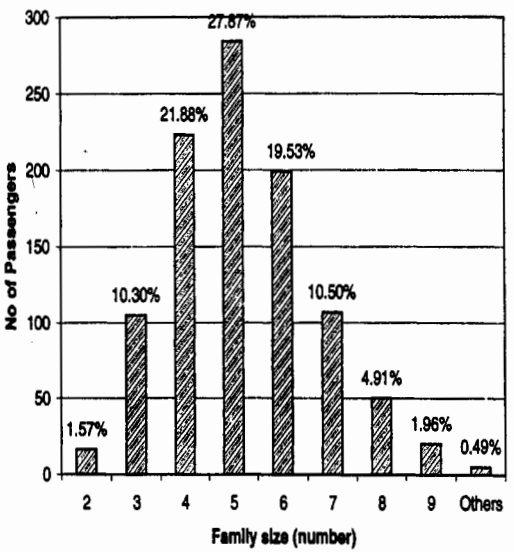

Fig 4. Distribution of Passengers by Family Size

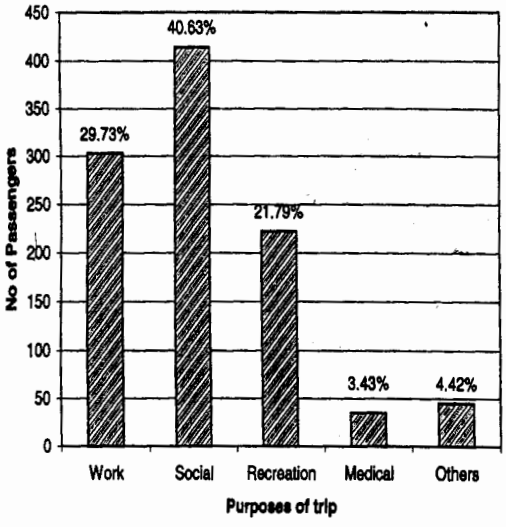

Fig 5.

Distribution of Passengers by Purpose of Trip

The values of the parameters of the utility function were calibrated using the Maximum Likelihood Method. From these calibrated parameters the value of travel time (VOT) of inter-city bus passengers and other attributes, such as behavioural value of introducing air-conditioning (V_{AC}) can be estimated as follows:

$$VOT = \frac{q}{p} \qquad \text{and } V_{AC} = \frac{r_{ac}}{p}$$

Initially, the logit model was calibrated with all the data pooled together. Using the estimated parameters, the average value of travel time for all the interviewed passengers was determined as Taka 54 per hour and the average value of introducing air-conditioning in the bus was determined as Taka 76 per trip. Related statistics are shown in Table 1.

The market segmentation approach (Ortuzar and Williumsen, 1990) was then used by categorizing the whole sample population interviewed among various groups depending on socio-economic variables. For individual socio-economic group the logit model was calibrated to determine the behavioural values of different travel attributes. Values of travel time for different socio-economic groups are presented in Table 2 (for statistics please see Rahman, 2000).

Table 2 shows that for total male passengers including air-conditioned and non-air-conditioned buses, the value of travel time is Taka 54 per hour and for female passengers this value is Taka 53 per hour. So in Bangladesh the values of travel time for both male and female inter-city bus passengers seem to be equal. But, when existence

of air-conditioning is considered, male passengers are willing to pay more fare per trip than female passengers. The behavioural value of introducing air-conditioning in the bus was found to be Taka 86 per trip for male passengers and Taka 48 per trip for female passengers.

Results also reveal that the value of travel time depends significantly on various factors, such as occupation, income group, age, trip purpose, existence of air-conditioning, etc. One interesting finding was that when passengers pay fare by themselves, the value of travel time is Taka 49 per hour. But, when their employers pay the fare, passengers put more weightage on comfort and as a result, estimates reflect much higher values of travel time.

Furthermore, analysis on sample segments considering destination cities indicates that value of travel time varies significantly for different destination cities. Table 3 shows that passengers travelling to and from Jessore have the highest value of travel time (Taka 69), whereas passengers to and from Barisal have the minimum value of travel time (Taka 19). Such variations in value of travel time may reflect the socio-economic status of the people of that region.

Table 1. Calibrated Parameters and Behavioural Values

Variable	**Estimated Coefficients**	**t -statistics**
Fare (c)	- 0.007243	- 4.94029
Time (t)	- 0.38825	- 5.93011
Air - conditioning	- 0.55384	- 3.43024
Number of observer	6114	
L(0) L(β') Percent Correctly Predicted	-4237.90186 - 3850.95448 62.41	
Likelihood Ratio Statistics (ρ^2) Likelihood Index [-2{L(0) - L(β') }]	0.091 773.90	

Travel Attributes	**Behavioural Value**	**95% level of Confidence**	
		Upper limit	**Lower limit**
Average Value of Travel Time (Taka / hour)	53.6	65.16	46.62
Average Value of Introducing Air-conditioning in the Bus (Taka/trip)	76.46		

Table 2. Value of Travel Time for different Socio-Economic Groups

Sample Segment	Value of Travel Time (Taka / hour)
Sex: Male	53.76
Female	53.11
Occupation: Service	64.32
Student	19.12
Others	34.98
Income: Less than 2000	15.40
2000-4000	31.17
4001-6000	59.08
6001-9000	174.82
Reason for choosing route: Less Cost	30.59
Age: Less than 20	28.35
20-40	65.74
More than 40	80.54
Income and Age: 4001-6000 & 21-30	97.79
4001-6000 & 31-40	46.32
4001-6000 & > 40	44.94
Income and Occupation:	
4001-6000 & Service	58.45
4001-6000 & Business	35.45
Fare Paid by: Self	49.17
Trip Purpose:	
Social	42.54
Recreation, Medical & others	27.04
Travel Expense:	
Less than 10% of income	28.37
Type of Bus Passengers:	
Non-air-conditioned	30.10

Table 3. Value of Travel Time for Different Destination Cities

Destination Cities	Value of Travel Time (Taka / hour)	Upper Limit (Taka / hour)	Lower Limit (Taka / hour)
Jessore	68.92	93.55	58.68
Khulna	66.52	85.18	59.52
Rajshahi	44.04	87.53	38.61
Rangpur	38.08	39.17	36.85
Chittagong	46.07	53.93	41.03
Sylhet	30.20	36.37	26.32
Barisal	19.11	32.33	21.71

CONCLUSIONS

Consideration of users' socio-economic conditions and travel behaviour is vital in planning inter-city passenger transport services to make it effective and sustainable. This paper attempted to determine quantitative relationships between users' socio-economic conditions and their travel behaviour.

It was revealed that the choice proportion of alternative mode of transport and the values of travel time for inter-city bus passengers depends on various socio-economic and transport service factors, such as age, occupation, household size, income level, travel expenses, gender, etc. It was also found that in stated preference method, respondents over rate their choice preference and understate their actual income level. The issue is further compounded by the fact that in developing countries there exist many sources of shadow income, which causes economic and financial income to differ substantially. Market segmentation approach is preferred for this situation.

REFERENCES

ARRB (Australian Road Research Board) (1973), "Road Users Cost Manual", Special Report No. 9, Melbourne.

Ben-Akiva,M., Lerman,S.R. (1985), "Discrete Choice Analysis Theory and Application to Travel Demand", MIT Press, USA.

CRRI (Central Road Research Institute) (1977), "Road User Cost Study in India", Inception Report, New Delhi.

Haney,D.G. (1981), "Use of Two Concepts of the Value of Time", Highway Research Record No.12, Highway Research Board, Washington.

Harison,A.J. (1977), "The Economics of Transport Appraisal ", Croom Helms Paperback.

Howe,J.D.G.F. (1976), "Valuing Time Saving in Developing Countries", Journal of Transportation Economics and Policy, Vol. X-2.

Ortuzar,J.D. and Williumsen,L.G. (1990), "Modelling Transport" John Willey and Sons Ltd., England.

Rahman,M.M. (2000), "Socio-Economic Status, Travel behaviour and Value of Travel Time for Inter-City Bus Passengers in Bangladesh." M.Sc Engg, Thesis, Department of Civil Engineering, BUET, Dhaka.

Stubbs,P.C., Tyson,W.J. and Dalvi,M.Q. (1980), "Transport Economics", London, UK.

Winfery,R. (1969), "Economic Analysis for Highways", International Textbook Company, Scranton.