



THE INFLUENCE OF COMMUTERS SOCIO-ECONOMIC CHARACTERISTICS ON BUS SERVICE AFFORDABILITY AND USAGE IN KADUNA METROPOLIS, NIGERIA

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Abstract:

This study examines the influence of socio-economic characteristics of commuters on their level of bus accessibility and usage in Kaduna metropolis, Nigeria. Structured questionnaires and past literature were used as sources of data. This study used systematic random sampling to select eight major bus terminals from which 324 bus commuters were purposively selected for interview. Correlation and multiple regression models were used to analyze the data collected. The study revealed that trip frequency is positively correlated to the income of commuters with value (0.324)). This implies that as commuters' income increases so also is their bus service accessibility increases. Trip frequency is also found to be negatively correlated to gender with value of (-0.190) which implies that women travel less frequently than men and they also travel shorter distances than men. The study further reveals that women rely more on bus services than men. The regression model also shows that marital status and monthly income are found to be positively significant with P-value of (0.001) and (0.000) at 5% significant level respectively. The study therefore recommends that a public transportation system that is responsive to meet gender differentials in transport needs of commuters should be introduced in Kaduna City.

Keywords: Bus Service; Public Transport; Affordability; Trips; Accessibility; Commuters.

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1. Introduction

Transport is the life wire of urban life. It is one of the factors which determine the form and pattern of socio-economic development of a city. Mobility and accessibility provided by the transport system have been playing a major role in shaping countries, influencing the location of social and economic activity as well as the form and size of cities. Transport also facilitates trade, permitting access to people and resources, and enables greater economies of scale, worldwide (Zuidgeest, 2005). Public transport is a collection of modes of transport which are available to the public

irrespective of ownership (White, 2002). It include road-based modes like conventional buses, Para-transit vehicles, human and animal powered vehicles, cycles and walking; rail-based models like heavy rail system, light rail transit, street tramway; and rapid transit systems (Iles, 2005). The main function of the public transport system differs depending on its operating area. In sparsely populated areas, the purpose is to supply the basic transportation needs, while it in larger cities is to decrease traffic congestion and to improve the environment. On a regional scale the purpose is to create opportunities for education and increase the job market (Hydén et al., 2008).

Although the primary objectives may be different, there is an increasing demand for improvement of the performance of public transport both in developing and developed countries. In the developed world, the primary objective of improving the performance of this system is to shift modal share away from private car to reduce the negative side effects of transportation on quality of life as proposed by actors such as European Commission (Geerlings et al 2006). In developing countries however, the primary importance of public transport is to move large numbers of people with considerable flexibility in order to meet mobility demand, particularly access for employment throughout the city (Armstrong – Wright et al 1987). However, existing public transport capacities in developing countries do not satisfy the demand for a number of reasons: the quality of travel on public transport is poor; roads are badly maintained and managed; and cost of travel is high for the poor, making it difficult to access the public transport as often as possible (Armstrong – Wright et al 1987). Public transport in developing countries is characterized with so many problems. The problems include long and chaotic queues at bus stops, badly maintained old rickety vehicles and poor attention to passenger comfort (Vasconcellos, 2001). In addition, other problems are inefficient operations, unreliability of service, poor safety; poor enforcement of rules and regulations guiding public transport operations (Oluwole and Ojekunle 2016).

The dominant mode of public transport in developing countries is road based transport using conventional passengers buses with capacity ranging from 10-50 seaters. It has wider social and environmental benefits. It is the only affordable to the urban poor (Armstrong – Wright et al 1987). It is most flexible as it satisfies short and long distance mobility demands. It needs less investment on infrastructure, feasible economically to all groups and environmentally friendly system. However, the demand for this service particularly during peak hours is beyond its capacity and the quality of service is poor. Moreover, the general prevailing traffic congestion and inadequate street network constrain the level of service (Oluwole and Ojekunle 2016).

Measuring the effectiveness of public bus transportation performance is critical in assessing policy goals as well as planning for the future improvement (Murray et al 1998). Access and accessibility can be used to measure the performance of public transport system. Access is the opportunity to use system based on proximity and cost. Geur et al (2001) define accessibility of transport system as the extent to which the system facilitates people's participation in activities. Mobility, proximity and connectivity have been incorporated in accessibility by arguing that it is a function of land use configuration (which gives the idea of proximity), transportation networks and services (issue of connectivity between activities), and system performance, or quality of movement (notion of mobility). Access and accessibility of public transport therefore, improves accessibility of other basic services.

Accessibility involves aspects related to frequency of service, travel time and reliability. It also includes the adequate provision for passengers with special needs due to different kinds of

disabilities. Convenience involves comfort aspects on board the vehicle as well as at the bus stop, possibilities to change transport means and the road standard to and from the bus stop. The keyword for safety includes traffic safety but also safety concerning violence and abuse on board and when waiting at the bus stop. The most important factors in public transport are travel time, accessibility, reliability, comfort, security, price and information (Berge & Amundsen, 2001).

Public transport particularly bus service in Kaduna metropolis is associated with long distance walking from residences to bus stops and from bus stops to final destinations. In newly built-up areas of the city, where there is inadequate good road network the use of personal cars and walking is more prevalent. The city does not have separate bus lane, so it has to compete for space with other traffic in the busy and narrow road network. The distance between bus stops is longer which makes the travel time longer and the system less flexible. It also takes longer time in loading and unloading passengers at stops. Due to congested traffic on one hand and poor performance of the operators on the other hand the headway is long, hence people wait longer than necessary at the stops. The current chaotic situation of public transport system in Kaduna requires that we have adequate knowledge of the segment of the urban population that mostly depend on the use of the public transport particularly the bus service. The understanding will help transport policy makers and city transport planners to identify the area of need and how to meet it.

It is on this note, that this study tries provide this critical information for transport policy formulation and planning by trying to investigate the influence of socio-economic characteristic of commuters on their access to bus service in Kaduna Metropolis. In other words, this study therefore attempts to assess the level of bus service affordability among commuters and how their socio-economic characteristics influence their demand for bus service in the City.

1.1. Conceptual Issues and Literature Review

In the past few decades of research regarding accessibility, four main types of measures have emerged. Each type of measure highlights different ways to characterize the interaction between the transportation system and land use as well as a range of complexity.

1) Spatial Separation

This is the simplest form of an accessibility measure and it represents spatial separation in terms of distance or travel time between the origin and the destination. This form of measure does not account for the attraction level (e.g. land use intensity) at the destination end, nor does it reflect the sensitivity and needs of users with different characteristics.

2) Cumulative Opportunities

This is another simple accessibility measure that takes account of both distance and the objective of a trip. It defines a travel time or distance threshold and uses the number of potential activities within that threshold as the accessibility for that spatial unit. The only information needed for this measure is the location of all the destinations (e.g., jobs or hospitals) within the desired threshold. An argument for this method is that it bypasses the zonal aggregation problem of other methods (Wachs and Kumagi 1973, Hanson and Schwab 1987). Because attractions are counted individually, there is no loss of information due to averaging. The main criticism of this measure

is that there is no behavioral dimension, and near and far opportunities are treated equally (Voges and Naudé 1983).

3) Gravity Based Measure

Are derived from the denominator of the gravity model used to predict trip distribution; these measures weight the amount of the activity at different destinations by the cost, time, or distance to get there. Several researchers criticize the ability of gravity-based accessibility measures to accurately reflect accessibility. Many measures assign the same level of accessibility to all individuals in a zone; however, this does not reflect the possibility that two people in the same place may face different levels of accessibility. (Ben-Akiva and Lerman 1979, Handy and Niemeier 1997). A final criticism is that the general form of the gravity model implies a trade-off between attraction and distance. One unit of attraction is equal to one unit of distance (Whitbread as quoted in Morris et al. 1979).

4) Utility Measures

This type of measure is based on an individual's perceived utility for different travel choices. One criticism of the utility approach to measuring accessibility is that not all options are available to all individuals, and there are no natural constraints for the choice set (Ben-Akiva and Lerman 1979). Similarly, researchers need to be aware of including irrelevant alternatives in the choice set and the consequences thereof, such as decreasing the probability of viable choices (Ben-Akiva and Lerman 1979). And, an accessibility measure based on utility will only reflect observed behavior and not reflect the benefit of increased choices (Morris et al. 1979).

In the last few years, researchers showed great interest in customer satisfaction and accessibility measurements. The aspects generally describing transit services can be distinguished into characteristics that more properly describe the service (e.g. frequency of runs) and characteristics depending more on customer tastes and less easily measurable (e.g. comfort). Starting from the various studies regarding accessibility determinants in public transportation the aspects mainly characterizing bus services are: service availability, services reliability, comfort, cleanliness, safety and security, fare, information, customer care and environmental impacts. Each of these aspects can be measured in many ways by considering different indicators.

5) Service Availability

The attributes belonging to these categories of service aspects are represented by characteristics of the route of the bus line in terms of path and coverage, number of bus stops, distance between bus stops, location of bus stops, and characteristics of the service, like frequency, span of service, travel time, need for transfer. Eboli and Mazzulla (2011) evaluated the indicator regarding line path on the basis of the travel speed of the runs observed during a survey period. Also, in Friman and Felleson (2009) travel speed is introduced as indicator of the line path, the author highlight that in public transport travel speed corresponds to the perceived travel time. Nathanail (2008) introduces an indicator of the itinerary accuracy calculated as the average delay estimated for the considered network, weighted out by the number of offered seats, passenger occupancy, and itinerary length.

Another indicator regarding route characteristics refers to the stop spacing, or the distance between adjoining service stops of a path. Eboli and Mazzulla (2011) suggest as indicator of the bus stop

location the walking distance (or time) from home to the access bus stop. In fact, the time spent in walking for reaching the bus stop defines the level of accessibility to the transit services. Therefore, a transit stop must be located within walking distance, and the pedestrian environmental in the area should not discourage walking (Transportation Research Board, 2003a).

Among service characteristics, service frequency is the most distinctive aspect. Service frequency measures how often transit service is provided. It is an important factor in commuter's decision to use transit; in fact, the more frequent the service, the shorter the waiting time when the bus is missed, and the greater the flexibility that customers have in selecting travel times (Transportation Research Board, 2003a). Tyrinopoulos and Antoniou (2008) found that service frequency is the most important attribute across transit operators.

Service reliability is one of the most investigated transit service aspects and it is considered as a very important aspect for transit users. Turnquist and Blume (1980) define transit reliability as the ability of the transit system to adhere to schedule or maintain regular headways and a consistent travel time. Strathman et al, (1999) and kimpel (2001) agree that reliability is mostly related to schedule adherence, as well as Beirao and Sarsfield-Cabral (2007), who state that the lack of control due to the uncertainty of the vehicle arrival makes the service unreliable. Unreliable service results in additional travel and waiting time for passengers (Wilson et al, 1992; Strathman et al, 2003). As a consequence, service unreliability can lead to loss of passengers, while improvements in reliability can lead to attraction of more passengers (EJ- Geneidy et al, 2007).

Comfort during the journey is important for transit user, both the physical comfort regarding vehicles and comfort regarding ambient conditions on board or at stops. Comfort on board means having soft and clean seats, comfortable temperature, not many people on board, smoothness of the bus ride, low levels of noise and vibrations, not nasty odors. Some researchers have argued that the term amenities implies something extra and not necessary required (Transportation Research Board, 2003a). Iseki and Taylor (2008) found that stop and station area amenities were ranked as the least important by the users; however, these elements provided at bus stops or stations enhance also convenience and security. The indicator most frequently used for evaluating comfort during the journey is linked to the degree of crowding on bus.

The indicators regarding cleanliness refers to the physical condition of vehicles and facilities, and specifically the cleanliness of the bus interior and exterior, having buses and shelters clean of graffiti, cleanliness of seating and windows, and so on. Clean buses tend to promote a good public image and help to attract and maintain ridership (Transportation Research Board, 1995b).

The transport safety indicates the degree of safety from crime or accidents. Generally, the term safety is used to indicate the possibility of being involved in a road accident, while the term security refers to the possibility of becoming the victim of a crime. Safety during a journey may be considered as not very relevant aspect in the modal choice decision; in fact, the probability of being involved in accident or becoming the victim of a crime is not explicitly considered as a part of the choice mechanism. However, when explicitly queried about the importance of safety, this factor is given an extremely high rating of importance (Solomon et al, 1968). These findings are confirmed by Iseki and Taylor (2008) in their study about safety and security at stops, and Eboli and Mazzulla (2010) who explicitly investigated safety and security on board.

The word 'fare' connotes the reward usually payable to transport operator/carrier for the carriage of goods and people (Ndikcom 2008). Fare is the money paid by passengers as a partial or full contribution to the operational cost of the transport system. It could be partial where government is involved in subsidizing part of the cost of the operation. Where there is no subsidy, the end users of the transport borne the total cost of the transport operation as well as profit margin of the operators. Fare structure therefore is the system set up to determine how much is to be paid by various passengers of a transit vehicle at any given time (Wikipedia the free Encyclopedia, 2013)..

It has been also observed that public transport fare is central to solving the problem of public transport affordability (Slobodan and Rubin, 2005). Since the public transport fare is major determinant of transport affordability index; research efforts should therefore be intensified in the area of fare structure determination and collection methods. This is necessary because the more affordable is the public transport fare the less is the percentage of household expenditure on transport. Apart from the effects of fare on the level of patronage, the multiplying effects are quite numerous. Its effects may be seen in the rate of urban travel, access to job and other social and economic services as well as on the level of poverty. Provision of affordable transport service could therefore go a long way to help in reducing poverty level in cities.

Another factor affecting transit service accessibility is linked to the availability of information pertinent to the planning and execution of a journey. Passengers need to know how to use transit service, where the access is located, where to get off in the proximity of their destination, whether any transfers are required, and when transit services are scheduled to depart and arrive. Without this information, potential passengers will not be able to use transit service (Transportation Research Board, 2003a). Beirao and Sarsfield-Cabral (2007) found that several respondents think that the bus system is difficult to use and information is difficult to obtain; among bus users, the main problem occurs when bus companies change timetables or routes and do not provide enough information to users.

1.2. Study Area

Kaduna Metropolis is located between Latitude 10°25' 15" and 10° 36' 08" and longitude 7° 23' 3" and 7° 29' 3". The metropolis is the capital of Kaduna state and fourth largest city in the country. It is also one of the most populous Millennium cities and serves as the important trade and transportation center in northern Nigeria. The Metropolis is made up of two main local governments areas; Kaduna north with population of 364,575 and Kaduna south with population of 402,390 respectively (National Population Commission, 2009). It shares common boundaries with Igabi local government area to the northwest and northeast, Chikun Local government area to the southeast. Figure 1 shows the built-up area, the bus routes and various bus stops along the bus routes in Kaduna Metropolis.

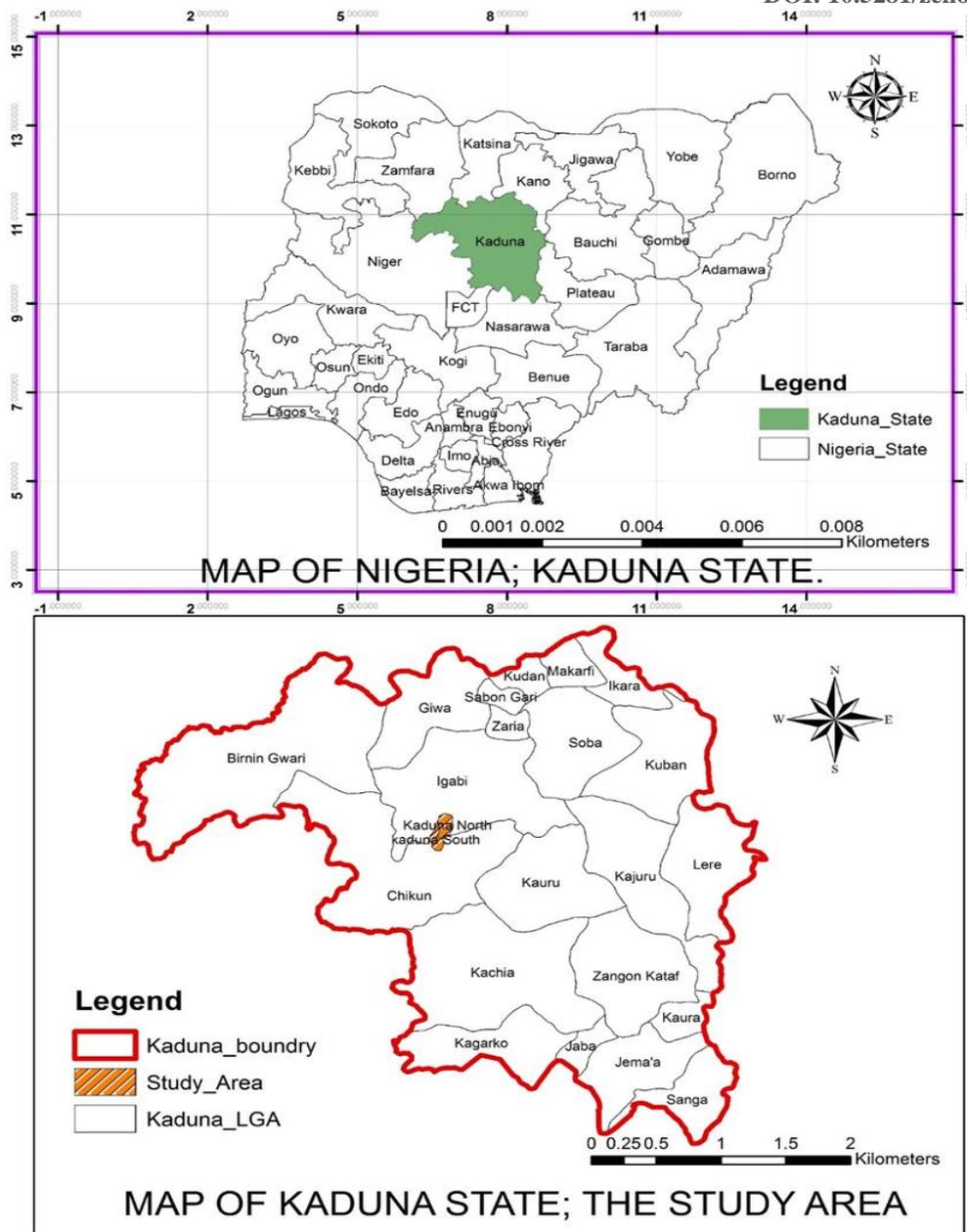


Figure 1: showing maps of Nigeria and the Study Area

2. Materials and Methods

A reconnaissance survey was carried out, during which commercial bus routes and passengers were identified. The purpose was to get the researcher familiarized with the environment in order to have a general overview of the study area. Other activities that were carried out during the preliminary field survey include physical inspections and observations that helped in gaining an insight into the problems under investigation and determining the appropriate methodology to be adopted for the study. After, the reconnaissance survey, the researchers collected primary data through the use of questionnaire. A questionnaire was designed to contain the following items of

question on travel characteristics of passengers such as travel times, travel purpose, waiting times, safety of services, affordability modal travel available, travel cost, proximity of bus stops to residences, and alternative modes.

For questionnaire administration, various sampling techniques were adopted. In selecting the sample bus stops, systematic random sampling technique of one out of 4 bus stops along the bus routes was selected which makes a total of 8 bus stops. However, for administering the questionnaires on commuters, purposive random sampling was used. Purposive sampling technique was preferred in this work because it enabled the researchers to choose respondents who were directly affected by accessibility problems and who are willing to respond appropriately and quickly to the questionnaire. In each selected bus stop, commuters were interviewed while waiting for the next available bus to be boarded. Information on socio-economic characteristics, affordability, bus stops characteristics, seat comfortability, journey time, safety measures, problems encountered by the bus users were obtained from the commuters. The interview was conducted for a period of one week, (Monday- Sunday) along the identified bus routes. The data were collected for morning peak period (6am-10am), afternoon off peak period (12pm-2pm) and evening peak hours (4pm-6pm). Figure 2 Map of Kaduna City showing the bus routes and selected bus stops. At the end of the survey, a total of 340 questionnaires were administered, but after removing the defectives ones only 324 were used for analysis.

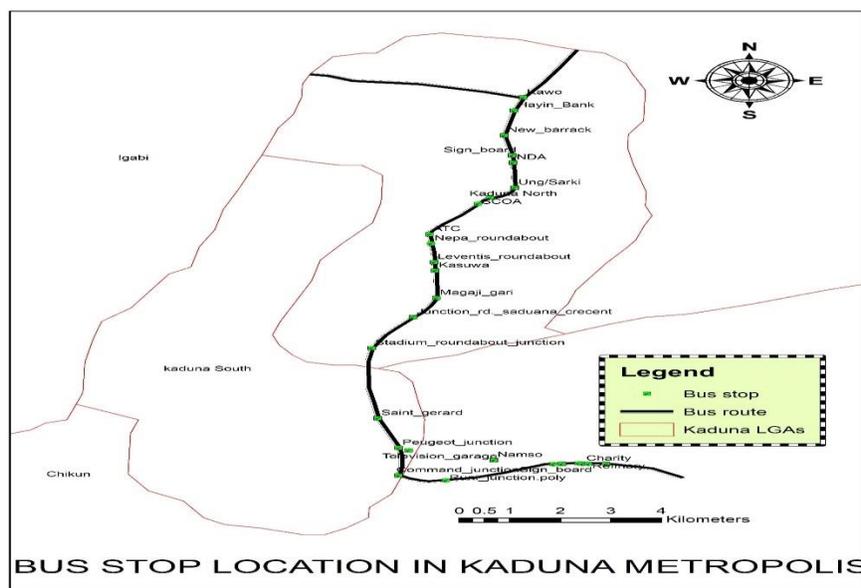


Figure 2: Map of Kaduna City showing the bus routes and selected bus stops

3. Result and Discussions

Transportation non-affordability is a significant economic and social problem. It constrains people's economic opportunities and forces households to spend an excessive portion of their budgets on transport. It also limits their ability to purchase other essential goods. This section

assess the bus service affordability among the passengers in Kaduna metropolis regardless of their income class which help them achieve social equity objectives and increase productivity as well as afford them access to basic services and activities, such as medical care, basic shopping, education and work. The assessment of bus affordability was analyzed with percentage and T-test respectively.

3.1. Passengers Level of Bus Service Affordability

A threshold level of transport affordability has been defined as the lower-income household's ability to spend less than 20% of their budgets on transport expenses, and less than 45% on combined transport and housing expenditures (CTOD and CNT 2006). Different income groups and their monthly transport cost are analyzed in Table 1.

Table 1: Comparison of Income Groups and Affordability Level

Average monthly income	Average trip made per week	Average daily transport cost	Monthly transport cost	% of transport cost
N18000	5	N100	N3000	16.67
N34500	9	N120	N3600	10.43
N75000	10	N125	N3690	4.9
N125000	10	N175	N5250	4.2
N150000	11	N125	N3700	2.5

Source: Field Survey, 2015

Table 1 reveals that bus service affordability is high in Kaduna metropolis. The low income class of N18, 000 and N150, 000 spent 16.67% and 2.5% of their income on transport expense. It can be concluded that bus fare is affordable because none of the income group spend above 20% of their monthly income transportation in the study area. The implication of this is that bus service in Kaduna metropolis is affordable, which helps to increase economic productivity. The low transportation cost has also encouraged people in attending schools, and increase mobility of city dwellers.

Table 2: The Paired Samples Correlations

Paired samples	N	Correlation	Sig.
Average cost-average income	324	0.943	0.000

Source: T-test Out-put, May 2016

The paired sample correlation in Table 2 indicates the direction of the relationship with absolute value indicating the strength. The larger the value the stronger is the relationship. The correlation of 0.943 on Table 2 indicates a strong relationship between average monthly income of passengers and average cost of transport as measure of bus service affordability in Kaduna metropolis. The relationship is statistically significant at 5% with P-value of 0.000.

Table 3: The Paired Samples T-Test

Pair Samples		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Average cost Average income	-.056	.329	.018	.020	0.092	3.038	323	0.003

Source: T-test Out-put

Table 3 shows the paired sample of the variables with average monthly income of passengers and average cost of transport a t-test value of 3.038 and is significant at 0. 003 at 0.05 level of significance In other words, this shows that there is a significant difference in the level of bus service affordability among passengers of different income groups in the Kaduna metropolis.

3.1.1. Socio-economic Characteristics of Commuters on the Level of Bus Service Usage

This section attempts to estimate the influence of socio-economic characteristics of commuters on the level of bus service usage in Kaduna metropolis using multiple regression models. The multiple regression models have been used severally in the literature to estimate degree of fitness and also forecast and determine the relationship between dependent variable and a number of independent variables. It can therefore be conceptualized that there is a set of variables $x_1, x_2, x_3, \dots, x_n$ which can be used to explain the influence of socio-economic characteristics of commuters on the level of bus service usage in Kaduna metropolis.

This can be expressed mathematically as

$$Y = f(x_1, x_2, x_2, x_n). \text{----- eqn 1}$$

As a result, equation can be written using multiple regression equation thus;

$$Y = a + b_1x_1 + b_2x_2 + \dots + b_nx_n + c. \text{----- eqn 2}$$

Where the Y is dependent variable

a = constant

$b_1, b_2, b_3, \dots, b_n$ = intercept

x_1, x_2, x_2, x_n = independent variables

c = error term.

In this study, the dependent variable (Y) is the weekly trip frequency of bus services on Ahmadu Bello Way route denoted as (TF). The following have been identified as independent variables;

X_1 = the gender comprises of male and female denoted by (G)

X_2 = marital status denoted as (MS)

X_3 = Age (in years) denoted as (AG)

X_4 = Occupation denoted as (OCC)

X_5 = Monthly income (in Naira) denoted as (INC)

The above variables are hereby operationalised as;

$$TF = a + b_1G_1 + b_2MS_2 + b_3AG_3 + b_4OCC_4 + b_5INC_5 + c$$

Table 4: Correlation Matrix of Dependent and Independent Variables

Correlations		TF	G	MS	AG	OCC	INC
Pearson Correlation	Trip Frequency	1.000	-.190	.019	.198	.061	.324
	Gender	-.190	1.000	.070	.020	.068	-.095
	Marital Status	.019	.070	1.000	.714	.172	.519
	Age	.198	.020	.714	1.000	.277	.690
	Occupation Type	.061	.068	.172	.277	1.000	.163
	Income	.324	-.095	.519	.690	.163	1.000

Source: Regression Out-put, March 2014

The first aspect of this analysis is the correlation analysis which is presented in Table 4. The table shows how both dependent and independent variables are related to each other. The table shows that Trip Frequency positively correlated to the Income (INC) with coefficient of (0.324).

It is also observed that Trip Frequency is positively correlated to Occupation Type with value (0.061), this implies that the livelihood of most of the respondents lies within their ability to engage in economic activities which is facilitated by their ability to move over space and interact using different types of public transport. There is a low positive correlation between Trip Frequency and Age (AG) with value of (0.198), this inferred that younger respondent makes more trips than older ones because they are still economically active, unlike older respondents with less physical strength and less viable economically. Trip frequency is also found to be negatively correlated to gender with value of (-0.190) which implies that women travel less frequently than men and they travel shorter distances than men do and rely on bus services to a greater extent than men. Historically, transportation planning and engineering have been gender neutral. The needs and responsibilities of women which now extend beyond the domestic sphere, due largely to the increase in female labour force participation play an important role in shaping their travel activity patterns, specifically, in their impact on trip purpose, frequency and distance travel, mode of transportation used, and complexity of trip making. However, as observed in during the field survey and response of respondent in the questionnaire, transportation planning models in the metropolis was not designed to capture these differences.

Table 5: Regression Model

Model Summary				
Mode	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.403 ^a	.163	.149	.633
a. Predictors: (Constant), what is your income per month in naira?, what is your gender?, occupational types, marital status, what is your age				

Source: Regression Out-put, March 2014

Table 5 showing the model summary revealed that the R² for the amount of variance in the regression table is 0.163 and the adjusted R² for the number of predictors added in the variable in the variance 0.149, which is still positive and significant which still corroborate the significance of socio-economic characteristics of commuters on the level of bus service usage in Kaduna metropolis. In other words 16.3% of socio-economic characteristics of commuters on the level of bus service usage responsible for trip frequency influence in the study area. This is very low for

trip frequency forecast and prediction. Other factors that can influence the trip frequency include spatial factors (land use and urban form, travel behavior), and public finance.

Table 6: Regression Model

Regression Coefficients						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.146	.132		16.216	.000
	Gender	-.201	.073	-.144	-2.766	.006
	Marital status	-.230	.067	-.251	-3.411	.001
	Age	.087	.056	.138	1.559	.120
	Occupational Types	.009	.025	.020	.378	.706
	Monthly Income	.239	.050	.343	4.766	.000

a. Dependent Variable: trip frequency

Table 6 shows the regression coefficient of five independent variables and their level of significance. It shows the regression coefficient for the independent variables and the constant term in the second column labelled "B". The column shows a constant term (a) of 2.146, gender is -0.201, marital status is -0.230, age is -0.087, occupational types is 0.009 and income is 0.239. The level of significance in column 6 on Table 4.13 shows that marital status and income per month are found to be positively significant with P- value of (0.001) and (0.000) at 5% significant level respectively because their P- values are less than 0.05. It can be inferred from the table that trip frequency by bus operators is positively related to marital status and income per month of the passengers. The other three variables, gender, age and occupational types are not found significant with their P- value of 0.006, 0.120 and 0.706 respectively at 5% significant level. The regression model of bus services trip frequency is described thus:

$$\text{Trip frequency} = 2.146 + 0.87 (\text{Age}) + 0.009 (\text{Occupation}) + 0.239 (\text{income}) + (-0.201) \text{Gender} + (-0.230) \text{Marital Status}.$$

4. Conclusion and Recommendations

4.1. Conclusion

This study has confirmed that socio-economic characteristics of commuters have some influence on their transport demand. The study therefore underscores the need to always consider socioeconomic characteristics of city residents while planning for transportation system of cities. The income of the commuters is a major factor that influences the level of bus usage, therefore, bus service should not only be cheaper but must be made attractive in terms of its service quality. It is believed that if recommendations made are also implemented it would no doubt improve accessibility of commuters to public transportation in the study area.

4.2. Recommendations

From the above findings some policy recommendations could be made. The study reveals that bus service in Kaduna is generally affordable. This implies that Kaduna State Government should deliberately promote the use of bus service in the City to further lower the cost and reduce dependence on private cars which is the major reason for traffic congestion in many cities in Nigeria.

The study further reveals that there is gender differential in the demand for transportation. Women use bus service more than men, government should therefore set operational standards for bus operators that will make bus services more attractive to both men and women. In addition, bus service quality should be improved upon to enable commuters' access to their work places as easy as possible. Transport service provision should consider occupational needs of the city commuters, as it is revealed in the study that trip frequency of commuters is related to their occupation.

References

- [1] Armstrong-Wright, and Sebastian Bus Services: Reducing Cost, Raising Standards, Urban transport series, 1987, The World Bank.
- [2] Armstrong-Wright, and Sebastian Bus Services: Reducing Cost, Raising Standards, Urban transport series, 1987, The World Bank.
- [3] Beimborn, E.A., Greenwald, M.J., and Jin, X. Accessibility, Connectivity, and Captivity: Impacts on Transit Choice, Transportation Research Record 2003, 1835, 1–9.
- [4] Ben-Akiva, M. and Lerman S., Disaggregate Travel and Mobility Choice Models and Measures of Accessibility Behavior Travel Modelling, Eds. Hensher, D., and Stopher, P., London: Croom Helm, 1979, 654-679”
- [5] Benson, D.E. Suburban Transit Planning and Forecasting. Transportation Research Record. No 519, 1974, 36–45.
- [6] Beirao, G., Sarsfield-Cabral J.A. Understanding Attitudes Towards Public Transport And Private Car: A Qualitative Study, Transport Policy. 14 (6), 2007, pp 478-489.
- [7] Eboli, L., Mazzulla, G. How To Capture The Passengers' Point of View on A Transit Service Through Rating And Choice Options. Transport Reviews 30 (4), 2010, pp. 435-450.
- [8] Eboli, L. & Mazzulla, G. A Methodology For Evaluating Transit Service Quality Based on Subjective and Objective Measures From The Passengers Point Of View. Transport Policy, 18, 2011, 172-181.
- [9] El-Geneidy, A., Horning, J. and Krizek, K.J. Using Archived ITS Data to Improve Transit Performance and Management, Minnesota Department of Transportation Research Services Section. 2007
- [10] Falcocchio, J.C., Pignataro, L.J., and Cantilli, E.J. Modal Choices And Travel Attributes of Inner-City Poor. Transportation Research Record 403, 1972, 6–17.
- [11] Friman, M., Fellesson, M. Service Supply and Customer Satisfaction in Public Transportation: The Quality Paradox, Journal of Public Transportation 12 (4), 2009 pp.57-69.
- [12] Geerlings and Klementschatz, et al., Developing of methodology for benchmarking public transportation organisations: a practical tool based on an industry sound methodology, Journal of cleaner production. 14, 2006, 113-123.
- [13] Geurs and Ritsema Van Eck Accessibility Measures Review and Applications, Utrecht, the Netherlands, and RIVM research for research for man environment: 256, 2001.
- [14] Handy, S.L., and Niemeier, D.A. Measuring Accessibility: An Exploration of Issues and Alternatives, Environment and Planning A, 29, 1997, 1175-1194.

- [15] Hanson S., and Schwab, M. Accessibility And Intra urban Travel, Environment and Planning A,19, 1987, 735-748.
- [16] Hydén, C. et al., Trafiken I Den Hållbara Staden. Lund: Studentlitteratur, 2008.
- [17] Iles “Public Transport in Developing Countries”, Elsevier Ltd., 2005 .
- [18] Iseki, H., and Taylor, B.D. “Style versus Service? An Analysis of User Perceptions of Transit Stops and Stations in Los Angeles”, Transportation Research Board, Proceedings from the 87th Annual Meeting, Washington, D.C., January 13-17 2008.
- [19] Kimpel, T.J. Time Point-Level Analysis Of Transit Service Reliability And Passenger
- [20] Demand, Urban Studies and Planning, Portland State University, Portland, 2001.
- [21] Morris, J.M., Dumble, P.L., and Wigan, M.R. (1979) “Accessibility Indicators for Transport Planning” Transportation Research A, 13A, 91-109.
- [22] Nathanail, E. Measuring The Quality Of Service For Passengers On The Hellenic
- [23] Railways”, Transportation Research 42 (A), 2008 pp. 48-66.
- [24] National union of road transport workers (NURTW), Bus Town Service Unit. Main Office, Kanti-Kwaripark, Kaduna, 2012 .
- [25] Ndikom, O.B.C. Elements of Transport Management, Bunmico Publishers, Nigeria 2008 pp- 403 415
- [26] Oluwole, M.S. and Ojekunle, J.A GIS Application for Determining Public Transport Access Level in The Federal Capital Territory (FCT), Abuja- Nigeria Journal of Geography and Regional Planning Vol 9 (8) 2016 pp 154-163
- [27] Slobodan, M. and Robin, C. The Concept of Affordability of Urban Public Transport Services For Low-Income Passengers. A World Bank Report, 2005
Worldbank.org/intURBANTRANSPORT/Resources/affordability-upt.
- [28] Solomon, K.M., Solomon, R.J. and Sillien, J.S. Passenger Psychological Dynamics: Sources Of Information On Urban Transportation, American Society of Civil Engineers, New York 1968.
- [29] Strathman, J.G., Kimpel, T.J., Callas, S. Headway Deviation Effects On Bus Passenger Loads: Analysis of Tri-Met’s archived AVL-APC Data, Center for Urban Studies, Portland, 2003.
- [30] Strathman, J.G., Kimpel, T.J., Dueker, K.J. “Automated Bus Dispatching, Operations Control, and Service Reliability” Transportation Research Record 1666, 1999, pp. 28-36.
- [31] Transportation Research Board. Highway Capacity Manual. National Research Council, Washington, D.C, 2003.
- [32] Turnquist M, Blume S. Evaluating Potential Effectiveness Of Headway Control Strategies For Transit Systems, Transportation Research Record 746, 1980, pp. 25-29.
- [33] Tyrinopoulos, Y., Antoniou, C. Public Transit User Satisfaction: Variability And Policy Implications, Transport Policy 15 (4), 2008, pp. 260-272.
- [34] Vasconcellos Urban Transport, Environment and Equity; The Case For Developing Countries, UK and USA, Earth scan publication Ltd, 2001.
- [35] Voges, E.M, and Naudes, A.H., “Accessibility in Urban Areas: An Overview of Different Indicators”, Technical Report RT/21/83, 1983, National Institute for Transport and Road Research, CSIR, South Africa.
- [36] Wach, M, and Kumagi, T.G., Physical Accessibility as a Social Indicator, Socio-Economic Planning Science, 7, 1973, 437-456.
- [37] White, T. Public Transport: Its Planning, Management and Operations, New York, New York Press, 2002.
- [38] Wilson, N. Nelson, D., Palmere, A. Grayson, T.H. Cederquist, C. Service Quality Monitoring for High Frequency Transit Lines”, Transportation Research Record 1349, 1992, pp. 3-11.
- [39] Wikipedia, www.en.wikipedia.org/wiki/fare 2013.
- [40] Zuidgest Sustainable Ruban Transport Development; A Dynamic Opositimisation Approach”. Department of Civil Engineering Centre for Transport Studies, Enschede, The Netherlands, University of Twente, phd:290, 2005.

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