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Critical factors determining public transport access level in Abuja federal capital territory of Nigeria

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This study aims to investigate the key factors which determine access to public transport service in Abuja, the Federal Capital Territory (FCT) of Nigeria. Data were collected based on ten public transport access levels indicators namely: Safety, transport fare, bus availability, comfort level, speed on transit, delays at parks, bus stops and on transit highway, adherence to estimated arrival time, adherence to estimated departure time, reliability of bus schedules and bus overloading. Data on these factors were collected from administration of questionnaires to 859 public transport commuters in 17 major road transport terminals across the FCT. The data were analysed using the factor analysis, correlation, and regression method. The result shows that three factors namely, adherence to estimated departure time, fare charged by the operators, and reliability of bus schedules on routes together explained about 54% of the cumulative total variance, leaving the remaining 46% to seven other factors and residuals. The Spearman's rank correlation matrix for all the variables indicates that they were all positively correlated at various degrees. The standardized co-efficient of the regression analysis revealed that, bus service reliability is the major determinant of public transport access level in the study area. In order to raise the current access level of commuters to public transport in FCT, operators must improve on the level of service in line with the three critical factors which the study has identified.

Key words: Factors, determination, public, transport, and accessibility.

INTRODUCTION

Accessibility according to Richardson and Young (1981) can be defined as the ease of getting to a place and as "nearness to place or nearness to activities", as such it can be measured in relation to distance-socially, economically, and physically.

Martinez (2000) and Wegener (1996) considered accessibility as one of the important factor in shaping land use patterns, this is because, individual will base their decisions of where to reside (or where to locate their businesses) on the ease of accessing the services they desire; therefore, making it an important consideration in the planning and development of policies associated with transport, and in determining land use configurations within urban space.

Within the framework of transportation planning, Niemeir (1997) noted that accessibility can be defined as the ease

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with which desired destinations can be reached. Although the nexus between accessibility and transportation planning is well acknowledged in literature, a major problem usually encountered in quantitative study of commuters' access to public transport is that of deciding what constitute factors and the yardstick to determine the level of accessibility. However, Ahmed (2005), Abumere (1993) and Sumaila (1989) opined that accessibility should be defined in broad sense which include indicators that measure the physical, economic, social and other aspects.

Mfinanga and Ocheng (2006) defined public transport access level as the overall measured or perceived performance of the public transport system from the view-point of the commuters, this can be used to denote the ease of getting to and quality of service derived from the operational characteristics of transportation facilities. This reflects the degree to which transit service is available to a given location and the comfort and convenience of the service provided to commuters (Papacostas and Prevedouros (2008), Qualtro (2004) highlighted the indices of an accessible public transport system to include:

1. Safety
2. Reliability
3. Comfort
4. Availability
5. Public transport fare
6. Distance to access points and convenience.

The road-based transportation which is dominant mode of urban commuting in Nigeria is continuously deteriorating, the quantity and quality of all related service and infrastructures have been on the decline and the cost of vehicle maintenance is increasing (Ashiodu (2011), Amiegbebhor (2009) Oyesiku, 2002). Pederson (1980) asserts that cities are creatures of transport system, and Ogunsanya (2002) observed that transport is the "maker and breaker of cities", as the same transport that makes a city could also destroy and stagnate it if it is not effectively planned and managed.

The spatial location of life enhancing activities in urban centers brought about the increasing need for people to travel to work, school, and shopping centers in order to satisfy their daily needs. Overcoming the distance separating them from their activities requires a means of movement, and the majority without personal vehicles must make use of public transport for such journey (Oluwole and Ojekunle, 2016).

This study investigates the critical factors among many others which largely influence commuters' access to public transport service in the Abuja, FCT-Nigeria.

LITERATURE REVIEW

Fundamentally, urban transportation seeks to link residents and employment as well as producer and users of goods and services. The demand for public transport in most Nigerian cities is projected to be on the increase because large proportions of urban residents are low-income earners who cannot afford personal vehicles.

Mabogunje (2008) pointed out that the estimate of transport demands in metropolitan Lagos in the 1990 range from 7 to 10 million passenger trips daily out of which over 95% are undertaken by road, primarily by car bus and taxi. The current available means of public transport are very few and limited especially when compared with what is obtains in developed countries of Europe and America where trains are used for intra and inter urban movement (Sumaila, 2004).

Adasanya (2011) observed that cities across the world are in a state of rapid transition, the inability and sustainability of these cities are intrinsically interwoven with not only the degree of efficiency and effectiveness with which existing transport capacity is managed but also how well intermediate and future transportation plans and programmes are articulated, laid out, and implemented in order to meet the needs of the people. The spatial structure of cities especially in developing countries is highly varied and complex, some areas are adequately provided with services and facilities while in other area is grossly inadequate (Oluwole 2016 and Ogwude (2011). The variation in the spatial structure results in different socio-economic characteristics of urban dwellers with strong challenges of getting equal and efficient urban service for the disadvantaged. The quality of life in most cities is poor and closely related to accessibility to alternative employment, education and medical facilities, essential public services and nature of recreational open spaces (Vasconcellos 2011). A comparison of government and private operation of public transport operations in Nigeria shows that the state and local government public transport are more organized while private sector operators are largely unorganized.

Government-owned public transport have better trained staff and maintenance facilities than most of the private sector operators; their service are often provided on fixed routes and are relatively cheaper than those provided by private sector operators. Government owned public transport operator also have service schedules, but in practice are rarely followed because of the inadequacies of vehicle, declining fleet utilization rates, growing competition with private and para-transit operators, poor traffic management, congestion especially during peak travel periods and other problems associated with the operating environment (Umar, 2003).

In a study of public transport in Nigeria, the World Bank (1990) and Adetunji (2000) reported that taxis and private vehicles carrying fare paying passengers represent 53% of the public transport trips, while 30% made use of motorcycles. In many cities in developing countries, motorcycles account for about 90% of feeders' trips to taxis and mini bus terminals.

Similarly, in a study of the supply of transport infrastructures in Lagos metropolis, Ogunsanya et al.

(2004) noted that most urban road networks are not only poorly developed with feeder streets, they are grossly inadequate and their inadequacies more often than not forced vehicles to concentrate on the primary roads with serious implications on commuters modal choice and mobility pattern especially along the same urban transport corridors, a situation which has compounded public transport accessibility problems in the environment. The Ogunsanya and Galtima (1993), World Bank (1997) and Adesanya et al. (2002) affirmed that urban parts in Nigeria pay very high proportion of their income for transport services and spend long period of time trekking, travelling, and waiting for infrequent and unreliable bus service. Ndikom (2008) identifies the poor state of Nigerian roads as one of such problems. He further noted that both the rural and regional roads in Nigeria are in high degree of deterioration, the result of which is poor public transport service quality.

The public transport system in Abuja FCT which caters for about 1.4 million commuters (Oniyangi, 2012) is today faced with numerous challenges, the complex and heterogeneous traffic pool, largely dominated by private vehicles and poor service level of the public transport operator creates unbearable waiting time and traffic congestion.

The centralization of government functions, commercial activities and key private sector organizations in the city center, leaving majority of the populace at the surrounding towns and settlements leads to large volume of vehicular movement to and from the city, and the adjoining satellite settlements every day. The emerging features of this commuting challenge is poor access to public transport and this need to be thoroughly studied, because it will not only help in mitigating the commuting challenges, but also form a reliable and objective information source for the transportation operation plans for the territory which the FCT Transport Policy admitted will be dynamic and could be subject to change as the city grows and as the commuting pattern is formed over time (Oluwole, 2014). It is in the light of the foregoing that this study investigates commuters' access to public transport service in the Abuja the federal Capital territory (FCT) of Nigeria.

METHODOLOGY

The data types collected were factors influencing commuters access level to public transport, frequency of commuter's trip using public transport, level of public transport usage by commuters who own car, distance from commuters residences/offices/activities centers (Point of Interest (PoI's) to public transport bus stops, terminals, and average walking time to bus stops/terminals (Service Access Points (SAP's)) from commuters' trip origin and destination.

Others are duration of time commuters wait at the bus stop, transit highway and terminals before boarding the bus and variation in commuters waiting time at the different traffic conditions, monetary costs of transport along a route under different traffic condition (peak and off-peak), commuters' responses to different public transport fare regime among others. These data were sourced from FCT bus commuters.

Five of the six FCT Area Councils were purposively selected, because they accounted for almost 96% of FCT's population. These Area Councils were the closest to the city centre where majority of the intra commuters reside. The Area Councils were: Abuja Municipal Area Council (AMAC), Bwari, Gwagwalada, Kwali and Kuje. In each of the five area councils, all the major settlements and terminals which serve as commuters' traffic concentration points for smaller settlements around them were covered during questionnaire survey. Considering the target populations which are commuters, it is believed that the best form of contact with them will be at their respective terminals and bus stops.

To this end, fourteen terminals which were operated by private concerns and three government-owned were chosen. Deriving from the pilot survey, a total of 16,563 commuters were estimated under the privately operated public transport, while 740 commuters were estimated under the government operated public transport. Therefore, a total of 872 commuters representing 5% and private operators and 315 representing 30% of government operators were adopted for survey as the sample size.

Borg and Gall (1971) suggested a minimum of 5% sample size as being adequate for population above 10,000 and minimum of 10% for population below 5000, especially where the population of studies is homogenous as it is the case with the current study. Furthermore, the need to reduce the likelihood of double sampling, bearing in mind that commuters can make multiple trips between and along a route within and between days of the months which the survey lasted.

The survey was conducted over different time scales, morning, afternoon and evening period of the weekdays (Monday-Sunday) and over different traffic and weather conditions between June and August 2016 so as to capture the various dimensions that the different conditions may introduce into the public transport fare, time, and the general access level in the FCT.

Different sampling technique were used in order to reach the target respondents, first the purposive sampling method was adopted to choose five Area Councils out of the existing six, while the stratified sampling methods was used in the selection of buses, based on two classes of private and government operators. This is hinged on the preliminary understanding that there are different public transport operators and vehicle types (small, medium and large), which the commuters used and must all be captured. The systematic random technique (1 out of 5) was then used in the identification of the specific vehicle types and commuters to be surveyed. This is because there is no sampling frame from which random numbers can be generated for the purpose of adopting a simple random scheme.

Since vehicles and commuters are always mobile, the point of interaction with them is the motor parks or bus stops. This is because the waiting time during the period of boarding and disembarking by commuters provide the allowance for the elicitation of the information required with the aid of field assistants that were well trained. Figure 1 shows the study area.

Selection of variables (Factors)

The access level determinants were based on ten widely reported public transport access level measurement items (Ali, 2011; Basorun and Rotowa, 2012) as contained in Table 1. Thus, ten variables were selected for investigation, namely: safety level of the vehicle; fare changed by the operators; real time availability of the vehicle; vehicle comfort level; public transport speed on transit; delays at parks, bus stops, and on transit highway; adherence to estimated arrival time; adherence to estimated departure time; reliability of bus schedules on routes; and level of overloading practices.

Kaiser–Meyer–Olkin criterion (KMO) and Bartlett's test of

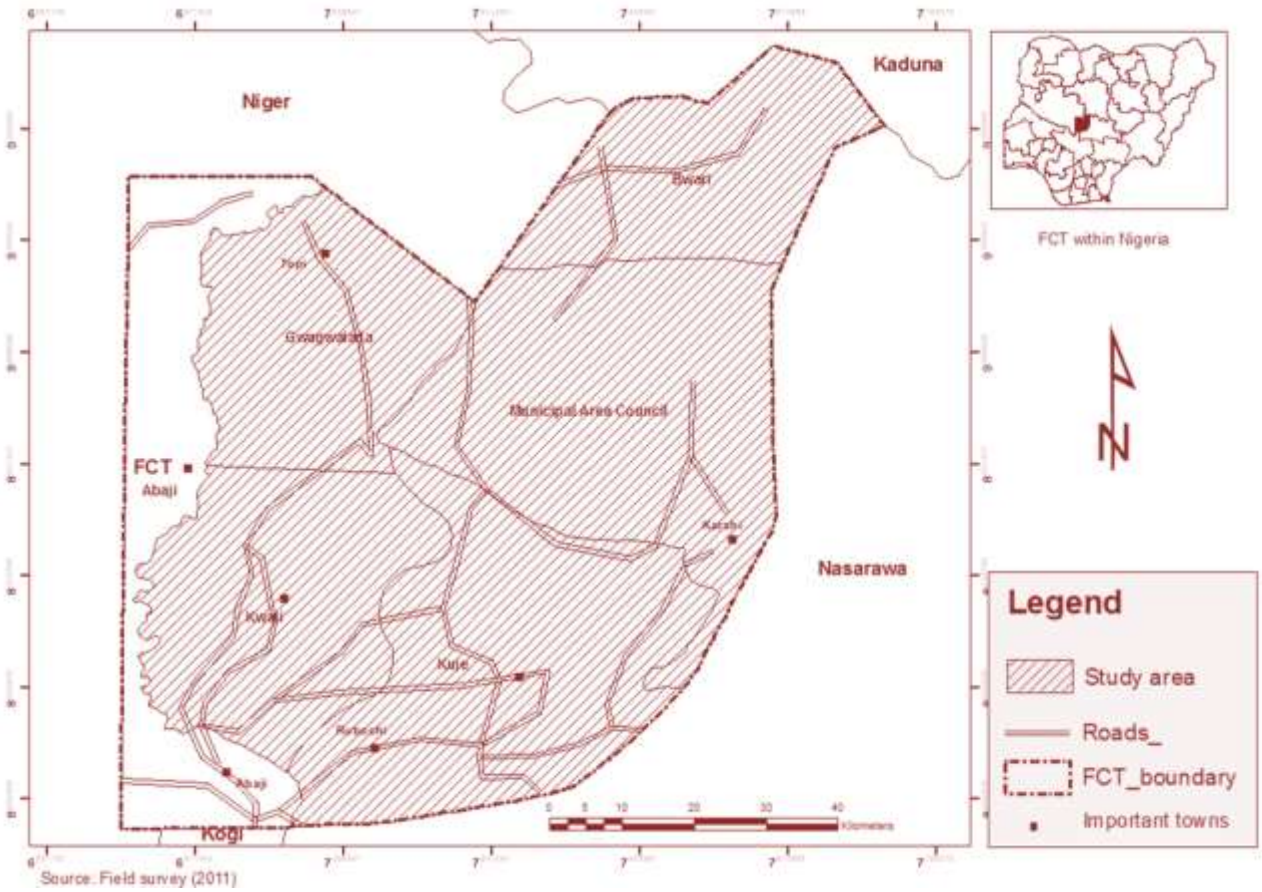

Figure 1. The study area.

Table 1. Factors influencing public transport access level.

S/N	Variable	Label
1	Safety level of the vehicle	x_1
2	Fare changed by the operators	x_2
3	Real time availability of the vehicle	x_3
4	Vehicle comfort level	x_4
5	Public Transport Speed on transit	x_5
6	Delays at parks, bus stops and on transit highway	x_6
7	Adherence to estimated arrival time	x_7
8	Adherence to estimated departure time	x_8
9	Reliability of bus schedules on routes	x_9
10	Level of overloading practices	x_{10}

Source: Researcher's compilation (2016).

measure of sampling adequacy was used to evaluate the reliability of the instrument internal consistency, the KMO and Bestlett's test according to Landau and Everitt (2004), is the average of all possible split - half coefficient resulting from different ways of splitting the scale items.

A value of 0.7 or below indicates unsatisfactory consistency and reliability, any value above 0.7 indicates satisfactory reliability and it is significant enough for the variables to be correlated. The result as indicated in Table 2 shows that the internal consistency of each measure is 0.889 which implies a good level of reliability. Furthermore, factor analysis was used to derive the set of variables in terms of smaller (critical) number of dimensions out of the total number of variables in the analysis. Essentially, it assesses whether the co variances between the set of variables can be explained

Table 2. Reliability (KMO and Bartletts) test statistics.

Kaiser-Meyer-Olkin measure of sampling adequacy		0.889
	Approx. Chi-square	3366.277
Bartlett's test of Sphericity	Df	45
	Sig.	0.000

Source: Authors computation (2016).

Table 3. Communalities of the factors influencing the use of public transport.

S/N	Factors	Initial	Extraction
1	Safety level of the bus	0.246	0.403
2	Fare changed by the operators	0.453	0.616
3	Real time availability of the bus	0.440	0.563
4	Bus comfort level	0.471	0.558
5	Speed	0.447	0.524
6	Delays at parks, bus stops and on transit	0.404	0.472
7	Adherence to estimate arrival time	0.515	0.574
8	Adherence to estimate departure time	0.669	0.690
9	Reliability of bus schedules on routes	0.484	0.604
10	Level of overloading practices	0.319	0.360

Extracted method principal axis factoring. (Source: Authors computation (2016).

in terms of smaller (critical) common factors otherwise called latent variable. The factor analysis model expresses each variable as a linear combination of underlying common factors $f1$, $f2, \ldots, fm$, with an accompanying error term to account for that part of the variable that is unique (not in common with the other variables).

For $y1$, $y2, \ldots, yp$ in any observation vector **y**, the model is as follows:

$$y1 = \lambda 11\, f1 + \lambda 12\, f2 + \cdots + \lambda 1m\, fm + \mu 1 + \varepsilon 1 \tag{1}$$

$$y2 = \lambda 21\, f1 + \lambda 22\, f2 + \cdots + \lambda 2m\, fm + \mu 2 + \varepsilon 2 \tag{2}$$

$$\ldots yp = \lambda p1\, f1 + \lambda p2\, f2 + \cdots + \lambda pm fm + \mu p + \varepsilon p \tag{3}$$

The f's is the random variables that engender the y's. The coefficients $\lambda i\, j$ are called *loadings* and serve as weights, showing how each individually depends on the f's. With appropriate assumptions, $\lambda i\, j$ indicates the importance of the jth factor $f\, j$ to the ith variable yi, and can be used in interpretation of $f\, j$.

The variables $y1$, $y2, \ldots, yp$ *are represented* as linear combinations of a few random variables $f1$, $f2, \ldots, fm$ $(m < p)$ called *factors,* with mean vector μ_i. The factors are underlying *constructs* or *latent* variables that "generate" the y's. The F_1 and $F_2 \ldots F_k$ are the common factor in each variable Y. While $\lambda 1, \lambda 2$ signify *loading* and serve as weights, which shows how y_i depends on the common factors F_i. It is therefore open to question. If the original variables $y1$, $y2, \ldots, yp$ are at least moderately correlated, the basic dimensionality of the system is less than p.

The Spearman's correlation matrix was used to investigate the types and strength of association between the pairs of variables in table 6 that influence commuters' access to public transport services in FCT. The regression analysis was used to build a model that will explain the contribution of each of the accessibility factors to commuters' level of access to public transport service in Abuja FCT Nigeria.

It was conceptualized that, there is as set of variables $X_1, X_2, X_3 \ldots X_n$, which can be used to explain public transport access level in the FCT. This may be mathematically stated as:

$$y = f(X_1, X_2, X_3 \ldots X_n) \tag{4}$$

And can be operationalized using the multiple regression equation thus:

$$y = a + b1X_1 + b_2X_2 + b_3X_3 \ldots bnXn + e \tag{5}$$

Where:

y= the dependent variable i.e. access to public transport;
a= Constant;
$b_1, b_2, b_3 \ldots b_n$= the coefficient of independent variables;

$X_1, X_2, X_3 \ldots X_n$ are the independent variables, that is, distance from bus stops/terminals to commuters' trip origin and destination, public transport fare, bus service comfort, safety, speed in transit, adherence to estimated arrival time etc.
e = random error term (measuring the unexplained variable).

RESULTS AND DISCUSSION

The result of the analysis as presented in Table 3 shows that the estimates of the communality before and after the extraction of the variable reveals that not much of the variance of the variable items safety (40%), delays in terminals/bus stops and in-transit (47.2%) and overloading

Table 4. Total variance of the factors that determines public transport access level.

Factors	Total	Initial Eigen values		Extracted sums of square loadings		
		% of variance	Cumulative %	Total	% of variance	Cumulative %
1	4.410	44.101	44.101	3.967	39.669	39.669
2	1.676	16.755	60.856	1.208	12.078	51.746
3	0.714	7.136	67.994	0.188	1.881	53.628
4	0.604	6.046	74.034	-	-	-
5	0.545	5.454	79.487	-	-	-
6	0.469	4.687	84.174	-	-	-
7	0.443	4.429	88.603	-	-	-
8	0.412	4.116	92.719	-	-	-
9	0.407	40.69	96.788	-	-	-
10	0.321	3.212	100.00	-	-	-

Extracted method: Principal Axis Factoring (Source: Author's computation (2016).

of buses (36%) can be attributed to the three common factors in the communalities table.

However, variables like adherence to estimated departure time, fare charged by the operators and reliability of bus schedules on routes, showed a variance of 69, 61.6 and 60.4%, respectively. This high percentage variance suggests that the variable can be attributed to the three common factors.

In addition, the variances of the extracted factors (Table 4) shows that the percentage of the total variance accounted for two factors with Eigen values greater than 1. The total variance explained indicates that factor one with an Eigen value of 4.410 accounts for 44.10% of the total variance explained by the analysis.

Similarly, factor two with an Eigen value of 1.676 accounts for 16.76%. The factor loadings provide a clear indication of the underlining level of the quality of the services of public transport that influence its accessibility. The importance of the loadings is that it has reduced the most influencing factors to two major factors with Eigen value greater than 1:00. These are the dominant loadings for each factor. These Eigen values are the proportion of the total variation in the data set that is explained by a factor.

As observed in Table 4, two factors accounted for about 52% of the explanations that is, determining commuters access to public transport service in Abuja the FCT. Interestingly, the third factor accounts for very small proportion of the total variation of the explained variables (about 1.9%). The scree plot in Figure 2 shows the pattern in which this unexplained variation is distributed among the variables. This plot demonstrates the distribution of the variance among the factors graphically. The 'elbow' shape of the curve indicates that higher order factors contribute to a decreasing amount of additional variance with a marked decrease in the second (fare charged by public transport operators) and third factor (real time availability of the bus). This implies that access to public transport can be greatly influenced by the first two factors.

Since the communality table alone cannot be relied upon to identify the factors which determines commuters' access to public transport service (Landau and Everih, 2004), the factor rotation (varimax) was further employed. The objective is to maximize the variance of the square loadings to produce orthogonal factor that will be used to interpret the factor analysis. To this end, an arbitrary threshold value of 0.4 is equated as high loadings. Furthermore, variables that load on factors 1 and 2 are considered important explanatory variables.

Table 5 shows the rotated factor matrix, a careful examination of the table indicate that all the variable load on at least one factor. Variable 4 (comfort of the bus) load on factor 1, 2 and 3, while variable 5 (the bus speed) load on factor 1 and 3. However, Bus departure (number 8 in Table 5) time appears to be the most important factors which determine commuters' access to public transport as it loads the highest value (0.812) on factor 1. This is followed by the Ninth variable (bus service reliability) which loads 0.769 on factor 1, while the seventh factor arrival time load *700 on factor 1. Notwithstanding, factor 4 (bus comfort) and 5 (bus speed) are also very important determinant factors as they load on more than 2 factors.

All these important factors, (departure time, bus service reliability, arrival time and speed) can be summed - up in one phrase: *fast access and short transit time*. This implies that commuters will be attracted and patronize public transport service if the time spent at bus stop, terminals or transit highway before getting bus to commence the trip as well as the time spent before reaching the destination is short.

The implication of these can be explained against the background of the fact that, the FCT is predominantly an administrative territory with high concentration of economic and administrative activities at the city center, while majority of the workers (commuters) reside at the

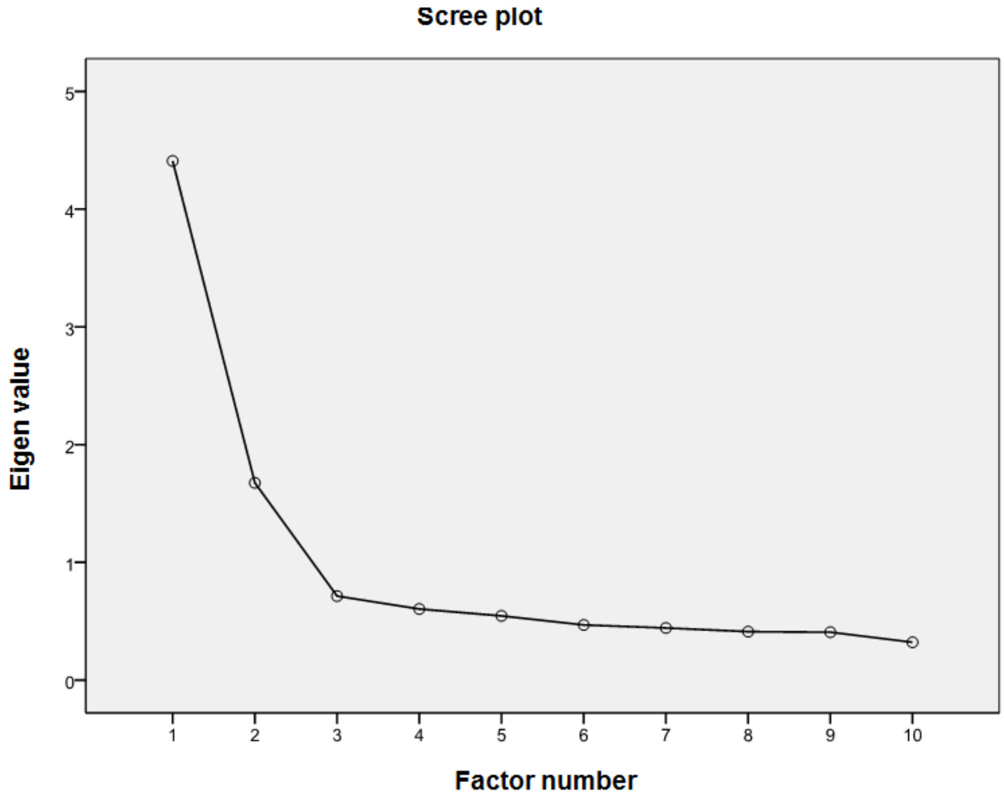

Figure 2. Distribution of the factor loading.

Table 5. Rotated factor matrix of the public transport access level variables.

Bus service level element	Factor		
	1	2	3
Bus safety level	-	0.631	-
Fare charged	-	0.710	-
Availability of Bus	-	0.688	-
Bus comfort level	0.429	0.446	0.418
Bus speed	0.520	-	0.409
Minimum delays	0.509	-	-
Adherence to estimated arrival time	0.700	-	-
Adherence to estimated departure time	0.812	-	-
Reliability of Bus	0.769	-	-
Bus overloading practice	0.589	-	-

Extracted Method: Principal Axis Factoring; Rotation Method: Varimax with Kaiser Normalization. (Source: Author's computation (2016).

periphery, having to commute daily over a working hours that is less flexible (as all work places, schools, etc.) which open between 7 to 9am and close between 2 to 5pm. It is expected that there will be serious rush to catch - up any available public transport vehicle at that hour where most often, the supply capacity of the public transport service is very limited.

During this time, commuters will be less mindful of the fare charged and safety level of the bus, all in a bid to just reach their activity places. It is therefore not surprising that strict adherence to departure time of bus (0.812), reliability of bus service (0.769), and the adherence to estimated arrival time at the point of destination (0.700) stand out as the most important factors that FCT bus commuters consider as determining their patronage of public transport. This finding is similar to the outcome

Table 6. Correlation matrix of the public transport access level factors.

Variable	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
X_1	-	-	-	-	-	-	-	-	-	-
X_2	0.436	-	-	-	-	-	-	-	-	-
X_3	0.420	0.573	-	-	-	-	-	-	-	-
X_4	0.251	0.496	0.492	-	-	-	-	-	-	-
X_5	0.147	0.395	0.412	0.534	-	-	-	-	-	-
X_6	0.132	0.371	0.344	0.488	0.478	-	-	-	-	-
X_7	0.065	0.257	0.291	0.451	0.509	0.510	-	-	-	-
X_8	0.061	0.232	0.301	0.446	0.498	0.479	0.650	-	-	-
X_9	0.056	0.179	0.239	0.407	0.457	0.423	0.555	0.635	-	-
X_{10}	0.021	0.115	0.130	0.319	0.367	0.377	0.404	0.484	0.486	-

Source: Author's computation (2016).

ofthe UK Department of Transport (2003) study, which identifies high frequency of services that are reliable as important needs of the UK public transport users. Conversely, Mistral and Nandagopal (1993) and Naniopoulos (1999) identify in India that public transport service elements are by nature not independent of one another, but to some extent depend on the degree of ratings which commuters attach to them, this justifies the need to determine the degree of the relationships between the ten variables as presented in Table 6. The factors are denoted as:

X_1 – Bus safety level
X_2 – Fare changed
X_3 – Availability of Bus
X_4 – Bus comfort level
X_5 – Bus speed
X_6 – Minimum delays
X_7 – Adherence to estimated arrival time
X_8 – Adherence to estimated departure
X_9 – Reliability of Bus
X_{10} – Bus overloading practices

The results, as presented, show that the associations of the variables are all positively correlated. It is instructive to note that the strongest positive correlation between the pairs of variable is between availability of bus and public transport fare along the route, (r= 0.573, P<0.001).

The implication of this is that the more available the public transport bus in real time and commuters are seeing it to be meeting their daily commuting needs, the more they feel less bothered with the fare charged by the operator. Since the commuters are getting value for their money, they tend to be less sensitive to how high or low the fare charged for the use of such public transport.

Similarly, the correlation between bus speed and comfort level shows partial positive correlation (r= 0.534, P < 0.001). This means that, the faster the bus in transit, the more likely, they will consider the trip comfortable and will be disposed to the use of public transport. This again is expected; because a rationale commuter will want to maximize his /her time while making his/her trip.

Furthermore, the association between adherence to estimated arrival time and minimum delays (r= 0.510, P < 0.001), is also strong. This suggests that the trip transit time will be short and the estimated arrival time to the destination by the bus will be achieved. It is fundamental to understand that this correlation provides integrity checks on the commuters' responses on the variables under investigation.

Result of regression analysis

The overall access level to public transport service in the FCT (dependent variable) was determined using a regression model which incorporate: bus safety level, fare charged, availability, adherence to departure time, bus service reliability, estimated arrival time, bus comfort, delays in transit and bus overloading to come out with a model which explains access level to public transport services in the FCT (Table 7). Therefore, the overall commuters' access to public transport service is described thus:

Commuters' level of access to PT= 1.41 (constant)+-0.003 (safety)+-0.088 (Fare charged) +0.094 (Availability)+0.038 (Comfort) +0.100(Speed) in transit)+0.001(Delays) +-0.074(adherence to estimated arrival time)+-0.050 (Adherence to estimated departure time) +0.470 (bus service reliability)+0.182 (bus overloading)

The interpretation of the aforementioned equation as observed from the regression slope is that overall commuters' level of access to public transport will increase as these ten (10) factors get better. The standardized regression coefficient beta (β) values indicate bus service reliability has the greatest impact (β =.470p=.000) on commuters' overall access level. This is

Table 7. The regression model.

Independent variable	Unstandardized coefficients		Standardized coefficients	t	Sig.(p)
	B	Std. Error	Beta		
(Constant)	1.407	0.411	-	3.424	0.001
Safety	-0.003	0.071	-0.003	-0.041	0.968
Fare charged	-0.84	0.073	-0.088	-1.156	0.249
Availability	0.093	0.076	0.094	1.219	0.224
Comfort	0.031	0.059	0.038	0.522	0.602
Speed	0.093	0.065	0.100	1.427	0.155
Delays	0.001	0.085	0.001	0.007	0.994
Arrival time	-0.071	0.076	-0.074	-0.926	0.355
Departure time	-0.049	0.086	-0.050	-0.574	0.567
Reliability	0.461	0.070	0.470	6.557	0.000
Overloading	0.182	0.072	0.182	2.523	0.012

R^2= 0.375, Adjusted R^2= 0.345 $P \leq$001; *Dependent variable: Commuters' access to public transport service (Source: Author's computation (2016)).

followed by absence of overloading in bus (*β*= .182,*p* .012), bus speed in transit *(β = .100,p .156)* and bus availability (*β* = .094,*p .224)* in that order of magnitude.

The R^2 which is the percentage of the variance in y (dependent variable) that can be predictable from x (independent variables) is 0.375 or 38%. Keren (2013) observed that there are two reasons why it might just be fine to have low R^2 value.

Firstly, investigation which attempt to predict human behavior regarding certain issue- such as this study has done, typically has R^2 lower than 50%, this is because humans are just harder to predict than any physical process. Secondly, if R^2 is low but predictors are statistically significant, important conclusion about how changes in the predictor values are associated with changes in the response values can still be drawn. This is because regardless of the R^2, the significant co-efficient still represent the mean change in the response for one unit of change in the predictor, while holding other predictors in the model constant. Furthermore, noting the closeness between the R^2 value (.375) and the Adjusted R^2 value of 0.346 in Table 7 it can be concluded that the data is fit for the model.

These four factors (bus service reliability, absence of overloading in bus, speed of bus in transit and real time availability of bus) therefore, can be said to be very important and critical in determining the level of commuter access to public transport service in FCT. The reliability of bus service along the routes, devoid of breakdowns and delays on the road, combine with the real-time availability in the bus stop and terminals when the commuters intends to make their trip will determined the continuous patronage of the public transport by the car-owned and non-car groups of commuters.

The result therefore indicates that if public transport service can be made more reliable, available and speed in transit enhanced, therefore, commuters' access level to public transport service in FCT can be boosted. The principle of real-time availability of public transport vehicles when needed is very important, because commuters trip are mostly work, school, office or business appointment related, whose time are fixed. The demand for public transport at this time is usually high. This time also coincides with the popular *peak or rush hours* in the FCT, and it occur in the early morning between 7:00 to 9:00am, and early evening hours between 3:00 to 5:00pm during the working days (Monday to Friday).

The service comfort of FCT public transport at the time of field investigation was relatively poor; this has been a disincentive for commuters who have private car. For example, the basic requirements like comfortable seats, open window for air flow, bus floor height among others do not measure up to standard. Majority of the vehicles are minibuses which do not provide adequate leg room or adequate ceiling height for standing.

The situations can be critical during rush hours when commuters' will have to stand for a long time, in a crowded bus and on a congested road. Though the issue of comfort at the time of this survey does not influence access level as it might be expected, it is important that consideration should be given to it in the public transport improvement effort. This is because most commuters on provided cars which this study could not elicit data from are likely to be attracted to public transport patronage if the current level of comfort is improved upon.

CONCLUSION

This study has established, with respect to FCT Abuja-Nigeria, the four major factors influencing commuters' usage of public transport and by implication commuters' adoption of it. Therefore, basic standards should be set with regard to these parameters and compliance should be strictly monitored by the law enforcement agents that is, directorate of road traffic service (DRTS), federal road safety commission (FRSC) and FCT Transport Secretariat. The study has also identified some key factors such as walking distance to bus stops/terminals, public transport fare, reliability, comfort, adherence to estimated departure and arrival time as very crucial in raising commuters' access to public transport in the FCT.

Therefore, constant improvement of the service level of these factors should constitute part of the public transportation planning and administration agenda of the Federal Capital Territory hence forth. The implementation of these recommendations is important because transport as a derived demand can affect the quality of life and the general productivity and development of the territory.

RECOMMENDATION

In view of the forgoing result and discussions, the following recommendations are offered towards enhancing better public transport service that will be accessible to the commuters in Abuja FCT in particular and in general, other places with similar public transport access challenges in Nigeria:

1. There should be collaboration by the private sector organizations and FCT administration towards providing a safer public transport buses for commuters, with a view to increasing the general access level.
2. Affordable public transport should be provided to link residential areas and work places in line with the criteria setup by the FCT master plan and land transport policy. This will eliminate frequent need for intermediate transport, and the associated costs or walking distance to the existing public transport bus terminals/stops in the FCT;
3. There should be a periodic public transport driver and operators' training/ sensitization to be jointly carried out by FCTA, DRTS, FRSC and transport operators unions, in order to initiate and sustain good attitudinal modifications amongst public transport operators. Such training/sensitization should include but not limited to defensive driving, road traffic rules and regulation, accident causes and prevention methods, the right of other road users, quality service management among others;
3. There should be a dedicated public transport lane in all the routes which will separate public transport vehicles from other vehicular traffic, this will not only increase bus frequency, it will reduce transport fare and transit time and also, in a way, discourage private car usage for commuting within the FCT. The FCT Transport Secretariat, Ministry of Federal Capital Territory, Federal Ministries of Power, Works and Housing should conscientiously strive to make public transport attractive;
4. The accessibility and patronage of public transport depends largely on commuters' perception of their service quality, closeness of terminals to their trip origin/destination, cheap fare, and comfortable interior and safe operation as all things being equal; they are likely to attract commuters than other means of transport. Therefore, the policy goal, objectives, and strategies should be formulated and implemented on each of the factors.

CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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