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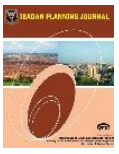

Satisfaction of Commuters with Public Transport and its Implications for the Transition to Green Mobility in Ibadan

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Abstract

Mobility is a basic prerequisite of life which is essential to human livelihoods and economic sustenance. Mobility accounts for about a quarter of global energy consumption and about half the carbon and pollutant emissions in cities and is a major contributor to environmental pollution, global warming and climate change. Limiting the impacts of mobility on the environment is pivoted upon the transition to green mobility which seeks greener environment-friendly and sustainable modes of commuting. This infers a shift from the traditional popular mode of mobility – private automotive transport (cars) or self-provided transportation – to sustainable alternatives with lower carbon footprint provided by public transport solutions. This study seeks to determine the perceptions and satisfaction of commuters in Ibadan with the public transport modes in the city with the aim to explore its implications for the transition to green mobility. Ibadan is a regional economic and administrative hub for south western Nigeria and one of the largest and most populous cities in West Africa. The study adopted the survey approach utilizing the questionnaire, key informant interview and traffic surveys as research instruments at three significant traffic nodes along the major traffic corridors in the city. Findings revealed four predominant public transport modes which are the tricycle (keke), taxi (micra), mini-bus (danfo) and large city bus (Ajumose). The satisfaction of commuters with the public transport modes in Ibadan is low and the green index of the public transport is also low as the predominant modes of public transport are those on the lower rungs of the green index (taxi and tricycle). There is also a strong relationship between the preferred mode and frequently used mode of public transport by commuters. The transition to green mobility in Ibadan is dependent upon increased quality of public transport to discourage personal automotive modes and the proliferation of public transport modes with higher green index which are the Ajumose and danfo buses.

Keywords
Green mobility, Public transport, Commuter satisfaction, Green infrastructure, Sustainable transportation

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1. Introduction

Mobility is an indispensable condition and basic prerequisite of life as there can be no life without mobility. Amongst the most deep-rooted qualities of man is the quest for freedom as well as the desire to explore which typifies movement. This is while incarceration is considered a punitive or correctional measure in the criminal justice system. The desire for mobility is not an invention of the modern age, however, as the technological aptitude of the human race evolved, mobility likewise transformed from the naturally gifted self-mobility of walking or running, to the various modern technologically advanced mobility modes provided by road, rail, sea and air transit.

Mobility is vital for prosperity, progress and development as it is a key factor of modern society and a requisite for human survival. To be mobile is imperative because without mobility there is hardly any possibility for the sustenance of livelihoods as every sector heavily depend on the existence of efficient mobility. However, about a quarter of global energy consumption goes into worldwide mobility (Gruden, 2001).

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In a world witnessing worsening impacts of climate change and diminishing natural resources, mobility has to be sustainable (Sims et al., 2014). That is, it should be climate resilient, socially inclusive, and should contribute to a reduction of absolute carbon emissions.

Globally, cities are envisioning and implementing green mobility stratagems in line with the realities of climate change. In a nutshell, there has to be a transition to green mobility. For the transition to green mobility, the ecological priority will be the drive to minimize the environmental burden caused by automotive transport. This infers a shift from the traditional popular mode of mobility – private automobile transport (cars) or self-provided transportation – to sustainable alternatives with lower carbon footprint provided by mass and public transport solutions.

In most urban areas around the world with Nigeria inclusive, road transportation remains largely the major medium for the transit of people. Green mobility requires efficiency in road transportation which can be provided by public transport modes. Public transport services is substantial to facilitate mobility of people, goods and services. Without efficient public transport services, the transition to green mobility will be considerably hindered. Public transportation will not only promote green mobility, it is also an integral construct of low carbon transit and climate change resilience (Jiaru. and Xiangzhao, 2015).

The transition to green mobility and the uptake of public transportation depends on the availability of optimum public transit services and the choice of commuters to travel with public transit rather than private automotive transit. The choice to commute with public transit is invariably determined by the attitude and perception of commuters to public transport services which is typically determined by their satisfaction with the public transport service delivery.

2. Conceptual Anchor and Related Literature

Mobility is essential to human livelihoods and economic sustenance. The various modes of mobility are responsible for about a quarter of global energy consumption and about half the carbon and pollutant emissions in cities. Mobility is a major contributor to environmental pollution, acid rain and greenhouse gasses (Nylund and Belloni, 2014). Mobility is responsible for emissions of 26% of carbon dioxide, 54% of nitrogen oxides, 57% of lead, 74% of carbon monoxide, and 28% of particulate matter – PM10 as well as small amounts of sulphur dioxide, and other gases which have effects on morbidity, fertility and mental development (Sims et al., 2014; Jiaru. and Xiangzhao, 2015; Earley, 2019; Chao et al., 2020).

Nonetheless, curbing mobility is not an option as it is an indispensable element of the economic cycle and is the most obvious feature of modern prosperity. Mobility is unavoidable but we have to fulfil mobility needs in smarter and more sustainable ways. The aspiration to achieve smart and sustainable mobility led to the emergence of the green mobility paradigm (Sims et al., 2014). The focal points of green mobility is to minimize the ills associated with motorization and to seek greener ways of commuting with fewer impacts on the environment. On the bottom rung of green mobility modes we have motorcycle and passenger cars (private transport) while buses (public transport) and non-motorized transport are at the top of the ladder. As one climbs up the ladder, the level of carbon combustion, energy consumption and pollution reduces. As Nylund and Belloni (2014) puts it, public transport will take you much further than motorized personal transport, because as more people travel in a single motorized transport mode, the combined travel distance per unit of fuel increases tremendously as illustrated in the green mobility ladder in Figure 1.

At the global level, huge efforts were invested to reach five main climate change agreements: the United Nations Framework Convention on Climate Change, 1992; the Kyoto Protocol, 1998; the Copenhagen Accord, 2009; the Doha Amendment, 2012; the Paris Agreement, 2015 (Opresnik, 2018). These agreements have been implemented by introducing green policies and actions in the transport sector, since transport is one of the major greenhouse gases emitters.

Green mobility is a concept that has emerged in response to the worsening challenges of global warming and climate change (Sims et al., 2014). It is submerged within the sustainability construct and the unfolding resilience paradigms. Green mobility evolved to reduce the volume of carbon emissions and air pollution from transportation as well as to promote climate change resilience. Green mobility is an integral thematic area within the green city construct. Green mobility is fostered by a transition to public transport and improved efficiency of public transportation service delivery.

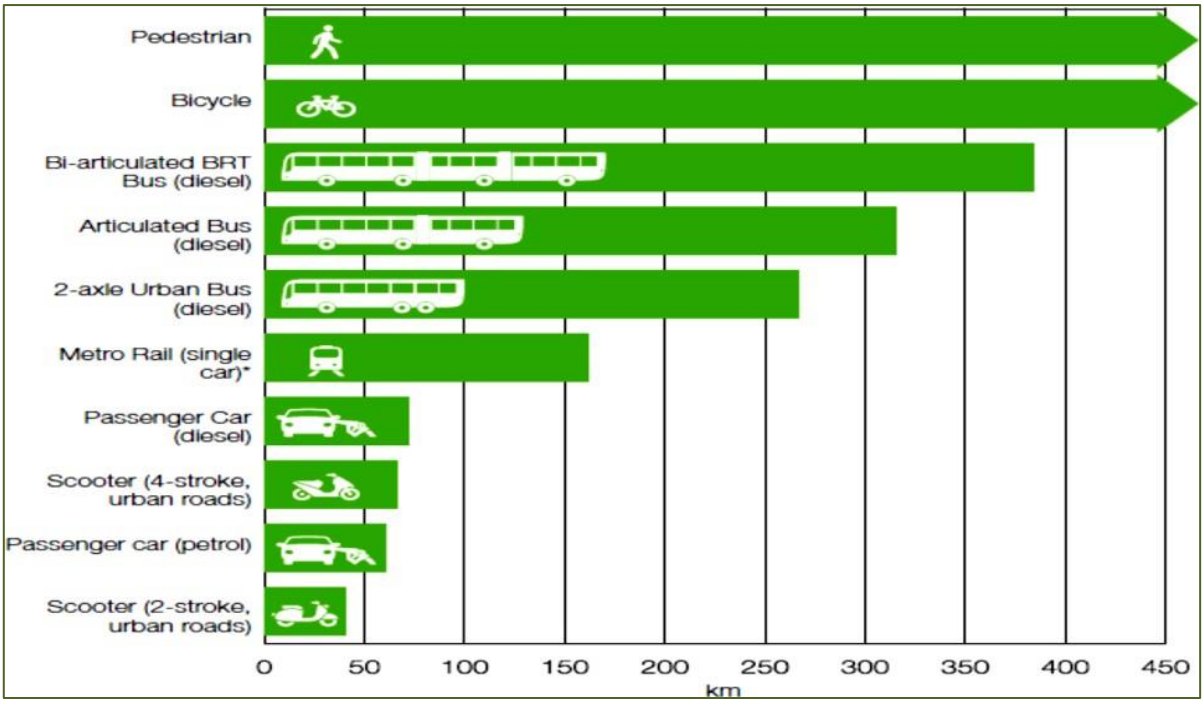

Figure 1: Distance travelled on one litre of fuel
Source: Nylund and Belloni (2014)

Mobility categories include air, water, rail and road modes (European Commission, 2011). Amongst intra-urban mobility modes, road transport is by far the most extensive. In Nigeria, other modes of intra-urban mobility asides road transport are relatively under-developed. Intra-city rail lines, subways, trams and other rail-based intra-urban transit are absent. In Ibadan, the rail lines traversing the city are just a stretch of the national narrow gauge railway grid that was constructed in 1904 and cuts across the city from north to south on the Lagos-Kano rail line (Omirin, 2014).

More recently, a new railway corridor similarly traversing north-south within Ibadan is the standard gauge national railway grid from Lagos to Kano. Consequently, the predominant intra- urban transit mode in Ibadan is road transport.

For a city dependent predominantly on road transport, any sustainable transition to green mobility is pivoted on reducing the emissions from road transport and the proliferation of sustainable modes of road transport. Therefore, transition to green mobility in Ibadan is hinged upon the uptake of public transportation.

Road transportation has revolutionized mobility. Private automobile transport has transformed mobility, connectivity and urban structure. Before the advent of mass car ownership after World War II, people travelled short distances by foot or bicycle, while longer journeys were made by bus or, occasionally, by rail. Life was centred on the neighbourhood with work, schools, shops and other facilities available locally while travel outside the neighbourhood was rare on special occasions. In 1960, it was estimated that each person travelled on average some 5,600 km, by 2000 average travel distance per individual had doubled mainly as a result of private automobile transport (Gruden, 2001). On the average, since 1950, car outputs have grown by an average one million units every year (Matthews, 2013). It is generally regarded undoubtedly as the most preferred system of mobility and will ordinarily be used, no matter how attractive the alternatives might be.

With more than 80% of passenger traffic in cities handled by cars, automobility has turned into a veritable challenge for urban areas with significant negative threats to urban livelihood and sustainable cities (Ching-Chih et al., 2019). Vehicular mileage will grow by 22% to 2010, with congestion across inter-urban trunk road network expected to increase by 15% and by 28% (Banister, 2002). Vehicular road traffic crashes are a major cause of premature death in cities. In Nigeria, the volume of road traffic crashes as well as the number of casualties and losses has been on the rise (Salau, 2015). To add to the conundrum, a significant number of private automotive transit in Nigeria and other developing countries relies upon aged inefficient vehicles

mostly second-handed imported from Europe and North America.

Public transport constitutes an integral feature of modern urban areas. High quality public transit reduces traffic congestion in three ways (Litman, 2007): (1) it provides a speed advantage over driving and tends to attract a portion of motorists who would otherwise drive, and thereby reduces congestion on parallel roadways; (2) public transit can stimulate transit-oriented development and can reduce private vehicle travel of households residing in transit-oriented locations; and (3) quality transit service can reduce travel time cost to people who shift mode because many travellers consider their per minute cost for comfortable transit service to be lower than driving. A number of studies show that quality public transit service improves the travel speeds on roadways while congestion delay in cities seems to decrease with the provision of good public transit service (Aftabuzzaman, 2011).

Mobility makes possible an increased spatial interaction to exchange ideas and goods, which will increase productivity and at the same time increase the demand for commuting. Matthews (2013) stated that public transport is essential to the wellbeing of any nation, and the benefits of a well- planned and efficiently managed public transportation system spread far beyond the rubric of mobility.

3. Materials and Methods

This study was conducted in the city of Ibadan located in the Southwest geopolitical zone Nigeria. Ibadan was the capital of the old western region of Nigeria since the days of the British colonial rule and is currently the administrative headquarters of Oyo State. The State is one of the thirty- six states in the Nigerian Federation with a land area of 28,456 square kilometres (3 per cent of Nigeria's land mass) and the fifth largest population in the country with 5,580,894 as at 2006 (NPC, 2007). Ibadan is located in the south-eastern part of Oyo State with an area of 3,145.96 square kilometres (11 per cent of Oyo State land mass) and a population of 2,559,853 (46 per cent of Oyo state population). From a regional outlook, Ibadan is approximately 119 kilometres north- east of Lagos at the Atlantic coast, 120 kilometres east of the border with Republic of Benin, and 659 kilometres from Abuja the Federal Capital Territory. Adjoining major cities include Lagos, Abeokuta, Sagamu, Osogbo, Ile-Ife, Ogbomoso, Oyo and Ilorin as illustrated in Figure 2.

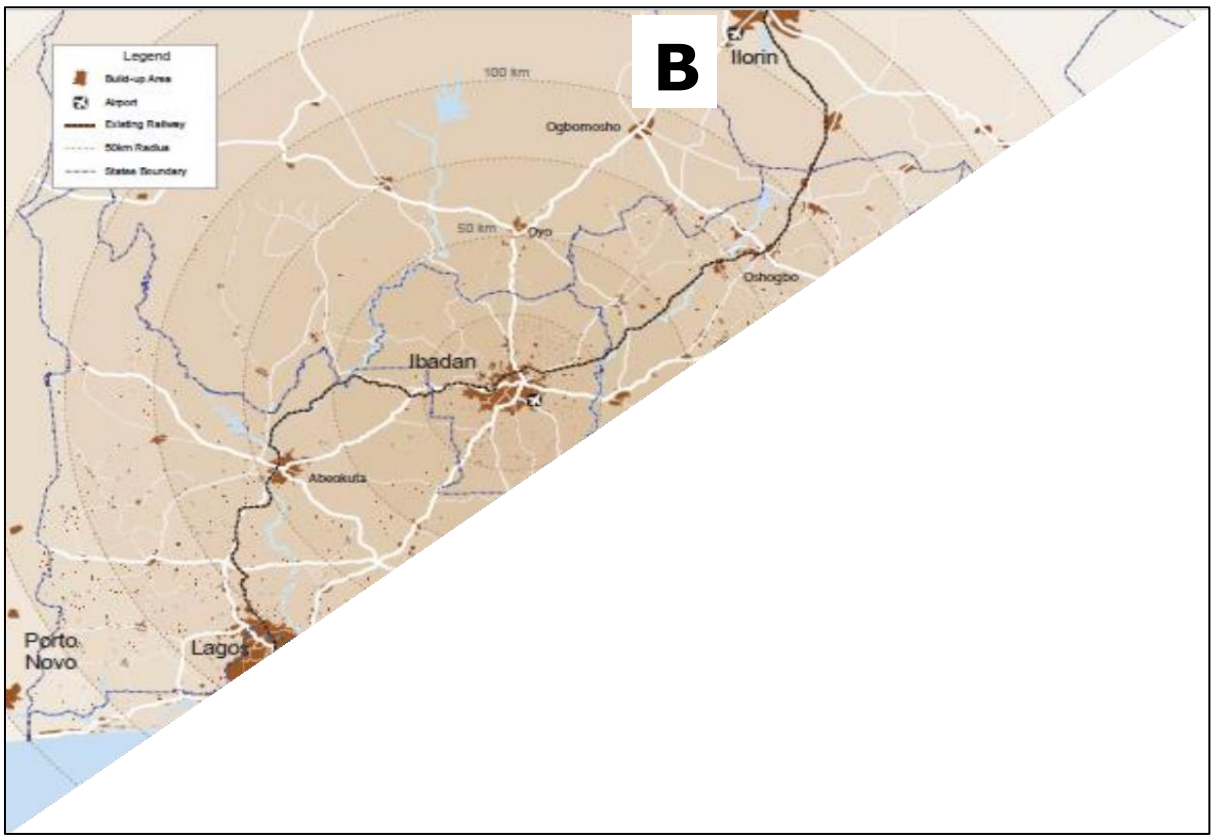

Figure 2: Regional Location of Ibadan
Source: Oyo State Government 2016

The spatial growth and physical expansion of Ibadan like that of a number of cities around the world has been influenced by its transportation networks. Early urban expansion occurred during the colonial period along the railway line that reached Ibadan from Lagos in 1901. Most of the subsequent expansion of the city were catalyzed by corridor growth along the major road arterials leading into Ibadan from the adjoining cities of Lagos, Abeokuta, Oyo, Osogbo, Ile-Ife and Ijebu- Ode with infill developments occurring thereafter.

In terms of land use, the transportation networks in Ibadan as at 2016 took up 2.07 per cent of the land area of the city, built-up area accounted for 15.68 per cent of the city's land area, while green/open spaces, agricultural land, forest reserves and other land uses accounted for the rest (Oyo State Government, 2016).

Oyo State has thirty-three (33) local government areas (LGAs) while the city of Ibadan comprises eleven local government areas (LGAs), with five LGAs in the inner-city and six LGAs in the outer city accounting for a third of the LGAs in the state.

For this study, the inner-city LGAs was examined. The inner-city LGAs are Ibadan North, Ibadan Northeast, Ibadan Northwest, Ibadan South-east and Ibadan Southwest. The combined land area of the inner-city LGAs is 463.33 square kilometres constituting about 15 per cent of the land area of Ibadan with a population of 1,418,820 about 54 per cent of the population of the city (NPC, 2006). As a result, the population density of the inner-city is six times that of the outer-city. The inner- city houses the principal commercial and administrative hubs in the city. As such, traffic congregates within the inner-city manifesting in long lines of traffic build up and traffic jams at major intersections and junctions.

Integrated road development in Nigeria dates back to 1925, when the Road Board was established by the then colonial administration with the responsibility to evolve blueprints for trunk road network, connecting major administrative centres across the country (CBN, 2003). This category of roads was known as Trunk A roads. The roads connecting regional administrative headquarters to other towns and cities within a region were referred to as Trunk B roads. Other roads such as arterials, collector, distributor and access roads were referred to as Trunk C roads. Upon independence and the practice of the federal system of government, the hierarchy of road classification were similar to the administrative hierarchy in government (federal, state and local) with each tier of government saddled with the responsibility for planning, construction and maintenance of the network of roads under its jurisdiction. This 3-class road hierarchy was also similar to the classification adopted during the days of colonial rule. According to CBN (2003) and Paraphantakul (2014), recently, a fourth class of roads in Nigeria has been delineated as outlined below:

i. The Federal Trunk 'A' Roads: These roads form the skeleton of the national road grid. They cut across regional boundaries in the country and even extend to the international borders of neighbouring West African countries. These categories of roads are under Federal Government's ownership. They are designed, constructed, maintained and financed by the Federal government through the Federal Ministry of Works. The Federal Road Maintenance Agency (FERMA) is in charge of carrying out maintenance of this class of roads.
ii. The Federal Trunk 'F' Roads: These were formerly under state ownership, but were taken over by the Federal Government, with a view to upgrading them to Federal highway standards.
iii. The State Trunk 'B' Roads. These roads are the second category of main roads in Nigeria. They link the major cities within States with the State capitals. These roads are designed, developed, financed and maintained by the State governments through their Ministries of Works, Transport or Infrastructure. The primary objectives of Trunk B roads are to enhance the socio-economic development of the various States in the country.
iv. The Local Government Trunk 'C' Roads: These roads are local feeder roads constructed and maintained by the Works Department of Local Government Authorities in Nigeria. This class of roads are primarily not concrete asphalted and are affected by seasonal weather changes. The roads link villages and communities in the remote parts of each local government region.

The city of Ibadan is an important regional administrative and commercial centre apart from its designation as the administrative headquarters of the Oyo State Government. All the typologies of road in Nigeria can be found in the city. For the traffic survey and the administration of questionnaire,

emphasis will be placed upon the Trunk A road corridors that traverse the inner- city LGAs as illustrated in Figure 3. There is a congregation of these trunk A roads at Iwo Road which is the major traffic node for inter-city transport to Ibadan. Apart from being an inter-city node, it is also an important intra-city node for traffic within the city. Sequel to this, three traffic corridors forming a loop will be adopted for this study originating and ending at the Iwo Road interchange.

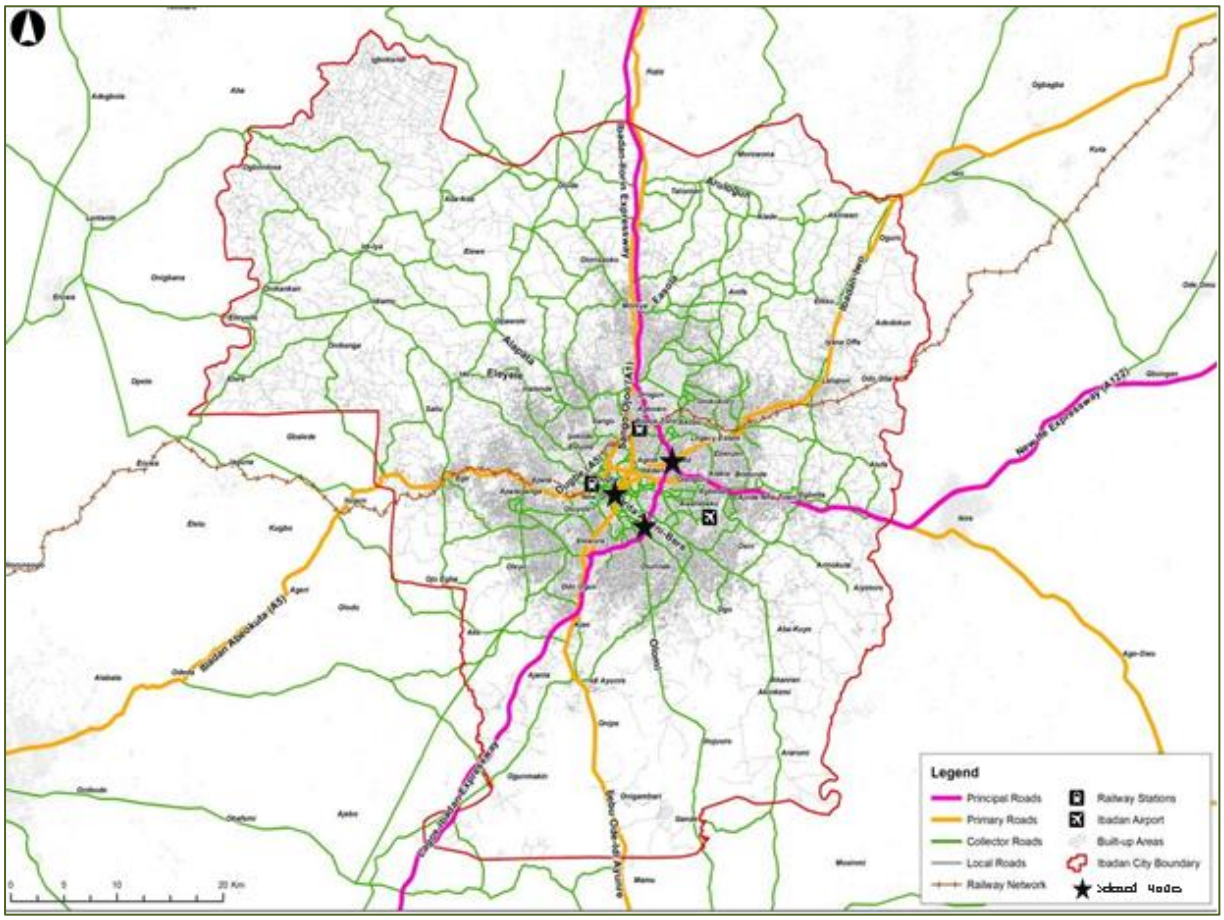

Figure 3: Transportation Network of Ibadan
Source: Oyo State Government 2016

The first traffic corridor traverses Iwo Road and Olorunsogo Link Bridge on the Lagos-Ibadan expressway. The second corridor traverses the Olorunsogo Link Bridge to Beere roundabout, it is a Trunk-B Road and the third, from Beere roundabout to Iwo Road which is a Trunk-A Road. These three traffic corridors form a loop around the boundaries of the Ibadan Northeast LGA. The nodes of the three selected traffic corridors will be employed for the surveys.

Two distinct research instruments were adopted. The first research instrument was a questionnaire directed at eliciting responses from commuters. The second research instrument involved a structured interview of public transport operators, with the aid of an interview guide.

For the questionnaire survey for commuters, a self-rated questionnaire was adopted to collect data. The questionnaire was divided into two sections. First section obtained information on the socio-demographics attributes of public transport users such as gender, age, education, marital status, household size, monthly income, vehicle ownership and reasons/frequency of public transport patronage. The second section deals with commuters' satisfaction with public transport (bus services) in the city. This was required to elicit information on the operations and facilities used by the private transit operators. This study evolved sixteen (16) service quality attributes that could influence users' perceptions and satisfaction with bus services derived from existing literature (Ali, 2014; Nyongesa and Kitale, 2014). The ranking of the attributes was achieved with a five-point Likert scale (very satisfied = 5, satisfied = 4, undecided = 3, dissatisfied = 2 and very dissatisfied = 1). This scale

will be adopted to rank the parameters developed for the study with the aim to determine the level of perception and satisfaction of respondents with public transport services in Ibadan.

Three major bus terminals (Iwo Road, Bere, and Olorunsogo) which are important transit nodes along the specified survey corridor providing access to vital commercial, institutional, public and residential areas were selected for the questionnaire survey. At each of the bus terminals, 150 commuters were randomly selected for the administration of questionnaire. In all, 450 questionnaire was administered. A total of 430 questionnaire that were properly filled and collated was used for the analysis.

The data collected were analysed using descriptive and inferential statistics. The socio-economic characteristics of transit users were analysed using frequency values. The mean score and standard deviation of the ranked 16 service quality attributes of public transit services was used to discuss commuters' perceptions and satisfaction with public transport services in the study area. Furthermore, principal component analysis (PCA) was employed to identify clusters of attributes or important underlying factors (dimensions) of service quality determining commuters' perceptions and satisfaction with public transport services. The PCA is appropriate for this study because it is a tool for exploratory analysis. In addition, correlation analysis was employed to determine if there is a significant relationship between preferred mode of public transit and frequently used public transit mode.

4. Findings and Discussions

Public transportation in Ibadan is limited to road transport due to unavailability of intra-city rail network even though the existing national rail network traverses the city. The public transport system is operated by both the private and the public sector. Private operators within the public transport system in Ibadan employ the mini bus (locally referred to as danfo), taxi cars (the popular model is the Nissan Micra) and the tricycle (locally referred to as keke) to provide for the city's transport needs. On the other hand, the public transit operations owned by the State government which provides transport services on some few selected routes employ the double-axle urban buses with the local appellate "ajumose" buses. The various public transport modes in Ibadan are illustrated in Figure 4.

Figure 4: Public transport modes in Ibadan

Findings revealed a fair distribution of patronage of public transit amongst the genders. There was only a marginal difference between male and female patronage of public transportation with the male category having a slightly higher representation. People within the age brackets 20-40 had the highest representation followed by those within the 40-60 age bracket. Jointly, majority of commuters were between the 20-60 age bracket constituting 71.9% of the representative sample. The highest number of commuters employing public service were those in informal employment while the formal sector comprises only 4.7% of the commuters sampled. Income can be described as a major predictor of public transport patronage as more than three-quarter of the respondents earned below #36,000 which is a sum slightly about the national minimum wage and can be categorized as low-income earners.

The Likert scale was employed to determine commuters' satisfaction with public transportation modes utilizing a purposive ranking scale. The scale used the following responses: Not Satisfactory, Somewhat Satisfactory, Neutral, Satisfactory and Very Satisfactory. Each response was coded as follow: Not Satisfactory (SN) = 1, Somewhat Satisfactory (SS) = 2, Neutral (N) = 3, Satisfactory (S) = 4 and Very Satisfactory (VS) = 5.

Table 1: Socio-demographic characteristics of respondents

Variables	Options	Respondents N=430	Percentage (%)
Gender	Male	220	51.2
	Female	210	48.8
Age (Years)	Below 20	59	13.7
	20 - 40	201	46.8
	40 - 60	108	25.1
	60 and above	62	14.4
Occupation	Formal Sector	57	4.7
	Informal Sector	189	32.6
	Students	48	9.3
	Unemployed	66	23.7
Average Level of Income	< minimum wage #18,000	134	31.2
	#18,000 - #36,000	197	45.8
	> #36,000	99	23.0
Marital Status	Single	191	44.4
	Married	218	50.7
	Separated	21	4.9

The commuters' satisfaction on transportation modes weight value (CSTMWV) was obtained by summing up the product of the total number of responses to each variable and the weight attached to each rating i.e. (a x 5) + (a x 4) + (a x 3) + (a x 2) + (a x 1). The mean used for computation was obtained by summing up the CSTMWV and dividing it with the total number of variables. The deviation (which is also used as condition index) and standard deviation were also calculated, to ascertain the level of commuters' satisfaction with the public transportation modes in Ibadan. From the calculation, a positive deviation indicates a high level of satisfaction and when the deviation is negative, it depicts a low level of satisfaction and the values are higher the farther from zero.

NR (f) = Number of Respondents (questionnaire)
CSTMWV = Commuters' Satisfaction on Transportation Modes Weight Value
$\ddot{X}$ = Mean = CSTMWV/NR (f)
No of Variables
D = Deviation (Condition index) = CSTMWV - $\ddot{X}$.

Table 2 presents the index of the parameters of commuters' satisfaction criteria with public transportation modes in Ibadan. Positive deviation indicates satisfaction with the variable measured and the higher the value, the greater the satisfaction while a negative deviation indicates low level of satisfaction and the more the negative value from zero, the lesser the satisfaction. The level of commuter satisfaction on public transportation in the study area based on analyzed parameters indicates an overall satisfaction of 2.74. The mean weighted value (∑) of 2.74 confirms that majority of the respondents were not satisfied with the listed parameters of public transportation in the study. Six of the parameters had positive deviation while eight parameters had negative deviation. The ranking of the variables captures the relative importance or weight of the variables on the level of satisfaction of the commuters.

In order to identify the constraints to commuter satisfaction, Factor analysis was used. Factor analysis is a statistical method used to describe variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors. For example, it is possible that variations in four observed variables mainly reflect the variations in two unobserved variables. Factor analysis searches for such joint variations in response to unobserved latent variables. The observed variables are modelled as linear combinations of the potential factors, plus "error" terms. The information gained about the interdependencies between observed variables can be used later to reduce the set of variables in a dataset.

Table 3 shows the extraction of each parameter. It can be concluded that each variables is positively related to each other. But some are weak while some are strong. Less than 0.5 is regarded as weak while more than 0.5 is strong. Furthermore, 16 items showed a more than 0.5 extraction level of relationship, while 6 items revealed weak relationship. The strongest parameter is reliability of public transportation with 0.650 while the weakest parameter is satisfaction criteria on courtesy with 0.310.

Table 2: Parameters of Commuter Satisfaction with Public Transportation

S/N	Parameters	Rating and Weighted Value				Index of Condition				
		HS (5)	S (4)	N (3)	D (2)	HD (1)	SWV	CSTMWV	D	Ranking
1	Waiting Time	-	70(280)	85(255)	33(66)	27	**628**	**2.92**	**0.18**	5
2	Condition of the mode	12(60)	38(152)	102(306)	48(96)	15	**629**	**2.93**	**0.19**	4
3	Driver's Behaviour	-	26(104)	44(132)	105(210)	40	**486**	**2.26**	**-0.48**	14
4	Crowding	40(200)	39(156)	16(48)	20(40)	100	**544**	**2.53**	**-0.21**	12
5	Cleanliness of Vehicle	-	30(120)	55(165)	92(184)	38	**507**	**2.36**	**-0.38**	13
6	Ease of Entering/Exiting the mode	15(75)	87(348)	35(105)	43(86)	35	**649**	**3.02**	**0.28**	3
7	Journey Time	3(15)	36(144)	92(274)	39(78)	45	**556**	**2.59**	**-0.15**	11
8	Seat Comfort	10(50)	58(232)	52(156)	35(70)	60	**568**	**2.64**	**-0.10**	8
9	Cost of Travel	44(220)	51(204)	50(150)	22(44)	48	**666**	**3.10**	**0.36**	2
10	Safety and security in the Mode	17(85)	43(172)	48(144)	72(144)	35	**580**	**2.70**	**-0.04**	7
11	Information about bus stops	42(210)	63(252)	35(105)	51(102)	24	**693**	**3.22**	**0.48**	1
12	Reliability	30(150)	18(72)	92(274)	50(100)	25	**621**	**2.89**	**0.15**	6
13	Level of Customer service	-	87(348)	20(60)	43(86)	65	**559**	**2.60**	**-0.14**	10
14	Appearance of the Vehicle	10(50)	45(180)	55(165)	65(130)	40	**565**	**2.63**	**-0.11**	9
	Total							**38.39**		
	Mean of ∑CTSWV = 38.39/14 = 2.74									

Source: http://www.ondobudget.org/download_budget.php

Table 3: Communalities of the Variable

Communalities	Initial	Extraction
Satisfaction Criteria on Reliability	1.000	.577
Satisfaction Criteria on Responsiveness	1.000	.578
Satisfaction Criteria on Competence	1.000	.629
Satisfaction Criteria on Courtesy	1.000	.310
Satisfaction Criteria on Credibility	1.000	.477
Satisfaction Criteria on Security	1.000	.521
Satisfaction Criteria on Access	1.000	.584
Satisfaction Criteria on Communication	1.000	.684
Criteria on Understanding to the customer	1.000	.725
Satisfaction Criteria on Empathy	1.000	.419
waiting time	1.000	.804
Condition of the mode	1.000	.527
Driver's Behaviour	1.000	.734
Crowding	1.000	.432
Cleanliness of Vehicle	1.000	.375
Ease of Entering/ Exiting the mood	1.000	.501
Journey Time	1.000	.413
Seat Comfort	1.000	.613
Cost of Travel	1.000	.628
Safety and Security in the Mode	1.000	.629
Information about bus stops	1.000	.650
Reliability	1.000	.846

Table 4 shows the rotated component matrix which may be used for factor loading. It is the key output of rotated components analysis. It contains estimates of the correlations between each of the variables and the estimated components. In this case, there are 3 categorical components which are commuter satisfaction on quality of service (11 variables), commuter satisfaction on mode of commuting (6 variables) and commuter satisfaction on trip cost/credibility (3 variables).

Table 4: Rotated Component Matrix

	Component		
	1	2	3
Reliability	.853		
Level of customer service	.783		
Driver's Behaviour	.768		
Satisfaction Criteria on Responsiveness	.736		
Satisfaction Criteria on Reliability	.722		
Appearance of the vehicle	.691	.519	
Safety and Security in the Mode	.689		
Information about bus stops	.648		
Satisfaction Criteria on Security	.643		
Satisfaction Criteria on Competence	.637		
Satisfaction Criteria on Courtesy	.550		
Satisfaction Criteria on Understanding to the customer	.546		
waiting time		.762	
Satisfaction Criteria on Access		-.612	
Seat Comfort		.602	
Condition of the mode		.596	
Satisfaction Criteria on Communication	.547	-.577	
Crowding		.553	
Cost of Travel			.733
Ease of Entering/ Exiting the mood			.699
Satisfaction Criteria on Credibility			-.619

Source: Authors' fieldwork, 2018

Principal components communalities with varimax rotation were used to determine the underlying primary dimensions governing the full set of variables employed to determine commuter's satisfaction with the public transportation modes in Ibadan. The 21 variables presented in Table 5 (out of 25) are those with factor loadings greater than 0.5 while the remaining variables which were not shown in the table have factor loadings less than 0.5. The factor analysis generated two underlying dimensions of the determinants influencing commuters' satisfaction in public transport modes in Ibadan which made good conceptual sense and explained a total variable of 57.238% of the observed variance, as shown in Table 5. The factors include; commuter satisfaction on quality of service, commuter satisfaction on mode of commuting and commuter satisfaction on trip cost/credibility. All the 3 factors exhibit satisfactory level of construct reliability.

There is a positive strong relationship between the preferred mode of public transit and the frequently used mode of public transit amongst the four identified public transport mode in Ibadan which are Ajumose bus, minibus, taxi and tricycle. The most preferred mode of public transit is the taxi (micra) and it is also the most frequently used mode of public transit. The result is similar to that of the other public transit modes as the percentage of commuters that preferred a particular transport mode was almost the same as the frequency of using the public transport mode was employed as illustrated in Figure 5.

Table 5: Principal Component Analysis

Factors	Factor loadings	Eigen values	% Variance explained	Cumulative %
Factor 1: **Commuter satisfaction on quality of service**		7.053	28.213	28.213
Reliability	.853			
Level of customer service	.783			
Driver's Behaviour	.768			
Satisfaction Criteria on Responsiveness	.736			
Satisfaction Criteria on Reliability	.722			
Safety and Security in the Mode	.689			
Information about bus stops	.648			

Factors	Factor loadings	Eigen values	% Variance explained	Cumulative %
Satisfaction Criteria on Security	.643			
Satisfaction Criteria on Competence	.637			
Satisfaction Criteria on Courtesy	.550			
Satisfaction Criteria on Understanding to the customer	.546			
Satisfaction Criteria on Communication	.547			
***Factor 2:* Commuter satisfaction on mode of commuting**		4.012	16.048	44.260
Appearance of the vehicle	.519			
waiting time	.762			
Satisfaction Criteria on Access	-.612			
Seat Comfort	.602			
Condition of the mode	.596			
Crowding	.553			
Factor 3: Commuter satisfaction on trip cost/credibility		3.244	12.977	57.238
Cost of Travel	.733			
Ease of Entering/ Exiting the mood	.699			
Satisfaction Criteria on Credibility	-.619			

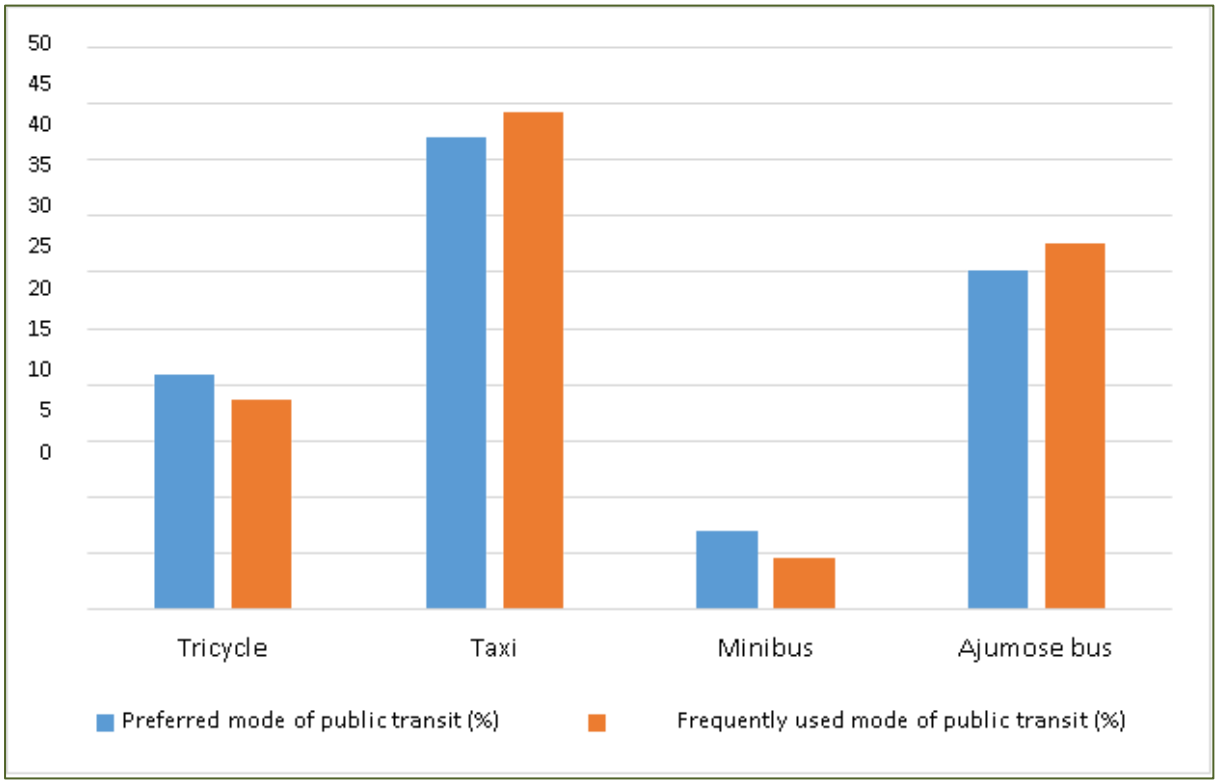

Figure 5: Preferred and most frequent public transit mode

It is important to note that, as an important fulcrum for the transition to green mobility, public transportation is vital. An increased dependency on public transportation by the commuters in a city reduces the dependency on private or self-provided automotive transport which has been identified to be contrary to the dictum of green mobility. Increased patronage and dependency on public transport is also hinged upon the quality and effectiveness of public transportation. In terms of green mobility not all the four existing public transport modes in Ibadan have the same ranking on the green ladder. The large buses (Ajumose) and the mini-bus (danfo) have significantly higher ranking on the green ladder in comparison with the tricycle (keke) and taxi (micra) with the Ajumose bus having the highest. Therefore, any significant transition to green mobility in Ibadan will be stimulated by the proliferation of the

Ajumose bus as the most preferred and frequently used mode of public transport in Ibadan.

5. Conclusion

The aim of this study was to determine the satisfaction of commuters in Ibadan with the public transport modes in order to address its implications for a transition to green mobility. Public transportation is one of the strategic themes to foster green mobility as more people can travel on less fuel with lesser impacts on the environment. Public transportation is an energy efficient and environment friendly road transport mobility. An increased patronage of public transport by commuters is one of the objectives of green mobility, when a higher percentage of commuters travel with public transport especially those with higher green index (large buses), in the case of Ibadan – Ajumose bus, the negative effects of road transportation on the environment is significantly reduced.

This study has linked the satisfaction of commuters with public transport modes and their preference or choice to employ public transport for their intra-city travels in Ibadan. There is a close relationship between the satisfaction of commuters which is a function of the quality of public transport and the ease or frequency with which they employ public transport. A transition from frequent commuting by personal automobiles to public transport depends upon the quality and efficiency of the public transport modes and system.

Findings revealed that amongst the existing public transport modes in Ibadan (taxi, minibus, Ajumose bus) the most preferred and predominant public transport mode in Ibadan is the taxi. On the rung of green mobility, amongst the four identified public transit modes in Ibadan, the taxi has a low green mobility index. Although the tricycle has the least green index, the taxi in comparison with the minibus and the Ajumose bus has much less rating on the green mobility index. Therefore, sustainable transition to green mobility in Ibadan significantly depends upon improving the quality of service and the satisfaction of commuters derivable from the greener modes of public transport – the Ajumose bus and minibus. This can be further reinforced by increasing the numbers of these buses as well as the conditions of the buses.

The general satisfaction of commuters with the public transport system in Ibadan is relatively low. In order to foster increased patronage of public transport and the transition to green mobility, the following recommendations are proposed. First, there is the need to address some of the identified challenges of the public transport system by general improvements in the quality and conditions of the public transport modes, less crowding in vehicles, enhanced safety, security and reliability, information about bus stops, reduced waiting time and improvements in driver behaviour, courtesy and competence. Second, there is the need to transit to greener modes of public transport. The Ajumose bus which has the highest green index amongst the existing public transport modes in Ibadan should be proliferated. The use of the tricycle should be phased out while the taxi which is currently the most common public transport mode should be discouraged in favour of greener modes of mobility like the mini-bus.

Furthermore, asides improving the quality of public transport and engendering greener modes of mobility (minibus and Ajumose bus), there should be a drive towards incentivizing the use of public transport modes by operators and commuters alike. The state-owned Ajumose buses should be deregulated in favour of private-public partnership or private sector driven Bus Rapid Transit (BRT) and commuter bus lines. It has been established that the proliferation of public transport especially the greener modes of public transport (buses) facilitate the transition to green mobility. However, it should be noted that the transition to green mobility is a process where improvements and innovations never ceases, it also requires commitment and considerable investments. It is an unremitting objective which should be tied to the visions of urban governance.

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