Intra-City Mobility and Characterization in a Fast-growing City of Lagos, Nigeria

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Abstract - **Effective urban transportation no doubt serves as engine room and catalyst for driving national economic development. Significantly, the purpose of urban transport is to provide both passenger and freight mobility over specific parts of urban areas including cities, and its efficiency is characterized upon transporting effectively and achieving economies of scale. Hence, this study examined intra-city mobility and characterization in Lagos, Nigeria. The data was sourced from both primary and secondary sources. Primary data detailed the use of two sets of questionnaires administered to commuters and motorists. 182 copies of questionnaire were randomly administered to commuters, while 60 units of the questionnaire were purposively and conveniently administered to motorists. Descriptive and inferential techniques were used for data analysis. Major findings revealed obvious variations in socio-economic parameters of intra-city trip makers and factors influencing trip making. It was observed that journey to work, school, shopping cum business constituted the major trips characterizing in Lagos. Findings also revealed that high patronage priority was given to most used and preferred means due to vehicle travel speed, trip purpose, and availability than safety and comfortability of modal choice. Regression analysis result revealed that commuters' modal choice and patronage is statistically influenced by operational attributes of mode (e.g. transit time, delay duration, safety, vehicle condition and transit fare etc.) at Sig. p=0.000 and F^{14}_{165} 15.667 which is greater than table value at 5% significant level. The study recommended among others the formulation and implementation of effective policy for urban transport activities; standardization of service operations and expansion of infrastructural facilities including the last-mile in the city.**

Index Terms- **Urban Mobility, Transportation, Mobility Index, Lagos**

I. INTRODUCTION

Human settlements have been growing and expanding at an alarming rate in term of territorial space and population since the emergence of the industrial revolution in which transportation has been among the prime factors. Of importance is the rapid growing and expansion of cities in different countries and continents of the world. Aside from the fact that the development of modern cities such as Peking (Beijing), London, New York, Berlin, Los Angeles and Australian among others was anchored on Industrial Revolution [2, 3, 6, 21], twin functions of mobility and accessibility provided by transportation ignited the prominence of those cities and the emerging ones as people continually exploit socio-economic potentials of cities [21].

Transportation has always been closely related to the structure and density of cities since the emergence of human settlement aside from the use of land for human satisfaction [8, 16]. Unlike the pre-industrial revolution settlements where traditional towns and cities were small, compact and confined most activities to walking distance [14, 15]; cities as from the post-industrial revolution to date are characterized by industrial cum commercial dimensions. These have brought about complex spatial patterns and changing land uses occasioned by ever-increasing mobility demand and movement of people and services within and across geographical locations.

As the world's population and productive activities increasingly concentrated in cities, [9] observed that urbanisation and globalisation have brought several challenges, most especially mobility challenges around the world. With the rate of urbanization being alarming globally; more

people are continuously moving to emerging urban centres to seek better means of livelihoods with extreme land-use intensity. Therefore, this rapidly increasing intensity of land-use which brought about an everlasting separation between workplace and residential areas led to the growth of travel demand in cities. As a result, [18] opined that the demand for transport and travel intensity tends to increase sharply with the size of the city since mobility vis-à-vis transportation in urban areas becomes highly complex due to the characteristics of the modes involved, the multitude of origins and destinations as well as varieties of traffic.

Nigeria cities centres are not exempted from the wind of globalization, industrialization, urbanization and their accompanied mobility challenges. Intra-city movement as a reflection of urban mobility in mega and cosmopolitan Nigerian cities including Lagos is usually dominated by an urban transportation mode (road) with diverse means involved. The door-to-door services and flexibility characteristics of the road mode makes it the most used, readily accessible and the most problematic with noticeable costs which include but not limited to increasing level of motorization and car ownership, congestion, environmental damages, deteriorating air, crime activities, informal transport services, infrastructure degeneration and urban stress in the city. The high rate of influx of people from various parts of the country and beyond to Lagos has not only resulted to the earlier identified costs, but it has also increased the trip demand and complexity of urban mobility and thus making the characterization of intra-city Lagos trips unorganized, haphazard and unpredictable. It is because of this that the 2014 Urban Mobility Index ranked Lagos 72nd of 84 cities worldwide and 3rd in Africa [15] behind Cairo and Johannesburg. This inefficient urban mobility in Lagos and many Nigeria cities calls for an enhanced strategy towards making urban mobility more organized, proactive, efficient and sustainable.

Based on these foregoing that this paper analyses intra-city mobility and characterization in Lagos, Nigeria with particular reference to Ikeja. In achieving this aim, specific objectives pursued were to examine the socio-economic characteristics of commuters in the study area, analyze the journey characteristics of commuters and the transport operators, identify the challenges experienced by transport operators towards justifying the complex understanding of the urban mobility in the study area as well as establish the influence of the operational attributes of modes on the modal choice of commuting in Lagos, Nigeria. In other words, for logical and factual understanding, this study was structured into five sections. Following the introductory section was the brief literature review. The third section dealt with the study methodology. It gave an insight into the study area and sampling collection methods. The fourth section presents the analyzed data and discussion of findings, while the fifth and the last concludes with the way forward.

Research Hypothesis

H_0: The means of transport used in urban commuting is not conditioned by the operational attributes of such mode.

H_1: The mean of transport used in urban commuting is conditioned by the operational attributes of such mode.

II.   CONCEPTUAL CLARIFICATION AND BRIEF LITERATURE REVIEW

A. COMPLETE URBAN MOBILITY CONCEPT

This study is anchored on complete urban mobility concept. The complete urban mobility Index concept emanated from Siemens in 1995 as a result of a study conducted on the mobility of global cities [1]. The concept aimed at identifying a pathway for a city to develop the most efficient, sustainable and user-centred passenger and freight mobility system. It describes a mobility system which is actively managed to balance individual lifestyle choices with environmental quality, global competitiveness and quality of life ambitions in an urban area.

Five infrastructure sectors covered in the concept are water, electricity, transportation, healthcare and safety/security. However, transportation emerged as the top challenge for megacities among

the five sectors because of its impact on city competitiveness. "Ref. [20]" presented the Complete Mobility Index (CMI) which gives a comparative insight into the status of global cities concerning their complete mobility achievements in which 46 global cities were scored against 11 indicators. The first index was done in 1995 with eleven indicators, while 15 indicators were used in 2008 from which Zurich was ranked first, and Lagos 45th out of 46 cities.

Similarly, the Urban Mobility Index, according to [14, 15] showed the extent of maturity and performance of public transport of 84 global cities. The selection of the criteria used to measure the maturity and performance of the cities was governed by a desire to cover the classical areas of mobility measurements–security, quality, accessibility, affordability, sustainability, innovativeness and convenience. The 19 criteria which make for a representative and comprehensive view of cities' mobility are financial attractiveness of public transport, share of public transport in modal split, share of zero-emission modes in modal split, roads density, cycle path, network density, urban agglomeration density, smart card penetration, bike-sharing performance, car-sharing performance, public transport frequency, initiatives of public sector, transport-related CO_2 emissions, NO_2 concentration, PM concentration, traffic-related fatalities, increase of share public transport in modal split, increase of share of zero-emission modes, mean travel time to work and density of vehicles registered.

Based on the fact that there is no perfect mobility system in the world, the analysis of the Urban Mobility Index showed among others that only 11 cities are above average. The European urban mobility systems are the most matured, while Indian Cities had more than global average score. Also, North American cities ranked bottom worldwide due to orientation towards cars while the most matured mobility system in Paris and the best performing mobility system in Copenhagen. However, Africa and the Middle East are the lowest-performing regions in the world [21]. Specifically, Lagos is ranked 72 of 84 worldwide and ranked 3 of 5 in Africa behind Cairo, and Johannesburg [21].

Worldwide, effective public transportation has been identified as a significant engine room driving national economic development [10]. The purpose of collective transportation or public transport is to provide publicly accessible mobility over specific parts of a city, and its efficiency is based upon transporting large numbers of people and achieving economies of scale. According to [13] and [18], public transport consumes on average 10 times less space than individual transportation unlike in car-dependent cities where a much larger amount of space must be allocated to transportation than in transit-oriented cities. In this view, "Ref. (2)" observed that the inability of transport operators to solve the mobility needs of Nigerians made the Federal Government established the Federal Urban Mass Transit Program in 1988 to ameliorate the transport situation in Nigeria. Through the program also, State Transport Corporations were established and assisted by the Federal Government with busses and training to actualize the objectives of the program which is improved urban mobility in the country.

B. BRIEF LITERATURE REVIEW

Urban transportation system is a key component and an engine of growth, development and sustainability of any society including developed and developing. A well-organized and functional urban transportation system provides citizen's access to not only the points of employment, recreation centres and health facilities but to all land uses within and around urban areas [4, 19]. It promotes geographical propinquity, urban unity and social contacts, socio-economic integration, urban infrastructural development as well as bridges egocentric affinity and spatial dichotomies [19]. Urban transportation is a system of conveying people, goods, information, idea and services by ether private or public (government-sponsored or supported) carriers (motorized and non-motorized) for money or a common carrier for hire and reward purposes. However, the significance of urban transportation as an unavoidable interface irrespective of the demographic class cannot be overemphasized as it primarily facilitates vital links for accessibility and mobility for all a sundry conveniently and safely [4, 5, 19].

Despite the noticeable significance of urban transportation to the socio-economic development and affluence of any city, the urban transportation, particularly in the third-world countries including Nigeria, is still characterized with several noticeable accessibility and mobility issues which are not unconnected with the increasing and unguided population agglomeration and urbanization, industrialization and land-use changes. This thus led to the complex nature and understanding of urban mobility in cities.

Meanwhile, urban mobility/travel is the most important component for higher transport efficiency of a city and metropolis [15]. With the development of cities, the pressure of sustainable transportation in urban areas is becoming a serious and alarming issue. However, urban travel is also the most difficult problem to be resolved for rapidly developing cities and metropolises as the complexity of urban travel is becoming more and more obvious [7, 15]. Generally, population increase land-use changes in urban and interurban areas affect the demand for trips in most cases. Also, new trips affect the transportation system and this usually leads to the redesign of the transport infrastructure to satisfy the new demand so that the improvement of the transport infrastructure will positively affect the socio-economic development of an area. As a result, new land uses are attracted, which in turn increase the demand for new trips [17].

Households of limited mean particularly in developing cities have fewer choices in both where they can afford to live and how they can travel. In this regard, [11] conclude that low-income adults are more likely to travel regularly by public transit, while public transit use for commuting and job-searching purposes corresponds with an inability of low-income adults to access a vehicle and having poor or limited local bus service. Similarly, transport attributes such as travel cost and trip distance as well as external factors such as urban form and land use, and socio-demographic characteristics are all critical determinants of transport mode choice. With this, [22] observe that gender, household composition, income and car ownership are the most significant socio-demographic factors in influencing urban travel behaviour.

Supporting this notion, [12] remarked that transportation demand is influenced by various factors like availability of facilities, level of motorization, city structure, the pace of economic growth, local culture, and so on. Therefore, it is very important to analyze the salient issues in intra-city urban mobility by examining the travel behaviour and modal choice of commuting in Lagos as well as the relationships among the factors the aids complex understanding of urban mobility in Lagos, Nigeria towards grasping the current and future travel demand in the city. Again, there is still an obvious poor variation in the operation and services of informal and formal urban transportation in the study area. However, this study examined these research gaps towards suggesting better measures to improve urban mobility and trip making functions in Lagos and other cities with similar issues in Nigeria.

III.   MATERIALS AND METHODS

A.   Study Area (this study is delimited to the capital city of Lagos (Ikeja), Nigeria)

The city of Lagos is a fast-growing city in the Nigerian state of Lagos. Lagos with its adjourning conurbation is the most populous city in Nigeria and one of the world most populous and fast-growing cities. The city is situated in the south-western part of Nigeria with its administrative capital as Ikeja which is located at approximately 3° 30′ West latitude, 7° 30′ North [10]. The total population of Ikeja, Lagos is put at 648,720 and it lies in the upland area of Lagos State. The study area is one of the major commercial and administrative centres in Lagos state as several economic and administrative activities are concentrated there. Hence, there is a need for efficient mobility of people and services therein for efficient functional activities in Ikeja. Among the notable communities in the Ikeja area include Oregun, Ojodu, Opebi, Akiode, Alausa, Agidingbi, Ikeja, Ogba, Maryland and Government Residence Area, Ikeja.
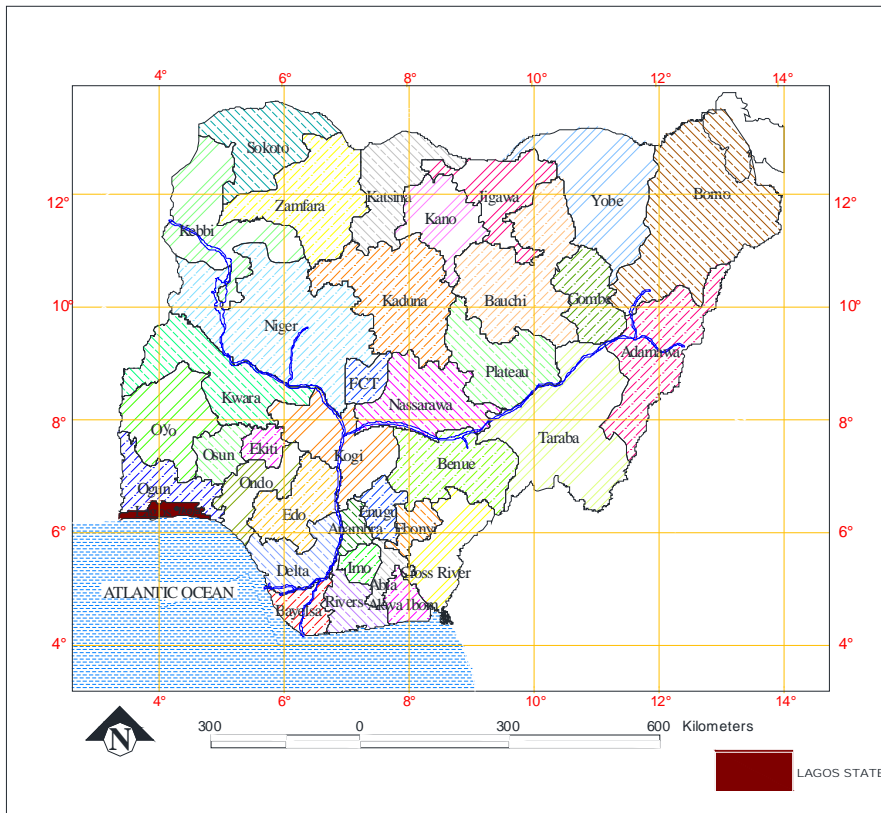
Source: Ministry of Physical Planning & Urban Development, Alausa, Ikeja, Lagos, 2015

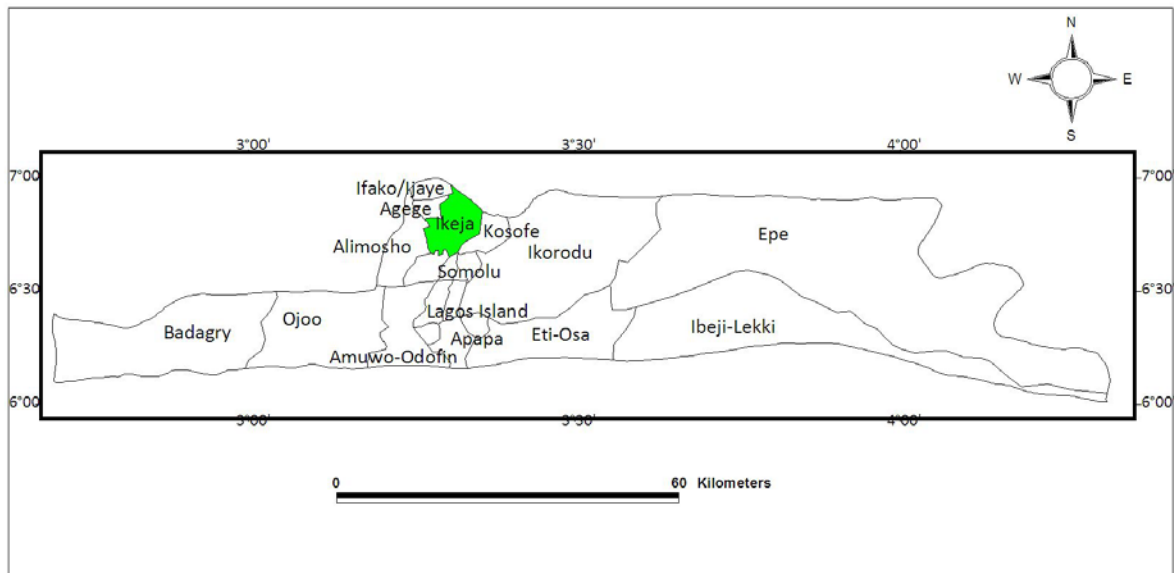Figure 1: Lagos State in Map of Nigeria

Figure 2: Map of Lagos Showing Local Government Areas and the Capital City
Source: Ministry of Physical Planning & Urban Development, Alausa, Ikeja 2015.

B.   Sampling Collection

The cross-sectional research design of both qualitative (well-defined theoretical approach) and quantitative (empirical evidence) was adopted to answer the study research questions. The criterion for this research design was based on its unique characteristics of descriptive analysis, interpretation, as well as the determination of relationships between variables. Data collected were sourced through primary and secondary sources. The study derived its authority majorly from primary data (questionnaire, field observations, and interview), while information from various published and unpublished materials including books, articles, dissertations, reports etc. supported the study. Two sets of questionnaires were designed and administered to road users (commuters and motorists) to understand varying issues surrounding intra-city mobility in Lagos with a specific focus on the capital of the city (Ikeja) as the study area in which the commuters/passengers and Motorists/operators of public and public-private transport were the targets. The criterion for the selection of Ikeja was based on its socio-economic and political status as well as its characteristics of both conventional public transport and non-conventional public transport operations.

The questionnaire designs were divided into two sections; the first section sought for information about socio-economic characteristics of the commuters and motorists including age distribution, marital status, educational background and average monthly income, while the second section probed into (questionnaire A) journey characteristics of commuters including trip origin and destination, purpose of trip making, most patronized or used means, reasons for modal usage and preference, commuters waiting period etc.; (questionnaire B) mobility characteristics of motorists including driving experience, factors responsible for route patronage, factors considered in vehicle brand selection, criteria used in fixing fare; as well as the challenges experienced and suggestions on the means to improve the service delivery were taken. However, the questionnaires comprised of closed and open-ended questions and the administration of these research instruments were done by hand-to-hand delivery (On the spot collection of the questionnaire).

Meanwhile, sample frame of 0.028% which equivalent or resulted to 182 respondents (commuters) as the sample size was selected and sampled using random sampling technique from the study population (648,720), out of which 180 copies were completed, retrieved and used for analysis, while 60 transport operators also known as motorists were systematically selected along major corridors in the study area for further analysis. Respondents were selected at major bus stops and traffic corridors in Ikeja, Lagos. Furthermore, data collected were analyzed using both simple descriptive and inferential statistics. Descriptively, the questionnaire administered was subjected to simple frequencies distributions with frequency percentage tables drawn to support the illustrations. Also, charts such as pie charts and histogram were used as graphical illustrations of the study findings and to support frequency tables. Meanwhile, inferential analytical technique (regression analysis) was employed to examine the extent of the relationship that exists between independent (the operational attributes of modes) and dependent (modal choice of commuting) variables used (Table 1). Regression analysis was carried out to enable the drawing of scientific inferences from the data evaluated. It was used to analyze the impact of the operational characteristics of modes (predictor variables) on the modal choice of commuting (dependent variable) and to identify the most significant factors that affect or influence the modal choice of respondents. Invariably, regression analysis which was used to test the postulated hypothesis and the descriptive statistics used for data presentation were run through the use of Statistical Package for Social Sciences SPSS IBM version 21. In other words, the calibration of variables that is the labels and operational definition of both the independent and dependent variables were presented in Table 1. However, the operationalization of the variables was done with some having dichotomous definition presented as dummy variables 0 and 1, and others were continuously defined (Table 1).

Table 1: Variables Description, Label Code and Operational Definition for Modal Choice of Commuting and the Operational Characteristics of Modes

S/N	Variable Description	Label	Variable Operational Definition
1	Means of Commuting	Y	Continuous: 1= Mini bus, 2= Private Cab (ride hailing), 3= BRT/FUMT Bus, 4 = Cab/taxi, 5= Adapted Van (Molue), 6= Tricycle
2	Ease of Accessibility	X1	Dichotomous (dummy): 0 = not at all accessible/not accessible 1= very accessible/ moderately accessible
3	Waiting time at the terminal	X2	Continuous: 10= below 10mins 15= 10-20 mins, 26= 21-30 mins, 36= 31-40 mins, 40= Above 40 mins
4	Transit fare charges	X3	Continuous: #100= below #100 #125= #100-#150, #176= #151-#200, #226=#201-#250, #250= above 250
5	Transit duration (travel time)	X4	Continuous: 30= below 30mins 45= 30mins- 60mins, 76= 61mins-90mins, 105= 91-120 mins, 120= Above 120mins
6	Transit delay duration	X5	Continuous: 10= below 10mins 15= 10-20 mins, 26= 21-30 mins, 36= 31-40 mins, 40= Above 40 mins
7	Trip Purpose	X6	Continuous: 1= Work, 2= School, 3= Business, 4= Shopping, 5= Recreation
8	Pattern of trip making (origin/destination)	X7	Continuous: 1= Within Ikeja (centre), 2= Ikeja – Mainland, 3= Ikeja – Island, 4= Ikeja – Outskirts
9	Frequency of vehicular stops while on transit	X8	Continuous: 1= no stop, 3= 1- 5 stops, 8= 6- 10 stops, 10= above 10 stops
10	Vehicle Condition	X9	Dichotomous (dummy): 0 = not at all adequate/not adequate 1= very adequate/ moderately adequate
11	Safety	X10	Dichotomous (dummy): 0 = not at all adequate/not adequate 1= very adequate/ moderately adequate
12	Speed	X11	Dichotomous (dummy): 0 = not at all adequate/not adequate 1= very adequate/ moderately adequate
13	Availability	X12	Dichotomous (dummy): 0 = not at all adequate/not adequate 1= very adequate/ moderately adequate
14	Affordability	X13	Dichotomous (dummy): 0 = not at all affordable/not affordable 1= affordable/ moderately affordable
15	Comfortability	X14	Dichotomous (dummy): 0 = not at all comfortable/not comfortable 1= very comfortable/ moderately comfortable

IV.   RESULTS AND DISCUSSION

A.   Socio-Economic Characteristics of Commuters

The socio-economic characteristics of commuters sampled in various strata of Ikeja Local Government Area of Lagos State revolved around age, marital status, level of education, occupation, working experience and average monthly income of sampled respondents.

Table 2: Age Group of Commuters

Age of Commuters			Marital Status of commuters		
Age in years	Frequency	Percentage	Status	Frequency	Percentage
Below 25	21	11.7	Single	41	28.8
25-34	38	21.1	Married	93	51.7
35-44	26	14.1	Divorced	33	18.3
45-54	50	27.8	Widow/widower	13	7.2
55 and above	45	25.0	Other specify	-	-
Total	180	100.0	Total	180	100.0

Source: Fieldwork, 2018.

Table 2 shows the age variation of the commuters sampled in the study area in which commuters with age less than 25 years has the lowest frequency and accounts for 11.7 per cent of the respondents. Slightly higher than one-fifth (21.1%) are within 25-34 years, while those of 34-44 years are less than one-fifth (14.1%). The predominant ages of commuters sampled are 34-54 years which is almost one-fifth of the respondents (27.8%) and the remaining 25.0% respondents are 55 years and above. With this age variation, commuters sampled can be regarded as an adult and their views on urban mobility could be relied on as a reflection of their experiences. Similarly, on the marital status of commuters, almost half of commuters (51.7%) are married, while 22.8% are single. The divorced accounted for less than one-fifth, while the remaining 7.2% of the respondents are widow/widower. This showed that those who are married dominated respondents sampled on urban mobility in the study area than the single.

Table 3: Highest Educational Attainment of Commuters

Qualifications	Frequency	Percentage
No formal education	7	3.9
WASC/SSCE	26	14.4
ND/NCE	61	33.9
HND/BSc.	71	39.4
Higher degrees	15	8.3
Total	180	100.0

Source: Fieldwork, 2018

It is observed in Table 3 that more than one-third (33.9%) and almost two-fifth (39.4%) of commuters' has ND/NCE and HND/BSc as highest educational attainment among the respondents. Also, slightly more than one-eighth (8.3%) possessed Higher Degrees, while 14.4% has Secondary School Certificates and the remaining 3.9%has no formal education. It can be deduced from this analysis that commuters have various categories of academic qualifications and thus, their view could be relied on as they truly understand the context of informational required from them.

Table 4: Occupation of Commuters

Occupations	Frequency	Percentage
Retiree	5	2.8
Civil servant	44	24.4
Private employee	56	31.1
Personal business	58	32.2
Students	17	9.4
Total	180	100.0

Source: Fieldwork, 2018

The respondents sampled in the study area belong to various working groups in the society. According to Table 4, slightly less than one-third (32.2%) respondents involved in personal business, while 31.1 per cent are a private employee. The public civil servants among the commuters are slightly less than one-quarter (24.4%), while less than one-eight (9.4%) of the commuters are students and the remaining 2.8% were not working as they are a retiree.

Table 5: Average Monthly Income of Commuters

Average Income	Frequency	Percentage
Below #25,000	16	8.9
#25,000-#49,000	31	17.2
#50,000-#74,000	66	36.7
#75,000-#99,000	41	22.8
#100,000 and above	26	14.4
Total	180	100.0

Source: Fieldwork, 2018

Results of the average monthly income of commuters presented in Table 5 shows that 8.9 per cent earns below #25,000 monthly and those who earn #25,000-#49,000 are 17.2% of respondents. Also, 36.7% earns #50,000-#79,000, while less than a quarter (22.8%) earns #75,000-#99,000 and the remaining 14.4% have average monthly income of #100,000 and above. This analysis shows that commuters have an average monthly income that exceeds the national minimum wage of #18,000 in the study area.

B. Journey Characteristics of Commuters in the Study Area

Concerning the journey characteristics of residents, variables discussed include the pattern of movement, vehicle ownership, modal patronage, trip purpose, the reason for modal patronage and waiting duration among others.

Table 6: Pattern of Trip Making (Trip origin/Destinations of commuters)

Origin/destinations	Frequency	Percentage
Within Ikeja (centre)	19	10.6
Ikeja - Mainland	49	27.2
Ikeja – Island	75	41.7
Ikeja - Outskirts	37	20.6
Total	180	100

Source: Fieldwork, 2018

Table 6 shows pattern of movement of respondents in their daily mobility functions in the study area in which four corridors dominated the pattern in which more than a quarter (41.7%) of commuters has Ikeja-Island as their point of origin/destination, while one fifth (20.6%) usually has Ikeja-Outskirts as their origin/destination. Also, more than a quarter (27.2%) travels towards Ikeja-Mainland and the remaining 10.6% make trips within Ikeja. This shows that majority of respondents have their destinations outside Ikeja as the majority of the trips transcend the study area and are beyond walking distance.

Table 7: Purpose of Trip Making

Factors	Frequency	Percentage
Work	45	25.0
School	60	27.8
Business	52	34.4
Shopping	20	11.1
Recreation	3	1.7
Total	180	100.0

Source: Fieldwork, 2018

Table 7 shows the purpose of urban mobility of commuters sampled in Ikeja, Lagos in which one third (34.4%) of such trips are for business purposes and one-quarter (25%) are work-related trips. Also, slightly higher than one-eighth (27.8%) of the trips are for school, while 11.1% are shopping trips and the remaining 1.7% are other personal trips. This showed that journey to school, journey to business and journey to work are the most ranked in the urban mobility of commuters in the study area supporting the three major established trips in intra-urban movement.

Table 8: Means Mostly Used by Commuters

Transport Means	Frequency	Percentage
Minibus	47	26.1
Private Cab (ride-hailing)	81	45.0
FUMT Bus	11	6.1
Cab/taxi	15	8.3
Adapted Van (Molue)	21	11.7
Tricycle	5	2.8
Total	180	100.0

Source: Fieldwork, 2018

The means of transport mostly used by commuters for urban mobility in the study area is presented in Table 8 where more than one-quarter (26.1%) mostly uses mini-buses, while about half of the commuters (45%) uses ride-hailing (private cab), and less than one-eighth (11.7%) uses adapted van locally called Molue. However, 6.1% and 8.3% of respondents use FUMT-bus and taxi respectively for their intra-city movement, while the use of the tricycle accounts for 2.8% to satisfy their urban mobility. From the above analysis, it is observed that various means of transport are available for trip-makers to choose or use. The use of the newly introduced ride-hailing (private cabs) accounted for the most used means. Although the use of mini-buses is still relevantly used among the Lagosian as its rate of use is next to the ride-hailing and preferably use than the use of adaptive van (Molue) which sometimes in the past accounted for the most used means for within the city. Thus, it is fading out like motorcycle within the city of Lagos, Nigeria.

Table 9: Reasons for Modal Usage and Preference

Reasons	Frequency	Percentage
Safety	20	11.1
Speed	45	25.0
Affordability	26	14.4
Availability	33	18.3
Comfort	15	8.3
Purpose of trip	41	22.8
Total	180	100.0

Source: Fieldwork, 2018

Six reasons were giving by commuters for modal choice and preference in the study area as shown in Table 9 from which a quarter (25%) of commuters consider speed while less than one quarter (22.8%) consider the purpose of the journey for their modal preference in their intra-city movement decision in the study area. Also, 18.3% consider affordability of transport means, while 14.4% consider the availability of modes for their urban mobility. Further, 11.1% based on their modal choice and preference on the safety of modes of transport while the remaining 8.3% has comfort for their modal preference. This shows that commuters laid emphasis speed and trip purposes rather than the safety as major factors influencing their modal preferences.

Table 10: Adequacy of the Frequently Used Modal Choice

Adequacy of modal choice	Very Adequate		Adequate		Not Adequate		Not at all adequate		Total	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Ease of accessibility	18	10	108	60	54	30	0	0	180	100
Vehicle condition	18	10	54	30	90	50	18	10	180	100
Safety	9	5	99	55	54	30	18	10	180	100
Speed	18	0	108	60	72	40	0	0	180	100
Availability	15	10	108	60	36	20	10	10	180	100
Affordability	27	15	54	30	99	55	0	0	180	100
Comfortability	18	10	54	30	108	60	0	0	180	100

Source: Fieldwork, 2018

The adequacy of the frequently used modal choice was presented in Table 10. Findings revealed that majority (70.0%) of the sampled commuters noted that the modal choice ease of accessibility and level of availability is adequate, while 30.0% observed that the modal choice ease of accessibility and level of availability is not adequate. Meanwhile, the majority (60%) of the commuters observed that the frequently used modal choice safety and speed level is adequate, while 40% noted not adequate. A worthwhile, majority (over 50%) noted that vehicle condition, comfortability and affordability of the most used modal choice is not adequate, while some commuters observed that the vehicle condition (40%), comfortability (40%) and affordability (45%) of the frequently used mode is adequate. However, it can be deduced from the findings that the sampled commuters mostly used

the modal choice based on its speed, safety, ease of accessibility and level of availability within the study area.

Table 11: Commuters' Waiting Period at Bus Stop

Periods	Frequency	Percentage
below 10mins	12	6.7
10-20 mins	75	41.7
21-30 mins	76	42.2
31-40 mins	13	7.2
Above 40 mins	4	2.2
Total	180	100.0

Source: Fieldwork, 2018

Table 11 depicts that close to a quarter (42.2%) of respondents have a waiting time of 21-30 minutes, while those with 10-20 minutes are more than a quarter (41.7%). Also, 7.2% and 6.7% have waiting times of 31-40 minutes and below 10 minutes respectively, while the waiting period of the remaining 2.2% of the respondents exceeds 40 minutes. The waiting periods at designated bus stops can be seeing to be relatively high, and this shows the irregularity in the rate of frequency of the means traversing the corridors in relation to the commuter's travel demand in the study area.
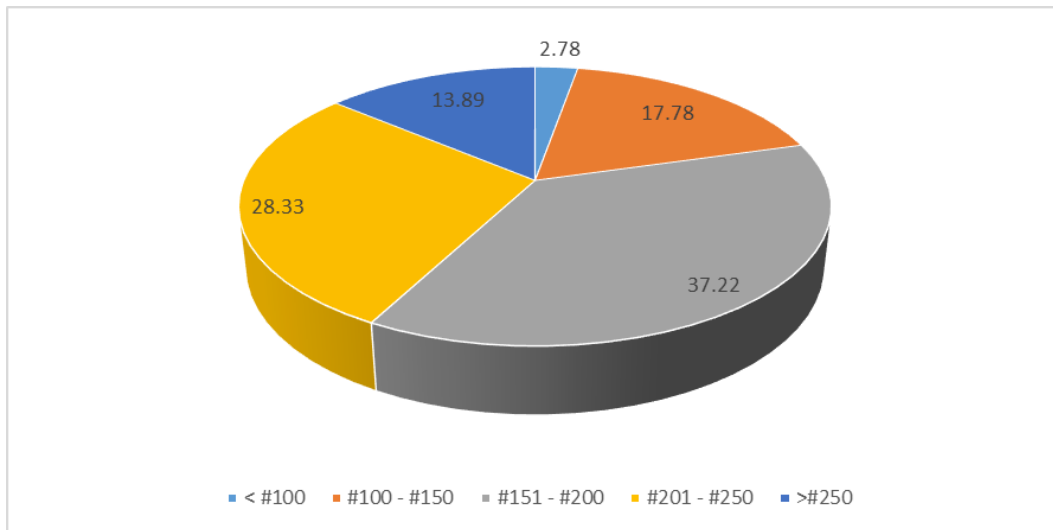

Figure 3: Ranges of Transport Fare
Source: Fieldwork, 2018

The transport fare payable by commuters was presented in Figure 3. It is observed that more than one-third (37.2%) of commuters pay #151-#200 for one direction trip, while more than a quarter (28.3%) pays #201-#250 per trip. Also, less than one-eighth (17.8%) pays #100-#150 per trip, while those who pay less than #100 per trip accounts for 2.8% of the respondents and the remaining one-eight (13.9%) are those who pay more than #250 per directional trip in the study area.

Table 12: Transit Duration (Average Travel Time per Trip)

Transit Duration	Frequency	Percentage
Below 30 minutes	0	0
30 minutes – 60 minutes	18	10
61 minutes – 90 minutes	36	20
91 minutes – 120 minutes	90	50
Above 120 minutes	36	20
Total	180	100

Source: Fieldwork, 2018

The presented data as shown in Table 12 shows that majority, half (50.0%) of the commuters observed the travel time to be between a range of 91minutes -120minutes, more than a quarter (36.0%) noted between 61minutes- 90minutes and above 120minutes respectively. More so, more than one-eighth (18.0%) observed travel time between 30munites- 60minutes, none of the respondents do spend below 30 minutes while commuting within the city. These findings are not surprising as the influx of people to the city keeps increasing with less development of transport infrastructural facilities and the encouragement of intermodal transport services.
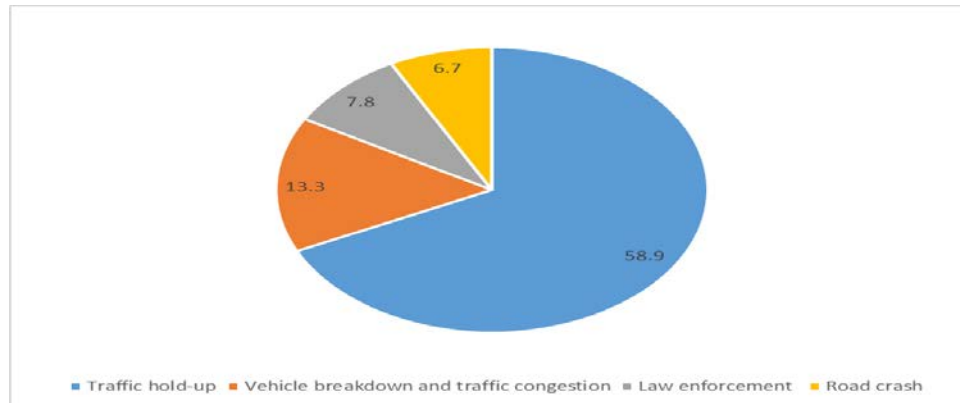

Figure 4: Delay Experiences during Intra Urban Mobility by Commuters
Source: Fieldwork, 2018

In Figure 4, traffic hold-up accounts for nearly two-thirds (58.9%) of delay experienced by commuters during their urban mobility process in the study area. Also, 13.3% each of respondents attributed the delay experienced to vehicle breakdown and traffic congestion in Lagos, while 7.8% and 6.7% attributed delay experienced to obstruction caused by law enforcement and road crash respectively.
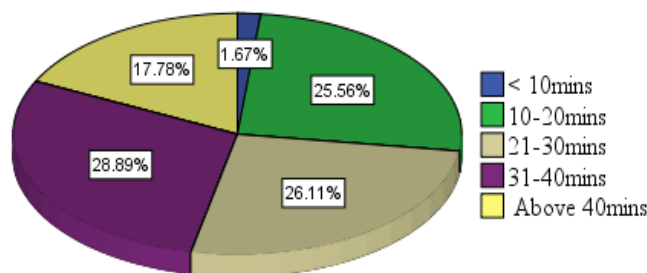

Figure 5: Transit Delay Duration
Source: Fieldwork, 2018

The delay duration of commuters' transit varies and ranges from less than 10 minutes to several minutes or hours as presented in Figure 5. Accordingly, more than a quarter (28.9%) experienced a delay for 31-40 minutes, and a quarter (25.6%) has experienced such for 10-20minutes, while those who usually experience a delay of 21-30 minutes are slightly higher than a quarter (26.1%) of the sampled commuters. It is inferred from this analysis that traffic hold up and congestions are still the major impediments to free flow of vehicular movement and intra-city movement in Lagos as such hurt urban mobility in the state.

Table 13: Frequency of Vehicular Stops while on a Trip

S/N	Frequency of stops	Frequency	Percentage
A	No stop	18	13
B	1 – 5 stops	99	55

C	6 – 10 stops	54	30
D	Above 10 stops	9	05
	Total	180	100

Source: Fieldwork, 2018

The frequency of vehicular stops while on transit is revealed in Table 13. More than half (55%) of the commuters observed that they do have vehicular stops between 1-5 stops while on transit, more than a quarter observed between 6-10 stops. Less than one-eighth (18.0%) and (5.0%) of the commuters observed no stop at all and above 10 times vehicular stops while on any form of intra-city trips that are either shot or long-distance trips. This justification for this is not unconnected to the unpredictable nature of traffic in the city and the over-reliance on-road mode of transport within the study area.

Table 14: Commuters' Suggestion for Improved Services

Suggestion	Frequency	Percentage
Infrastructure upgrading	41	22.8
Effective supervision	26	14.4
Stringent regulations	44	24.4
Development of other modes	35	19.4
Other specify	32	17.8
Total	180	100.0

Source: Fieldwork, 2018

The suggestions made by commuters towards improving urban mobility in Lagos were reported in Table 14. Accordingly, slightly less than a quarter (24.4%) suggests stringent regulation to enhance efficiency, while less than a quarter (22.8%) recommended infrastructural upgrading in Lagos. Also, less than one-fifth (19.4%) are of the view that other transport modes should be developed, while those who expressed effective supervision of the existing operations are slightly higher than one-eighth (14.4%), and the remaining 18.9% is indifference.

C. Urban Mobility Transport Operators

This subsection presents the analysis of responses obtained from selected operators of transport service in the study area. This to balance and scrutinize responses received from the commuters on urban mobility in the area.

Table 15: Operational Experiences of Transport Operators

Years involved	Frequency	Percentage
< 6 months	6	10.0
6-12 months	10	16.7
13-18 months	18	30.0
19-24 months	13	21.7
> 2 years	13	21.7
Total	60	100.0

Source: Fieldwork, 2018

The operators involved in urban mobility transport operation in the study area have different operational experiences. According to Table 15, slightly less than one-third (30%) have 13-18 months operational experience; while more than one-fifth (21.7%) have two years' experience. Operators with less than six months experience account for less than one-eighth (10%), while more than one-eighth (16.7%) possessed 1-12 months experience and the remaining 21.7% has an experience that transcends 2 years. With this, it can be inferred from the analysis that the operators are not amateur in the operations of urban mobility transport in the study area. Hence, their views could be relied on as true operational experiences that have been acquired over a reasonable period.

Table 16: Factors Responsible for Route Patronage

Factors	Frequency	Percentage
Population	22	36.7
Owner's decision	11	18.3
Commercial reason	7	11.7
Government allocation	16	26.7
Undisclosed	4	6.7
Total	60	100.0

Source: Fieldwork, 2018

Table 16 shows the factors that operators consider in plying a typical route in the study area. More than one-third of the operators (36.7%) consider the population/market potential of routes, while less than one-fifth (18.3%) based their route plying decision of bus's owner. Also, less than one-eighth (11.7%) considers the commercial nature of the origin/destination before plying such route as less than three-quarter (26.7%) ply government allocated routes. The remaining 6.7% have undisclosed reasons behind their decision to ply route for operation.

Table 17: Factors Considered in Vehicle Brand Selection

Years involved	Frequency	Percentage
Maintenance	7	11.7
Operating cost	16	26.7
Spare parts	10	16.7
Owner's decision	27	45.0
Total	60	100.0

Source: Fieldwork, 2018

The analyzed data as shown in Table 17 shows that more than a quarter (26.7%) of the operators consider cheap operating cost in selecting the typical brand of vehicles used for servicing urban mobility in Ikeja. More so, more than one-eighth (16.7%) consider the availability of spare parts, while more than one-quarter (45%) based their selection factor on owner's decision and the remaining 11.7% consider the maintenance cost of the vehicle in selecting brand being used for urban mobility transport service in the study area.

Table 18: Criteria Used in Fixing Fare by Motorist/Operators

Criteria	Frequency	Percentage
Trade Union position	26	33.3
Trip Distance	15	25
Period of the day	17	28.3
Weather condition	8	13.4
Total	60	100.0

Source: Fieldwork, 2018

According to Table 18, different criteria are used by operators in charging transport fare in the study area. Motorists who based their fare charges on trade union position are slightly less than two-fifth (33.3%), while those who consider remoteness or trip distance to destination accounts for one-quarter (25%) of the sample population. Less than one-third (28.3%) of the operators consider the time of the day, while the remaining 13.4% used weather condition in determining their fare. However, generally, all the operators in the study area use manual method of collecting fares from passengers as the use of electronic payment are not in place among the operators sampled.

Table 19: Difficulties Experienced by Motorist/Operators

Nature of Difficulty	Frequency	Percentage
The high cost of spare parts	18	30.0
Deplorable road condition	18	30.0
High operating cost	19	31.7
Frictions with Law Agents	5	8.3

Total	60	100.0

Similarly, four difficulties were stated by the operators to be militating against their smooth operations and services of urban mobility in the study area. Table 19 shows that less than one-third (30%) of the operators attributed the problems experienced to the high cost of spare parts for vehicles, while equal numbers also expressed deplorable conditions of roads. Close to two-thirds of the operators (31.2%) identify the high daily operating cost of transport services in the country, while the remaining 8.3 per cent complain of persistent frictions with law enforcement agents in the study area in particular and Lagos state in general.

Table 20: Operators Suggestions for Improved Service Delivery

Nature of Difficulty	Frequency	Per cent
Government assistance	12	20.0
Improved road condition	26	43.3
Improved national economy	9	15.0
Affordable fuel price	10	16.7
Reforms of Law Agents	3	5.0
Total	60	100.0

Various suggestions made by operators for improved urban mobility operations in the study area are presented in Table 20 in which one-third (20%) sought for government assistance in provision of subsidized vehicles to add to their fleet, while close to three-quarter (43.3%) suggested improved road condition to enhance urban mobility in the study area. Operators who suggested improved national economic conditions accounted for 15%, while those who sought for affordable pump-price of fuel are 16.7% and the remaining 5% canvassed for institutional reform of law enforcement agents to make them proactive for efficient urban traffic flow and urban mobility in the study area.

D. Test of Hypothesis

Further investigations were carried out to establish the degree of affinity between the dependent (modal choice of commuting) and independent variables (operational attributes of modes like ease of accessibility, waiting time at the terminal, transit fare charges, transit duration (travel time), transit delay duration, trip purpose, pattern of trip making (origin/destination), frequency of vehicular stops while on transit, vehicle condition, safety, speed, availability, affordability, comfortability) and was examined through the use of multiple regression analysis. This analytical technique was measured on both continuous and dummy variable scales of the regression model to calibrate some of the qualitative predictor variables to quantitative variables in a dichotomous form of 0 and 1 scale.

Table 21 revealed the major output of multiple regression results that includes the model summary, analysis of variance table of the test of significance of the model and model Unstandardized and standardized Coefficients table. Table 21 revealed the value of correlation coefficient, R as 0.755 denoting strong positive correlation between the mode of transport and their functional attributes. More so, table showed that R Square (R^2) is 0.571, reflecting that about 60% of the variation in means of transport used by residents is explained by the independent variables (predictors) identified as ease of accessibility, waiting time at the terminal, transit fare charges, transit duration [travel time], transit delay duration, trip purpose, pattern of trip making (origin/destination), frequency of vehicular stops while on transit, vehicle condition, safety, speed, availability, affordability, comfortability. This level of explanation has an analysis of variance of the model of F ratio value of 15.667, which is statistically significant at 0.000 (Table 21). However, the independent variables (predictors) combined to explain significantly the means of transportation used for urban mobility incurred by respondents within the study area.

With decision rule that H_0 should be accepted if calculated p. value is more than 0.05 significance level, it is observed from Table 21 that the calculated p.value (0.000) is less than 0.05 significant level.

Hence, the H_1 is accepted while the H_0 is rejected. However, it is observed that the commuting modal choice within the city is a function of its attributes. In other words, it is observed that waiting time (0.034), transit delay duration (0.045), transit fare charges (0.011), vehicle condition (0.000), safety (0.001), speed (0.000), ease of accessibility (0.011), and availability of service (0.036) are the dominating predicators as they contribute significantly to the predicting power and the model unlike the socio-economic characteristics of the trip makers.

Table 21: Regression Results (H_0: The means of transport used in urban commuting is not conditioned by the operational attributes of such mode)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.755[a]	.571	.534	.30652

a. Predictors: (Constant), Trip purpose, Safety, Pattern of trip making (origin/destination), Transit fare charges, Transit duration, Availability, Affordability, Waiting time, Speed, Transit delay duration, Comfortability, Frequency of vehicle stop, Ease of accessibility, Vehicle condition

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	20.608	14	1.472	15.667	.000[b]
1	Residual	15.503	165	.094		
	Total	36.111	179			

a. Dependent Variable: Mostly used means of commuting

b. Predictors: (Constant), Trip purpose, Safety, Pattern of trip making (origin/destination), Transit fare charges, Transit duration, Availability, Affordability, Waiting time, Speed, Transit delay duration, Comfortability, Frequency of vehicle stop, Ease of accessibility, Vehicle condition

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	.345	.117		2.955	.004
	Pattern of trip making (origin/destination)	.032	.031	.058	1.035	.302
	Vehicle Condition	.550	.106	.560	5.193	.000
	Transit duration	-.085	.055	-.085	-1.554	.122
	Availability	.104	.090	.089	1.166	.245
	Affordability	.129	.061	.144	2.109	.036
	Comfortability	-.065	.044	-.107	-1.487	.139
1	Transit delay duration	.061	.030	.143	2.024	.045
	Safety	-.221	.067	-.218	-3.302	.001
	Speed	.705	.067	.660	10.483	.000
	Frequency of vehicle stop	-.079	.060	-.077	-1.331	.185
	Waiting time	-.245	.115	-.227	-2.135	.034
	Transit fare charges	-.224	.087	-.224	-2.564	.011
	Ease of accessibility	-.251	.098	-.212	-2.574	.011
	Trip Purpose	.032	.017	.101	1.887	.061

a. Dependent Variable: Mostly used means of commuting

V.   CONCLUSION AND RECOMMENDATIONS

As cities are having a high level of accumulation and concentration of economic activities with more complex spatial structures, such must be supported by modern transportation systems. The rapid increase intensity of land-use which brought about an everlasting separation between workplace and

residential areas will continue to lead to the growth of travel demand in the cities. As a result, the demand for transport and travel intensity tends to increase sharply with the size of the city. Based on the findings, it is crystal clear that a large proportion of respondents embraced various forms of public transport at their disposal for urban mobility considering their requirements and purpose of urban mobility. Hence, there is always a need for an efficient and effective transport service to achieve efficient urban mobility. It is on this basis that this study concluded that there is a need for improving urban mobility in the study area to improving the performance and subsequent ranking of the city in the global urban mobility index.

Towards having efficient urban mobility in Ikeja and by extension Lagos, the followings are recommended;

First, the formulation of effective fiscal policy for the national economy is very essential towards boosting urban mobility of major cities in the country. The government should as a matter of urgency formulate and strengthening fiscal policy to reduce the cost of spare parts and new vehicles in the country.

Also, the policy should encourage indigenous technological development in the country. This measure would not only stabilize the cost of spare parts and new vehicles in our local markets. But also discourage fake spare-parts procurement in the country at large, but reduce the prices and make them more affordable. The policy shall equally take care of regular hike in the pump price of petroleum products as well as its regular availability and eradication of adulterated fuel in the country.

The government should take the issue of standardization of the operations and operators of public transport as a matter of urgent importance. The institutional agencies involved in supervising this should be made accountable on monitoring standards and performance of the operators on our roads to return sanity and dignity to the system. In this regard, transport fare should not be arbitrarily fixed but regulated by the government to protect commuters and passengers through a measure that would eliminate their exploitation by greedy transport operators.

Also, regular vehicle inspection should be carried out to determine those operating below the stipulated standards and sanction such operators adequately.

Similarly, the government should eradicate all forms of illegal extortion and multiple taxes in road transport within the city and the country at large to make transport operations friendly to both the operators and commuters.

The government should monitor the activities and excesses of Transport Unions/ Trade Unions that levy un-remitted fees on the operators especially on mini-bus operators and others.

Technologically, special road screening machine could be installed strategically on our urban roads to bring to book road traffic offenders who obstruct or disrupt the free flow of traffic. One such machine is in place, operators would be more curious about the way they operate of the road and adjust to the new system.

Also, traffic signal control, highway signage, road markings, lighting and pedestrian facilities should be upgraded and automated, where necessary to fast-track efficient urban mobility in the study area.

Finally, there is a need for the government to take a concrete step towards integrating all the public transport modes in the state for better coordination and organization. Both the water and rail potentials of the city should be speedily harnessed and fully integrated to complement road intra-city movement in Lagos. Last, Lagos State Government should extend the operations of Bus Rapid Transit and Bus Franchise Scheme around the city with total consideration and attention on the *LAST MILE*. This will go a long way in expanding infrastructure facilities for efficient intra-city mobility in the study area and will give urban trip makers more accessibility to various modal choice when making decisions on the intra-city trip generation and distribution.

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