Impact of Improved Bus Rapid Transit (BRT) Operation System on Commuters Satisfaction in Metropolitan, Lagos, Nigeria

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ABSTRACT

The Lagos Metropolitan Area Transportation Authority (LAMATA) established Africa's first Bus Rapid Transit (BRT) scheme, which went into operation on March 17, 2008, in Lagos, Nigeria, to reduce the number of vehicles navigating our constantly congested roads as well as to reduce, curtail, the level of gas emission, and curb the menace constituted by the commercial bus drivers in Lagos State. It is important to note that the public transportation sector, especially the BRT in Lagos is characterized by long waiting queues, irregularity, and uncertainty around the bus arrival time which has frustrated so many to result in alternative transportation mediums or perhaps the purchase of individual cars, which has further increased the number of vehicles on our ever-busy roads, particularly during the peak period. This research is, therefore, aimed at examining the impact of the BRT operation system on passenger satisfaction in metropolitan Lagos, Nigeria. To achieve the aim, the opinion of the commuters was sampled using a questionnaire, which was distributed to the commuters through an online medium such as email, Google form and other digital mediums. The research reveals the BRT operation in the state has its dedicated lane which has been instrumental to its expansion. However, the research reveals an unnecessary delay of commuters at some major bus terminals which is sometimes connected to the non-adherence of buses to the scheduled timetable. BRT's operation has significantly impacted the travelling pattern of commuters around the corridor; hence, further improvement in its service will enhance the confidence of the commuters in its service.

Keywords: Bus Rapid Transit (BRT), Commuters, Corridor, Metropolitan, Terminals, Transportation.

1.1 Introduction

Lagos is the most populous metropolis in Nigeria and the second-largest city in Africa after Cairo. According to population projection, Lagos may emerge as the largest city by 2100

with an estimated population of 61 and 100 million people (1). The current metro area population estimation, in Lagos, is projected to be 14,862,111 in 2021 (2).

According to the United Nations, Lagos is growing by 2,623,000, approximated at 3.44% annually (3). The consequential impact of the population growth is an increase in demand for transportation, which will hence, result in traffic congestion in the Lagos Metropolis. Lagos has the highest record traffic index in Africa, with an estimated number of 5 million cars and 200,000 commercial vehicles on the roads (4). It is also important to note that Lagos has a record of an average of 227 vehicles per kilometre on the road compared to the national average of 11 vehicles per kilometre (5).

Given a fast-growing mega city like Lagos, mobility is considered a crucial ingredient to its functionality, as it enhances socio-economic activities, which is therefore responsible for the high demand for transportation within the city (6). It is also crucial to highlight that while it is true that a country's transportation infrastructure and economic development are intertwined, transportation is one area of society where policies intended to reduce greenhouse gas emissions will be most divisive (7).

Traffic is a hindrance to effective mobility in Lagos and is estimated to have drained the commuters 40% is their monthly income. (8). Nairobi's traffic costs are 37 billion shillings each year, or nearly $570,000 per day. In a similar vein, it may have cost Cairo and Egypt $8 billion (9); (10). It is also important to note that Lagos is not an exemption, as the traffic is occasioned by greater access of individuals to cars, attributed to the increase in purchasing power of the middle-income classes, access to credit, population growth and a large supply of used cars, as well as poor quality of driving especially by the commercial vehicle drivers (6).

The Lagos Metropolitan Transport Authority (LAMATA) Law, which was established in 2002, gave the authority over the conurbation in Lagos State, jurisdiction over a declared network of primary and secondary roads, which carried the vast majority of road traffic, and the authority to plan and coordinate public transportation as well as the authority to recommend changes to route planning. Several of the highly motivated employees at LAMATA came from the Nigerian Diaspora and had international experience in management and transportation.

In a bid to reduce the number of vehicles plying our road and curtail the menace constituted by the commercial bus drivers in Lagos state, LAMATA established Africa's first Bus Rapid Transit (BRT) scheme, which began operations on March 17, 2008, in Lagos, Nigeria. The implementation of the BRT concept aims to provide a transportation system that will satisfy local users' needs while enhancing residents' quality of life, economic efficiency, and safety within a predetermined spending limit.

1.2 Statement of Problems

Analysis of the transport situation identified the lack of an appropriate mechanism to coordinate the plans and actions of the various agencies at Federal, State and Local Government roads for the management, maintenance, and development of the transport network in a holistic and integrated manner (11). Public transportation operations in Lagos have been impacted by the fact that the majority of these agencies lacked a stable financial foundation for their operations and that their budgets were at risk due to increased political priorities and fiscal pressures.

The public transportation sector, especially the BRT in Lagos is characterized by long waiting queues, irregularity, and uncertainty around the bus arrival time which has frustrated so

many to result in alternative transportation medium or perhaps the purchase of individual cars, which has significantly further increased the number of vehicles on our ever-busy roads, particularly during the peak period. This research is, therefore, aimed at analyzing the impact of the improved Bus Rapid Transit (BRT) operation system on commuter satisfaction in metropolitan Lagos, Nigeria. To achieve the aim, the following objectives shall be adopted:

1. To examine the significant impact of improved BRT operation system on commuters' satisfaction in metropolitan Lagos.
2. To examine if a relationship exists between commuters' satisfaction and the modal choice of commuters.
3. To recommend the implication of the findings to the government and its stakeholders for further improvement of BRT operation in metropolitan Lagos, Nigeria

1.3 Research Questions

1. Does a relationship exist between an improved BRT operation system and commuter satisfaction?
2. Does a relationship exist between commuter satisfaction and modal choice?

1.4 Statement of Hypotheses

H0: Improved BRT operation system does not have a significant impact on commuter satisfaction in metropolitan Lagos.

H0: No relationship exists between commuters' satisfaction and modal choice

1.5 The Study Area

Lagos state is located in southwestern Nigeria, on the coast of the Bight of Benin. Lagos is bounded in the North and East by Ogun State, to the South by Bight of Benin and the Republic of Benin to the west. While Lagos mainly consists of the Yoruba tribe, it has grown heterogeneously with the migration of other Nigerians and neighbouring West African countries to the state. The state engages in agriculture and fishing. The fish products are collected in the lagoon port of Badagry, Epe and Ikorodu, and ferried to markets in Lagos city.

In a bid to alleviate transportation challenges of the commuters in Lagos state and enhance economic activities Bus Rapid Transit (BRT) was introduced in the state. The 1st phase of the BRT scheme became operational on 17th March 2008, after the 14th month of design and planning. The BRT corridor began with a 22 km bilateral station that links Mile 12 to its conclusion at Marina/TBS. Dedicated lanes, 29 bus shelters and laybys, 3 terminal facilities at Mile 12, Moshalashi, and CMS, a bus depot/garage, service lane repairs, lightning, fencing, traffic signs, and road markings were all actively provided by LAMATA.

Oshodi-Abule-Egba Bus Rapid Transit Lane is a 13.65 km lane from Oshodi to the Abule-Egba area of Lagos, Nigeria. The Lane was intended to help 60,000 people who use the facility daily, with its own dedicated lane, bus terminals and bus depot respectively.

Figure 1 Image showing Ikorodu – TBS BRT Route
Source: Lagos State Government Transportation Statistics Bulletin, 2017

2.1 Literature Review

Bus Rapid Transit (BRT) is a modern breed of urban transportation system receiving attention globally, considering its significance; and its ability to implement mass transportation capacity quickly and at a low-to-moderate cost (12). The definition of BRT describes it as "a rubber-tyred rapid transit service that combines stations, vehicles, running ways, a flexible operating plan, and technology into a high quality, customer-focused service that is frequent, fast, reliable, comfortable, and cost-efficient" may be the most comprehensive and goal-driven definition available (13).

BRT applications are designed to be appropriate to the markets they serve and their physical surroundings, and they can be incrementally implemented in a variety of settings and types. The vast potential of BRT could be used at its maximum rate in congested urban environments where adequate mass transit services are not readily available to road users by more expensive modal options such as light rail or metro. BRT, thus, is a homogeneous transportation facility, services, and amenities that have become an alternative form of transportation, that are far more competitive to car-oriented mobility than conventional buses, to the degree that it could redefine the very identity of a city.

A BRT system is composed of the following components:
1. Vehicles, not only contribute significantly to BRT's image and identity but also play a strong role in achieving measurable performance success (14).
2. The system's operational region is defined by stops, stations, terminals, and corridors.
3. A wide range of rights-of-way, such as bus priority at signalized intersections, dedicated lanes on surface streets, and—most importantly—special BRT bus lanes that are entirely separate from other traffic; BRT routes can be operated almost anywhere on disused rail lines, in the middle of a highway, or on city streets (15)
4. Pre-board fare collection, which separates ticketing from the on-board user experience and offers a mechanism for long-term system viability hypothecation.
5. The use of information and communication technology to increase client convenience, speed, reliability, integration, and safety in the services offered.
6. According to Levinson et al. (16), all-day service should run for at least 16 hours per day with peak headways of 10 minutes or less.
7. Brand identity is made up of perceptual constructs that are supported by the strategic deployment, placement, and management of communication elements. These elements include visual and nominal identifiers (such as the system name and logo), a colour scheme, and long-term strategic marketing and advertising plans (17).

2.2 BRT Operation and Customer Satisfaction

Many studies have discovered a link between customer perception and service outcomes including loyalty, positive word-of-mouth, and purchase intentions. Prior research has defined many service parameters related to transit service quality. They include, but are not limited to, service accessibility, dependability, travel time, safety & security, appearance, and comfort (18). Baltes (19) carries out user surveys for the South Miami-Dade BRT and the Orlando BRT. He asks respondents to rate their pleasure with service quality and overall BRT satisfaction. He then creates regression models to determine which characteristics contribute to greater overall happiness. He concludes that while service frequency, travel time, seat availability, convenience, hours of service, safety aboard the bus, and dependability are significant elements for South Miami-Dade BRT, comfort, travel time, reliability, and safety are important characteristics for Orlando BRT.

A study by Cao et al. (20) using the BRT in Guangzhou as a case examines transit users' satisfaction with BRT and contrasts it with traditional bus and metro service. To investigate the influence of different service characteristics on riders' overall satisfaction with the three modes of transit, a trivariate ordered probit model was created. Riders are most satisfied with the BRT's travel cost, the convenience of use, and trip time, and are least satisfied with other riders, customer service, and comfort while riding, out of the 14 service criteria examined.

Many studies have discovered a link between customer satisfaction and service outcomes including loyalty, positive word-of-mouth, and purchase intentions. Prior research has established many service parameters linked to the quality of transportation service. They include, but are not limited to, service accessibility, dependability, travel time, safety & security, appearance, and comfort (18). Baltes (19) studies BRT users in South Miami-Dade and Orlando. He requests information on respondents' general happiness with BRT as well as their satisfaction with service-related aspects. Next, he creates regression models to evaluate which characteristics enhance overall pleasure. He concludes that comfort, travel time, dependability, and safety are significant elements for Orlando BRT, whereas service frequency, travel time, seat availability, convenience, hours of service, safety on the bus, and dependability are significant factors for South Miami-Dade BRT.

Using Guangzhou BRT as a case study, Cao et al. (20) conducted a study that examines transit users' satisfaction with BRT and contrasts BRT with traditional bus and metro services. To investigate the influence of various service parameters on riders' overall satisfaction with the three modes of transit, a trivariate ordered probit model was created. Riders are least satisfied with fellow riders, customer service, and comfort when riding, and are most satisfied with the BRT's travel cost, ease of use, and journey duration.

2.3 Impact of BRT Introduction on the Transportation Corridors

Bus rapid transit combined all aspects of rail and bus travel to produce a cutting-edge form of travel that excels in terms of speed, capacity, and comfort. Cities are also utilizing BRT routes in innovative ways, erecting landmark stations that serve as the development's focal point in neighbourhoods, and creating "complete streets" that combine walking, biking, and transit to enhance the vibrancy and harmony of urban environments. The following benefits are just a partial list of the benefits:

a) **Faster, More Open Conduits throughout the City:** The BRT operation has a dedicated lane and is forbidden to other forms of mobility, thereby, reducing traffic congestion for the operators, hence, it provides a faster travel time for drivers and also provides faster travel times for transit riders.

b) **Transit-Oriented, Sustainable Development:** As Lagos grows to the status of a Mega-city, BRT can help direct sustainable development and build vibrant, desirable neighbourhoods. It is, therefore, important to note that, the BRT introduction is a significant tool for economic development in Lagos.

c) **Reduced Emissions**: By increasing capacity in transit corridors and the provision of faster and more attractive transportation options, BRT introduction has significantly reduced the number of vehicles on our road and idling in traffic, in combination with more efficient operations, BRT introduction has helped improve air quality in cities and helped reach CO2 reduction goal.

d) **It is Cheaper:** Currently, the BRT medium charges ₦700 from Ikorodu to Lagos Island, while the conventional bus charges not less than ₦1,000. Hence, the BRT charges are relatively cheaper compared to other commercial buses (Danfo).

e) **Less travel time:** Despite the introduction of BRT operation, some locations still experience traffic congestion during the peak period, such as Owode, Mile 12, Ketu, and

Ojota, but with BRT, it usually takes a shorter period to travel, you can be sure of escaping that traffic as the Buses has a dedicated BRT lane.

f) **Job creation:** The BRT system is making its fair share of contributions to lowering unemployment in Lagos State and Nigeria by creating both direct and indirect jobs for individuals, ranging from drivers to maintenance technicians and from cleaners to ticketing workers.

g) **Physical activity:** Since the BRT terminal is not located at every place, unlike regular buses, some people will have to stand inside the bus while others will have to walk a distance to the terminal or their last mile. This is one of the reasons why there are so few overweight and obese people in London and New York City.

h) **Safety and comfort:** The safety of the BRT buses ranges from its terminal to its buses as they are well regulated, unlike some of the Danfo buses that have unprofessional drivers on their wheel, that are more particular about going to as many trips as possible, thereby exposing the commuters to unsolicited dangers. The BRT also provide its occupant with Air conditioning, comfortable seats, charging ports etc.

3.0 Methodology
3.1 Sources of Data

For this research, descriptive statistics was adopted. The sources of data for the research were primary and secondary data. The primary data was sourced through the use of a questionnaire, while the secondary data was sourced from Lagos Metropolitan Area Transport (LAMATA) periodical and other articles on the subject matter. The data obtained helped analyze the perception of passengers towards BRT operation in the metropolitan area, and the BRT operation was significant in commuters' modal choice.

3.2 Data Collection

A questionnaire was designed to collect information from the commuters, to sample their opinion on their level of satisfaction with the BRT operation in Lagos Metropolis. The opinion of the respondents in the 20 local governments council in Lagos was considered significant for the research, as the majority has had an encounter with the BRT operation in one way or the other. This was made possible electronically through Google form, social media platforms and e-mail. A total of One Thousand Five Hundred questionnaires were retrieved from all the respondents across the board, however, 1,200 (that is 80%) were considered relevant for the research, as 20% were not properly filled or do not encounter the BRT operation along the corridor. The questionnaire contains three (3) sections, the 1st section contains the demographic characteristics of the respondents, the second section contains the travel behaviour of the commuters, and the last section contains questions aimed at testing the level of the commuter's satisfaction with the BRT operation.

3.3 Data Analysis

A total one thousand five hundred (1,500) data were received and subjected to scrutiny; One thousand two hundred (1,200) were properly filled and considered relevant for the research. Those that were poorly filled which may result in spurious results were discarded, while the remaining was integrated into the research analysis. The first section of the analysis was subjected to descriptive analysis. The first section which contains the demographic characteristics of the respondents was treated at a nominal scale, while the second section which contains the commuter's level of acceptance was treated at the ordinal level. The researcher was able to determine the prevalent demographic characteristics of the respondents, the commuter's travel behaviour at different transportation corridors, and the impact of the BRT operation on commuters' satisfaction at the sampled corridor appropriately.

The third section which is aimed at analyzing the commuter's level of satisfaction with the BRT operation contains five (5) questions classified with all their related questions. The section that is aimed at testing service attribute that is widely known to affect customer satisfaction were investigated using a Likert scale under five categories ranging from Strongly Disagreed (SD) to Strongly Agreed (SA).

To test the hypotheses Correlation analysis shall be carried out. Correlation analysis is a statistical method used to measure the strength of the linear relationship between two variables and compute their association. This will be significant in the calculation of the significant changes in the commuter's level of BRT patronage due to the itemized variables, considered for testing the commuter's level of satisfaction.

TABLE 1 Demographic Characteristic of Respondents

Variables	Frequency	Percentage
Age of Respondents		
Below 18 years	209	17.4
18-25 years	161	13.4
26-35 years	298	24.8
36-45 years	284	23.7
46-55 years	207	17.3
Above 55 years	41	3.4
Total	1200	100.0
Sex of Respondents		
Male	420	35.0
Female	780	65.0
Total	1200	100.0
Marital Status of Respondents		
Single	360	30.0
Married	684	57.0
Divorced	84	7.0
Widow/ Widower	72	6.0
Total	1200	100.0
Occupation of Respondents		
Business	432	36.0
Trading	348	29.0
Civil Servant	336	28.0
Students	48	4.0
Unemployed/ Retiree	36	3.0
Total	1200	100.0
Education level of Respondents		
Basic 6 Certificate	84	7.0
West African School Certificate	84	7.0
Ordinary National Diploma/Higher National Diploma /Bachelor of Science	588	49.0
Post Graduate Certificate	444	37.0
Total	1200	100.0
Income level of Respondents		
Less than N50,000	48	4.0
N 51,000 – 100,000	168	14.0
N 101,000-150,000	300	25.0
N 151,000 – 200,000	408	34.0
N 201,000 – 250,000	180	15.0
N 251,000 – 300,000	96	8.0
Total	1200	100.0

Respondents size of Household		
1-5 people's	312	26.0
6-10 people's	732	61.0
11-15 people's	156	13.0
Total	1200	100.0

Source: Researcher Output, 2023

The data retrieved and analyzed reveal the following, 17.4% of the respondents are below the age of 18 years, 13.4% are between the ages of 18-25 years, 24.8% are between 26-35 years, 23.7% are between 36-45 years, 17.3% are between 46-55 years while 3.4% are above the age of 55 years. Hence, the research reveals majority of the commuters are between 26-35 years, 35% of the respondents are male, while 65% are female, the research also reveals a larger percentage of female respondents. The marital status of the respondents is as follows, 30% are single, 57% are married, and 7% are divorced, while 6% are widows/widowers.

The occupation of the respondents is presented as follows, 36% are into business, 29% are into trading, 28% are civil servants, 4% are students and 3% are Unemployed/ Retiree, as the majority of the respondents are into trading followed by the businessmen/ women. The occupation of the sampled respondents reveals the larger percentage of Ordinary National Diploma/Higher National Diploma /Bachelor of Science holders, followed by 7% of Basic 6 Certificate and West African School Certificate holders respectively, while respondents with postgraduate certificates are 37%. The income level of the respondents is as follows, 4% earn less than N50,000, 14% earn between N 51,000 – 100,000, 25% between N 101,000-150,000, 34% between N 151,000 – 200,000, 15% between N 201,000 – 250,000, 8% earn between N 251,000 – 300,000. The family size of the respondents is as follows, 26% are between 1-5 people 61% are between 6-10 people and 13% are between 11-15 people as represented with table 4.1 above.

4.2 Travel Behaviour of Respondents

The data analysed revealed the motive behind the respondent's trips as follows, 16% travelled for business purposes, 63% to their office, 1% for visitation, 17% for religion and 3% travelled for personal reasons. Hence, the majority of the respondents travel to their offices. The frequency of their travel is as follows, 7% once a week, 6% twice a week, 9% more than twice a week, 72% commute all through the weekdays, while 6% only commute over the weekends. It thus reveals majority of the respondents commute majorly during the weekdays. The majority of the sampled respondents commute using the BRT (80%), while 20% commute using conventional buses (Danfo). The distance of commuter's trip is as follows, 30% travel less than 50km and 50-100km respectively, 25% travel between 100-150km while 15% travel over 150km. The trip duration of the respondents is as follows, 75% less than one hour, while 22% take about 2-4hours, hence the majority of the trip takes less than 1hour, but sometimes overstretch for over 2hours during the peak period according to the commuters. A larger percentage of the respondents do not have a personal vehicle (91%), while (9%) do not have a car.

TABLE 2 Level of Commuters Satisfaction with the BRT Operation along sampled corridors

	Ikorodu to TBS					Oshodi to Abule Egba				
Reliability Variables	SD%	D%	U%	A%	SA%	SD%	D%	U%	A%	SA%
The bus always arrives on time.	31	50	5	5	9	14	9	6	36	35
The bus never breaks down on the road.	9	9	11	34	37	15	20	5	35	25
Staff satisfies passengers' request irrespective of the person	19	22	3	16	40	31	50	5	5	9
Assurance Variables										
Passengers feel safe in their transactions with staff.	7	5	4	25	59	10	12	7	20	51
Passenger's luggage's are safe.	3	10	32	34	21	12	15	10	37	26
The behavior of staff instils confidence in the passengers.	3	3	16	39	39	12	10	11	36	31
Tangibility Variables										
Bus companies have a professional appearance.	3	3	8	23	63	27	40	10	12	11
Bus companies have adequate shed for passengers.	5	9	11	42	33	6	10	5	52	27
Bus companies have spacious seats for passengers on board.	14	2	14	39	31	10	12	6	40	32
Empathy Variables										
Bus companies have passengers' interest at heart.	3	8	11	45	33	10	7	12	43	28
Bus companies convenient operating hours.	7	7	36	30	20	15	35	12	14	24
Easy to book ticket office/station/online	10	12	8	40	30	8	12	10	31	39
Responsiveness Variables										
Staff provides individualized attention to help customers.	8	12	5	45	30	8	7	10	43	32
Bus companies provide timely and efficient services	31	44	12	7	6	10	7	15	40	28
Communication with staff is clear and helpful.	13	25	17	14	31	10	9	10	43	28

TABLE 3 Mean value and Regression analysis

Variables	2013			2023		
	Mean	t-value	Sig.	Mean	t-value	Sig.
The bus always arrives on time.	2.11	-4.64	.000	3.15	63.927	.000
The bus never breaks down on the road.	3.81	17.498	.000	2.5	94.985	.000
Staff satisfies passengers' request irrespective of the person	3.36	3.2	.000	4.2	72.010	.000
Assurance Variables						
Passengers feel safe in their transactions with staff.	4.24	2.912	.000	4.41	124.364	.000
Passenger's luggage's are safe.	3.6	-10.453	.000	3.7	124.975	.000
The behavior of staff instils confidence in the passengers.	4.08	-4.221	.000	4.1	146.897	.000
Tangibility Variables						
Bus companies have a professional appearance.	4.4	2.729	.000	4.5	157.144	.000
Bus companies have adequate shed for passengers.	3.89	2.66	.000	4.22	110.095	.000
Bus companies have spacious seats for passengers on board.	3.71	-1.067	.000	3.1	101.172	.000
Empathy Variables						
Bus companies have passengers' interest at heart.	3.97	-25.108	.000	4.1	138.681	.000
Bus companies convenient operating hours.	3.49	-13.038	.000	3.9	112.175	.000
Easy to book ticket office/station/online	2.09	1.688	.000	4.4	62.286	.000
Responsiveness Variables						
Staff provides individualized attention to help customers.	1.92	-0.524	.000	2.2	53.228	.000
Bus companies provide timely and efficient services	2.13	1.14	.000	1.7	65.373	.000
Communication with staff is clear and helpful.	2.95	17.708	.000	3.2	76.118	.000

Source: Researcher Output, 2023

The mean value and regression analysis of the data obtained by Amiegbebhor and Popoola, 2013 as represented in table 3 above and the data obtained from the respondents in 2023, which aims to analyse the significant difference of value received for both years. The data analysis revealed a significant difference in the mean value for both years, as a significant increase was observed in the arrival time of the buses in 2023 compared to the data obtained in 2013. However, there is an observed significant drop in the mean value for the buses never breaking down on the road; this significant drop is connected to the tear and wear of the buses being used for the BRT operation along the corridors.

The obtained data also reveal a slight increase in the passenger feeling safe in their transaction with staff and the safety of passenger's luggage respectively. The data also reveal a significant improvement in the professional appearance of the bus companies' appearance, with no significant improvement in the bus companies, having spacious seats for passengers on board. The data further reveal a significant improvement in the buses' operating hours and a significant improvement in the easy booking of a ticket at their various offices, terminals or online.

It is however important to note that the bus companies provide timely and efficient services mean value significantly dropped from 2.12 in 2013 to 1.7 in 2023, this is connected to the delay in the arrival of buses at some of the terminals. The table further reveals a significant

improvement in the communication of commuters with the staff of the bus operators as represented in table 3 above and figure 2 below.
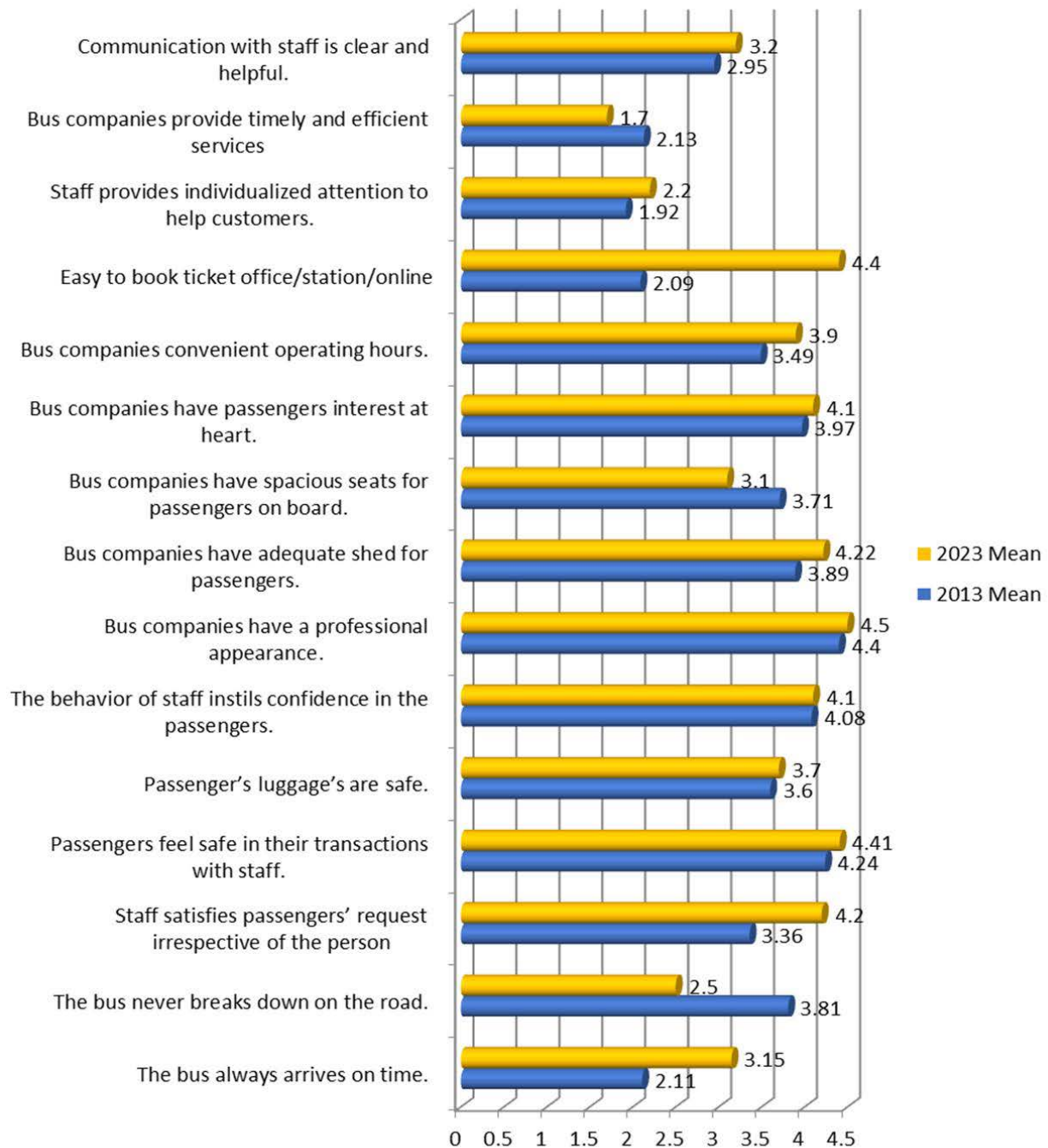

Figure 2 Graph showing mean value of customer's satisfaction variables for 2013 and 2023.

Re-Statement of Hypotheses

Hypothesis One

H0: Improved BRT operation system does not have a significant impact on commuter satisfaction

H1: Improved BRT operation system has a significant impact on commuter satisfaction.

Hypothesis One

H0: No relationship exists between commuters' satisfaction and modal choice

H1: Relationship exists between commuters' satisfaction and modal choice

TABLE 4 Test of Research Hypotheses

Test	Hypothesis One	Hypothesis Two
R	0.926	0.886
R Square	0.858	0.784
Durbin-Watson	1.071	0.618
F-statistics	475.432	269.150
Sig.	0.000	0.000

R-value has been used to measure the success of the regression in predicting the values of the dependent variable within the sample. It is therefore used to test the significance of improvement in BRT operation on commuter satisfaction in metropolitan Lagos. The result reveals an R-value of 0.926 for the first hypothesis and 0.886 for the second hypothesis respectively, which shows the identified variables are having a positive relationship with the level of customer satisfaction. This explains the fraction of dependent variables explained by the independent variables.

The estimated R-square result for the first hypothesis is 0.858 while that of the second hypothesis is 0.784, which reveals that holding other variable constants, an improvement in BRT operation will result in 85% increase in customers satisfaction, which means a significant relationship exists between improved BRT operation and customers satisfaction. The second hypothesis reveals that holding all variables constant, a slight improvement in commuter satisfaction will result in the selection of BRT as the commuter's modal choice.

Durbin –Watson statistic is used to detect if there is autocorrelation in the residual from a statistical regression analysis. The value of DW always lies between 0 and 4, if the Durbin–Watson statistic is 2, it means there is no autocorrelation, a value between 0-2 indicates positive autocorrelation, while a value between 2-4 indicates a negative autocorrelation. The analysis reveals a DW value of 1 for hypothesis one and 0 for hypothesis two. The Durbin Watson, therefore, reveals a positive autocorrelation among the variables. It thus reveals that improved BRT operation is a great determinant of commuter satisfaction and modal choice.

In an attempt to validate the earlier stated null hypotheses, the significance value shall form the basis for the decision-making. The earlier stated null hypothesis will be rejected if the p-value is less than 0.05. The result thus reveals a p-value of 0.00 for the first hypothesis, which is less than 0.05, hence, the null hypothesis which states that improved BRT operation system does not have a significant impact on commuter's satisfaction, the rejection of the null hypothesis is due to lack of statistical support, therefore the alternative hypothesis shall be

adopted, which states that Improved BRT operation system has a significant impact on commuter's satisfaction.

In the same vein, the second hypothesis reveals a p-value of 0.00, which is less than 0.05, it is, therefore, pertinent to reject the earlier stated null hypothesis which states that no relationship exists between commuters' satisfaction and modal choice, the rejection of the null hypothesis is due to lack of statistical support, therefore the alternative hypothesis shall be adopted, which states that relationship exists between commuters' satisfaction and modal choice.

5.0 Summary Recommendations and Conclusion
5.1 Summary

One of the fundamental features of a BRT operation is its dedicated BRT lane **(as presented in figure 4 and 6)** and dedicated bus terminal **(as presented in figure 3),** which has helped keep the commuters ahead of other commuters. However, the research reveals non-adherence to the bus's scheduled timetable. It is important to note that some of the buses are old, but little record of breakdowns on the road by commuters. The bus operation has witnessed drastic development recently, through the introduction of electronic ticket booking with the introduction of the Cowry card **(as presented in figure 5,** this ticket booking system gives an individual the avenue to recharge their card through bank applications, in the banking hall or at the BRT terminal, which has made ticket booking seamless.

The passengers feel relatively safe when on board the BRT, however, it is important to mention that the BRT has recorded some unpalatable incidence in the past such as the case of a 22 years old lady (Miss Bamise Ayanwole), who was suspected to have been murdered by the BRT driver (Mr Nice Ominikoron on February 26, 2023. It is also important to also note that the commuters acknowledged that their luggage is also safe. Furthermore, the staffs have an in-depth occupation of their job and are always polite, and the behaviour of the staff instils confidence in the passengers.

The commuters confirmed the staff attire is always neat; hence the company has a professional appearance. The research reveals the company have adequate shed for passengers in their designated bus terminals**.** The ticket offices have gradually depreciated and lack maintenance compared to when the service commenced newly.

The research reveals the company has the passenger interest at heart, as they provide individualized attention to help customers, and communication with staff is clear and helpful as they are always willing to help passengers.

Figures and their assigned numbers:
3. Image showing a BRT terminal
4 A BRT approaching its corridor
5 Image showing Lagos state digital travelling card (Cowry card)
6 BRT in its right of way

5.2 Recommendations

Given the above-mentioned observation, the research recommends the following:

1. The development of an application to track the movement of BRT buses, to ensure their strict compliance with timetable.
2. The introduction of surveillance cameras at various major terminals to ensure immediate drafting of buses to locations with log queues to avoid incessant waiting.
3. Some of the buses that have tear and wear need to be replaced, to avoid incessant breakdown.
4. The introduction of Closed-Circuit Television (CCTV) cameras in all the buses to ensure proper surveillance of operational buses while in transit.
5. Periodic training and retraining of BRT staff on in-depth knowledge of contemporary work ethics;
6. Periodic appraisal of BRT operation to maintain conformity, and areas of weakness strengthened appropriately.
7. Provision of a management hotline to enable commuters to express themselves in case of dissatisfaction with BRT operation to enhance improvement.

5.3 Conclusion

The research reveals the BRT operation has significantly impacted the travelling pattern of commuters around the BRT corridors. It has defined a new interpretation of BRT entwined in effective service delivery. Periodic training and retraining of staff cannot be overemphasized in an organization that has a direct relationship with the public; hence, the company should invest more in the staff in the area of training to positively project the image of the organization, consequently, enhance customer satisfaction.

To discover BRT potential and for further advancement, it is also necessary to establish closer coordination with local planning and operational bodies. To increase commuter confidence in the BRT service, the government and its agencies must also conduct research, create operating procedures, and encourage the usage of the service.

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