BUS RAPID TRANSIT (BRT) SCHEME AND PASSENGERS’ TRAVEL TIME ALONG IKORODU-TAFAWA BALEWA SQUARE (TBS) CORRIDOR

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ABSTRACT

The bus rapid transit system is a scheme meant to move passenger within the city fastly and comfortably. However, it was observed that BRT buses are not moving passengers as fast as expected. This study therefore ascertained the possible causes responsible for the long travel time experienced by BRT passengers along Ikorodu-TBS corridor in Lagos metropolis. Using a structured questionnaire, 289 passengers were randomly selected at Ikorodu/TBS BRT bus terminals and some bus-stops along the corridor. The structured questionnaire focused on the respondents' biographical information, factors determining travel time and preferences for BRT buses. The descriptive statistics (percentages, tables and bar chart) were used for the data analysis while the stepwise regression was used to test the stated hypothesis. The findings showed that passengers’ waiting-time at BRT terminals and bus-stops was mainly responsible for long travel time experienced by BRT passengers. The step-wise multiple regression results indicated that passengers waiting-time was 85.2% responsible for the long travel time and was found to be significant at (F=29786.572, p<0.05). The study suggested that the BRT managers should provide more buses to meet the travel demand of the commuters particularly at the peak-periods. Also, adherence to rules guiding the global standard of BRT operation must be activated and strictly observed.

Keywords: Bus Rapid Transit, mass transit, travel time, waiting-time, Lagos metropolis,

1. Background

The smooth and effective road transport system plays a crucial role in the functioning of metropolitan centres, particularly in highly populated areas like Lagos. The mobility and transportation patterns within metropolitan regions are predominantly reliant on the public and mass transit systems utilised by commuters on a daily basis. The Bus Rapid Transit (BRT) system plays a significant role in facilitating the transportation of large numbers of passengers in numerous cities worldwide. As of the present day, over 150 cities across the globe have successfully implemented various iterations of Bus Rapid Transit (BRT) systems, facilitating the transportation of approximately 28 million passengers on a daily basis. Currently, the global landscape of Bus Rapid Transit (BRT) systems has 280 corridors, spanning a total of 4,300 km in length. These corridors are equipped with 6,700 stations and serve as the operational grounds for a fleet of 30,000 buses (BRTDATA.ORG). According to the findings of Taiwo (2005), the city of Lagos is equipped with an extensive road network spanning over 2,600 km. However, it is worth noting that these roads experience
persistent congestion as they are subjected to the daily influx of over 1 million vehicles during working hours. According to Zacchaeus (2017), the number of cars in Lagos exceeds 5 million, while the number of commercial vehicles is over 200,000. This figure is significantly higher compared to the national average of 11 vehicles per km. Public transport plays a crucial role in numerous cities worldwide, including those situated in Africa, such as Nigeria. Nevertheless, the excessive reliance on automobiles and the inadequate urban road infrastructure are progressively proving ineffective in accommodating the escalating urban activities. Moreover, the allocation of land for the development of roadways and highways, in conjunction with the associated energy consumption and ecological ramifications, presents a significant deterrent to the sustainability of continued investment in transportation systems centred around automobiles. In light of these issues, a significant number of urban areas are implementing measures to facilitate the integration and optimisation of their transportation systems, including the provision of mass transit alternatives that can serve as substitutes for individual automobiles. In contemporary urban transport planning, there is a growing imperative for accurate prediction of how transport demand will react to alterations in the attributes of the transport system (Ndulu & Ogundare, 2020). The concept of mobility holds significant importance within the realm of transportation, particularly in relation to its susceptibility to various factors that exert influence. Mobility can be understood as a spatial undertaking, as it involves the exchange of space for monetary resources (Rodrique, Comtois, & Slack, 2006; Ogunbodede, 2017). The equilibrium between technological and economic factors has undergone numerous fluctuations throughout history. However, in recent decades, there has been a notable increase in the availability of space at a comparable expense. Hence, it is unsurprising to observe that technology has enhanced the velocity, capacity, and effectiveness of transportation. The enhanced mobility has facilitated opportunities for both individuals and corporations to capitalise. One of the key factors contributing to the functioning of the global economy is the capacity of transport systems to efficiently deliver substantial volumes of commodities and accommodate a significant number of passengers. The global community has experienced increased interconnectedness across various dimensions. This emerging geographical aspect surpasses the conventional perspective of traffic centred around cities or countries. Bus Rapid Transit (BRT) is a novel bus transportation system that operates on exclusive lanes, thereby facilitating passenger movement and minimising travel duration. Bus Rapid Transit (BRT) systems are characterised by their contemporary infrastructure, efficient speed and frequency, commendable reputation, and comfortable travel experience. These systems are designed with fixed bus routes that prioritise seamless integration with urban areas, offering the potential for enhanced energy efficiency and economic benefits. The concept of flexibility in force deployment, along with the ability to maintain high quality standards while minimising costs, is a crucial consideration in various domains. According to Cervero (2013), whereas conventional bus systems often run in mixed traffic on streets or in dedicated lanes, BRT (Bus Rapid Transit) effectively achieves high capacity by directing passengers into a lane system. Despite being born in the late 1930s, Bus Rapid Transit (BRT) earned global
recognition with the achievements of Curitiba and Bogota. Over the past two decades, there has been a significant resurgence in the use of public transportation on a global scale. Approximately 100 Bus Rapid Transit (BRT) systems have been successfully implemented, and a comparable number of such systems are currently under development worldwide (Wright, 2011). Lagos, as the pioneering state in Nigeria, has successfully implemented a Bus Rapid Transit (BRT) system for efficient urban passenger transportation. Over time, the service coverage of BRT has been extended to encompass additional regions within the state beyond its initial limited routes. Lagos, Nigeria, a rapidly expanding urban centre, encounters a multitude of obstacles, notably deficiencies and inefficiencies within its transportation infrastructure. Based on the 2006 census forecasts, it is anticipated that Lagos will surpass a population of 17 million. However, the majority of this population is confined to a limited geographic area (Braimoh and Onishi, 2007), resulting in significant strain on the current public infrastructure. According to Odufuwa (2010) and Mobereola (2009), the implementation of Bus Rapid Transit (BRT) in Lagos on March 17, 2008, was a strategic response by the state government to address the existing challenges in public transportation. This initiative aimed to provide the residents of Lagos and its neighbouring areas with a more efficient and dependable mode of transportation.

Excursions within the urban area The selection of Lagos municipality as the study's focal point was predicated on the presence of accessible BRT operations. Furthermore, it is worth noting that Lagos boasts the highest concentration of public transit markets. Additional factors contributing to the aforementioned phenomenon encompass the multifaceted nature of economic endeavours, the presence of a well-developed system of roadways, and the trailblazing implementation of Bus Rapid Transit (BRT) services within the Nigerian context. Moreover, Lagos boasts the highest urban commuter population in Nigeria, with an approximate daily count of six million urban commuters. This is particularly evident in the inland sections and regions of Lagos Island (as depicted in Figure 1), which encompass around 75,000 unregulated zones. Minibuses and taxis have been discussed in a study conducted by Olokesusi, Aiyegbajeje, Mboup, and Mwaniki (2016).

2. Statement of problem
The regulation of public transport in Lagos remains predominantly inadequate. People who lack proper registration and training operate public transportation most of the time. The inadequate implementation of regulatory measures over an extended period has led to suboptimal governance of the road transport subsector within the nation. Hence, road transport in Nigeria has emerged as a widespread endeavour involving various participants. The BRT scheme from Ikorodu to Tafawa Balewa Square (TBS) encompasses several notable features. These include the provision of a dedicated right-of-way, the presence of upgraded stations equipped with shelters, the implementation of pre-board fare collection systems, the use of brand new air-conditioned buses with high passenger capacity, and the incorporation of an Intelligence Transport System. These features played a significant role in establishing a favourable perception, resulting in the project receiving praise from clients throughout the corridor. Nevertheless, in recent years, the programme has experienced a decline in utilisation, characterised by subpar service...
quality and inefficiency. Passengers have expressed growing discontent due to the persistent occurrence of extended travel durations, which can be attributed to a multitude of factors. These factors encompass prolonged waiting periods for buses at both BRT bus terminals and bus stops, an insufficient quantity of buses available for service, buses waiting for passengers to board, suboptimal bus speeds, drivers' demeanour, and the failure to utilise dedicated lanes. It is crucial for this study to determine the reasons behind passengers' increased trip time in BRT buses, despite the presence of designated lanes for these buses, and their subsequent deviation from the anticipated travel duration.

Furthermore, travellers frequently experienced prolonged waiting periods at terminals and, in certain instances, bus stops prior to boarding a bus that would transport them to their intended location. Nevertheless, despite the implementation of Bus Rapid Transit (BRT) in the intra-city bus services within the Lagos metropolitan area, which was intended to decrease passenger travel time among other objectives, there continues to be dissatisfaction among passengers regarding the extended duration it takes to reach their respective destinations. This study aims to investigate the potential factors contributing to the extended duration of travel experienced by individuals. Consequently, it is imperative to conduct this investigation to enhance the current body of knowledge pertaining to the topic. Moreover, the primary objective of this research endeavour is to ascertain the underlying factors contributing to the prolonged duration of trips inside the Bus Rapid Transit (BRT) system in Lagos, with a specific focus on the Ikorodu-TBS corridor as a representative case study. The primary aim of this study is to determine the impact of the intervention on the passengers. The present study postulated that various factors, including the duration of passengers' wait at the bus stop, the time spent by the bus waiting for passengers, the lack of available buses, the speed at which the bus operates, and the absence of dedicated lanes, would have a substantial impact on the extended trip time experienced by passengers utilising the Bus Rapid Transit (BRT) system.

3. Literature review
This literature study primarily centres on the examination of trip time in relation to the Bus Rapid Transit (BRT) transport system. The Bus Rapid Transit (BRT) system is a transportation initiative primarily implemented to mitigate the journey duration for commuters within Lagos City. Nevertheless, there remains a dearth of knowledge regarding the accurate state of affairs pertaining to that objective. The existing body of literature on Bus Rapid Transit (BRT) is large and encompasses a wide range of topics and issues. Multiple scholarly studies have underscored the significance of Bus Rapid Transit (BRT) in delivering superior bus services that are characterised by flexibility, speed, and reduced costs compared to traditional bus systems (Cervero, 1998; Wright and Hook, 2007; Deng and Nelson, 2011). In addition, Suzuki et al. (2013) conducted a comparative analysis between the Bus Rapid Transit (BRT) system and metro-rail systems, ultimately determining that the BRT system offers cost-saving advantages and is capable of achieving comparable capacity to metro-rail systems, despite being significantly more affordable with a cost ratio of 1:10 for identical lengths. According to Olokesusi et al. (2016), Lagos has the largest number of intra-city commuters in Nigeria. The study estimates that approximately six million passengers
travel within the metropolis on a daily basis, specifically in the mainland areas and Lagos Island areas. These commuters rely on approximately 75,000 unregulated minibuses and taxis for transportation. The duration of travel is a crucial determinant in shaping individuals' inclination towards a particular method of public transport over another. According to the findings of Golob et al. (1972), it is evident that commuters are unable to continuously extend their travel duration, thus highlighting the significance of travel time. The various constituents of travel time in relation to public transport encompass walking time, waiting time, and journey time. These three primary elements of travel time are subject to individual variation in terms of their perceived importance by commuters (Polat, 2012). The duration spent on travel holds significance for traffic engineers and is crucial for the system's end-users. Travel time is a metric used to assess the degree of reliability of transport services for a specific mode, journey, route, or corridor within a designated timeframe. The issue of travellers' apprehension regarding the unpredictability of trip time has been highlighted in many surveys conducted by Lomax, Schrank, Turner, and Margiotta (2003). According to Taylor (2010), the reliability of travel time is primarily influenced by several factors of traffic congestion, which may be categorised into distinct sources, including bottlenecks, traffic incidents, adverse weather conditions, work zones, suboptimal signal timing, and special events. Bertini (1978) previously introduced several indicators of congestion, encompassing delay, level of service, trip time, volume/capacity, and speed. Scholars are increasingly interested in developing a methodology for assessing the variability of journey time. In academic discourse, trip time is commonly characterised through the utilisation of statistical distributions. Numerous academics (Richardson & Taylor, 1978; Rakha, El-Sharwarby, Arafah, & Doin, 2006; Faouzi and Maurin, 2007) posit that the distribution of trip time conforms to either the normal distribution or the log-normal distribution. Susilawati, Taylor, and Somenahalli (2011) introduced the Burr distribution in their research. In their study, Noland and Polak (2002) conducted a comprehensive examination of travel time variability, focusing on both theoretical and empirical aspects. Their analysis specifically centred around the travel behaviour framework introduced by Polak (1986), which employed the mean-variance approach.

Susilawati et al. (2010) included two reliability parameters in their study to assess trip time dependability. The parameters under consideration are the variance in journey time and the buffer time index. The concept of trip time pertains to a metric that gauges the degree of traffic congestion and is closely associated with the buffer time index, which serves as an indicator of transportation dependability (Cambridge Systemics and Texas Transportation Institute, 2004). In addition, Noland (1997) devised a simulation methodology to examine the efficacy of congestion reduction initiatives and investigate the impacts of disseminating journey time information to commuters. In their study, Saberi and Bertini (2009) utilised the travel time reliability concept and applied a methodology to identify areas of high traffic congestion on a motorway. They analysed the spatio-temporal dimensions of the highway to identify the sources of congestion. The assessment of motorway travel time reliability was conducted by Arezoumandi (2011) using a similar methodology. Lyman and Bertini (2008)
employed the aforementioned methodology to enhance real-time transportation management. Despite the manifold significance it has, not all Bus Rapid Transit (BRT) systems have seen uneventful trajectories. Instances of substantial congestion during the boarding process of buses have been documented in many regions, including Transmilenio in Bogota, Colombia, and Metrobus in Istanbul, Turkey. According to a study conducted by the Inter-American Development Bank, similar instances of extensive waiting lines were observed in several locations, including Lima (Peru), Montevideo (Uruguay), and Cali (Colombia) (Scholl et al., 2015; 2016). Lagos, Nigeria, has been identified as another location where instances of substantial queuing were observed within the Bus Rapid Transit (BRT) system, as documented by van den Berg and Verhoef (2014). Scholars have consistently focused on many aspects of Bus Rapid Transit (BRT) systems, including their operation, design, and impact on urban commuting. A substantial body of research exists on these topics. However, the study conducted by Basso and Silva (2014) primarily examined the effectiveness and interchangeability of bus lanes and pricing strategies, such as congestion pricing, within a static congestion framework. It is important to note that their research did not exhibit any bias towards economic transportation. The research conducted by Basso, Fernando, and Silva (2019) introduced a novel method for addressing congestion dynamics. This technique incorporates the ability to internally simulate queuing phenomena, both on roadways and at terminals and bus stops within bus rapid transit (BRT) systems. It is well acknowledged that individuals residing in a certain residential locality must make a decision between utilising private vehicles or opting for public transportation while commuting to the urban core. Additionally, the timing of their departure plays a crucial role, hence emphasising the need for schedule punctuality. Research conducted by Afolabi (2016) investigated the perceptions and preferences of commuters on the Lagos Bus Rapid Transit (BRT) system. The primary focus of this study was to analyse the evaluation of passengers regarding the Bus Rapid Transit (BRT) service, with a specific emphasis on two variables: quality of service and reason for patronage. The study revealed a statistically significant positive relationship between affordability for patronage and service quality. In a separate study conducted by Alade and Olaseni (2018), the authors examined the performance of the Bus Rapid Transit (BRT) system in Lagos. They used a passenger satisfaction index consisting of 13 variables to assess the quality of service provided by the BRT. The findings of the study indicated that, overall, the BRT system offers a satisfactory level of service. However, it was concluded that the BRT system has not yet achieved satisfactory levels in terms of waiting time to board and comfort during transit, despite being operational for over a decade.

4. Research methods and materials
The major source of data for this study mostly consisted of structured questionnaires and key informant interviews (KII). The selection of the BRT main terminals at Ikorodu and Tafawa Balewa Square (TBS) for this study was based on their representation as the origin and/or destination points along the corridor. The study focused on individuals who use BRT buses for their daily commute. Specifically, those who possessed BRT tickets were chosen for further participation and were provided...
with questionnaire forms to complete. The core data collection was a structured questionnaire that concentrated on gathering demographic information, assessing passenger preferences for Bus Rapid Transit (BRT) services, and determining the impact of BRT operations on passengers' journey duration. The research focused on individuals who were 18 years of age or older and were passengers. Based on available data, it can be observed that the Ikorodu-TBS route is serviced by an average of 13 buses on a daily basis. Each vehicle has a passenger capacity of 80, resulting in a cumulative total of 1,040 passengers. A participant rate of around 88.7% was achieved, with 283 structured questionnaire forms retrieved out of the 289 questionnaires issued. The movements of BRT riders were monitored at the BRT terminals located in both Ikorodu and TBS. Occasionally, passengers were also subjected to interviews while on the bus during the course of the ride. Given the general lack of willingness among passengers to participate, the study employs a random selection method that is contingent upon passengers' willingness to participate. The determination of the sample size was conducted using Yamane's (1967) sampling techniques, following the acquisition of the annual average number of passengers travelling on the Ikorodu-TBS route from LAMATA. Yamane's technique is described as follows:

\[ n = \frac{N \times (e)^2}{1 + N \times (e)^2} \]

Where, \( n \) = sample size, \( N \) = sampled population and \( (e)^2 \) = significant level or level of precision 0.05²

Passengers at Ikorodu/TBS terminals

Ikorodu/TBS terminals: 1+1040 x 0.0025 = 5.2025

\[ 1,040 \div 3.6 = 288.888 \]

Approximately, a total of 289 structured questionnaire forms were distributed while a total of 383 questionnaire forms were retrieved.

The study employed a basic statistical frequency analysis to elucidate the impact of Bus Rapid Transit (BRT) services on the duration of customers' journeys along the designated route. The explanation was facilitated through the use of frequency tables and cross-tabulations, if deemed suitable. The open-ended responses provided by the respondents were collected and analysed using Statistical Package for Social Sciences (SPSS) version 21. The study employed a step-wise multiple regression model to examine the impact of various factors, including passengers' waiting time at the bus stop, bus waiting time for passengers, unavailability of buses, bus speed, and non-use of a dedicated lane, on the travel time of passengers utilising the Bus Rapid Transit (BRT) system. The study employed a step-wise multiple regression model to examine the hypothesis that various factors, including passengers' waiting time at the bus stop, bus waiting time for passengers, unavailability of buses, bus speed, drivers' attitudes, and non-use of dedicated lanes, will have a significant impact on the travel time of passengers using the Bus Rapid Transit (BRT) system. The stepwise regression model is formulated as follows:

\[ Y = Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_n X_n + c \]

Where: \( Y \) = Passengers’ long travel time in BRT bus system along Ikorodu-TBS corridor (dependent variable)

\( a \) = intercept

Independent variables are:

\( X_1 \) = waiting time at the bus stop
\( X_2 \) = bus waiting for passengers
\( X_3 \) = inadequate number of buses
\( X_4 \) = speed of the bus
X$_5$ = drivers’ attitudes
X$_6$ = non-use of dedicated lane

The study classified the replies of BRT passengers along the Ikorodu-TBS route to determine the dependent variable, which pertains to the determinants of passengers' long trip times in the BRT bus system. The passengers were asked the following question: "Do you encounter extended travel durations when using BRT buses?" The replies were recoded into two binary variables: one representing those who do not experience long travel time (coded as 0), and the other representing individuals who do experience long travel time (coded as 1). The measurement of the independent variables was conducted through the use of replies provided by passengers of the Bus Rapid Transit (BRT) system. The Likert style was employed to arrange the questions, with response options ranging from "strongly agreed" to "strongly disagreed." The aforementioned responses were subsequently categorised into three distinct groups: those who expressed agreement, those that expressed uncertainty, and those that expressed disagreement. The responses categorised as "strongly agreed" and "agreed" were consolidated into the category labelled "Yes," while the remaining responses categorised as "undecided," "disagreed," and "strongly disagreed" were consolidated into the category labelled "otherwise." According to this categorisation, any response categorised as yes is assigned a score of one (1), whereas responses falling under the category of 'else' are assigned a value of zero (0). The variables that were measured independently include X$_1$, which represents the waiting time at the bus stop. The replies to this question were measured using the following methodology: Is the extended duration of waiting at BRT terminals and bus stops a contributing factor to the prolonged journey time? (1 = Yes; 0 = No) The variable X$_2$ represents the presence of buses waiting for passengers at terminals or bus stops. The responses to this question were measured on a binary scale, where a response of "Yes" was coded as 1 and any other response was coded as 0. Similarly, the variable X$_3$ represents the availability of buses at BRT terminals or bus stops. The responses to this question were also measured on a binary scale, with a response indicating that the unavailability of buses was considered the main reason for passengers spending longer on their journey. In the context of binary logic, the value of "Yes" may be represented as 1, whereas the value of "Otherwise" can be represented as 0. The variable X$_4$ represents the speed of the bus. The data collected for this variable was obtained by asking the question, "Does the driver’s failure to adhere to the required speed limit for BRT buses contribute to the extended travel time?" The value of "Yes" is represented as 1, whereas the value of "Otherwise" is represented as 0. The variable X$_5$ represents the attitudes of drivers, which were assessed by asking whether the drivers’ attitudes are responsible for the extended duration of journey experienced by passengers. The responses to this question were measured using a binary scale, where a response of "Yes" was coded as 1 and any other response was coded as 0. The variable X$_6$ represents the non-utilisation of dedicated lanes by bus drivers operating bus rapid transit (BRT) systems. The responses to this question were assessed using a binary measurement, where a response of "Yes" was coded as 1 to indicate that the non-use of dedicated lanes by BRT bus drivers is really responsible for the increased journey time, while any other response was coded as 0.
5. Study Area
Lagos undoubtedly stands out as one of the most rapidly expanding cities in Africa. Due to the significant magnitude of commercial operations occurring inside its metropolis, it can be regarded as the primary economic hub of Nigeria. The persistent increase in population implies that the infrastructure of the city should be developed in order to accommodate the rising demand. One example of such infrastructure is transport infrastructure, which plays a crucial role. The significance of this matter lies in its fundamental role as the foundation for various human endeavours, encompassing economic, social, political, and other domains. This study has opted to investigate the Bus Rapid Transit (BRT) system in Lagos, along with many other sectors of the transportation system in the same city. The BRT Ikorodu-Tafawa Balewa (TBS) corridor was chosen as the preferred option for accomplishing this objective. Ikorodu is a municipality located at a distance of around 36 kilometres to the north of Lagos.

It is geographically surrounded by the Lagos Lagoon to the south, a boundary with Ogun State to the north, and a boundary with Agbowa-Ikosi, a town in the Epe Division of Lagos State, to the east. In contrast, Tafawa Balewa Square (TBS), which was constructed in 1972, encompasses an area of 14.5 hectares (35.8 acres) and serves as a ceremonial venue. Initially referred to as the "Race Course," this site is located in Marina and currently serves as the primary terminal for the Bus Rapid Transit (BRT) system on Lagos Island. The route from Ikorodu to TBS encompasses several bus stops along its trajectory. The route depicted in Figure 1 includes the following locations: Ikorodu Garage-Aruna-Agric-Majidun Ogolonto-Majidun Awori-Irawo-Idero-Iduro Onirin-Mile 12-Ketu-Ojota-New Garage-Maryland-Idiroko-Anthony-Obanikoro-Palmgrove-Onipanu-Fadeyi-Yaba-Moshalasi-Barracks-Stadium-Iponri-Costain-Leventis-CMS/Marina-TBS, as shown in Fig.1. (www.primerotsl.com/newsite/bus-routes/).

![Fig. 1: Bus Rapid Transit route from Ikorodu terminals to TBS](image)

Source: Lagos Metropolitan Area Transport Authority (LAMATA) (2022)
6. Results and discussions
6.1. Demographic profile of passengers

This section presents the demographic profile of the passengers. The variables encompassed in this category are gender, age, level of education, and occupation. According to the data presented in Table 1, a significant proportion of the passengers, specifically 92 individuals (32.5%), fall within the age range of 21–40 years. Additionally, 125 passengers (44.2%) are situated within the age bracket of 41–60 years. These findings indicate that a majority of the passengers belong to the working-age population and are likely utilising BRT buses for their daily commute to their various workplaces. The data shown in the Table indicates that a significant proportion of the participants, specifically 150 individuals (53.0%), identified as females. Additionally, the majority of passengers that use the BRT system were found to be self-employed, accounting for 58.0% of the sample. In addition, a significant proportion of the sample, specifically 207 individuals (73.0%), possessed diverse academic qualifications, including an Ordinary National Diploma (OND), a National Certificate of Education (NCE), a Higher National Diploma (HND), and Bachelor's degrees from universities. Conversely, a smaller subset of 46 individuals (16.3%) held Senior Secondary Certificates.

Table 1: Demographic profile of passengers  n = 283

<table>
<thead>
<tr>
<th>Items</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20 years</td>
<td>43</td>
<td>15.2</td>
</tr>
<tr>
<td>21 - 40 years</td>
<td>92</td>
<td>32.5</td>
</tr>
<tr>
<td>41 - 60 years</td>
<td>125</td>
<td>44.2</td>
</tr>
<tr>
<td>&gt;60 years and above</td>
<td>23</td>
<td>8.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>283</td>
<td>100</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>133</td>
<td>47.0</td>
</tr>
<tr>
<td>Female</td>
<td>150</td>
<td>53.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>283</td>
<td>100</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSCE</td>
<td>46</td>
<td>16.3</td>
</tr>
<tr>
<td>ND/NCE</td>
<td>104</td>
<td>36.7</td>
</tr>
<tr>
<td>HND/B.Sc.</td>
<td>103</td>
<td>36.4</td>
</tr>
<tr>
<td>No response</td>
<td>30</td>
<td>10.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>283</td>
<td>100</td>
</tr>
<tr>
<td><strong>Occupation</strong></td>
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<td></td>
</tr>
<tr>
<td>Self-employed</td>
<td>164</td>
<td>58.0</td>
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<tr>
<td>Paid employment</td>
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<td>35.0</td>
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<tr>
<td>Unemployed</td>
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<td>7.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>283</td>
<td>100</td>
</tr>
</tbody>
</table>

*Source: Author’s Analysis (2023)*

6.2. Determinants of travel time in the BRT bus system

Multiple factors were identified as contributors to the duration of the journey experienced by passengers utilising the Bus Rapid Transit (BRT) system along the Ikorodu-TBS line. According to the data presented in Figure 2, the primary determinant of extended journey duration for passengers was the duration spent
waiting at the bus stop, which constituted 210 instances, equivalent to 74.2% of the total. According to the findings, a significant majority of the passengers interviewed, specifically 165 individuals representing 58.3% of the total sample, said that the failure of certain drivers to utilise the dedicated lane for the Bus Rapid Transit (BRT) system was identified as the second contributing factor to the prolonged duration of journey experienced by passengers. The factors discovered in hierarchical order were as follows: 'bus waiting for passengers' (141 occurrences, accounting for 49.8%), 'inadequate number of buses' (128 occurrences, accounting for 45.3%), 'attitude of the drivers' (83 occurrences, accounting for 29.3%), and 'speed of the bus' (79 occurrences, accounting for 27.9%).

![Determinants of long travel time](image)

**Fig. 2: Determinants of long travel time in the BRT system**

*Source: Author’s analysis, (2023)*

6.3. Step-wise regressions of the determinants of long travel time in the BRT bus system

The present study employed stepwise regression analysis to examine the impact of various factors, including passengers' waiting time at the bus stop, bus waiting time for passengers, unavailability of buses, speed of the bus, and non-use of the BRT dedicated lane, on BRT passengers' trip time. The results of this research are presented in Table 2. The findings presented in Table 2 indicate that the waiting time experienced by passengers at the BRT terminals and bus stops is a significant predictor variable in determining the extended trip duration of BRT passengers along the Ikorodu-TBS line. This particular component accounted for 85.2% of the factors identified as contributing to the extended trip duration encountered by passengers of the Bus Rapid Transit (BRT) system. The findings from the stepwise multiple regression analysis indicate a significant relationship between passengers' waiting time at the BRT terminals and bus stops and the duration of their travel time on the BRT system (F = 29786.572, p<0.05). The regression coefficients suggest that
passengers' travel time is significantly influenced by their waiting time at the BRT terminals or bus stops and their adherence to the BRT dedicated lane. However, factors such as the inadequate number of buses, bus speed, driver attitude, and bus waiting time at the terminals or bus stops do not have a significant impact on passengers' travel time. In light of the standardised regression coefficients pertaining to the predictors, it is evident that the waiting time of passengers at the BRT terminals and bus stops holds the highest magnitude in the model, with non-adherence to BRT dedicated lane usage following closely after. The results of the t-tests revealed that, out of the six sets of predictor variables, the waiting time of passengers at the BRT terminals and bus stops had a statistically significant impact on predicting the extended journey time of BRT passengers.

Based on the study conducted, it can be concluded that the waiting time of passengers at the BRT terminals and bus stops is the primary predictor variable that influences the extended journey time encountered by BRT passengers along the Ikorodu-TBS corridor. This element holds significant importance in the model due to the passengers' high level of anxiety regarding the prolonged waiting times encountered at terminals and bus stops. These extended waiting periods have a direct impact on their trip duration, consequently disrupting their daily economic and social routines. The mathematical expression used to estimate the long travel time of BRT passengers can be represented by the following equation:

\[ Y = 0.018 + 0.864PWT + 0.082NBD \ldots \]

Eqn. (ii)

Where: \( Y \) = is the predicted effect on BRT passengers’ long travel time

\( PWT \) = passengers’ waiting time at the terminals/bus-stops

\( NBD \) = Non-adherent to BRT dedicated lane usage

Table 2: Small-hold farming activities

<table>
<thead>
<tr>
<th>Predictor variables</th>
<th>b coef.</th>
<th>Std. Error of b</th>
<th>Multiple R</th>
<th>Level of explanation</th>
<th>Increase in level of explanation</th>
<th>t-value for variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passengers' waiting time at the terminals/bus stop</td>
<td>0.864</td>
<td>0.018</td>
<td>0.832</td>
<td>85.2</td>
<td>85.2</td>
<td>41.722*</td>
</tr>
<tr>
<td>Non-adherent to BRT dedicated lane usage</td>
<td>0.082</td>
<td>0.021</td>
<td>0.121</td>
<td>3.1</td>
<td>82.1</td>
<td>3.182*</td>
</tr>
</tbody>
</table>

Intercept: 0.018; \( F = 29786.572 \)

*Significant at 0.01 significance level; *Significant at 0.05 significance level; N=283

Source: Author’s Analysis, 2023

6.4. Discussion of findings

The study's findings elucidated the factors contributing to the prolonged journey duration experienced by passengers throughout their commutes using Bus Rapid Transit (BRT) systems. This discovery, to some extent, undermines the original purpose for the implementation of the Bus Rapid Transit (BRT) concept in the
Lagos metropolitan mass transit system. Transportation, the process of conveying individuals, commodities, and services from one place to another, holds significant importance in the daily pursuits of humanity. Consequently, any factors that impact transportation have the potential to significantly modify the everyday routines of individuals. The aforementioned findings indicate that the primary factors contributing to extended trip durations for passengers on BRT buses along the Ikorodu-TBS lines are the waiting times experienced at the terminal and bus stops prior to boarding. It has additionally been shown that the extended duration of waiting at the terminals predominantly occurs during peak periods as well as to a large extent during off-peak periods. One of the factors cited for this common phenomenon was the insufficiency of Bus Rapid Transit (BRT) vehicles to cater to the high demand experienced during peak periods. One additional factor contributing to extended waiting times for passengers at BRT stations during off-peak periods is the relatively low passenger volume, which can be attributed to the fact that these periods typically coincide with regular working hours. This phenomenon should not occur due to the primary rationale behind passengers' preference for travelling with BRT buses, which is primarily rooted in the perceived comparative advantage it holds over its competitors. The Bus Rapid Transit (BRT) system was specifically engineered to prioritise speed and minimise traffic disruptions through the provision of dedicated lanes. Nevertheless, it has been shown that bus rapid transit (BRT) drivers frequently deviated from the designated lanes without a clear explanation. The purpose of the dedicated lane is to facilitate speedier movement by ensuring it remains unaffected by traffic congestion. Additional factors contributing to the extended duration of the trip include instances of non-compliance with the designated lane by vehicles as well as the duration of time that Bus Rapid Transit (BRT) buses spend waiting for passengers at both terminals and bus stops. Although the latter often occurs during peak periods.

7. Conclusion and Recommendation

This study was conducted to analyse the duration of trip for passengers utilising the Bus Rapid Transit (BRT) system inside the Lagos metropolitan. According to the research findings, it was noticed that the duration of passengers' waiting time at terminals and bus stops significantly contributed to the overall length of trip time. The consequences of this unfavourable pattern suggest that a significant number of passengers experience a loss of productivity during their travels, since a journey that should ideally take thirty minutes may extend to an hour or even longer. Additionally, it was noted that the drivers' lack of adherence to dedicated lanes and the duration of time BRT buses spent waiting for passengers at terminals and bus stops were other influential issues. Nevertheless, despite the extended duration of trip encountered by passengers, the Bus Rapid Transit (BRT) system continues to attract a larger number of users due to its distinct advantage over alternative modes of transportation. For instance, the passengers acknowledged that the Bus Rapid Transit (BRT) system is perceived as a safer, more pleasant, and significantly more cost-effective method of transportation compared to other alternatives. This favourable perception among passengers contributes to the continued high patronage of the BRT system. Based on the empirical evidence, it is recommended and prudent for the managers of the Bus Rapid Transit (BRT)
system to devise a strategy for effectively resolving this issue. Furthermore, considering that Bus Rapid Transit (BRT) is the most appropriate mode of transportation for accommodating a large number of passengers, it is anticipated that an increased number of BRT buses will be deployed during peak periods in Lagos, a densely populated metropolis. This measure aims to efficiently transport a greater volume of passengers to their respective destinations. During peak hours, such as in the morning when commuters are travelling to their workplaces and in the evening when they are returning home, it is imperative to increase the number of buses available in order to mitigate the issue of extended waiting times at BRT terminals and bus stops. In conclusion, the research report posited that it would be advisable for BRT managers to increase the number of buses in order to adequately address the travel needs of commuters, particularly during peak periods. Furthermore, it is imperative to activate and rigorously adhere to the regulations that govern the global standard of Bus Rapid Transit (BRT) operation.

References


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