

INITIATING SMART PUBLIC TRANSPORTATION IN LAGOS: SETTING THE TONE FOR AFRICAN CITIES

Desmond AMIEGBEBHOR¹ and Boluwatife POPOOLA²

¹Lagos Metropolitan Area Transport Authority/Lagos State University, Lamata Place, 15
Ketu Interchange, Lagos Nigeria

² Lagos Metropolitan Area Transport Authority, Lagos Nigeria

Email: damiegbebhor@lamata-ng.com¹

ABSTRACT

After several initiatives in public transportation primarily anchored by both the private and public sector which were short-lived, the informal sector comprising two-wheeler motor cycles, the “danfoes” and “molues” being operated by the (National Union of Road Transport Workers and the Road Transport Employers’ Association of Nigeria) became the dominate operator of urban bus operations in Nigerian urban cities including Lagos. With the growth in population and economic activities making Lagos a mega city, the breach in urban transport operations became ostensible. It therefore became imperative to introduce initiative particularly quick win interventions that would deliver smart mobility innovations for efficient movement of the commuting public. Smart public transportation is essential to meet the challenges of urbanization in Lagos and other African cities. A detailed analysis as encapsulated in the Bus Route Network study is required to determine travel pattern, route alignments, infrastructure gap, transit service type (Bus Rapid Transit, Rail or regulated bus system) and technology type that would be required to guide decision makers and politicians. For African cities, however, there is need to domesticate our public transportation requirements for implementation and gradually ramp up with the deployment of mobility application technology like Intelligent Transport Systems comprising mobile apps, electronic ticketing amongst others.

Keywords: Smart, Public, Transportation, Intelligent, Ticketing, Cities, Bus

1. INTRODUCTION

Lagos is the commercial and financial nerves of Nigeria and Africa. The city houses one of the largest and busiest ports on the African continent. It occupies 0.5% of Nigeria’s total area, making it the state with the smallest landmass in the country (PwC, 2016). Lagos is the most populated city in the country, which is estimated at 21 million (12% of national population estimate) (LASG, 2017); it is also one of the most populated city in Africa and one of the fastest growing in the world. Its population surpasses over 25 individual African countries such as Zambia, Senegal, and Tunisia amongst others. Lagos urbanises at 6% annually and has an urban population density of about 20,000 people per km² (Fadairo and Taiwo, 2015); it is one of the densest cities in the world.

Lagos has always been an industrial city and currently enjoys the status of having one of the largest city economies in Africa, accounting for 90% of the nations’ foreign trade flow (LASG, 2017). It had a GDP of about \$136.6 billion in the year 2015, which is over 30% of the national GDP and about 65% of national non-oil GDP for the same year (LASG, 2017). Its GDP is higher than 42 individual countries GDPs in Africa and equivalent to a combination of 19 countries in Africa (PwC, 2016). Lagos GDP is ranked 4th amongst African cities; it is behind Cairo, Johannesburg and Cape Town consecutively (LASG, 2017).

Lagos is the home to many financial, telecommunications, manufacturing and oil companies, and accommodates some of the main and busiest ports (seaports and airport) in Africa (LAMATA, 2009). The city accounts for 65% of the nation's manufacturing activities and currently, "18 of the Fortune 100 companies operate in Lagos State" (PwC, 2016, p. 7). The city has the largest share of working population in Sub-Saharan Africa, and over 45% of Nigeria's skilled workforce reside in it (Orekoya, 2016; LASG 2017). It also has the highest standard of living in Nigeria with a per capita income of \$2900 (Mhango, 2013; PwC, 2016). However, Lagos has the highest rate of unemployment and underemployment in the country (Banjo and Mobereola, 2012). The above-mentioned is because of the minimal job opportunities in other states, which has made the city more attractive to job seekers. The high rate of underemployment has created a large gap between the high income-earners and low-income earners. Though Lagos is the economic leader of Nigeria, the state's yearly operating budget is significantly lower than cities of similar sizes such as Delhi, Mumbai, and Jakarta (Stimson, 2009, cited in Msulwa and Gil, 2015).

2. THE HISTORY OF PUBLIC TRANSPORTATION IN LAGOS

The initial conscious attempt to develop public transportation in Lagos began in 1899. A public tramway system designed to connect Lagos Island to Lagos Mainland was implemented and fully operational in 1902. The first privately owned commercial bus service was established in 1915 by Charlotte Olajumoke Obasa. She was a leading indigenous entrepreneur who pioneered organised bus transport with her 'Anfani Bus Service' with a fleet size of two buses (MoT, 2019). This was followed with the establishment of J.N. Zarpas & Co in 1929. Zarpas, a company owned by expatriates provided bus services along Obalende, Apapa and Idi-Oro routes. They dominated the Lagos transport scene for several years until their assets were acquired by the Lagos Town Council to form the Lagos Municipal Transport Service (LMTS) in 1958 (MoT, 2019).

The Government Agency, LMTS, was saddled with the responsibility of regulating and controlling the transport system in the metropolis. LMTS was transformed to Lagos City Transport Service (LCTS) and Lagos State Transport Corporation (LSTC) when Lagos became a city and state in 1962 and 1967 respectively (MoT, 2019). LSTC played a leading role in delivering formal intra-city bus services alongside new private companies such as Benson Transport Company Limited, Oshinowo Transport Service Limited, Elias Bus Service Company and Union Nigeria Trading Company. There were minimal mobility issues encountered by commuters during this period with a population of about 1.5m in the state (LAMATA, 2013).

In the late 60s, about 750,000 passengers travelled in and out of Lagos daily, and the formal operators carried about 33% while the informal operators carried 67% (MoT, 2019). The informal operators use public transport vehicles known as 'Bolekaja', 'Jalekun e', and later, 'Molue' and 'Danfo'. The 'Molue' is a Mercedes 911 chasis remodelled locally into a High Occupancy Vehicle (HOV) with 44 passengers seating and 30 standing. The 'Danfo' is a Volkswagen Type 2 (T3) minibus with 14 passengers seating capacity. The 'Danfo' and 'Molue' operators were known for jagged driving behaviour and fatal accidents (MoT, 2019). Since 2008, there was gradual phasing out of the Molues with the introduction of regulated High Occupancy Buses.

In the early 70s, the oil boom prompted a rapid urbanisation and migration to Lagos, especially for the unemployed. Economic opulence coupled with increase in population escalated vehicle ownership geometrically. The unforeseen developments led to chaotic traffic jams because the road infrastructures could not cater for the increasing demand (LAMATA, 2019). This situation became a major challenge as successive administrations struggled to mitigate the traffic condition. Several infrastructure projects such as the Cater Bridge, Ikorodu Road, Eko Bridge, Apapa-Ikeja Expressway, Obafemi Awolowo Way, first

phases of Lekki-Epe Expressway etc (LAMATA, 2013). Traffic management in the city was then focused on moving vehicles rather than people. This approach led to further traffic gridlock due to the rapid growth of personal vehicles usage compared to the slow development of road infrastructures (MoT, 2019).

The Lateef Jankande administration attempted to develop a multimodal transportation strategy in the early 80s focused on rail mass transit, bus and ferry to reduce traffic congestion. Two ferries with about 400 passenger capacity commenced services between Mile 2 Jetty and Marina in 1980 (LAMATA, 2013). The use of motorcycles 'Okada' as PT originated due to the combined effect of rapid urbanization, unemployment and inadequate intra-city public transportation in early 80s. The proposed metro line scheme was conceived as a 28.5km Light Rail Transit (LRT) system, with 19 stations from Race Course in Central Lagos to Agege (Via Iddo) at an estimated project cost of N600m (LAMATA, 2013).

The Jubilee Scheme whereby PT was fully re-privatised was introduced in 1992 (MoT, 2019). The scheme discontinued previous transportation initiatives with government disengaging from direct operations of public transport. About 100 buses were released to private operators on a wet lease with 30% subsidy. The ferry service, which was almost moribund, was rejuvenated with acquisition of MF Odoragunshin in 1993, a 1000 passenger capacity vessel. Also, two trains were leased from the Nigerian Railway Corporation (NRC) to operate the first Intracity rail service in Lagos through a partnership between the Federal and State Governments (MoT, 2019).

Until the recent promulgated State Traffic Law came into effect, 'Okada' (the two wheelers) was a growing but highly worrisome phenomenon and a reflection of the states' poor transport system.

As economic activities prospered, the population proliferated, and the city expanded. Lagos population had tripled between 1980 and 2000 without a complementary urban transportation plan (Barredo and Demicheli, 2003). By the 21st century, Lagos seaports handled about 75% of the nations' import by weight, and its airport handled about 80% of passenger travel in and out of the country (LAMATA, 2009). Over eight million Lagos residents also required one form of motorised trip daily, and road transport accounted for over 95% of motorised travel (LAMATA, 2009; Osoba 2012). Lagos had minimal inter-city rail travel, and water transport was ignored despite its transit potentials. The unexpected population growth led to high demand on the city's struggling road transport system.

The city lacked an organised public transit system, and its citizens use the danfo (mini-buses), molue (large buses) and kabu-kabu (shared taxis) for long distance travel. Okada (commercial motorcycles) and Keke-Marwa (three-wheelers) were frequently used for short distance trips. Public transport in Lagos was described as "unregulated, chaotic, inefficient, expensive, low quality and unsafe" (Amiegbebhor et al., 2016, p. 2). Lagos gradually became an automobile-oriented city due to the unrestricted import of relatively cheap second-hand vehicles coupled with subsidized fuel prices. Over 2600Km of road existed in Lagos in 2005, and they were frequently congested with about a million vehicles daily. The city's vehicular density of 222vehicles/Km is larger than the country average of 11vehicles/Km (Taiwo, 2005, cited in Amiegbebhor et al., 2016). In 2007, Lagos was identified "as the only mega city (with a population of over 10 million) without any formal public transport system or functioning rail system" (World Bank, 2017).

Poor public transport coupled with road dependency and high travel demand (especially during peak periods) resulted in regular chronic congestion in the city which causes a typical half hour journey to take over two hours. ROM (2009) found that Lagosian lose between 0.6 to 3 billion hours annually due to congestion.

3. THE CONCEPT OF SMART CITY AND PUBLIC TRANSPORTATION

A Smart City is a growing concept that draws from the success of Dubai’s innovative knowledge-based industry cluster “ to empower business growth for companies and knowledge workers all over the world”. It is an urban development vision to integrate multiple information and communication technology (ICT) solutions in a secure fashion to manage a city’s assets – the city’s assets include, but not limited to, local departments information systems, schools, libraries, transportation systems, hospitals, power plants, water supply networks, waste management, law enforcement, and other community services. The goal of building a smart city is to improve quality of life by using technology to improve the efficiency of services and meet residents’ needs. ICT allows city officials to interact directly with the community and the city infrastructure and to monitor what is happening in the city, how the city is evolving, and how to enable a better quality of life.

Broadly, city can be defined as smart when investments in human and social capital, traditional transport and modern ICT communication infrastructure fuel sustainable economic development and high quality of life, with a wise management of natural resources (Taiwo, 2016).

Digitization drives the increasing importance of technology that would enable smarter public transportation. Information and Communication Technology players are continuously developing new solutions by using digital infrastructure and platform. Smart transportation is connected solutions for shared passenger transport services such as buses, trains and ferries. It includes applications for connected vehicles and related infrastructure such as passenger information, ticketing and payment systems, cloud and analytics services as well as traffic management and control (Arthur, 2017). There are benefits of smarter public transport both to the passengers, operators, society and the transport authority, respectively. For the passengers, users will experience higher safety, punctuality, clearer and more relevant information, increased comfort, simpler and more universal ways of trip payments which would decrease environmental impact of traveling and increase access to other modes (overall life quality). For the operators, profitability and efficiency can be increased through higher operational efficiency and new revenue. Information flows will improve leading to more efficient communication and environmental reporting (increased efficiency). For the society, cities will be able to increase the share of public transport as well as improving the environment and traffic safety. Improved public transport will help cities increase their competitiveness and attract more competence (improved society). For the public transport authority, data would be generated for planning and improving transit systems (Planning).

From the figure below, connected vehicles are equipped with internet services and on-board tracking devices, they can only provide smart transportation when they are intelligently communicating with infrastructure and third parties.

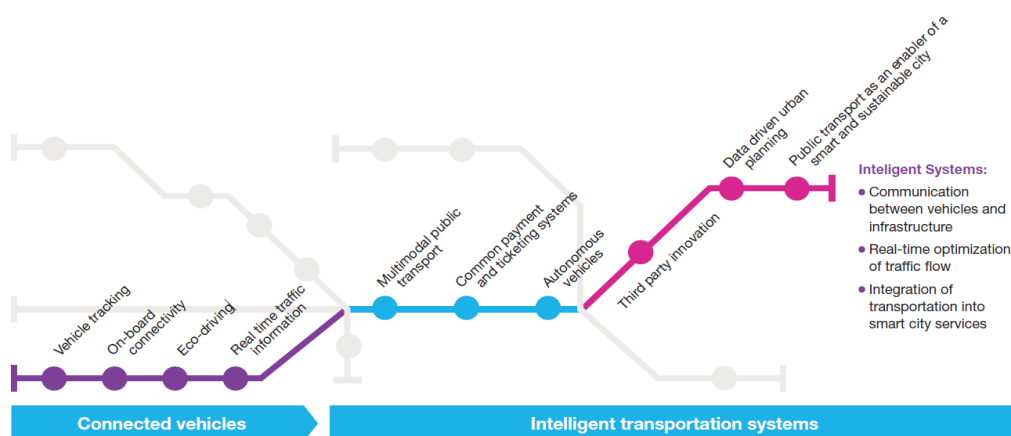


Figure 1. Connected Vehicle and Intelligent Transport Systems (Adapted, Arthur, 2017)

3.1 Lagos Bus Rapid Transit

LAMATA implemented the first BRT Lite system in Africa in 2008 as a quick intervention to alleviating the urban mobility challenges in Lagos. The scheme served as the first comprehensive and integrated approach to improving public transport in Nigeria.

The overall objective of the Lagos BRT system is to improve mobility and transport affordability in the city of Lagos through regulatory reform and by facilitation of person's movement on major corridors through a combination of traffic management and implementation of a high quality, high performance Bus Rapid Transit system. In 2015, the BRT Lite was upgraded to BRT classic with median and pass-up lanes. Each shelter is universally and safely accessible, equipped with Real-Time Passenger Information and using pedestrian bridges from sidewalks. They also provide weather protection and lighting, thus increasing comfort and security. They are physically integrated with other public and private transport modes; non-isolated and attractive (Wright and Hooker, 2007). The BRT-classics stations are quite basic but functional.

The Lagos BRT Classic buses are domesticated, but they do not meet the emission standard of high-quality BRT systems such as Silver Line in Boston, U.S.A or Guangzhou BRT, China (FTA, 2009; Hughes and Zhu, 2011; ITDP 2016).

3.1.1 Lagos Bus Route Network (LBRN) Study

To build the transport network that would meet the future needs of the commuting public, a Bus Route Network study was conducted to rationalize the bus routes in Lagos. Individual codes have been assigned to each bus route that forms part of the classified and rationalised network. According to the Lagos Bus Route Network study (ITP, 2015), the findings from the LBRN include:

- A future and rationalised network consisting of 485 individual bus routes, for context, the existing network contains 742 individual routes
- 38 new or extended bus routes have been proposed; thus, improving inter-connectivity and removing the need for forced passenger interchange
- The rationalised bus route network will cover 6,605km, with an average route length of 14km
- The shortest bus route is 3Km whilst the longest route measuring 77Km. These two services provide a demonstration of both a feeder bus service operating short distances and an inter-urban, commuter route serving the commercial hub
- During peak operating hours, it is estimated that the revised network will carry approximately 663,708 passengers
- All day, it is estimated that the revised network will carry approximately 7,000,000 passengers
- It is estimated that over approximately 12,000 buses will be required to service the demand across the network.

3.2 Smart Public Transportation Applications in Lagos

In Lagos, to align with the Smart City vision, the Lagos State government has deployed ICT to drive smart public transportation as follows:

3.2.1 Electronic Payment System

The culpabilities of the paper-ticketing systems necessitated the need for the introduction of electronic ticketing ie Lagos Connect Cards. The Lagos Connect Mifare Card is a public transport store-value contactless smartcard which allows you to "tap in and tap out" on the bus validators of the BRT-Class buses. The card can only be used to pay for public transport trips. Commuters are required to purchase value to top up the Mifare card.

The Mifare cards can be only be funded (topped –up) with the ticketing vendor’s agents at the bus stops and terminals along the BRT corridor through a Point of Sale (POS) Machine. Complementing Mifare cards are the Fare-pay contactless cards linked to personal bank accounts which allows a commuter to “tap in and tap out” on the bus validators of the BRT-Classic buses. The innovation provides the ability to use a contactless bank card on ATMs, POS, web transactions and to pay for bus trips amongst others. Also, commuters pay for fares directly from their personal bank account, rather than purchasing value. The features of the Electronic ticketing system comprise the software, Smart Cards, Bus Validators, Driver Console, Ticket machines, Vendor Handheld Machines, Connectivity and Backend. The e-ticketing system provides greater utility for public transport users through the following:

- Reduce the inconvenience of interchange for passengers who have to make multi-leg journeys in a public transport network where interchange is predicted to dramatically increase.
- Minimize changes in fares for the bulk of passengers who don’t interchange.
- Reduce queuing, complexity and inconvenience for passengers when moving around the network.
- Improve management information on travel patterns and improve operator responsiveness to changes in the market.
- Eliminate cash usage, reduce cash-handling costs and improve staff security without penalizing passengers.
- Permit a fair and efficient allocation of revenues earned between operators of different modes or different services within modes in the network.
- Reinforce the overall objective of achieving an integrated multimode transport system [including parking, park & ride, etc.].

The Fare-pay card can be funded (topped –up) through the Fare-pay agents, unstructured supplementary service data (USSD), Automated Teller Machines (ATM), Bank Deposit and Online inter-bank and intra-bank fund Transfer. The activities and transactions of the Fare-pay System is monitored and evaluated from the E-Ticketing Backend in real-time.

Both electronic ticketing systems coexist together to complement each other and provide the commuter with options. The Mifare Cards offer; Designated Transport Card with High Level of Flexibility, Integration and Interoperability, availability of ticketing card, through constant sales along the PT network, ease of purchase and usage without any personal information, support real-time reconciliation and settlement and high level of security. The EMV cards on the other hand, offer; use of personal banks cards to board PT systems, ease of topping up through various channels such as POS machines, USSD, ATM, Bank deposit and fund transfer, wide range of payment for both local and foreign transactions, flexibility of payment through Third party apps, barcodes, watches, wallets etc., higher level of security and support real-time reconciliation and settlement and auto-refund without physical presence.

3.2.2 *Intelligent Transport System*

An Intelligent Transport System (ITS) was commissioned in 2017 on the BRT to improve operations, safety, efficiency and effectiveness of transport and traffic conditions. The ITS comprises several modules such as a scheduling system, real time Passenger Information System (PIS), Automatic Vehicle Location System (AVLS) and central intelligent system. A control centre was also implemented at the Authority’s and Operator’s depots each to monitor and evaluate the BRT classic operations in real-time.

The Lagos BRT App provides real-time BRT bus arrival times to passengers. The BRT buses are equipped with an on-board tracking device. This device sends the location of the

buses in real time to a central intelligence server, which converts the GPS details to arrival time predictions for onward forwarding to real time applications (e.g. bus stop displays, mobile app etc.).

The app has different components and functionalities such as with the ability to plan journeys, identify bus stops near user's location as well as other bus stops along the BRT corridor.

3.2.3 Monitoring Mobile App

The app would be used by regulator of the public transport to facilitate the monitoring and evaluation of the Bus Operations in the state. The monitoring mobile apps would complement data being generated from the ITS control centre. It is aimed at eradicating any manual data collection, there by resulting in faster and more accurate collection. The app shall have all major reporting requirements for monitoring and evaluation such as accidents, bus cleanliness, route adherence, etc. The app shall use GPS to pinpoint exact locations of incidents / accidents. In addition, an accompanying web portal shall be developed for the extraction of reports for further analysis.

3.3 Lagos Future Transport Initiatives

3.3.1 Rail System

Lagos has been identified as one of the few megacities without a functioning rail system. In the Strategic Transport Master Plan (STMP), seven rail lines have been identified for implementation. The rail systems will be developed using similar PPP models as adopted in comparable cities such as Kenya, South Africa and India.

3.3.2 Multimodal Transport System

The need to ensure transportation is integrated between all modes have been identified in the STMP. The integration will ensure seamless travel and high quality of service between each mode. The Lagos State Government aims to ensure all transport schemes such as the ferries, BRTs, LRT, buses and feeder systems are integrated physically, institutionally and operationally. Other soft components such as scheduling, passenger information system, ticketing and institutions will also be integrated. The concept of multimodality learnt from the Victoria Station (UK), King Cross Station (UK) and Grand Central Terminal (US) are currently being developed at the Mile 2 interchange and Marina interchange in Lagos. At these interchanges, all PT modes will be designed and operated together.

3.3.3 Resilient Transport Development

The Lagos State Government will ensure future transport infrastructures that will serve the need of commuters while considering the local environment. The infrastructures will be designed and built to withstand the local climate, flooding and users' attitude amongst others. This will ensure the sustainability, safety, reliability and economics of maintaining the infrastructures. The Lagos State Government will employ a proactive, life-cycle approach to resilient transportation infrastructure in-line with the World Bank Standards.

3.3.4 Sustainable Transport

Transportation contributes to about 35% of air pollution in cities, and the negative effects such as global warming, oil shortages, premature death, respiratory and kidney diseases cannot be overemphasised. Lagos State Government aims at reducing traffic pollution and its impacts. Initiatives such as Mass Transit Alternatives, electric buses, electric rails, alternative fuels, low emission vehicles, Non-Motorised Transport and green vehicle purchase cost incentives would be explored. The Lagos State Government will ensure PT schemes serve the needs of both the present and future needs whilst preserving the

environment. Collaboration with the energy sector to ensure power generation for vehicles are renewable will also be fostered.

3.3.5 *Land Use and Transport Integration*

The public transport authority aims to ensure the integration of land use development (urban physical planning) and urban transport planning. This will ensure the transportation system will be able to cater for the present and future need of communities and developments within the cities. Lagos State Government has introduced mandatory traffic impact assessment for major land use development projects while focusing future developments along the main transit corridors. NMTs will also be promoted especially inside communities through the development of Pedestrian and Bicycle Master Plans. The development of alternative activity centres within communities that will reduce need for long-distanced motorized trips will also be stimulated.

4. CONCLUSION

Smart public Transportation is a component of the overall smart city vision. It is imperative that to solve urban transportation challenges, there is need for urban cities in Africa to institutionalize public transportation through the creation of a public transport authority to champion the Strategic Transport Master Plan that would identify the bus routes, rail lines, water routes and the technology to deploy to facilitate the operations of their services to the commuting public.

5. REFERENCES

- Amiegbebhor, D. E., Akarakiri, J. B. and Dickson, O. F. (2015). Evaluation of Technical Innovations in Bus Rapid Transit System in Lagos State, Nigeria. *Advance in Research*. [Online]. 6 (2) pp.1-12. [Accessed 12 February 2017]. Available from: www.sciencedomain.org
- Arthur, D. (2017). Smart Public Transport “New Digital Ecosystems unlock the growth Potential of the Smart City”.
- Banjo, G and Mobereola, D. (2012). LAMATA: Its Genesis, Design, Performance and Future Prospects. [Online]. [Accessed 5 February 2017]. Available from: <http://www.codatu.org/wp-content/uploads/1B-CODATU-XV-2012-LAMATA.-FINALpptx.pdf>
- Barredo, I. J. and Demicheli, L. (2003). Urban sustainability in developing countries' megacities: modelling and predicting future urban growth in Lagos. *Cities*. 20(5), pp. 297-310.
- Fadairo, G and Taiwo, A. (2009). Urbanization, Housing and Infrastructural Facilities in Lagos, Nigeria. *Journal of Architecture and Built Environment*. [Online]. 37 (1), pp. 9-14. [Accessed 20 April 2017] Available from: http://www.academia.edu/3206395/Urbanization_Housing_and_Infrastructural_Facilities_in_Lagos_Nigeria
- Federal Transit Authority (FTA), (2009). Characteristics of Bus Rapid Transit for Decision-Making: Update. [Accessed 20 April 2017] Available from: https://www.transit.dot.gov/sites/fta.dot.gov/files/CBRT_2009_Update_0.pdf
- Hughes, C. and Zhu, X. (2011). Guangzhou, China Bus Rapid Transit: Emissions Impact Analysis. [Online]. [Accessed 12 February 2017]. Available from: https://www.itdp.org/wp-content/uploads/2014/07/GZ_BRT_Impacts_20110810_ITDP.pdf
- Integrated Transport Planner, (2015). Development of Bus Route Network for Lagos. A study conducted for LAMATA

- Institute for Transportation & Development Policy (ITDP). (2016). The BRT Standard: 2016 Edition. [Online]. [Accessed 12 February 2017]. Available from: <https://www.itdp.org/wp-content/uploads/2014/07/BRT2016-REV7.75.pdf>
- Lagos Metropolitan Area Transport Authority (LAMATA), (2009). Lagos BRT-Lite: Africa's First Bus Rapid Transit Scheme. Lagos BRT-Lite Summary Report. [Online]. [Accessed 14 April 2015]. Available from: http://www.uitp-bhls.eu/IMG/pdf/BRT_Lite_Summary_Report_FINAL_V2.pdf.
- Lagos Metropolitan Area Transport Authority (LAMATA), (2013). The LAMATA Compendium
- Lagos State Government (LASG), (2017). Lagos State Website. <http://governor.lagosstate.gov.ng/about-lagos/>
- Mhango, Y. 2013. Nigeria Unveiled – Thirty-six shades of Nigeria. Renaissance Capital. Economics and Politics Nigeria. [Online]. [Accessed 28 May 2016]. Available from: <http://www.ft.com/cms/5752734c-c2f4-11e2-bbbd-00144feab7de.pdf>
- Ministry of Transport (MoT), (2019): Lagos State Policy Draft
- Msulwa, R. and Gil, N. (2015). LAMATA (Nigeria): A Beacon of Light for Lagos Transport System. [Online]. [Accessed 28 January 2017]. Available from: https://www.researchgate.net/publication/276145152_LAMATA_Nigeria_A_Beacon_of_Light_for_Lagos_Transport_System
- Orekoya, (2010). The Bus Rapid Transit System of Lagos, Nigeria. [Online]. [Accessed 28 May 2016]. Available from: https://sustainabledevelopment.un.org/content/dsd/susdevtopics/sdt_pdfs/meetings2010/egm0310/presentation_Orekoya.pdf
- Osoba, B. S. (2012). An analysis of intra-city patterns of residents in Lagos metropolis, Nigeria. *International Journal of Development and Sustainability*. 1 (2), pp 563-580.
- Price-water Cooperation (PwC) (2016). Lagos: City of Opportunities. An investor's Guide. [Online]. [Accessed 28 June 2017]. Available from: <https://www.lagosglobal.org/wp-content/uploads/2016/05/Lagos-Investors-Guide.pdf>.
- Taiwo, O (2016). The Guardian 17th of July
- World Bank (2017). Toolkit on Fare Collection Systems for Urban Passenger Transport Case Study: Lagos, Nigeria. [Online]. [Accessed 26 June 2017]. Available from: <https://www.ssatp.org/sites/ssatp/files/publications/Toolkits/Fares%20Toolkit%20content/case-studies/lagos-nigeria.html>
- Wright, L. and Hook, W. (2007). Bus Rapid Transit: Planning Guide. [Online]. pp. 1-836. [Accessed 20 November 2016] Available from: <https://www.itdp.org/wp-content/uploads/2014/07/52.-Bus-Rapid-Transit-Guide-PartIntro-2007-09.pdf>