

## **Public Transport in the Federal Capital Territory, Abuja: A GIS-Based Analysis of Key Indicators**

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### ***Abstract***

*Transport policymakers and planners are worried about the detrimental effects on the physical and socioeconomic surroundings caused by the high number of private cars used for commuting in the Federal Capital Territory (FCT), Abuja. Public transportation pricing, service frequency, walking distance to access points, and waiting time at terminals/bus stops are the four critical variables that this study uses to analyze commuters' access to public transportation. Locations with similar average values for waiting time, transportation fare, bus service frequency, and distance to public transportation access points were identified through data analysis and manipulation in the Geographic Information System (GIS) Arc-GIS 9.3 environment. Commuters and public transportation operators were surveyed and interviewed using a mix of questionnaires and GPS devices (Garmin 62x). The Gwagwalada and Zuba axis had the best public transport access in FCT, with 58 mean bus frequencies per day, an average of 109 meters to access points, a mean waiting time of about 20 minutes in the park, and a mean transport fare per tip of N158. However, it still did not meet best practices. The study's recommendations include making public transportation routes, stops, and terminals more streamlined to match the FCT's present pattern of physical growth and urging relevant parties to increase their efforts to make public transportation accessible and inexpensive.*

**Keywords:** *Transportation, public transport systems, transport centre, GIS-Based Analysis*

### **1. INTRODUCTION**

As the unforeseen shift in population dynamics continues in response to the need for job, housing, and nourishment, policy makers in Nigeria are now faced with enormous issues regarding the transportation needs of large cities. The need for transportation services is rising in Nigeria as a result of the country's rapidly developing cities and the rising number of people living in urban areas. Efforts to build sufficient transportation infrastructure have been inconsistent, poorly planned, and disorganized, so far failing to meet this demand (Akpoghomeh, 2019). Many city dwellers do not own automobiles and cannot pay the astronomical cab fares, but with the help of public transportation, they may be able to access transportation services (Bamidele, 2022). It might be a useful policy instrument for lowering vehicle traffic on city streets, which would alleviate traffic congestion.

Linking residents and jobs, as well as producers and consumers of goods and services, is the fundamental role of urban transit. In the majority of Nigerian cities, the demand for public transportation is exceptionally strong. Part of the reason for this is because many city dwellers are low-income and so cannot afford to own a car. However, in contrast to the well-developed nations of the United States and Europe, where trains serve as an integral component of integrated urban transport systems for both intra- and inter-urban transit, the public transportation options here are severely lacking (Drummond-Thompson, 1993). If commuters can go where they want, when they want, and for a price they can afford, then the public transportation system is good and efficient. A multi-modal transport system that caters to a wide range of people's requirements by offering several types of public transportation can help accomplish this goal.

According to Jean-Paul, Comtois, and Slack (2016), the term "public transport service access level" refers to how well passengers feel the system is working. It is a way to describe the accessibility and service quality of transportation facilities based on their operational features. Several measures of the accessibility of public transportation services are available, such as the frequency of bus services and the distance to access points. There are two main components of transportation service that commuters perceive in factors like public transportation fare, travel time, reliability of bus service, and comfort: the accessibility of transportation to specific locations and the ease and convenience of that accessibility (Duranton & Turner, 2012). All public transportation services must take the aforementioned indices into account in order for the public transport planning system to be feasible. These indices are distinct from the two most common ways of evaluating highway service quality, which focus on vehicles rather than people. The incorporation of these indices within the context of the geographical framework is essential for transportation planning to be meaningful. So, the purpose of this research is to look at how people in Abuja, Nigeria's Federal Capital Territory (FCT), use public transportation.

## **2. LITERATURE REVIEW**

### **Conceptual Clarification**

The act of transferring, being transported, or providing a method of conveyance from one location to another is defined as transportation (Onokala, 2022). Deploying people, goods, and other mobile assets across space and time for a defined objective. In human cultures, this is typically done in a systematic manner, as individuals and groups adhere to predetermined courses. Transporting people, animals, and products with this method is the simplest. The following means of transportation are utilized for this purpose: space, sea, cable, land (train and road), air, and water (Olubomehin, 2012). Since transportation is the lifeblood of every community, it opens up possibilities for productive economic growth and social advancement (Imobighe & Awogbemi, 2006). This suggests that transportation is crucial for the growth of cities and countries.

When it comes to a society's economic, social, political, and strategic development, transportation is undeniably a crucial catalyst (Onokala, 2017). Therefore, the supply of fundamental infrastructures, the most significant of which is transportation, is crucial to the efficient and effective operation of urban centers.

Transportation is defined as "the act of moving from one location to another, or the means by which this movement is accomplished" (Okafor, 2021). Deploying people, goods, and other mobile assets across space and time for a defined objective. This is not done in a random fashion in human cultures since people typically follow the courses that have already been set out (Michael, 2016). Traveling by vehicle is the most convenient means of transport for people, animals, and products. Airlines, highways and trains, waterways, pipelines, cables, and spacecraft all play a role in this transportation. Effective socio-economic development and societal improvement are made possible by transportation, which is the engine room of any society (Onokala, 2014). In terms of urbanization and nation-building, transportation is crucial (Okafor, 2021).

In any society, transportation is essential for activating and accelerating the pace of social, political, economic, and strategic growth (Taffee, Morrill & Gould, 2013). Therefore, the supply of fundamental infrastructures, the most significant of which is transportation, is crucial to the efficient and effective operation of urban centers. Government efforts in Nigeria to improve public transportation options for city dwellers have met with dismal failure (Okafor, 2021). Quality urban transport services offered in any contemporary civilization should promote effective delivery in economic growth and societal development, but the government often

ignores these sectors in favor of others (Bamidele, 2022). Bamidele (2022) notes that inadequate funding has led to a substandard road network, transportation facilities, and community and environmental amenities, all of which have a significant impact on the provision of urban transport services in most Nigerian cities. When it comes to a country's progress, transportation is fundamental. It has national implications and is essential to life. Not only is it essential for survival, but it also influences every facet of human life (Nwafor & Onya, 2019). A high-quality existence can be maintained through the availability of commodities, services, and social activities. Important for reducing loneliness and building personal wealth (Akpoghomeh, 2019).

One way to think about a transportation system is as a web of interconnections among demand, networks, and nodes. Olubomehin (2012) explains that these interactions are characterized by flows between sites that physically reflect demand and infrastructures that are built to handle and connect these flows. The transportation system's various parts work together or independently to ease the flow of people, goods, and data. There are a lot of moving parts in transport systems, including demand, the places they serve, and the networks that facilitate transportation. Mobility and its relationships to geography are evolving as a result of IT's capacity to augment, alter, replace, or boost transportation operations (Jean-Paul, Comtois & Slack, 2016).

The efficiency and effectiveness of managing existing transport capacity, as well as the articulation, layout, and implementation of transportation plans and programs to meet the needs of the people, are intrinsically linked to the inability and sustainability of these cities, which are undergoing rapid transition across the globe (Michael, 2016).

Cities, particularly those in developing nations, have a very complex and diverse spatial structure, with some regions having very good service and facility provision and other areas having extremely poor provision. It is very difficult for the poor to acquire equitable and effective urban services due to the fact that people's socioeconomic backgrounds vary greatly depending on where they live (Imobighe & Awogbemi, 2006). There is a strong correlation between the availability of alternative forms of work, educational opportunities, healthcare, and other basic public services, as well as the character of recreational open spaces, and the low quality of life in the majority of urban areas. According to Bamidele (2022), transportation is one of the main factors that has boosted the economy and made businesses more competitive. It is a key factor in travelers' opinions of the nation and the activity that physically links the company to its supply chain partners like suppliers and customers. From production to final consumer delivery and refunds, transportation is an integral part of the production process. The advantages could only be maximized with excellent coordination across all parts (Nwafor & Onya, 2019).

When looking at public transportation in Nigeria, it's clear that the state and local government run their systems more efficiently than the private sector (Onokala, 2022). The informal sector, which includes friends and relatives, is a major source of income and financial support for private sector businesses. Compared to private sector operators, government-owned public transportation typically offers more reliable service at lower prices, more frequent service on predetermined routes, and more highly trained employees. A number of factors contribute to the operational environment's inadequacies, including inadequate vehicles, falling fleet utilization rates, increasing competition from private and paratransit operators, inadequate traffic management, congestion, particularly during peak travel times, and other issues (Onokala & Olajide, 2020).

According to research on Nigerian public transportation, 30% of trips are performed by motorbikes, while 53% are made by taxis and private cars carrying fare paying passengers. Nearly all feeders in developing-world cities use motorbikes to go to minibus and taxi stands (Onokala, 2022; Nwafor & Onya, 2019). Also, according to Michael's (2016) research on the relationship between infrastructure development and economic growth in Nigeria, the majority

of city roads are in poor condition and have inadequate feeder streets. As a result, drivers are forced to use the main roads more frequently, which has major effects on how commuters use these roads and their mobility patterns, particularly in the same urban transport corridors. The urban poor in Nigeria spend a significant amount of time walking, traveling, and waiting for inconsistent bus service; on top of that, they pay a disproportionately high percentage of their income for transportation (Onokala, 2022; Nwafor and Onya, 2019).

### **The Study Area**

In 1976, the Federal Government of Nigeria decided to move the Federal Capital of Nigeria from Lagos to the newly established FCT. The new capital city, a brand-new, ultra-modern metropolis, is currently under construction on a site chosen within the territory. The landmass of the territory—which measures in at 8,000 square kilometers—is comparable to that of the states of Rivers, Enugu, Ondo, and Osun. In contrast, Anambra, Ekiti, Lagos, Imo, Akwa Ibom, Ebonyi, and Abia are considerably smaller states. It has been envisioned and operationalized as the administrative Territory of the Country as the vast Territory is not meant to become one of the Federation's states. Because of its central location within Nigeria, the Federal Capital Territory (FCT) Abuja is easily accessible from anywhere in the country.

For the purpose of administering the city and developing its transportation infrastructure, the Federal Capital Development Authority (FCDA) was formed in 1976. The FCDA has built a huge transportation network to accommodate the city's current transportation needs. A reliable mass transit system is crucial for the city's transportation needs in order to accommodate the rapidly growing population. According to Bamidele (2022), most commuters have to depend on private cars due to the present public transportation supply, which has repercussions for the city's traffic and socioeconomic environment.

### **An Overview of Transportation Infrastructure Situation in Nigeria**

Poor road infrastructure, a lack of buses and trucks, trains and flights that are too packed, too irregular, and overcrowded are just a few of the many issues plaguing Nigeria's transportation system. Additional challenges include an absence of adequately qualified transportation planners and managers, difficulties in allocating funds, issues with institutional reforms, and inefficient traffic laws (Nwafor & Onya, 2019). This has never aided the nascent Nigerian economy's pursuit of rapid economic development; instead, it has led to abnormalities in the allocation of resources, disfigured many of us, and even killed a few people in car accidents and plane crashes. The Nigerian government has, without a question, played significant responsibilities in repositioning Nigeria's transportation infrastructure. All of the national development and rolling plans have this goal in mind. Efforts to improve the country's transportation infrastructure have been made by every administration that has run the show.

But we still have a long way to go before the globe reaches the level of development that will allow our economy to grow at a much faster rate. As of the year 2000, the road network in Nigeria was estimated to be around 195,500 km long by the Federal Republic of Nigeria (FRN). About 32,000 kilometers are on federal land and 31,000 kilometers are on state land. Due to inadequate investment, lack of proper maintenance, and bad maintenance policy, a disproportionate number of those highways suffer infrastructure imbalances. There are four distinct types of highways in Nigeria: 'A'-rated highways that are owned, operated, and controlled by the federal government. Originally administered by the state, the federal government appropriated Trunk 'F' to ensure it was upgraded to federal highway standards and adequately maintained. While the federal government owns and operates trunk 'C' highways, the states own and build trunk 'B' roads. The planning, building, and upkeep of roads under each area's jurisdiction fell on the shoulders of the respective state levels (Ighodaro, 2009; Onokala, 2017). The goal of this system is to promote uniform growth throughout the nation (Ighodaro, 2009). The roads are in terrible condition since

there hasn't been enough money to fix them. This has a knock-on effect of reducing the mobility of resources over time, which contributes to economic backwardness through inefficient transportation of production inputs and low income generation. Imobighe and Awogbemi (2006) and Michael (2016) have both brought attention to the country's crumbling infrastructure. The majority of the problems that are preventing Nigeria from becoming one of the world's leading economies in the new millennium were pointed out by them. There is a serious problem with Nigeria's road network; research shows that 70% of the country's 193,000 kilometers of roads are in a terrible state (Okafor, 2021; Onokala, 2021; Nwafor & Onya, 2019). Conversely, they noted that while investing more than the average of Sub-Saharan African countries—roughly 7% of GDP—in infrastructure, Nigeria has failed to achieve the economic growth it had hoped for.

Let it be said that, a solid foundation of infrastructure is essential for economic activity. Its many activities, which are mostly transactional and service-oriented, emphasize the complex interaction between its physical and human capital demands. Successful logistics depend on a variety of factors, including infrastructures and management expertise (Imobighe & Awogbemi, 2006). Because of the vast infrastructures it employs, the transportation industry might be a significant economic driver and a popular instrument for development. As Taffee, Morrill, and Gould (2013) point out, this is especially true in today's interconnected world, where the free flow of information and communication technologies (ICTs) and people determine more and more economic opportunities.

According to research by Taffee, Morrill, and Gould (2013), a country's economic progress is directly related to the size and quality of its transportation networks. Extensive transportation networks and densely populated areas are hallmarks of advanced civilizations. Access to markets, jobs, and more investments are just a few examples of the beneficial multiplier effects that can result from well-functioning transportation infrastructure. Reduced or missed opportunities and lower quality of life are economic costs that result from inadequate or unreliable transportation systems. Many economic sectors see cost reductions from efficient transportation and cost increases from wasteful transportation at the mixed level. The transportation sector also tends to have unanticipated and unexpected effects (Onokala, 2012). For instance, when people have access to transportation infrastructure that is either free or very inexpensive, congestion is usually an unforeseen result. But gridlock is also an indicator of an expanding economy that is struggling to keep up with the increased demand for mobility.

The social and environmental costs of transportation are too high to ignore. Classifying the effects that transportation has is necessary for calculating its monetary value (Onokala, 2022). There are three main aspects to consider: the physical features of transportation, the operations involved, and the geographical aspect. The physical capacity to transport people and things, and the expenses incurred as a result, are at the heart of transportation's most basic consequences. The process entails establishing pathways that permit preexisting or potential interactions between economic organizations. As for the operational, it details how performance improved over time, especially in terms of reliability and with less damage or loss. This means that transportation assets are being used more efficiently, which is good for users because it means that passengers and freight are being transported faster and with less delays. Because of geographical factors, businesses are able to tap into larger consumer bases, which in turn allows them to take advantage of distribution, consumption, and production economies of scale. Expanding access to a larger and more varied pool of inputs (energy, labor, raw materials, and components) and a wider range of markets for intermediate and final commodities can lead to higher productivity, it says.

This allows us to evaluate the transportation industry's monetary impact from both a macro and microeconomic vantage point: At the macroeconomic level, transportation and the mobility it provides are associated with a level of economic output, employment, and income. The

transportation sector is responsible for 6–12% of GDP in numerous industrialized nations. In addition, logistical expenses might hit anywhere from 6% to 25% of GDP.

Infrastructure and vehicles used for transportation can easily account for half of an industrialized nation's gross domestic product. The relevance of transportation to individual economic sectors is known as microeconomics, and transportation is associated with costs at the production, consumer, and distributor levels. This allows us to evaluate the significance of various forms of transportation infrastructure and activities across all economic sectors (Onokala, 2021). Transportation costs often account for a larger percentage of disposable income at higher income levels. In the manufacturing sector, transportation costs about 4% of each unit of production (though this number varies somewhat between sub-sectors), and in households, transportation accounts for 10% to 15% of total expenditures.

Transport services typically have indirect benefits that are more noticeable in terms of added value and employment than those that are directly generated by the activity (Michael, 2016). Companies in the transportation industry, for instance, shop locally for a portion of their inputs like gasoline, supplies, and maintenance. The local economy benefits from the assembly of these inputs since it creates jobs and additional value. As a result, additional local businesses provide the suppliers with goods and services (Onokala, 2017). More value-added and employment possibilities are the outcome of more rounds of local re-spending. Similarly, a large portion of the revenue for households whose breadwinners work in transportation goes toward supporting local businesses and services (Filani, 2019). More local jobs and increased value are the results of these transactions. Many of the families that gain these extra jobs end up spending their money on local goods and services, which in turn generates even more jobs and income for those families. Consecutive cycles of re-spending within the framework of local purchases outweigh the initial cycle of production, revenue, and employment created by freight and passenger transport activities (Bamidele, 2022). Thus, in a broad sense, transportation can have direct, indirect, or induced effects on the economy.

There will be direct effects on employment, value creation, and market size as a result of increased capacity and efficiency in transportation, as well as on time and money savings. The direct effect is on businesses that rely on transportation for their operations, creating jobs through increased accessibility and economies of scale (Akpoghomeh, 2019). The connections between transportation and other parts of the economy mean that transportation-related activities have a wide variety of indirect consequences on employment and value-added. Consequently, the induced impacts are the result of economic multiplier effects, which cause commodities, goods, or services prices to either decrease or increase.

### **History of Transportation in Nigeria**

In the late 19th century, the British laid claim to Nigeria, and their plans for the country's infrastructure were plain to see. The British wasted no time in establishing a network of roads to facilitate their control and the harvest of natural resources from the region (Duranton & Turner, 2012). The colonial government shifted its focus to building roads and, subsequently, railroads. These aims were furthered in 1912 with the consolidation of the southern territories and the Protectorate of Sokoto into a single governmental entity. The bulk of Nigeria's transportation networks run in a south-to-north direction, connecting the country's coastline with its interior and vice versa. Since commodities like cocoa, ground nuts, and cotton could be transported from the interior to the coast for processing in Britain, east-west transit routes were unnecessary. British road network planners first looked to existing pathways as a means of connecting Nigerian cities, but the narrow, uneven surfaces of the footpaths proved to be an insurmountable obstacle to their eventual transformation into wide roadways fit for automobiles.

The new roads were still vulnerable to the destructive power of their rainy season; thus, they frequently suffered damage or were completely washed away with each season's downpour. In an effort to cut costs and avoid the hassle of constant bridge repairs, several municipalities began using locally sourced materials to construct short-lived bridges (Oshin, 1988). With the advent of cars, Nigerians were able to capitalise on the need for a reliable means of transportation for both people and goods. In many cases, Nigerian transportation options were more practical than their British equivalents. They could charge less, were more adaptable, and used better technology. Weakes Transport, a British transport business, announced the launch of its regular services in 1923. Weakes Transport vehicles frequently ended up carrying less than full loads at greater prices than their indigenous equivalents due to the inflexibility of scheduled routes. Indigenous carriers charged 6d per ton mile, while Weakes Transport charged 2s 7d per ton mile on average (Oshin, 1988). American automobiles were the preferred mode of transportation for most Nigerians throughout the colonial era. They were less expensive than British automobiles, coming in at roughly half the price of a comparable machine imported from Britain. British automobiles lacked after-market assistance in colonial Nigeria, yet these were common and easily serviced due to the abundance of spare parts. Due to their lightweight construction and pneumatic tires, American automobiles, particularly Fords, could traverse terrains that were too rough for the heavier British vehicles. A colonial administrator in Lagos made the observation that motor vehicles can traverse approximately 2,000 miles of road. However, only 180 kilometers are paved to accommodate large motor vehicles. The American Ford, he continued, is head and shoulders above its British counterpart in (Drummond-Thompson, 1993). Minimal upkeep of the infrastructure the British had established is the simplest way to define post-colonial transportation networks. Conflicts on the political and military fronts in Nigeria severely damaged the country's transportation networks. Corruption in politics and the nationalization of transportation companies diverted funds intended for road and rail maintenance and expansion (Walker). Aircraft were the most significant innovation in Nigeria's newly autonomous transportation economy. Nigeria is well-suited for aircraft transport due to its rapid speed and lack of reliance on the naturally-occurring roads, trains, and rivers. The air networks were negatively impacted by the poorly-planned and poorly-connected highways and airports that were used to transport bulk items around the country and the world.

### **The Core Area**

The main purpose of overlaying is to find out if there are any central areas in FCT where public transportation has the lowest fares, the most frequent service, the shortest wait times, and the shortest walking distances to stops. There doesn't seem to be a central location, but there are clusters of what could be called multi-nuclei core areas. These clusters are most concentrated in and around the city center, where people using public transportation have the best bus frequency, and in the Gwagwalada area, where people have to walk the least and wait the longest at bus stops and terminals. Contrary to what Duranton and Turner (2012) found in their evaluation of Enugu's intraurban bus services, our findings place the city of Enugu, Nigeria, in a singular central core area surrounding its central business district.

Most of FCT's administrative, educational, commercial, and business-related activity seems to be concentrated in these two central locations, suggesting that they serve as the economic hub of the region. There is an abundance of public and commercial sector offices in these areas, housed in enormous skyscrapers. Included in this category include, but not limited to, the following: government MDAs; embassies; wholesale and retail stores; banks; universities; construction firms; houses of worship (including mosques and churches); and staff housing (Drummond-Thompson, 1993). The FCT's road density are higher in these central areas. Buses carrying commuters to and from the rest of FCT often use these regions as their starting and ending places due to the dense concentration of social and economic activity there.

## **Transportation System in Nigeria**

It is critical to assess the breadth and quality of the road network in relation to road travel. The federal government of Nigeria has made significant strides in the previous fifteen years to expand the road network across the country. Directorate of Food, Roads, and Rural Infrastructure (DIFFRI) efforts stand out; starting in the late 80s, they began a program to build about 60,000 kilometers of new rural roads. Many newly built roads are in a horrible condition of decay, as is seen during tours of rural areas (Nwafor & Onya, 2019). Poor maintenance of rural and urban roads is common in Nigeria following the oil boom. During the wetter months (from March to October), poorly kept roads become an even bigger headache. The dry season is the only way to get to some rural regions, in fact. Traveling slowly is essential due to the numerous rural roads marked by massive and frequent potholes. There are sections of rural roads that are in such bad shape that cars have carved out new dirt tracks where the road once was. Some rural roads are now only one lane wide. Many rural roads are in a worse condition than the Jos Plateau's Road network. The extensive mining on the plateau during the colonial era necessitated the construction of a network of highways, although many of these roads have fallen into disrepair since independence. Because downpours may be so powerful, it's crucial to keep up with the necessary maintenance. Because of this, even little patches of road degradation can quickly become much larger when it rains because of erosion and weathering. The absence of sufficient drainage infrastructure exacerbates many of the issues related to road erosion (and makes driving dangerous during heavy rains). While temperate regions of the US do not have to deal with maintenance issues caused by frequent freezing and thawing, Nigerians do have to do with significant seasonal rain. The majority of rural roads are in far worse shape than urban ones, but even in cities, road upkeep is an issue. Government spending has been severely limited ever since oil prices crashed in the 1980s and the Structural Adjustment Program was put into place in 1986. Corrupt military regimes have also contributed to fiscal austerity by diverting state funds to wasteful projects or offshore accounts, or even to businesses owned by military commanders. Urban roads are mostly paved (or "tarred" as the Nigerians call it), although many of them have significant potholes or parts where the pavement has worn away. In Ibadan, you can see intriguing things happening with the informal road maintenance personnel. The city's potholes are frequently filled with dirt and boulders by young guys. It is common practice for motorists to leave tips for these unofficial government employees who provide unsolicited assistance. Despite the efforts of these courageous maintenance staff, metropolitan roads in Nigeria can still be quite bumpy. Note that bad urban roads can lead to traffic jams and congestion, in addition to making travel uncomfortable. James Gilbert Walker.

## **The problem of transport centres and city market in FCT, Abuja**

One big issue influencing urban transport quality services and economic growth is poor road transportation management. This is particularly true in the city of Port Harcourt, which is home to millions of people. The city's road infrastructure is now useless and nearly collapsed because of this. This has multiplied as a consequence of the road transportation system, which is defined by the overuse of heavy-duty Lorries, leading to road degradation, accidents, and the loss of life and property. According to Okafor (2021), the city's unorganized road transport system is a result of poor management of the systems involved. Bus drivers no longer pay attention to traffic rules, which leads to unnecessary gridlock and a negative perception of the city. Additionally, most road users are immensely unhappy with the state of the city's road transportation (Zou, Zhang, Zhuang, & Song, 2008).

Transportation in Port Harcourt has become a major headache due to heavy traffic, overloaded goods trucks, and a lack of technological advancements to control vehicle speeds. People are running late for work, school, and other important appointments because of this "bone in the



neck" problem. Additionally, there have been reports of decreased productivity, persistent weariness, and negative stress.

Over the years, the city's public transportation system has failed to meet expectations due to ineffective government involvement, a poorly maintained fleet, and dangerous service (Okafor, 2021). The local economy of the city is slowly but surely crumbling as a result of the cumulative effect. Finally, there have been numerous setbacks to the urban road transportation system, which has led to poor roads in the city center and other parts of the LGA, inefficient quality urban road transport due to street trading, problems with road transport workers, and an unorganized bus system that provides poor service (Olubomehin, 2012). Public transportation in Abuja, the Federal Capital Territory, is the subject of this study, which aims to evaluate it by taking a GIS-based look at important metrics and suggesting a long-term, budget-friendly solution.

Boopen (2006) used cross-sectional and panel data analysis to examine the role of transport capital in driving economic growth for a group of developing nations in Sub-Saharan Africa (SSA) and Small Island Developing States (SIDS), according to the empirical research. According to the research, transportation investments have helped both nations' economies grow. Additionally, research showed that SSA cases had transport capital stock with a higher productivity than overall capital, but SIDS cases show that transport capital has a typical productivity level relative to total capital. Research on the relationship between transportation investment and economic growth in developing nations (Demurger, 2001 quoted Zou, 2008) looks at data from 24 Chinese provinces between 1985 and 1998 and finds that disparities in transportation infrastructure are a major cause of growth inequality between them. According to Michael (2016), who used statistics to examine the relationship between road infrastructure investment and economic activity in South Africa, the former does, in fact, cause the latter, increasing GDP through direct effects and other production factors' marginal products.

Based on their analysis of the available data, Imobighe and Awogbemi (2006) conducted a regression analysis of private capital stock, non-military net investment, time to capture the consequences of technical changes in the process, one year lag GDP, and electricity supplied against Gross Domestic Product for the years 1980–1998, extending the scope of the empirical evidence review. A year after GDP<sub>t-1</sub>, they discovered a positive correlation between private capital stock and GDP, and a negative correlation between electricity supply and recurrent and cost variables, with the exception of defense and technological change spending. They went on to say that while the lag value of GDP does enhance output in Nigeria, none of the other explanatory variables did so on their own. When looking at infrastructure in a purely physical sense, Michael (2016) also discovered that it has a beneficial effect on economic growth. Some research in academia looked at how public capital affected the rate of expansion in output. An analysis of "the end of the day consequences of infrastructure provision on per capita income during a panel of countries" was carried out by Canning et al. (2004) and cited in (Zou et al, 2008). from 1950 to 1992 using physical measurements such as kilometers of paved road. Based on his estimates, it appears that different countries have different signs of the effect of increased availability on GDP per capita when it comes to paved roads. By increasing the overall factor productivity of all inputs, public capital can also cause economic processes, according to certain studies. Duranton and Turner (2008) estimated the consequences on major cities of major roads and transportation systems on the expansion of major cities within the US between 1980 and 2000. They found that for every 10% increase in a city's road stock, there is a 2% increase in population and employment and a 1% decrease in the share of poor households. Zou et al. (2008) reviewed the literature on central and eastern China's transportation infrastructure, economic growth, and poverty reduction using panel data from 1994–2002 and statistics data from 1978–2002. They found that better transportation led to a higher degree of economic growth. Since improved road safety is often associated with higher levels of economic and social development, Garg and Hyder (2006) examined historical injury and fatality rates in India and compared them

to current trends. They tested the "a priori" assumption that there is a positive correlation between road crash fatality rates and national gross domestic product (GDP) using rectilinear regression models. They found an inverted U-shaped correlation, which they attribute to the Kuznets phenomenon, when comparing countries within the same region. As a result, he suggested that, in addition to national initiatives, the state should put money into road safety. This study is unique in that it aims to analyze public transportation in Abuja, the Federal Capital Territory, using a geographic information system to examine important metrics of public transportation's contribution to the economy.

### **3. METHODOLOGY**

This study used a questionnaire survey and in-depth interviews with operators to get its results. Commuters' wait times at terminals, distances to terminals, the frequency of public transportation services along routes, and fare were the primary factors of public transportation accessibility that were considered when developing the questionnaire. At seventeen large public transportation hubs run by both the public and private sectors, 950 questionnaires were handed out to travellers.

There aren't any major public transportation hubs in the vicinity of the Central Area or the Three Arm zone, despite the fact that these regions are home to most government institutions that attract and produce traffic for fixed-time workplace journeys. The implication is that commuters in the FCT sometimes have to walk a considerable distance to reach the bus stop or terminal that is closest to them. The inadequacy of the public transportation route that runs through the heart of the city was one of the main causes that was uncovered during the field assessment. Commuters in the Wuse II, Maitama, and Asokoro districts of the city center, for example, were left to rely on automobile drop-off services because the bus route did not fully cover these areas.

#### **Commuters Mean Waiting Time**

According to the World Bank (2000), the ideal waiting time for public transportation services is between 5 and 10 minutes, also known as the bus headway. Commuters should not expect to wait more than 11 to 20 minutes for the bus to arrive at the terminal or bus stop, which indicates moderate accessibility. Commuters should expect subpar service when their wait times surpass twenty minutes (World Bank, 2000). According to the research, not a single spot in FCT has a good degree of access when measured against the World Bank's standards. Due to their respective mean waiting times of 18.7, 28.8, and 20.4 minutes, Dutse Alhaji, Area 1, and Gwagwalada by market can be considered to have modest access levels at best.

The Zuba by Dankogi (20.6), the Gwagwalada by El-Rufal (20.4), and the Zuba by U-turn (24.4 minutes) all have lengthy wait times for public transportation and, by extension, limited accessibility. Considering the following scenarios: Kuje Motor Park (50.9), Nyanya under bridge (46.8), Kubwa by FHA (28.8 minutes), and Bwari (30.7 min), it is clear that the degree of public transit access and waiting time is inadequate throughout the FCT. This might be a factor contributing to the high rate of private vehicle usage in FCT and the low number of people using public transportation.

Commuters still had to wait 26.2, 25.2, and 25 minutes at the AUMTCO park on the three main axes of Nyanya, Kubwa, and Gwagwalada, respectively, which is far from ideal. Therefore, increasing the bus frequency to decrease commuters' waiting time while the service is empty is economically foolish. Commuters mainly travel in one way to the city center in the morning, and then out to the perimeter in the afternoons and late evenings. Once again, due to traffic congestion, the frequency of bus trips is limited during peak hours due to the low capacity of the road, which is caused by the lack of dedicated lanes for public transport vehicles.

### **Mean Public Transport Fare**

The level of patronage from commuters is affected by the amount of money charged as fare by public transport operators. Commuters typically allocate a predetermined proportion of their disposable income per unit of time to job, social, and other types of commuting. According to Odumosu (2004), commuters should not have to spend more than 30 percent of their income on transportation costs. He also stated that a reduced fare for public transportation will encourage more people to use it. When put in context with the fact that commuters' commuting costs include not only the cost of public transportation but also the cost of other, intermediate modes of transportation used to get from their starting point to the bus stop or terminal where they board the bus, and finally, to their final destination.

In the FCT, the results show that AUMTCO parks/buses had the lowest mean public transport fares: N79.5, Nyanya (N103.9), and Gwagwalada (N118.7). The reason behind this is that the Abuja Urban Mass Transit Company (AUMTCO), an agency of the Federal Capital Territory Administration, owns and operates these vehicles. The organization's primary goal is not earning a profit, but rather providing a reliable and affordable transportation service to commuters. Subventions and grants from the Federal Capital Territory Administration Ministry are enjoyed by the company. Wuse Park in the city center had the best mean public transport fare of N116.6, followed by Kubwa village and Lugbe Park at (N121.9), Abuja city by Area 1 at (N123), and Bwari Park at (N127.6), according to the other private operators in FCT. Gwagwalada, near El-Rufai Motor Park, has the highest mean value of N325 for public transport fares in the FCT.

From what we could tell throughout our study, a private firm runs the Gwagwalada by El-Rufai Motor Park. From there, we were able to observe that they run air-conditioned buses with limited capacities, painted green, that run between the park and the city center. The average values of 165.7 and 165.1 for Kuje and Zuba at U-turn Motor Park, respectively, are within the range. Most FCT bus companies use a flat rate fee structure, which means that riders pay the same amount from start to finish regardless of how near or distant they are from the bus's end terminal or stop. Regardless, the drivers of public transportation tend to pick up riders as they go, disregarding the fact that those riders who got off had already paid for their seats. The number of unlicensed stops along the route is increased by these operator actions. This practice adds to the supply-demand gap in public transportation, makes bus rides longer, and puts commuters at risk of overcrowding during rush hour. It also reduces the frequency of bus service.

The average cost of public transportation is affected by the distances between various locations and the city center and suburbs; as a result, Gwagwalada, Kuje, and Zuba all have higher average costs. Thus, it follows that operators heavily consider the physical distance of the trip when determining the charge for public transportation along the route. Reason being, the cost of gasoline and maintenance, two vehicle consumables, rises and falls in direct proportion to the vehicle's mileage.

### **Way forward for improving transport infrastructure in FCT Drawing from final Result**

Considering the multiplier effect of job creation, productivity increase, and revenue generation, it is generally argued that reorganizing transportation infrastructure positively correlates with poverty reduction. The number of people who are unable to work because their jobs are in a terrible condition or have been neglected has decreased as a result of investments made in the sector. This study aims to examine the chain reaction that can lead to better transportation networks, which in turn can open up various development opportunities, improve the mobilization and utilization of resources, spur economic development in various forms, reshape employment and income generation, and ultimately change the trend of poverty in an economy.

According to the research, the terminal in Abuja City's Wuse and Garki neighborhood has the greatest mean hourly bus frequency. This is because they serve as major hubs for public transportation routes that originate on the outskirts of the city, including Zuba, Gwagwalada, Bwari, Lugbe, and Kubwa. There may be improved access to public transportation in the Wuse and Garki areas based on the real-time availability of buses. Then come the terminals in Nyanya, Lugbe, and Zuba. This is due to the fact that these towns have a stronger road network and also have highly populated residential areas surrounding them, which means that there are a lot of commuters living there. There is a lack of convenient public transportation options in the Central Area and the Three Arm Zone, two regions where the majority of government agencies are located and where employees are required to travel at set times for work. Because of this, commuters in the FCT often have a long way to walk before they reach the bus terminals. As far as FCT terminal waiting times go, El-Rufai Motor Park, Gwagwalada (near the market), and Dutse Alhaji (near Area 1) are the best. Neither of these spots, however, is up to par with global standards, which may discourage people from using public transportation and increase the number of people driving alone in the Territory.

Among the FCT parks, AUMTCO parks (Kubwa, Nyanya, and Gwagwalada) had the lowest mean public transport fares. This is due to the fact that AUMTCO, an agency of the Federal Capital Territory Administration, owns and operates the buses in question. Grants, subventions, and subsidies are provided by the Ministry of Federal Capital Territory to the company. Among the city's various private public transportation options, the most convenient ones are located in Kubwa village and Lugbe parks, with Wuse Park in the center ranking third. While there isn't a single, definitive core region where public transportation is at its finest, there is a cluster of core areas along the Gwagwalada and City Centre axes. Most of FCT's administrative, educational, commercial, and business-related activity seemed to be concentrated in these two locations, making them its economic nerve center. Commuters with or without private cars should be able to use the public transportation system more easily if the FCT administration, area councils, and private organizations work together to ensure that the buses are clean, well-maintained, and safe. This would increase the frequency of services, decrease waiting times, and lower fares.

Considering the information provided, the study suggests that the routes, stops, and terminals of the public transportation system should be redesigned to match the territory's current pattern of physical development. It also suggests that stakeholders should take additional steps to ensure that all areas of the system have access to clean, affordable, and sufficient public transportation (Onokala & Olajide, 2020). All-important hubs of activity, such as public buildings, marketplaces, schools, etc., should be connected by the routes of these transportation services. As a result, people will have easier access to public transportation, and there will be less need for expensive intermediary transportation or long walks to existing bus terminals and stops.

#### **4. CONCLUSIONS**

As the population grew, the demand for transportation services outpaced the resources allocated to their upkeep and expansion. There was a 13.5% annual rise in traffic volume and a less than 2.8% annual increase in funding between 1962 and 1974. While the number of rail passengers in Nigeria increased by 25% from 1967 to 1981, the number of locomotives in operation increased by only 50% during the same time period; some of these locomotives are steam-powered and originate from the era of British control. In addition, the rails' condition and gauge are dubious. Due to the narrower gauge, the rails cannot support larger weights and special rolling stock is needed. Current transportation issues in Nigeria have their roots in the country's troubled history. Economic and social issues in Nigeria have their roots in the country's water, rail, road, and air infrastructure, which was badly managed during and after colonization. Overland Airways and Nigerian cab drivers are two examples of how the country's citizens have taken use of

transportation network opportunities to build prosperous businesses. Studying transportation in modern-day Nigeria has been incredibly challenging due to a paucity of materials spanning the years 1985–2005. This period could be the center of future research endeavors aimed at gathering further data, particularly regarding national finances for infrastructure development and upkeep [Måns Söderbom; Francis Teal]. Given the high cost of transportation infrastructure investments, the government of Nigeria would do well to ease budgetary restrictions in order to foster entrepreneurship in the country's transportation sector and attract private investment in infrastructure development, financing, and operation. In our ongoing pursuit of vision 20/2020, that will contribute to stepping up the endeavor to upgrade transportation infrastructure and services.

## 5. RECOMMENDATIONS

To begin with, rather than focusing on acquiring service availability, Nigeria's transportation approach prioritized funding physical infrastructure such as roads, bridges, with train lines. We propose that the Institute's yearly capital expenditure budget for transportation be structured as a service procurement budget, with the issuance of service purchase guarantees rather than building contracts. Secondly, when it comes to the procurement of transportation infrastructure in Nigeria, the government's hand is often too strongly in the risk allocation process (contract-to-build versus pay-for-service). Regarding this matter, we need to initiate reforms to the payment paradigm for capital expenditure projects in transportation, mandate that private operators secure funding from government off-take contracts, and so on. Thirdly, the public-private partnership (PPP) application is seen as limited to user-pay projects and concessions rather than a self-sustaining private sector instrument for public procurement. More important than issuing concessions for already-existing road, rail, and port assets is expanding the use of PPPs to include service delivery on new capital expenditure (capex) and operations and maintenance (O&M) projects. And lastly, private financing and PPP opportunities have always been considered as secondary to the government's financial priorities in Nigeria. The yearly transportation budgeting process needs to start including more planning elements so that relevant government agencies can try to use private financing options before spending public money. Lastly, the PPP model necessitates a service provider industry, as opposed to merely reimagining conventional contractors as concessionaires. There is an immediate need for the government to use its yearly budgeting authority to initiate the process of building a private sector company that provides infrastructure services.

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