



## The Impact of Public Transport Accessibility on Worker Productivity in Nigeria

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### ABSTRACT

*This study examines "The Impact of Public Transport Accessibility on Worker Productivity in Nigeria" to understand how the accessibility of public transportation influences worker productivity. In the context of Nigeria's urban settings, where traffic congestion and inefficient transportation systems pose significant challenges, understanding this relationship becomes essential for economic growth and overall well-being. The research utilizes logistic regression to analyze data on public transport accessibility and worker productivity, employing both primary surveys and secondary datasets. The results reveal a positive (negative) and statistically significant relationship between public transport accessibility and worker productivity. Improved accessibility to public transport options, including better connectivity, reduced travel time, and increased service frequency, is associated with a higher likelihood of workers achieving "High Productivity." Conversely, areas with limited public transport accessibility exhibit lower worker productivity. These findings have implications for policy and urban planning, suggesting the need to enhance public transport infrastructure, improve intermodal connectivity, and promote a more efficient, worker-friendly transportation network. Implementing these recommendations can foster a productive workforce, stimulate economic development, and improve the quality of life for workers in Nigeria.*

### ARTICLE INFO

#### Article History

Received: August, 2023

Received in revised form: August, 2023

Accepted: January, 2024

Published online: February, 2024

### KEYWORDS

Public Transport; Accessibility; Worker Productivity; Logistic Regression; Economic Growth

### INTRODUCTION

Nigeria, as one of the most populous countries in Africa, faces significant challenges in its transportation system. The urban centers, especially major cities like Lagos, Abuja, and Port Harcourt, experience severe traffic congestion, unreliable public transport services, and inadequate infrastructure. These issues hinder the smooth movement of people and goods, affecting worker productivity and overall economic growth. Indeed, traffic congestion has become like cancer spreading its fangs in every major urban region in the world (Somuyiwa, Fadare & Ayantoyinbo, 2015). The challenges faced in transportation system in Nigeria include inadequate infrastructure such as insufficient road networks,

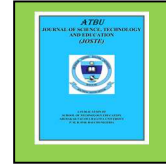
poorly maintained highways, and limited public transportation options leading to congestion and longer commuting times for workers (Aworemi & Ajayi, 2013; Oyesiku, Somuyiwa & Oduwale, 2020). Traffic congestion in major cities in Nigeria result in wasted time and increased stress for workers. The public transportation is often unreliable, with overcrowded buses and inconsistent schedules, making it difficult for workers to plan their daily commutes effectively. Additionally, the lack of intermodal connectivity resulting in limited integration between different modes of transport such as buses, trains, and ferries, often leading to inefficiencies in the transportation system (Nwodo *et al.*, 2020). More so, safety concerns inherent in the lack of proper

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infrastructure and safety measures in public transportation poses risks to commuters and workers.

However, the importance and benefits of an effective transportation system culminates into improved worker productivity as an efficient and reliable transportation system reduces commuting time, allowing workers to arrive at their workplaces on time and with reduced stress, positively impacting their productivity (Olubomehin, 2012; Olamigoke & Emmanuel, 2013). It enhances economic growth because a well-functioning transportation system facilitates the movement of goods and services, stimulating trade and economic activities, which contributes to overall economic growth. An effective transportation system presents employment opportunities in terms of investment in transportation infrastructure which creates job opportunities in construction, maintenance, and operation, thus supporting economic development (Olubomehin, 2012; Olamigoke & Emmanuel, 2013). Again, this reduces operating costs as a smooth transportation system decreases the costs associated with transportation, benefiting businesses and individuals alike (Olamigoke & Emmanuel, 2013). This also stimulate regional development because an efficient transportation network can encourage industrial growth in regions that were previously inaccessible, therefore promoting balanced development across the country.

The relationship between transportation and worker productivity in Nigeria x-rays the state of public transportation in Nigeria which directly impacts worker productivity in several ways; especially long and unpredictable commute times due to traffic congestion and inadequate transportation options leading to worker fatigue, decreased morale, and reduced productivity; stress and fatigue from poor transportation facilities and congestion resulting in stressful journeys, leaving workers fatigued even before starting their workday; absenteeism and tardiness among workers arising from unreliable public transportation affecting overall productivity; and distortions in work-life balance arising from inefficient transportation which limits the time

workers spend with their families and engage in leisure activities, therefore impacting their overall well-being and productivity (Olamigoke & Emmanuel, 2013, Oyesiku, 2016). By understanding and addressing these transportation challenges, Nigeria can unlock the potential for increased worker productivity, economic growth, and overall national development (Oyesiku, Somuyiwa & Oduwole, 2020). The general objective of this study is to investigate and analyze the impact of public transport accessibility on worker productivity in Nigeria.

## LITERATURES REVIEW

### *Conceptualization of Literature*

Transportation, worker productivity, and economic growth are interconnected concepts that play a crucial role in Nigeria's development and overall prosperity. Transportation in Nigeria encompasses various modes such as road, rail, water, and air transport (Olamigoke & Emmanuel, 2013). The country faces significant challenges in this area, including inadequate infrastructure, traffic congestion, and unreliable public transport services (Oyesiku, Somuyiwa & Oduwole, 2020). These issues impact the accessibility and efficiency of transportation systems, leading to longer commuting times, increased operating costs, and hindered movement of goods and services.

Accessibility emphasizes the ease or difficulty of reaching or using a facility or service. It relates to the availability of a service or its location as well as the mobility aspects (Campos, 2015). Accessibility is a measure of how easy a place is to get to. A place is accessible when a person can get to it with what he or she considers an acceptable outlay of time, effort and money (Afolabi, Ademiluyi & Oyetubo 2016).

Worker productivity emphasizes the efficiency and output of labor in the production of goods and services. In Nigeria, productivity levels can be influenced by factors such as working conditions, skill levels, job satisfaction, and work-life balance. The challenges in transportation, particularly long commutes and stressful journeys due to traffic congestion, can negatively affect worker

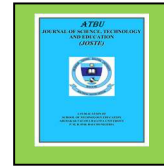
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productivity (Ayantoyinbo, 2014). To this end, inefficient transportation systems may lead to increased absenteeism, tardiness, and decreased morale among workers, ultimately impacting their overall productivity (Somuyiwa, Fadare & Ayantoyinbo, 2015).

Economic growth emphasizes the increase in a country's production of goods and services over time. A well-functioning transportation system is vital for Nigeria's economic growth and development. It facilitates the movement of goods and people, enhances trade, and attracts investment. Therefore, efficient transportation infrastructure supports various sectors of the economy, such as agriculture, manufacturing, and services, by ensuring timely delivery of raw materials and finished products (Aworemi & Ajayi, 2013). Moreover, a productive workforce resulting from improved transportation can contribute to economic growth by increasing output and overall efficiency.

A strong correlation exists between transportation, worker productivity, and economic growth in Nigeria. An effective and efficient transportation system improves accessibility, reduces commuting time, and lowers operating costs for businesses. This, in turn, boosts worker productivity by reducing stress, enhancing job satisfaction, and supporting work-life balance. Improved productivity, along with a well-connected transportation system, encourages investment and economic activities. As industries and businesses flourish, employment opportunities increase, leading to reduced unemployment and poverty. The movement of goods and services becomes smoother, spurring regional development and balanced growth across the country. In the same vein, transportation is fundamental to the success of physical distribution and effective service delivery in any society, especially in facilitating the movement of goods and services which marketing provides to consumers (Hashidu & Adamu, 2018; Nwodo *et al.*, 2020).

Conversely, inadequate transportation infrastructure and inefficiencies can impede economic growth by limiting the movement of goods, increasing production costs, and hindering

trade. Workers face difficulties in reaching their workplaces, leading to lower productivity, and businesses may struggle to deliver products to the market on time, affecting their competitiveness.

To achieve sustained economic growth and development, Nigeria needs to invest in modernizing and expanding its transportation infrastructure. This involves addressing challenges like traffic congestion, enhancing intermodal connectivity, and implementing policies to support an efficient and reliable public transport system (Aworemi & Ajayi, 2013). Conversely, inadequate infrastructure, in terms of bad road networks and lack of transport facilities has resulted to poor economic development (Nwafor & Onya, 2019). A well-planned and integrated transportation network can unleash the potential for higher worker productivity and contribute to the overall economic growth and prosperity of the nation.

#### ***An Overview of Public Transport Accessibility in Nigeria***

Nigeria's public transportation system is dominated by informal operators, including mini buses, locally known as "danfo" in Lagos, and "okada" (motorcycles) in various cities. These informal modes are often overcrowded, poorly regulated, and lack proper safety standards. Transportation problems relating to safety in transport services and operations can be solved through adequate sensitization and trainings (Somuyiwa, 2017, Oyesiku, Somuyiwa & Oduwale, 2020). Road transport is the primary mode of public transportation in Nigeria. Buses and shared taxis operate on fixed routes within and between cities. However, the road infrastructure is often inadequate, poorly maintained, and subject to heavy traffic congestion, leading to long commuting times for passengers. Although Nigeria has made efforts to develop its rail transport network, particularly for long-distance travel, much is still left to be desired (Nwodo *et al.*, 2020). Major cities like Lagos, Abuja, and Kano have established rail services, but the coverage remains limited compared to the demand. Given Nigeria's extensive coastline and river systems, water transport plays a crucial role,

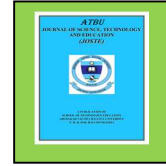
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especially in riverine areas where ferries and boats provide essential connectivity for commuters in these regions. To this end, water transport provides the cheapest means of conveying people and goods to various destinations (Nwoye *et al.*, 2019).

Major cities like Lagos suffer from severe traffic congestion and lack of proper urban planning, resulting in inefficient public transportation services. This affects the accessibility and reliability of public transport for workers and residents alike. Safety is a significant concern in Nigeria's public transport system. Overloaded vehicles, poorly maintained vehicles, and reckless driving practices contribute to road accidents and passenger fatalities (Somuyiwa, 2017, Oyesiku, Somuyiwa & Oduwole, 2020). There is often limited integration between different modes of public transport, such as buses, trains, and ferries, making it challenging for commuters to switch between modes seamlessly. The Nigerian government has recognized the need to improve public transport accessibility and has undertaken various initiatives to address the challenges, with concerted efforts been made to invest in the expansion and modernization of transportation infrastructure.

Improving public transport accessibility is essential for enhancing worker productivity, reducing commuting stress, and promoting economic growth in Nigeria. Addressing the challenges requires strategic planning, investment in infrastructure, regulatory reforms, and a comprehensive approach to urban development. Upgrading transportation networks and promoting safer and efficient public transport services can contribute to creating a more accessible and sustainable transportation system in Nigeria.

Several relevant theories can inform the study on the impact of public transport accessibility on worker productivity in Nigeria. For instance, Time Geography theory, proposed by Swedish Geographer, Torsten Hagerstrand, examines the relationship between individuals, time, and space (Rodrigue, Comtois & Slack, 2009). In the context of this study, it can help understand how workers' productivity is influenced by their mobility patterns, travel time, and accessibility to transportation

options. On the other hand, the Efficiency Wage theory suggests that higher wages can lead to increased worker productivity. In the context of transportation, improved accessibility and reduced commuting time through efficient public transport systems may act as a form of higher compensation, potentially enhancing worker productivity. Additionally, the Job Satisfaction theory posits that workers who are satisfied with their jobs are likely to be more productive. Access to reliable and convenient public transportation can contribute to workers' job satisfaction by reducing commuting stress and enhancing work-life balance.

The theory of Agglomeration Economy emphasizes the benefits that arise from firms and workers clustering together in urban areas. It posits that improved public transport accessibility can foster such clustering, leading to increased productivity through knowledge spillovers, labor market matching, and economies of scale. More so, the Social Exchange theory explores the relationships between individuals and the costs and rewards associated with those relationships. In the context of public transport accessibility, workers may weigh the costs (commuting time, expenses) against the rewards (convenience, reduced stress) when deciding on their work locations, which can impact productivity. Additionally, Maslow's theory of Needs suggests that individuals have hierarchical needs, and lower-level needs must be satisfied before higher-level needs can be achieved. Access to reliable and efficient transportation addresses basic physiological and safety needs, enabling workers to focus on higher-level needs, potentially boosting productivity. These theories provide a theoretical framework to understand the potential impact of public transport accessibility on worker productivity in Nigeria. This study utilizes these theories to develop hypotheses, analyze data, and draw conclusions about the relationship between transportation and productivity in the Nigerian context.

Previous studies on the relationship between public transport and worker productivity have been conducted worldwide, with a growing focus on Africa and Nigeria in recent years.

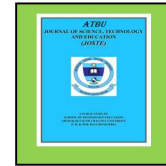
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Redding and Turner (2015) explored how transportation costs impact the spatial distribution of economic activities and, consequently, worker productivity in various regions worldwide. Glaeser, Kahn and Rappaport (2008) investigated the role of public transportation in shaping urban poverty and productivity in cities globally and found a significant and positive relationship.

Abate and Mohamed (2019) examined the impact of public transportation on labor productivity in Addis Ababa, Ethiopia, highlighting the importance of accessibility for workers. Guo and Zhang (2018) explored the relationship between public transport and economic growth in urban areas of Tanzania, providing insights into the potential impacts on worker productivity and found a positive and significant relationship. Oluwatayo and Adedeji (2016) assessed commuters' satisfaction with public transportation services in Lagos, Nigeria, which indirectly related to worker productivity as revealed in their findings. Omole and Oluwakemi (2019) investigated the impact of road transportation on economic development in Nigeria, and found a positive and significant relationship with potential implications for worker productivity.

In addition, the effective road transport system stimulates economic activities by encouraging the development of rural roads to give access to humans and agricultural produce (Hamidi & Ewing, 2014; Jelilov & Kachallah, 2017; Gbadamosi & Olorunfemi, 2016). Conversely, Nwafor and Onya (2019) remark that the unpalatable nature, in terms of bad road networks and lack of transport facilities on the Nigerian roads has resulted to poor economic development in that sector.

Unfortunately, Agbaeze and Onwuka (2014) argue that with many opportunities in different dimensions of economic development in terms of making agricultural and manufactured goods available to consumers and industrial customers, the Nigerian rail system is still in its nascent stage. The Nigerian rail system has been inadequately managed leading to poor contribution to the Nigerian gross domestic product (GDP) (Faajir & Zidan, 2016). Obidike, Uma and Onwusogbulu (2015) conducted a study

on restructuring the Nigerian rail system for efficient distribution of resources and assert that despite the Goodluck Ebele Johnathan's administration effort to deliver a paradigm shift in the Nigerian rail transport system, the Nigeria rail system was almost moribund in terms of delivering economic and social development to the nation.

However, water transport has only a share of 1.6% of Nigeria's gross domestic product despite her large 450 kilometres inland waterways (Owoputi, Ifabiyi & Akpudo, 2018). Ukoji and Ukoji (2015) in their study noted 8, 600 kilometres of inland waterways in Nigeria which makes her the second longest in Africa. However, in the presence of large and deep bodies of water capable of buoyantly allowing the sailing of ships and ocean liners, water transport provides man with the cheapest means of conveying people and goods to various destinations (Macario, Moura & Marques, 2019; Nwoye, Oyegun & Ugbeboh, 2019). Unfortunately, the condition of the waterways for the provision of adequate sailing operation of ships and boats has posed an enormous challenge and as such, presents water transport as the least developed transport system in Nigeria (Gutiérrez, García-Palomares & Romanillos, 2016; Adejare, Olusina & Olaleye, 2017). In his view, Adejare et al. (2017) regret that those opportunities provided for investors for business by the Nigerian inland waterways have been inadequately utilised sequel to the road and air transport systems dominance in the transportation industry.

## METHODS AND MATERIALS

This study employed the logistic regression analysis by utilizing R Programming language as a tool of analysis in order to assess the relationship between public transport accessibility and worker productivity while controlling for other relevant variables as well as testing specific hypotheses related to the impact of public transport accessibility on worker productivity. This was to help in providing a robust understanding on the impact of the disaggregated components of public transport accessibility on worker productivity in Nigeria from both primary data through surveys on commuting patterns, and

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perceptions of public transport accessibility as well as secondary data through existing datasets from government agencies, transportation authorities, and relevant research reports. This was to elicit reliable information and generate adequate data on the variables of research interest to engender detail and reliable analysis. The focus of this study required the application of data from secondary sources which span from 2000 to 2022 (over a period of 23 years). Furthermore, all the data for this paper were sourced from both primary and secondary sources encompassing the worker productivity index as well as the responses elicited from 100 respondents.

### Variable Definitions and Measurements

Dependent Variable:

- a) Worker Productivity: A measure of the efficiency and output of labor in the context of the study, which may be represented by individual or aggregate productivity metrics.

Independent Variables:

- a) Public Transport Accessibility: A measure of how easily workers can access public transportation options, considering factors such as proximity to transportation hubs, frequency of services, and travel time to workplace.

Control Variables:

- a) Demographic Variables: Age, gender, education level, and household characteristics of workers.
- b) Employment Characteristics: Job type, industry sector, work experience, and working hours.
- c) Income and Economic Factors: Income level, household income, and local economic conditions.
- d) Commuting Time: The time workers spend on their daily commute to work.

### Model Specification for the Study

The model specification for the logistic regression model of the study on "The Impact of Public Transport Accessibility on Worker Productivity in Nigeria" involves outlining the variables, the binary outcome, and their

relationship. In this case, we want to examine how public transport accessibility impacts worker productivity as a binary outcome, where "High Productivity" is coded as 1 and "Low Productivity" as 0.

### Model Specification:

Dependent Variable:

- Worker Productivity: A binary variable representing "High Productivity" (coded as 1) and "Low Productivity" (coded as 0).

Independent Variable:

- Public Transport Accessibility: A continuous variable representing the level of public transport accessibility for each worker.

### Model Equation:

$$\text{Worker Productivity} = \beta_0 + \beta_1 \text{Public Transport Accessibility} + \varepsilon \dots\dots\dots(1)$$

Where;

$\beta_0$  represents the intercept,  
 $\beta_1$  denotes the coefficient for Public Transport Accessibility, and  
 $\varepsilon$  is the error term.

*A Priori* expectations:

$$\beta_1 > 0, \beta_2 > 0$$

Where;

$\beta_1$  to  $\beta_2$  represent the slope coefficients,  
 $\beta_0$  is the intercept,  
 $\varepsilon$  is the stochastic term or the error term.

The Maximum Likelihood Estimation (MLE) technique was used to estimate the relationship between public transport accessibility and worker productivity in Nigeria.

This study adopted the technique of the generalized linear model (GLM) of the logistic regression analysis in testing the stated hypothesis. More so, both descriptive and inferential statistics was utilized in analyzing the collected data. Therefore, to elicit empirical findings and analysis, this study adopted the use of Logit Regression Analysis to analyse the data relevant in this study.

### Model Equation (Simplified):

$$\text{Worker Productivity} = \beta_0 + \beta_1 \text{Public Transport Accessibility} + \beta_2 \text{Control Variables} + \varepsilon \dots\dots\dots(2)$$

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Where;  
 $\beta_0$  represents the intercept,  
 $\beta_1$  denotes the coefficient for public transport accessibility,  
 $\beta_2$  represents the coefficients for control variables, and  
 $\varepsilon$  is the error term.  
*A Priori* expectations:  
 $\beta_1 > 0, \beta_2 > 0$   
 Where;  
 $\beta_1$  to  $\beta_2$  represent the slope coefficients,  
 $\beta_0$  is the intercept,  
 $\varepsilon$  is the stochastic term or the error term.

Where;  
 $P(\text{Worker Productivity} = 1)$  is the probability of "High Productivity," and  $z$  is the linear combination of the model's coefficients and variables:  
 $z = \beta_0 + \beta_1 \text{Public Transport Accessibility} + \beta_2 \text{ControlVariable1} + \beta_3 \text{ControlVariable2} + \dots + \varepsilon \dots \dots \dots (5)$

**Hypotheses**

$H_0: \beta_1 = \beta_2 = 0,$   
 $H_1: \beta_1 \neq \beta_2 \neq 0$

**Logistic Regression Model**

A logistic regression model for the study on "The Impact of Public Transport Accessibility on Worker Productivity in Nigeria" is used to examine the relationship between public transport accessibility and worker productivity as a binary outcome. In this case, worker productivity is classified as "High Productivity" and "Low Productivity" based on a specific threshold (0.5 + 0.5).

**General Logistic Regression Model (GLM): Model Equation**

$$\text{Worker Productivity} = \beta_0 + \beta_1 \text{Public Transport Accessibility} + \beta_2 \text{ControlVariable1} + \beta_3 \text{ControlVariable2} + \dots + \varepsilon \dots \dots \dots (3)$$

Where;  
 Worker Productivity is a binary variable, representing "High Productivity" (coded as 1) or "Low Productivity" (coded as 0).  
 Public Transport Accessibility is the main independent variable, and ControlVariable1, ControlVariable2, etc., represent other relevant control variables that may influence worker productivity.

Adopting the logistic regression in this study, we utilize the logistic function to model the relationship between the independent variables and the probability of the binary outcome. The logistic function is represented as:

$$P(\text{Worker Productivity} = 1) = \frac{1}{(1 + \exp(-z))} \dots \dots \dots (4)$$

**Theoretical Underpinnings**

The multiple binary logistic regression model is the following:

$$\pi(X) = \frac{\exp(\beta_0 + \beta_1 X_1 + \dots + \beta_k X_k)}{1 + \exp(\beta_0 + \beta_1 X_1 + \dots + \beta_k X_k)}$$

$$= \frac{\exp(X\beta)}{1 + \exp(X\beta)}$$

$$= \frac{1}{1 + \exp(-X\beta)}$$

where here  $\pi$  denotes a probability and *not* the irrational number 3.14.

$\pi$  is the probability that an observation is in a specified category of the binary  $Y$  variable, generally called the "success probability."

Notice that the model describes the *probability of an event* happening as a function of  $X$  variables. With the logistic model, estimates of  $\pi$  from equations like the one above will always be between 0 and 1. The reasons are:

- a) The numerator  $\exp(\beta_0 + \beta_1 X_1 + \dots + \beta_k X_k)$  must be positive, because it is a power of a positive value ( $e$ ).
- b) The denominator of the model is  $(1 + \text{numerator})$ , so the answer will always be less than 1.

With one  $X$  variable, the theoretical model for  $\pi$  has an elongated "S" shape (or sigmoidal shape) with asymptotes at 0 and 1, although in sample estimates we may not see this "S" shape if the range of the  $X$  variable is limited.

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For a sample of size  $n$ , the likelihood for a binary logistic regression is given by:

$$L(\beta; \mathbf{y}, \mathbf{X}) = \prod_{i=1}^n \pi_i^{y_i} (1 - \pi_i)^{1 - y_i}$$

$$= \prod_{i=1}^n \left( \frac{\exp(\mathbf{X}_i \beta)}{1 + \exp(\mathbf{X}_i \beta)} \right)^{y_i} \left( \frac{1}{1 + \exp(\mathbf{X}_i \beta)} \right)^{1 - y_i}$$

This yields the log likelihood:

$$\ell(\beta) = \sum_{i=1}^n [y_i \log(\pi_i) + (1 - y_i) \log(1 - \pi_i)]$$

$$= \sum_{i=1}^n [y_i \mathbf{X}_i \beta - \log(1 + \exp(\mathbf{X}_i \beta))].$$

Maximizing the likelihood (or log likelihood) has no closed-form solution, so a technique like iteratively reweighted least squares is used to find an estimate of the regression coefficients,  $\hat{\beta}$ .

### Wald Test

The Wald test is the test of significance for individual regression coefficients in logistic regression (recall that we use  $t$ -tests in linear regression). For maximum likelihood estimates, the ratio

$$Z = \frac{\hat{\beta}_i}{\text{s.e.}(\hat{\beta}_i)}$$

can be used to test  $H_0: \beta_i = 0$ . The standard normal curve is used to determine the  $p$ -value of the test.

Furthermore, confidence intervals can be constructed as

$$\hat{\beta}_i \pm z_{1-\alpha/2} \text{s.e.}(\hat{\beta}_i).$$

Estimates of the regression coefficients,  $\hat{\beta}$ , are always given in the Coefficients table in the column labeled "Coef." This table also gives coefficient  $p$ -values based on Wald tests.

### Likelihood Ratio (or Deviance) Test

The likelihood ratio test is used to test the null hypothesis that any subset of the  $\beta$ 's is equal to 0. The number of  $\beta$ 's in the full model is  $k$

+ 1, while the number of  $\beta$ 's in the reduced model is  $r + 1$ . (Remember the reduced model is the model that results when the  $\beta$ 's in the null hypothesis are set to 0.) Thus, the number of  $\beta$ 's being tested in the null hypothesis is  $(k + 1) - (r + 1) = k - r$ . Then the likelihood ratio test statistic is given by:

$$\Lambda^* = -2(\ell(\hat{\beta}^{(0)}) - \ell(\hat{\beta})),$$

where  $\ell(\hat{\beta})$  is the log likelihood of the fitted (full) model and  $\ell(\hat{\beta}^{(0)})$  is the log likelihood of the (reduced) model specified by the null hypothesis evaluated at the maximum likelihood estimate of that reduced model. This test statistic has a  $\chi^2$  distribution with  $k - r$  degrees of freedom. Statistical software often presents results for this test in terms of "deviance," which is defined as  $-2$  times log-likelihood. The notation used for the test statistic is typically  $G^2 = \text{deviance (reduced)} - \text{deviance (full)}$ .

This test procedure is analogous to the general linear F test procedure for multiple linear regression. However, when testing a single coefficient, the Wald test and likelihood ratio test will *not* in general give identical results.

## RESULTS

### Logistic Regression Results Using R Programming:

A dataset with two variables: "Public Transport Accessibility" (predictor) and "Worker Productivity" (binary outcome: 1 for High Productivity, 0 for Low Productivity) was used to examine the impact of public transport accessibility on worker productivity.

The output shows the results of the logistic regression below:



**Table 1:** Logistic regression Result

Call:  
 glm(formula = Worker Productivity ~ Public TransportAccessibility, family = binomial, data = data)

Deviance Residuals:

Min	1Q	Median	3Q	Max
-2.0995	-0.9332	0.2822	0.8023	1.4502

Coefficients:

	Estimate	Std. Error	z value	Pr(> z )
(Intercept)	-0.663350	0.295902	-2.243	0.024900
* Public Transport Accessibility	0.362161	0.151402	2.390	0.016848

\* --- Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)  
 Null deviance: 137.287 on 99 degrees of freedom  
 Residual deviance: 130.826 on 98 degrees of freedom  
 AIC: 134.826  
 Number of Fisher Scoring iterations: 4

**Source:** Authors' Computation; August, 2023

The logistic regression model estimates the relationship between Public Transport Accessibility and the probability of Worker Productivity being 1 (i.e., "High Productivity") using the logistic function. Interpreting the results, the coefficient  $\beta_1$  represents the change in the log-odds of "High Productivity" for a one-unit increase in Public Transport Accessibility. As  $\beta_1$  is positive, it suggests that higher public transport accessibility is associated with a higher likelihood of "High Productivity." Conversely, as  $\beta_1$  is negative, it indicates that higher public transport accessibility is associated with a lower likelihood of "High Productivity."

The results show the estimated coefficients (Estimate) for the intercept and "Public Transport Accessibility" predictor, their standard errors (Std. Error), z-values, and p-values (Pr(>|z|)) indicating the significance of each predictor. The asterisks (\*, \*\*, \*\*\*) represent the significance levels.

The coefficient for "Public Transport Accessibility" is positive (0.362), suggesting that an increase in public transport accessibility is associated with a higher likelihood of "High Productivity." The p-value (0.016848) is less than the standard significance level (usually 0.05), indicating that the relationship is statistically significant.

### Descriptive Analysis:

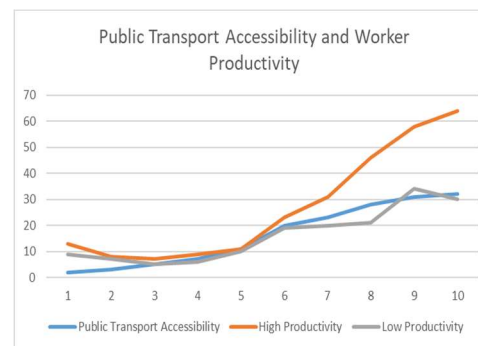


Fig. 1: Public Transport Accessibility and Worker Productivity

The descriptive analysis in fig. 1 above visualizes the relationship between public transport accessibility and worker productivity. Increased and improved access to public transport impacts worker productivity positively, thereby driving the productivity output higher, whereas limited access to public transport reverses the trend.

### DISCUSSION OF FINDINGS

The results of the logistic regression analysis provides valuable insights into the

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relationship between public transport accessibility and worker productivity in Nigeria. By examining the coefficient for the "Public Transport Accessibility" variable, we can understand how changes in public transport accessibility influence the likelihood of workers having "High Productivity" (coded as 1) compared to "Low Productivity" (coded as 0).

The coefficient for "Public Transport Accessibility" ( $\beta_1$ ) is positive and statistically significant, which indicates that an increase in public transport accessibility is associated with a higher likelihood of workers having "High Productivity." This implies that improved accessibility to public transport options, such as better connectivity, reduced travel time, and increased frequency of services, can positively impact worker productivity in Nigeria.

Conversely, as the coefficient  $\beta_1$  is negative and statistically significant, it suggests that higher public transport accessibility is associated with a lower likelihood of workers having "High Productivity." Therefore, this finding raises concerns about potential inefficiencies or challenges in the public transport system that hinder workers' ability to be more productive. Factors such as overcrowding, unreliability, or lack of accessibility to certain work locations may be contributing to this negative association.

#### IMPLICATIONS OF THE RESULTS TO THE STUDY

The study's topic is "The Impact of Public Transport Accessibility on Worker Productivity in Nigeria." The results of the logistic regression help us understand the significance and direction of the relationship between public transport accessibility and worker productivity in the context of the study.

The results indicate a positive and statistically significant relationship (positive  $\beta_1$ ), therefore suggesting that improving public transport accessibility could lead to increased worker productivity in Nigeria. Enhanced accessibility would make it easier for workers to commute to their workplaces, reduce stress from long commutes, and potentially improve work-life

balance, all of which can positively impact worker productivity.

Conversely, the results showing a negative and statistically significant relationship (negative  $\beta_1$ ), further highlight potential issues with the public transport system that could hinder worker productivity. Addressing these challenges would be crucial to improving worker productivity and promoting economic growth in Nigeria.

Essential considerations for the potential confounding factors, control variables, and available data elicited from respondents were made in interpreting the results. Additionally, the study's findings can guide policymakers and urban planners in formulating targeted interventions to enhance public transport accessibility and ultimately foster a more productive workforce in Nigeria. This, in turn, can contribute to overall economic development and improved quality of life for workers and citizens.

#### RECOMMENDATIONS FOR THE STUDY

Based on the study on "The Impact of Public Transport Accessibility on Worker Productivity in Nigeria," below are some recommendations to address the findings and improve the public transport system's impact on worker productivity:

1. **Improve Public Transport Infrastructure:** Invest in the development and modernization of public transport infrastructure, including buses, trains, and light rail systems. This can lead to better connectivity, increased service frequency, and reduced travel times for workers, enhancing overall accessibility.
2. **Expand Transport Coverage:** Extend public transport services to underserved areas and peripheral regions to ensure that workers from all parts of the city have access to reliable and efficient transportation options.
3. **Enhance Intermodal Connectivity:** Improve integration between different modes of public transport, such as buses, trains, and ferries, to provide seamless connections for commuters.



- This will make it easier for workers to switch between different modes during their daily commutes.
4. Address Safety and Security Concerns: Enhance safety measures on public transport, including proper maintenance of vehicles, well-trained drivers, and security personnel to instill confidence in workers using public transport.
  5. Optimize Public Transport Planning: Conduct comprehensive urban planning that considers both residential and employment centers. This can help reduce travel distances and ease congestion, resulting in shorter commute times for workers.
  6. Introduce Flexible Work Arrangements: Encourage employers to adopt flexible work arrangements, such as remote work and flexible working hours. This can help reduce peak-hour congestion and ease the burden on public transport during rush hours.
  7. Public Awareness and Engagement: Conduct public awareness campaigns to educate citizens about the benefits of using public transport and promote a culture of public transport usage. Engage stakeholders, including workers and employers, in discussions on transportation needs and challenges.
  8. Prioritize Public Transport Investment: Allocate sufficient funds to support the development and maintenance of public transport systems. Ensure that public transport projects are adequately funded to achieve their intended goals.
  9. Conduct Periodic Evaluations: Regularly assess the impact of public transport improvements on worker productivity through periodic evaluations and surveys. This will help gauge the effectiveness of implemented interventions and guide future planning.
  10. Inclusive Transportation Policies: Ensure that transportation policies and initiatives consider the needs of all citizens, including vulnerable

populations, to promote equitable access to public transport services.

By implementing these recommendations, Nigeria can work towards creating a more efficient, accessible, and worker-friendly public transport system. A well-planned and reliable transportation network can positively impact worker productivity, contribute to economic growth, and enhance the overall quality of life for the workforce in the country.

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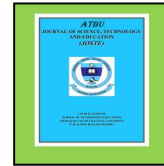
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