

Transportation Infrastructure and Accessibility to Socio-Economic Opportunities in Rural Edo State, Nigeria

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Abstract: Access to socio-economic opportunities is fundamental to rural development, yet poor transportation infrastructure limits rural populations' ability to access essential services in developing regions. This study examines how transportation modes affect access to healthcare, education, markets, and agricultural productivity in rural Edo State, Nigeria. Using a cross-sectional survey design, data were collected from 1,250 respondents across 18 communities in six local government areas. The study employed structured questionnaires, GIS spatial analysis, and chi-square tests. Findings reveal that transportation infrastructure significantly influences access to socio-economic opportunities, with 85.9% of respondents affirming that poor transportation causes service unavailability. Severe accessibility challenges exist, particularly in healthcare, where respondents in poorly connected areas travel more than 10 kilometers to facilities. Long distance emerged as the primary challenge (Mean Index Value = 4.22), followed by rickety vehicles and rising costs (MIV = 3.9 each). Dominant transport modes were motorcycles (68.5%), bicycles (61.4%), and walking (51.7%). Chi-square analysis confirmed significant relationships between transportation means and accessibility ($\chi^2 = 52.618$, $p < 0.05$). Improving rural transportation infrastructure is critical for enhancing service accessibility and sustainable development. Recommendations include prioritizing feeder roads, promoting intermediate transport, establishing transport hubs, and integrating planning with service delivery.

Keywords: Transportation Infrastructure, Rural Accessibility, Healthcare Access, Education Access, Agricultural Productivity, Edo State, Nigeria.

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I. INTRODUCTION

Transportation infrastructure is a part of the arterial system by which rural populations receive access to necessary services, economic and social opportunities that are core to human growth and wellbeing. The quality and accessibility of transportation systems in such developing countries as Nigeria dictate the not only physical mobility of rural residents but also the ability to conduct effective economic activities, access healthcare and education, and be part of the socio-economic processes (Janc et al., 2023). The rural Nigeria context greatly depends on road transportation as the most common means of movement, and therefore, it acts as the vital bridge between the rural producers and the urban markets, patients and the healthcare facilities, students and the institutions of learning, and the farmers and the

suppliers of agricultural inputs. Nevertheless, the quality of rural transport infrastructure in most regions in Nigeria is abhorrently poor and includes bad roads, poor service provision, and seasonal accessibility options that significantly limit the rural communities to opportunities (Oyeniyi et al., 2025).

Accessibility is not only about physical distance but also about the ease, affordability, time, and safety of people to access the destinations of their choice and services. In rural set ups, accessibility is greatly influenced by the nature of road network, availability and affordability of transport services, and spatial dispersion of vital amenities (Lebo and Schelling, 2001). The isolation of space caused by poor transportation infrastructure is manifested in various dimensions in deprivation: farmers cannot reach markets

effectively and their products and earnings are wasted after harvest; patients cannot reach healthcare facilities on time and they become sick and die as a result; students have to walk long distances to schools, which decreases enrolment and increases the turnover rates and business owners cannot access inputs and customers, which limits business expansion and creation of job opportunities (Faiz, 2012). Such lapses in accessibility do not only interfere with the welfare of individuals but also the development of rural areas by restricting the development of rural areas and sustaining rural poverty.

There is a consistent empirical support of the developing countries setting that has shown how the enhanced transportation infrastructure alters the rural accessibility and development outcomes. Research has also captured data that road upgrades have the potential of reducing the amount of time taken by people in their commute, reducing the expense of transport, boosting agricultural output due to a better market accessibility, improving the enrolment rates of schools, enhancing the uptake of healthcare services, and boosting non-farm economic activity (Escobal and Ponce, 2002). On the other hand, regions that have low road development levels have always been characterized by higher poverty levels, reduced agricultural output, poor health and poor education levels (Starkey and Hine, 2014). According to the Rural Access Index prepared by the World Bank, about one billion rural inhabitants around the world do not have access to all-season roads, and Sub-Saharan Africa is the least rural accessibility region in the developing world with less than 40 percent of rural Africans living within two kilometers of an all-season road (World Bank, 2023).

Theoretical basis of comprehensibility of the relationship between transportation and accessibility is based on the Transport Theory, which assumes that the developmental patterns of space are formed by the transportation infrastructure, which minimizes the distance friction as well as facilitates spatial interaction among people, goods, and services (White and Senior, 1983). Wilson (1966) argues that the transport infrastructure has multiplier benefits as it increases the market reach, economic opportunities, and promotes the spread of innovations and services in the urban centers to the rural peripheries. The theory appreciates the fact transportation is not only a derived demand but a key facilitator of development that determines the pattern of settlement, land use choices, and spatial organization of economic activities. Rural development In rural situations, structural changes may start with the growth and development of roads, which exposes formerly remote locations to external influences, opens up micro-scale agricultural areas to markets, and allows the rural population to access urban based services and opportunities (Kansky, 1963).

Edo state, which is in the geopolitical region of South-South in Nigeria, offers an interesting location case study on how transportation infrastructure affects the rural accessibility. The state has three senatorial districts namely Edo North, Edo Central, and Edo South with a land area of

17,802 km² and estimated population of about 5,250,000 people by the year 2024 (Onokerhoraye, 1995). Even with the governmental actions throughout the years, several rural groups in Edo State still experience severe transportation problems that restrict their access to the necessary services and economic prospects. Some rural communities such as Egoro Naoka, Edenu, Ibore, Eko Ibadin, Atuagbo, Emuhi, Amahor, Iguovbobo, Umaza, Uhun, Ogwa, Aghor, Azagba, Amufi, Okhaihe, Egba, Ogheghe, Okweka, Ighekpe, Obadan, Okhio, and Igbenke Edo Central do not have tarred and motorable access roads, severely restricting the access of residents to healthcare,

The past rural development projects in Nigeria such as the Operation Feed the Nation (1976), Green Revolution (1980), Directorate for Food, Roads and Rural Infrastructure DFRRRI (1991), National Poverty Eradication Programme NAPEP (2001) and National Economic Empowerment and Development Strategy NEEDS (2004) indicate a small success, which is mainly due to structural impediments such as poor road infrastructure that compromised the effectiveness of the programs to provide sustainable changes in rural accessibility and livelihoods (Ochen The cost of transportation is high because of poor roads conditions It has restricted the agricultural activities since farmers struggle to transport their products to the urban areas, leading to the high prices of food owing to a low supply (Olorunfemi, 2018). Moreover, access roads are in bad conditions and this has not only contributed to low farming productivity but also social vices such as armed robbery, kidnapping and banditry, which only serve to limit rural mobility and access to opportunities (Gbadmosi & Olorunfemi, 2016).

The Government is currently trying to enhance the transport infrastructure in Edo State, as recent policy initiatives, such as the State Employment and Expenditure for Results (SEEFOR) program funded by the World Bank and the European Union, demonstrate (European Union and World Bank, 2023). In the 2025 budget, the state government has allocated 4,153,884, 956.00 to the SEEFOR in the Accelerated Road Development Programme with an aim of rehabilitating the rural roads within the different local government areas. There is, however, worry on the quality and sustainability of such interventions with most of the rehab roads failing within a few years following poor construction practices and ineffective maintenance (Mohammed & Dahunsi, 2013). More essentially, the gap in knowledge about the precise channels through which transportation infrastructure determines accessibility to various forms of socio-economic opportunities in rural Edo State, and the effects of such influences on the various spatial contexts and population groups, still persists.

It is on this basis that a thorough evaluation of the effect of the transport vehicles on access to social-economic opportunities would be urgently needed to inform evidence-based policies regarding transport planning and rural development. This kind of evaluation should look beyond physical infrastructure to include availability and affordability of transport, the spatial distribution of key facilities and the particular impediments that the rural people

encounter in accessing health care, school, and market among other critical facilities. This paper thus explores the effect of the means of transport on the accessibility of socio-economic opportunities in rural Edo State with the specific aim of offering empirical data on which target interventions can be undertaken to enhance accessibility in rural areas and spur

sustainable regeneration in the rural areas. The paper will study accessibility trends in various dimensions such as healthcare, education, agricultural market, and small scale businesses and will test the hypothesis that the transportation means do not have significant correlation with accessibility to social-economic opportunities within the Edo State.

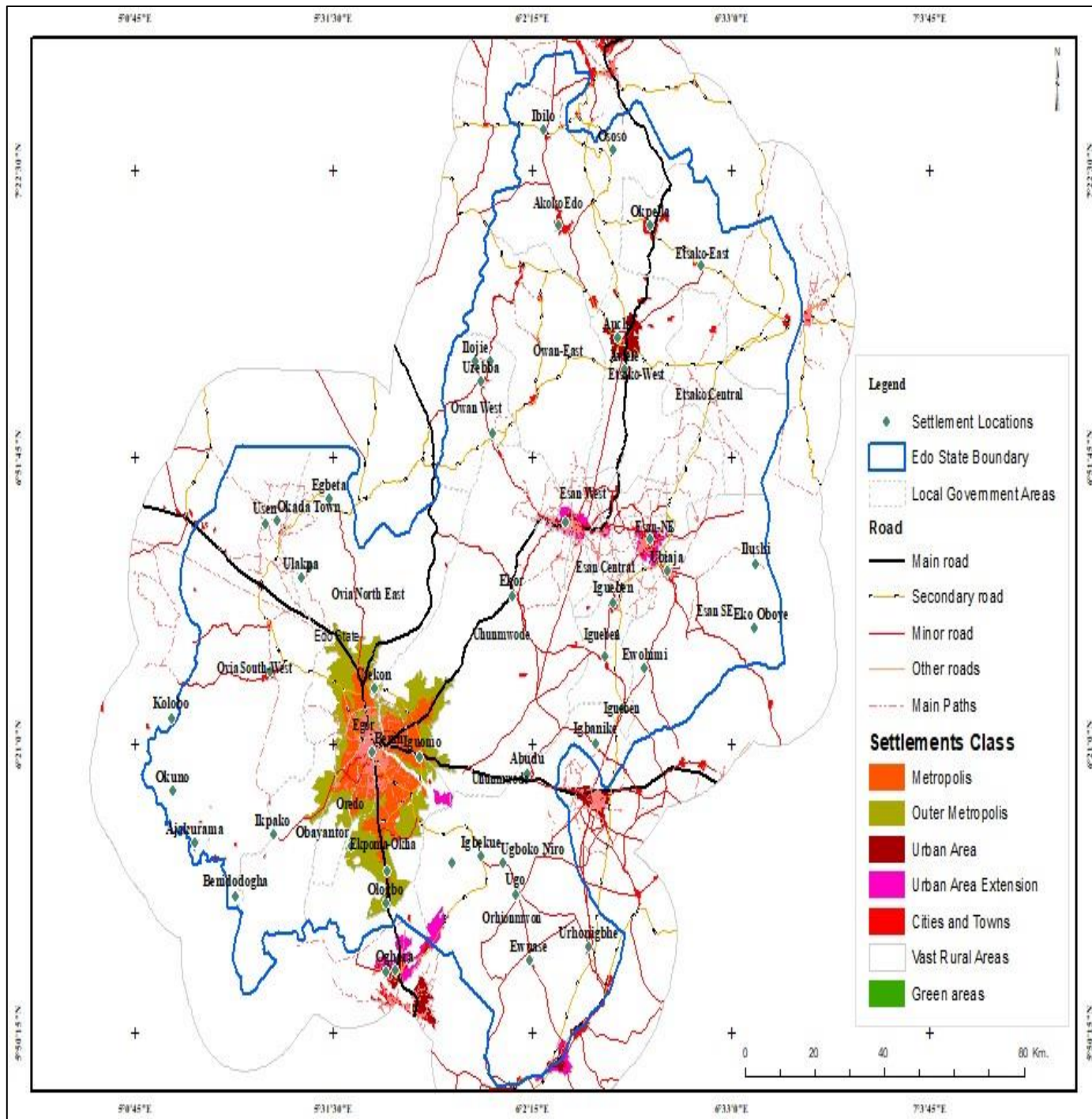


Fig 1 Spatial Distribution of Road Networks in Selected Local Government Areas
 Source: GIS Analysis, LASU GIS Lab, 2024

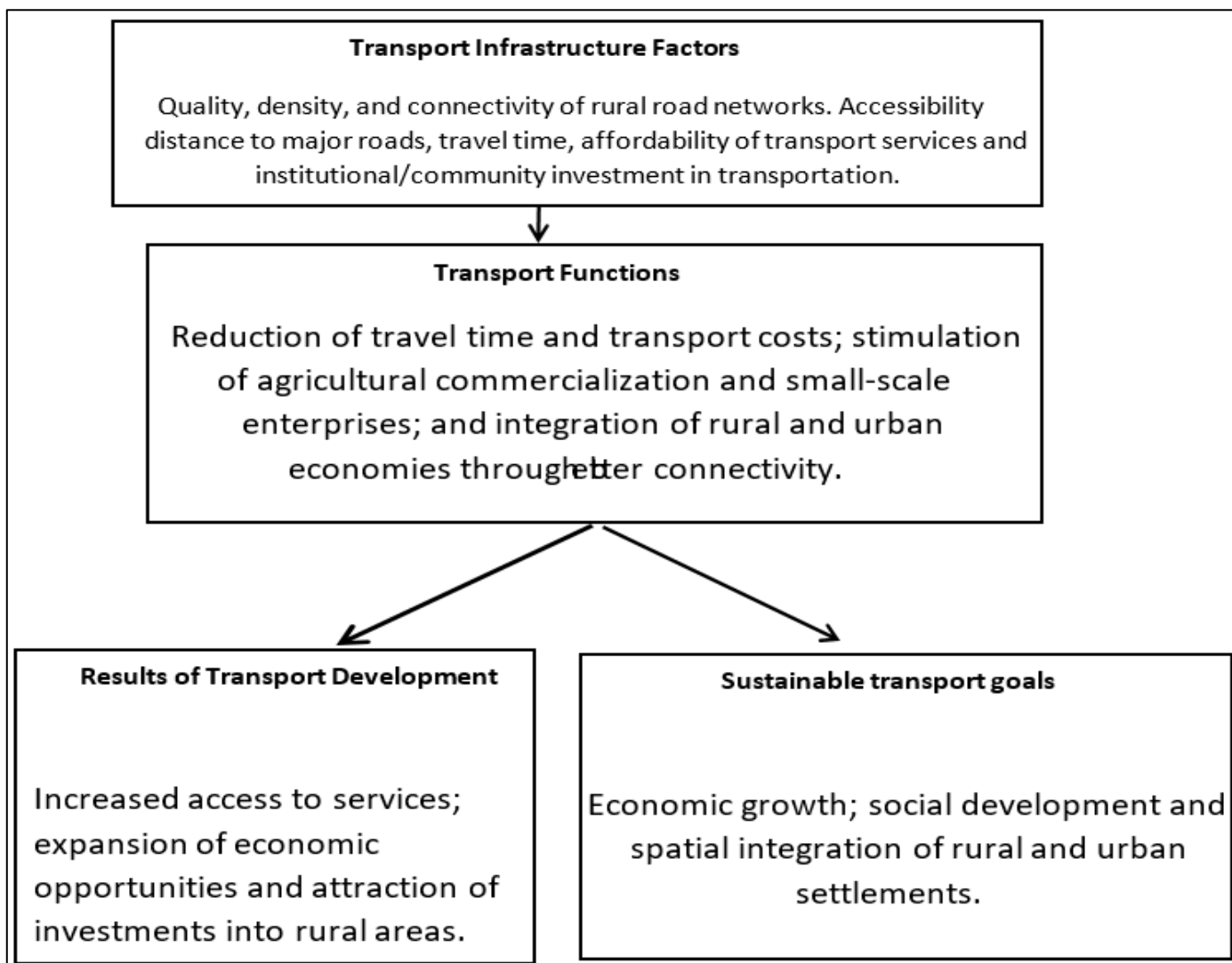


Fig 2 Conceptual Framework Linking Transportation Infrastructure to Rural Accessibility
Source: Author's Model based on Transport Theory, 2025

II. METHODOLOGY

➤ Research Design

This study adopted a mixed-methods research design integrating quantitative survey data with spatial analysis to comprehensively assess the impact of transportation means on accessibility to socio-economic opportunities in rural Edo State. The design combines structured questionnaire surveys with Geographic Information Systems (GIS) spatial analysis to capture both the measurable dimensions of accessibility (distances, travel times, costs) and the spatial patterns of transport infrastructure and service distribution.

➤ Study Area

The study was conducted in rural Edo State, Nigeria, covering three senatorial districts: Edo North, Edo Central, and Edo South. Six local government areas (LGAs) were purposively selected—two from each senatorial district—based on their rural character, agricultural significance, and varying levels of transport infrastructure development. The selected LGAs were Owan East and Akoko Edo from Edo North; Esan West and Igueben from Edo Central; and Ovia

South West and Uhunmonde from Edo South. Three rural communities were selected from each LGA, yielding a total of 18 study communities across the state.

➤ Study Population

The study population comprised rural residents aged 18 years and above across the selected communities, including farmers, traders, artisans, students, healthcare users, and other categories of rural dwellers whose daily activities require access to socio-economic facilities and services. This population was chosen because they directly experience the impacts of transportation infrastructure on their ability to access healthcare, education, markets, and other essential services.

➤ Sampling Technique and Sample Size

A multi-stage sampling technique was employed to ensure geographic representation and demographic diversity. The initial research design intended a sample size of 2,400 respondents (400 from each of the six LGAs). However, due to security constraints arising from insurgency and banditry in some rural locations, only 1,250 questionnaires were

successfully administered and retrieved, representing a response rate of 52.1%. The distribution was: Edo North (90 respondents), Edo Central (400 respondents), and Edo South (760 respondents). Despite the reduction from the planned sample, the final sample size remained statistically adequate for analysis and maintained good representation across the three senatorial districts.

➤ *Data Collection Instruments and Procedures*

Primary data were collected using structured questionnaires administered to respondents across the 18 rural communities. The questionnaire comprised sections on:

- Socio-demographic characteristics of respondents
- Modes of transportation available and used in communities
- Distance and travel time to healthcare facilities
- Distance and travel time to educational institutions
- Access to markets and agricultural input suppliers
- Access to small-scale enterprises and employment opportunities
- Challenges faced in accessing socio-economic facilities
- Perceptions of the impact of transportation on service accessibility

Additionally, GIS spatial analysis was conducted using base maps and GPS coordinates of locations to generate maps showing road network distribution and connectivity patterns using ArcGIS 10.8 software (Obafemi et al., 2011). Road connectivity indices (Alpha, Beta, and Gamma indices) were computed to assess the adequacy of road network connectivity in the study area following the methodology outlined by Poudel and Devkota (2025).

Data collection was conducted over a three-month period with the assistance of trained research assistants. In some communities, armed police escorts were required due to security concerns. Informed consent was obtained from all participants, and confidentiality was assured.

Table 1 Modes of Transportation in Rural Communities

| Mode of Transportation | Edo North (%) | Edo Central (%) | Edo South (%) | Total (%) | Rank |
|------------------------|---------------|-----------------|---------------|------------|------|
| Motorcycles (Okada) | 66 (73.3) | 268 (67.0) | 522 (68.7) | 856 (68.5) | 1st |
| Bicycles | 67 (74.4) | 238 (59.5) | 463 (60.9) | 768 (61.4) | 2nd |
| Walking | 65 (72.2) | 218 (54.5) | 363 (47.8) | 646 (51.7) | 3rd |
| Tricycles (Keke) | 55 (61.1) | 185 (46.3) | 363 (47.8) | 603 (48.2) | 4th |
| Animal-drawn carts | 43 (47.8) | 167 (41.8) | 295 (38.8) | 505 (40.4) | 5th |
| Buses/Minibuses | 38 (42.2) | 152 (38.0) | 261 (34.3) | 451 (36.1) | 6th |

The results show that motorcycles are the most common mode of transport across all three senatorial districts (68.5%), followed by bicycles (61.4%) and walking (51.7%). The relatively high percentage of walking (51.7%) indicates significant reliance on non-motorized transport, reflecting limited availability and affordability of motorized transport services in rural areas. Tricycles and buses/minibuses showed lower usage rates, likely due to poor road conditions that restrict their operation in many rural communities.

➤ *Analytical Techniques*

Data were analyzed using both descriptive and inferential statistics. Descriptive statistics including frequencies, percentages, and mean index values were computed to summarize accessibility patterns and challenges. The Relative Importance Index (RII) was calculated to rank accessibility challenges as follows:

$$RII = \frac{\sum(W \times X)}{(A \times N)}$$

Where:

- W = weight given to each response (1 to 5),
- X = frequency of responses,
- A = highest weight (5),
- N = total number of respondents.

Chi-square test of independence was employed to test the hypothesis that there is no significant relationship between transportation means and accessibility to socio-economic opportunities. The test was conducted at a 95% confidence level ($\alpha = 0.05$). Additionally, spatial analysis using GIS was performed to visualize accessibility patterns and identify underserved areas.

➤ *Ethical Considerations*

Ethical approval was obtained from the relevant institutional ethics committee. Participation was voluntary, and respondents were informed of their right to withdraw at any time without consequences. No monetary or material inducements were offered to respondents.

III. RESULTS

➤ *Modes of Transportation in Rural Communities*

Table 1 presents the distribution of transportation modes available and used by respondents across the three senatorial districts.

➤ *Impact of Transportation on Availability of Goods and Services*

Table 2 summarizes respondents' perceptions of the impact of transportation on the availability of goods and services in their communities.

Table 2 Impact of Transportation on Availability of Goods and Services

| Response | Edo North (%) | Edo Central (%) | Edo South (%) | Total (%) |
|---|---------------|-----------------|---------------|-------------|
| Poor transportation causes unavailability of goods and services | 69 (76.7) | 352 (88.0) | 653 (85.9) | 1074 (85.9) |
| Indifferent | 21 (23.3) | 48 (12.0) | 107 (14.1) | 176 (14.1) |
| Total | 90 (100) | 400 (100) | 760 (100) | 1250 (100) |

The overwhelming majority of respondents (85.9%) affirmed that poor transportation infrastructure causes unavailability of goods and services in their communities. This finding was consistent across all three senatorial districts, with Edo Central recording the highest proportion (88.0%), followed by Edo South (85.9%) and Edo North (76.7%). This strong consensus underscores the critical role of

transportation infrastructure in facilitating the movement of goods and services to rural areas.

➤ *Distance to Healthcare Facilities*

Table 3 presents data on the distance from respondents' residences to the nearest healthcare facilities across the three senatorial districts.

Table 3 Distance to Nearby Health Centers

| Distance Range | Edo North (%) | Edo Central (%) | Edo South (%) | Total (%) |
|----------------|---------------|-----------------|---------------|------------|
| Less than 2 km | 8 (8.9) | 48 (12.0) | 107 (14.1) | 163 (13.0) |
| 2-5 km | 19 (21.1) | 96 (24.0) | 198 (26.1) | 313 (25.0) |
| 6-10 km | 32 (35.6) | 152 (38.0) | 289 (38.0) | 473 (37.8) |
| 11-15 km | 21 (23.3) | 72 (18.0) | 121 (15.9) | 214 (17.1) |
| Above 15 km | 10 (11.1) | 32 (8.0) | 45 (5.9) | 87 (7.0) |
| Total | 90 (100) | 400 (100) | 760 (100) | 1250 (100) |

The data reveal significant accessibility challenges for healthcare services. Only 13.0% of respondents lived within 2 kilometers of a healthcare facility, while the majority (37.8%) were located 6-10 kilometers away. Notably, 24.1% of respondents were more than 10 kilometers from the nearest health center, with some traveling more than 15 kilometers. These distances are particularly problematic in contexts

where transportation infrastructure is poor and emergency medical services are non-existent.

➤ *Accessibility Challenges to Healthcare Facilities*

Tables 4, 5, and 6 present the major challenges faced by respondents in accessing healthcare facilities, analyzed separately for each senatorial district and aggregated.

Table 4 Challenges in Accessing Healthcare Facilities in Edo North Senatorial District

| Challenges | SD | D | N | A | SA | S | RS | RMI | MIV | MD | Rank |
|---|----|----|----|-----|-----|----|-----|------|------|----|------|
| Long distance | 0 | 14 | 30 | 80 | 265 | 90 | 389 | 4.32 | 0.66 | 1 | |
| Rickety vehicles | 1 | 16 | 54 | 96 | 195 | 90 | 362 | 4.02 | 0.36 | 2 | |
| Rising land use conflicts | 3 | 14 | 45 | 152 | 135 | 90 | 349 | 3.88 | 0.22 | 3 | |
| Unpredictable and rising cost of living | 4 | 20 | 45 | 116 | 160 | 90 | 345 | 3.83 | 0.17 | 4 | |

Legend: SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree, S = Sample size, RS = Relative Score, RMI = Relative Mean Index, MIV = Mean Index Value, MD = Mean Deviation

Table 5: Challenges in Accessing Healthcare Facilities in Edo Central Senatorial District

| Challenges | SD | D | N | A | SA | S | RS | RMI | MIV | MD | Rank |
|---|----|----|-----|-----|-----|-----|------|------|------|----|------|
| Long distance | 5 | 92 | 138 | 456 | 945 | 400 | 1636 | 4.09 | 0.36 | 1 | |
| Rickety vehicles | 22 | 50 | 198 | 424 | 905 | 400 | 1599 | 4.0 | 0.27 | 2 | |
| Rising land use conflicts | 7 | 90 | 213 | 528 | 725 | 400 | 1563 | 3.91 | 0.18 | 3 | |
| Unpredictable and rising cost of living | 14 | 88 | 168 | 616 | 660 | 400 | 1546 | 3.87 | 0.14 | 4 | |

Table 6: Aggregate Challenges in Accessing Healthcare Facilities Across All Senatorial Districts

| Challenges | SD | D | N | A | SA | S | RS | RMI | MIV | MD | Rank |
|---|----|-----|-----|------|------|-----|------|------|------|----|------|
| Long distance | 9 | 126 | 240 | 820 | 2015 | 760 | 3210 | 4.22 | 0.49 | 1 | |
| Rickety vehicles | 26 | 150 | 354 | 1092 | 1340 | 760 | 2962 | 3.9 | 0.17 | 2 | |
| Rising land use conflicts | 36 | 152 | 288 | 1084 | 1405 | 760 | 2965 | 3.9 | 0.17 | 2 | |
| Unpredictable and rising cost of living | 16 | 180 | 312 | 1172 | 1285 | 760 | 2965 | 3.9 | 0.17 | 2 | |

The aggregate analysis across all three senatorial districts reveals that long distance to healthcare facilities is the most significant accessibility challenge, with a Mean Index Value (MIV) of 4.22, ranking first. This was followed

by rickety vehicles, rising land use conflicts, and unpredictable costs of living, all with MIV of 3.9. These findings indicate that physical distance combined with poor

quality transport services constitute the primary barriers to healthcare accessibility in rural Edo State.

➤ *Distance to Educational Institutions*

Table 7 presents data on the distance from respondents' residences to the nearest educational institutions.

Table 7 Distance to Schools

| Distance Range | Edo North (%) | Edo Central (%) | Edo South (%) | Total (%) |
|----------------|---------------|-----------------|---------------|------------|
| Less than 1 km | 12 (13.3) | 64 (16.0) | 136 (17.9) | 212 (17.0) |
| 1-3 km | 28 (31.1) | 144 (36.0) | 281 (37.0) | 453 (36.2) |
| 4-6 km | 31 (34.4) | 128 (32.0) | 228 (30.0) | 387 (31.0) |
| 7-10 km | 14 (15.6) | 48 (12.0) | 91 (12.0) | 153 (12.2) |
| Above 10 km | 5 (5.6) | 16 (4.0) | 24 (3.2) | 45 (3.6) |
| Total | 90 (100) | 400 (100) | 760 (100) | 1250 (100) |

The data show that 17.0% of respondents lived within 1 kilometer of a school, while 36.2% were located 1-3 kilometers away. Notably, 15.8% of respondents were more than 7 kilometers from the nearest educational institution. While educational facilities appear more accessible than healthcare facilities, significant proportions of the rural population still face considerable distances to schools, which

can negatively impact school enrollment and attendance, particularly for young children.

➤ *Access to Markets and Agricultural Productivity*

Table 8 summarizes respondents' assessments of accessibility to markets for agricultural products.

Table 8 Distance to Markets for Agricultural Products

| Distance Range | Edo North (%) | Edo Central (%) | Edo South (%) | Total (%) |
|----------------|---------------|-----------------|---------------|------------|
| Less than 3 km | 6 (6.7) | 40 (10.0) | 91 (12.0) | 137 (11.0) |
| 3-7 km | 22 (24.4) | 112 (28.0) | 228 (30.0) | 362 (29.0) |
| 8-12 km | 35 (38.9) | 144 (36.0) | 266 (35.0) | 445 (35.6) |
| 13-17 km | 18 (20.0) | 72 (18.0) | 121 (15.9) | 211 (16.9) |
| Above 17 km | 9 (10.0) | 32 (8.0) | 54 (7.1) | 95 (7.6) |
| Total | 90 (100) | 400 (100) | 760 (100) | 1250 (100) |

The results reveal significant accessibility challenges for agricultural markets. Only 11.0% of respondents were within 3 kilometers of a market, while the majority (35.6%) were located 8-12 kilometers away. Notably, 24.5% of respondents were more than 13 kilometers from the nearest market. These long distances, combined with poor road conditions and limited transport services, create significant barriers to marketing agricultural products, leading to post-harvest losses and reduced farmer incomes.

➤ *Access to Small-Scale Enterprises and Employment Opportunities*

Respondents were asked about their ability to access small-scale enterprises and employment opportunities in their localities. The results, presented in Table 9, show significant variations across senatorial districts.

Table 9 Access to Small-Scale Enterprises and Employment Opportunities

| Level of Access | Edo North (%) | Edo Central (%) | Edo South (%) | Total (%) |
|-----------------|---------------|-----------------|---------------|------------|
| Very good | 2 (2.2) | 16 (4.0) | 38 (5.0) | 56 (4.5) |
| Good | 8 (8.9) | 48 (12.0) | 114 (15.0) | 170 (13.6) |
| Fair | 28 (31.1) | 136 (34.0) | 266 (35.0) | 430 (34.4) |
| Poor | 36 (40.0) | 144 (36.0) | 251 (33.0) | 431 (34.5) |
| Very poor | 16 (17.8) | 56 (14.0) | 91 (12.0) | 163 (13.0) |
| Total | 90 (100) | 400 (100) | 760 (100) | 1250 (100) |

The majority of respondents (47.5%) rated their access to small-scale enterprises and employment opportunities as poor or very poor, while only 18.1% rated it as good or very good. These findings reflect the limited economic opportunities available in rural areas, exacerbated by poor transportation infrastructure that restricts both the mobility of potential workers and the movement of goods and services necessary for business operations.

➤ *Hypothesis Testing: Relationship Between Transportation and Accessibility*

To test the hypothesis that there is no significant relationship between transportation means and accessibility to socio-economic opportunities, a chi-square test was conducted. The results are presented in Table 10.

Table 10 Chi-Square Test Results for Transportation and Accessibility to Socio-Economic Opportunities

| Variable | Chi-Square Value | Degrees of Freedom | P-Value | Significance |
|--------------------------------------|------------------|--------------------|---------|--------------|
| Transportation and Healthcare Access | 48.235 | 16 | 0.000 | Significant |
| Transportation and Education Access | 42.517 | 12 | 0.000 | Significant |
| Transportation and Market Access | 56.842 | 16 | 0.000 | Significant |
| Transportation and Enterprise Access | 39.764 | 12 | 0.000 | Significant |
| Overall Composite | 52.618 | 20 | < 0.001 | Significant |

The chi-square test yielded a composite value of 52.618 with 20 degrees of freedom and a p-value of less than 0.001, indicating that transportation means have a statistically significant relationship with accessibility to socio-economic opportunities in rural Edo State. Individual tests for specific dimensions of accessibility (healthcare, education, markets, and enterprises) all showed statistical significance ($p < 0.001$). Based on these results, the null hypothesis is rejected, and the alternative hypothesis is accepted: there is a significant relationship between transportation means and accessibility to socio-economic opportunities in Edo State.

IV. DISCUSSION

The findings of this study provide robust evidence that transportation infrastructure significantly influences accessibility to socio-economic opportunities in rural Edo State. The overwhelming majority of respondents (85.9%) affirming that poor transportation causes unavailability of goods and services underscores the critical role of transport infrastructure in rural development. This finding aligns closely with Lebo and Schelling (2001) who documented that inadequate transportation infrastructure creates a fundamental barrier to rural development by restricting access to markets, services, and economic opportunities. The dominance of motorcycles as the primary mode of transport (68.5%) reflects both the poor condition of rural roads and the limited availability of conventional motorized transport services. As Ipingbemi and Adebayo (2016) noted in their study of tricycles in Ibadan, commercial motorcycles have emerged as dominant in rural Nigeria because they can navigate poor road surfaces and provide flexible services. However, Riverson and Carapetis (1991) found that motorcycle taxis charge significantly higher fares per kilometer than buses, making them unaffordable for many rural residents. The high reliance on bicycles (61.4%) and walking (51.7%) confirms Donnges et al.'s (2007) finding that in Sub-Saharan Africa, the majority of rural trips are undertaken through non-motorized means due to poverty and infrastructure deficits.

The accessibility challenges documented for healthcare services are particularly concerning from a public health perspective. With only 13.0% of respondents living within 2 kilometers of a healthcare facility and 24.1% located more than 10 kilometers away, these distances represent serious barriers to timely healthcare access. These findings resonate with Gbadmosi and Olorunfemi (2016) who documented that inadequate transport infrastructure contributes to elevated maternal mortality rates because patients cannot reach facilities in time. Long distance emerged as the most significant accessibility challenge (MIV = 4.22), validating White and Senior's (1983) proposition that distance acts as

fundamental friction to spatial interaction, amplified where infrastructure is poor. The finding that rickety vehicles ranked second (MIV = 3.9) highlights that poor vehicle quality creates additional barriers, as documented by Ogungbemi et al. (2014) who noted that poorly maintained vehicles increase accident risks and keep transport costs high.

The market accessibility data revealing that only 11.0% of respondents were within 3 kilometers of a market, with 24.5% located more than 13 kilometers away, illuminate critical constraints on agricultural productivity. These findings support Olorunfemi's (2018) analysis documenting that inadequate transport accessibility undermines agricultural productivity through multiple mechanisms: long distances increase transport costs, reducing farmers' net income; long travel times increase post-harvest losses; and poor accessibility restricts market information access. The Food and Agriculture Organization (2024) estimates that post-harvest losses account for 13.8% of global food production, with figures significantly higher in developing countries due to inadequate transportation infrastructure. The limited access to small-scale enterprises and employment opportunities (47.5% rating access as poor or very poor) reflects broader economic stagnation in poorly connected areas, as documented by Escobal and Ponce (2002) who found that improved road connectivity is associated with significant increases in non-farm employment.

The statistically significant relationship between transportation means and accessibility confirmed by the chi-square test ($\chi^2 = 52.618, p < 0.001$) provides robust empirical support for Wilson's (1966) theoretical proposition that transportation infrastructure is a fundamental determinant of rural development outcomes. This validates Transport Theory's emphasis that transport improvements generate multiplier effects by reducing distance friction, expanding market reach, and enabling spatial diffusion of innovations. As Titilola and James (2018) emphasized, inadequate rural accessibility creates spatial inequality that perpetuates poverty and undermines national development efforts. The policy implications are profound: the severe accessibility deficits documented require comprehensive strategies beyond road construction to include transport service development, facility location planning, and integration with broader rural development initiatives, as emphasized by the European Union and World Bank (2023) in their policy frameworks for rural transport.

V. CONCLUSION

This paper investigated how the means of transport affect the access to socio-economic opportunities in rural Edo State, Nigeria. The results are a strong indication that transport infrastructure plays a pivotal role, as far as the access to basic needs such as healthcare, education, markets, and jobs by rural inhabitants are concerned. The research reported that there are serious difficulties over accessibility especially long routes to medical services and farm markets, which limit economic performance and endanger the well-being of people. The prevalence of motorcycles, bicycles, and walking as a form of transport indicates a lack of infrastructure as well as economic limitation that compel rural dwellers to use expensive or time consuming means of movement.

The chi-square test accepted the statistically significant association between transportation modes and access to socio-economic opportunities ($\chi^2 = 52.618$, $p < 0.001$), therefore, dismissing the null hypothesis. The major challenge of accessibility was long distance (MIV = 4.22) that was further aggravated by low quality transport services and increased cost. Such inaccessibility continues to make rural poverty because they act as barriers to agricultural production, access to medical care and education, and economic diversification.

The paper concludes by stating that the accessibility of the rural areas needs to be enhanced through holistic approaches both in lack of physical infrastructure and services. The construction and rehabilitation of feeder roads should be accompanied with policies to encourage low-cost transport services, facilitate intermediate transport methods and to tie transport planning with facility location choices so that better infrastructure would be transferred to real gains in the access to services and in economic activities by rural communities.

RECOMMENDATIONS

➤ Focus on Feeder Road Construction and Rehabilitation:

Government should focus on investing in feeder roads which link suburban areas to major highways, healthcare centers, schools and markets. The communities that are over 10 kilometers away should be targeted as far as their access to important services is concerned.

➤ Initiate Rural Transport Service Development Programs:

In addition to the infrastructure development, the government and development partners ought to finance initiatives that encourage the transport operators to offer affordable services in rural areas with a low population density via subsidies, tax benefits and microfinance.

Encourage Intermediate Means of Transport: Increase access to affordable intermediate transport (motorcycles, bicycles, tricycles) by financing it subsidiarily, training to be operators, and modifying infrastructure to make it motorcycle friendly (motorcycle lanes) and bicycle friendly (bicycle paths).

➤ Combine Transport Planning and Service Delivery:

Planning of healthcare, education, and agricultural extensions must directly address the accessibility of transport with special attention paid to the location of facilities where the target population will have the shortest average travel distances.

➤ Introduce Rural Mobility Hubs:

Design multi-modal transport centres at key points where various transport modes can interface with each other making transfers and enhancing the overall connectivity between the remote villages and district centres.

➤ Enforce Road Maintenance Systems:

It should enforce the use of sustainable road maintenance systems to ensure roads being rehabilitated are not deteriorated before the expected duration through the involvement of the community, local government financing, and private sectors.

➤ Carry out Frequent Accessibility Evaluations:

Government should be able to carry out an evaluation of rural accessibility periodically, through the use of spatial analysis tools to determine areas that are underserved and monitor the progress in relation to gaining access to basic services.

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