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Road Infrastructure and Socio-Economic Development in Akwa Ibom State, Nigeria

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Authors' Contributions

This work was carried out in collaboration among all authors.
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Research Article

ABSTRACT

Despite significant investments by the Akwa Ibom State government in road infrastructure, the state continues to face developmental challenges. Poor road conditions have hampered economic activities, access to education, healthcare service delivery, and limiting the state's potential for comprehensive socioeconomic growth. This study assessed the nexus between road infrastructure and socio-economic development in Akwa Ibom State using a survey research design. Data were collected through questionnaires using stratified random sample from Akwa Ibom State's population of 7.2 million. The study established significant positive association between road infrastructure and agricultural, access to education, and access to healthcare delivery services. Thus the good road infrastructure in the state supports the increased agricultural productivity, gave good access to educational facilities, and aided access to health care delivery services within the state. The study recommended that Akwa Ibom state government should prioritize road investments to boost market access and reduce transportation costs for farmers. Also, roads to schools should be rehabilitated to improve attendance and learning outcomes' and rural roads should be upgraded to enhance healthcare access. Addressing these problems will significantly improve Akwa Ibom's socioeconomic development.

Keywords: Agricultural productivity, road infrastructure, socioeconomic development,

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INTRODUCTION

In Nigeria, road infrastructure is a vital component of national development, comprising transportation, communication, utilities, and more. However, the country's road network is plagued by poor maintenance, low finance, and faulty construction, leading to severe deterioration. According to Kessides (1993), road infrastructures are crucial for connecting diverse sectors of the economy and boosting the quality of life. However, in Nigeria, the road network is plagued by poor maintenance, low finance, and faulty construction, leading to severe deterioration (Onolememen, 2012). This leads to higher transportation costs, increased traffic accidents, and impeded economic operations. Good road infrastructure considerably benefits the economy by decreasing transportation costs, promoting corporate efficiency, and expanding access to markets (Ogunsanya, 2022). It also increases educational outcomes by ensuring that kids and staff can travel securely to schools, which positively impacts attendance and academic achievement. Similarly, good roadways enable rapid access to medical facilities, which is crucial for both emergency responses and normal healthcare delivery (Egunjobi, 2004). Conversely, bad road conditions enhance vehicle operating costs and travel times; leading to higher consumer prices and diminished corporate competitiveness. Poor road infrastructure also adds to road traffic accidents, resulting loss of lives and additional pressures on the healthcare system. In remote locations, these shortcomings can increase poverty by limiting access to important services (Akinyemi, 2013).

Nigeria's road infrastructure is characterized by severe defects, with many roads in poor condition due to inadequate

design and funding (Onolememen, 2012). In Akwa Ibom State, these difficulties are visible, with roads deteriorating rapidly due to the absence of a coordinated maintenance strategy. This condition limits economic operations and access to social services, impacting the general quality of life in the state. The impact of good road infrastructure on socioeconomic development is profound, as it facilitates efficient movement, boosts productivity, attracts investments, creates jobs, reduces poverty, and promotes social inclusion by improving access to education and healthcare, reducing disparities between urban and rural areas (Aderamo & Magaji, 2010). Several causes contribute to the poor state of Nigeria's road infrastructure, including inadequate financing, corruption, bad maintenance culture, and technical errors in construction. Inadequate funding leads to delayed or abandoned road construction, while corruption results in inadequate work and inflated expenses. The lack of regular maintenance further accelerates road deterioration, and technical inadequacies in construction procedures result in roads that are not durable (Odeleye, 2000). To address these difficulties, the Nigerian government has enacted policy reforms, boosted budget allocations, and promoted public-private partnerships targeted at improving road infrastructure. Public-private partnerships have been essential in bridging financial gaps and using private sector knowledge to improve road construction and maintenance.

The deteriorating road infrastructure in Akwa Ibom State has become a significant barrier to the region's socioeconomic development. Poor road conditions have consistently hindered the efficient movement of goods and people, leading to higher transportation costs, frequent delays, and reduced productivity. These challenges have disproportionately affected businesses, particularly small and

medium-sized enterprises, by driving up operational costs and limiting access to markets. In addition to economic consequences, inadequate road infrastructure has severely affected education and healthcare. In rural areas, students and teachers face hazardous and lengthy commutes to schools, leading to lower attendance rates, chronic punctuality issues, and declining academic performance. This has widened the educational gap between urban and rural communities, exacerbating disparities in resources and outcomes. Despite the recognition of the critical role road infrastructure plays in economic development, the specific impact on the socioeconomic development of Akwa Ibom State has been inadequately addressed. This situation underscores the urgent need for targeted policy interventions to improve road infrastructure and enhance the overall development of the region.

The specific objectives of this study were to examine the influence of road infrastructure on agricultural productivity in Akwa Ibom State; ascertain the relationship between road infrastructure and access to education in Akwa Ibom State; and determine the influence of road infrastructure on healthcare service delivery in Akwa Ibom State.

CONCEPTUAL CLARIFICATION

The history of road infrastructure may be traced back to ancient civilizations, where roadways were initially created for military and trade objectives. The Roman Empire is notably renowned for its large network of highways, which allowed for the efficient movement of troops and supplies across its territory. Roman roads were recognised for their durability, frequently containing many layers of materials like gravel and stones to provide stability and lifespan (Chevallier, 1976). The Industrial

Revolution in the 18th and 19th centuries heralded a transformative phase for road infrastructure development, with the construction of turnpike roads, funded through tolls, becoming widespread in Britain and other parts of Europe. The highways, constructed to superior standards, diminished trip durations and transportation expenses, considerably enhancing economic efficiency. The National Road, constructed in the early 19th century in the United States, was among the initial extensive government-funded road initiatives, promoting westward expansion and economic development by offering a dependable passage across the Appalachian Mountains (Searight, 1894). The 20th century saw significant improvements in road infrastructure, propelled by the emergence of the vehicle and urbanisation.

The necessity for improved roads to support motor vehicles prompted numerous governments to initiate extensive road construction initiatives (Pawson, 1977). The U.S. Interstate Highway System, established in the 1950s under President Dwight D. Eisenhower, is a significant achievement of this period. Similarly, Germany's autobahn network created new norms in road construction, emphasizing high-speed capabilities and engineering quality. The expansion of road networks extended beyond industrialised nations; numerous developing countries, particularly in Africa, Asia, and Latin America, commenced investments in road infrastructure as a component of their development goals (Blanton, 1936).

In emerging nations, road infrastructure has been essential to national growth, especially in post-colonial countries. For instance, Nigeria's focus on extending its road network since independence in 1960 has been vital for boosting connectivity and stimulating economic growth. Significant initiatives, such as the Lagos-Ibadan Motorway

and the East-West Road, enhanced connectivity to major centres and industrial areas. However, the viability of Nigeria's road infrastructure has often been undermined by inadequate maintenance, corruption, and insufficient funding (Onolememen, 2012).

The 21st century has introduced novel difficulties and prospects in road infrastructure development. Rapid urbanization and technology improvements have transformed how countries handle road building and maintenance. One notable trend is the incorporation of smart technology, such as Intelligent Transportation Systems (ITS), which integrates digital technologies to optimise traffic flow, road safety, and efficiency (Ghosh & Lee, 2000). Another major breakthrough is the use of sustainable materials in road construction. Eco-friendly solutions, such as recycled asphalt and permeable pavements, mitigate the environmental impact of road infrastructure while improving durability and resilience (Hansen, 2009). Public-private partnerships (PPPs) are essential for financing road infrastructure projects, bridging funding deficits and accelerating the implementation of crucial road networks (Federal Ministry of Works, 2013).

Socioeconomic Development

Socioeconomic development refers to the process of improving the economic, social, and environmental well-being of individuals and communities. It aims to enhance living standards, reduce poverty, and achieve sustainable progress across multiple dimensions (United Nations, 2020). According to Todaro and Smith (2015) Socioeconomic development drives growth by increasing productivity, fostering innovation, and attracting investments, generating employment, raising incomes, and reducing poverty. Sustainable socioeconomic initiatives mitigate

ecological degradation and promote conservation efforts, while politically, it strengthens governance and stability by reducing social tensions and promoting equitable policies (Sen, 1999). On a global scale, nations engaging in socioeconomic development contribute to international stability by participating in trade, sharing knowledge, and working toward collective goals such as the Sustainable Development Goals (World Bank, 2020).

Socioeconomic development is a critical aspect of economic growth, but it also faces numerous challenges. These include persistent economic inequalities, marginalized groups, youth unemployment, underemployment, environmental degradation, social exclusion, weak governance structures, infrastructure deficits, and global economic uncertainties. To address these issues, it is essential to build resilience through diversified economies and adaptive strategies (UNESCO, 2020; WHO, 2020).

Measuring socioeconomic development requires a range of indicators that capture economic, social, and environmental progress. Economic measures such as GDP and per capita income provide insights into a nation's prosperity and growth trajectory. Educational outcomes are assessed through metrics like literacy rates, school enrollment ratios, and levels of educational attainment. Healthcare accessibility is measured through indicators such as life expectancy, immunization rates, and maternal mortality (UNEP, 2020). Environmental sustainability is evaluated through indicators like carbon emissions, access to clean water, and biodiversity conservation (World Bank, 2020). Social inclusion and equity are captured by measures of gender equality, access to basic services, and participation in decision-making. Governance and institutional quality are assessed through indicators of

transparency, accountability, and the rule of law (UNDP, 2020).

Agricultural Productivity

Agricultural productivity plays a crucial role in socioeconomic progress, contributing significantly to food security, economic growth, job creation, and poverty reduction. It involves improving agricultural practices, technologies, and structures to enhance productivity, sustainability, and profitability. For countries like Nigeria, where agriculture forms the backbone of the economy, agricultural productivity is essential for economic diversification (FAO, 2020). This includes activities such as crop cultivation, animal husbandry, and the commercialization of agricultural products, all of which support rural livelihoods and drive national economic growth (World Bank, 2021).

Livestock farming, or livestock farming, is a vital component of agricultural productivity. In Nigeria, staple crops like maize, cassava, rice, and yam are essential for sustenance and form the backbone of local diets (Nwafor et al., 2021). Cash crops like cocoa, oil palm, and rubber contribute to foreign exchange earnings, supporting economic growth. The commerce of agricultural products bridges the gap between production and consumption, facilitating the distribution of goods (Akinola & Adeniran, 2020).

However, agricultural productivity faces significant challenges: limited access to modern farming technologies, poor infrastructure, and inadequate financing hinder productivity and growth. Many livestock farmers still rely on traditional methods, which limit productivity and increase vulnerability to diseases. Similarly, crop farmers often lack access to improved seeds, fertilizers, and irrigation systems, leading to low yields and food insecurity. The commercialization of agricultural

products is also constrained by poor road networks, inadequate storage, and weak market linkages, resulting in post-harvest losses and reduced profitability (Adesina & Salau, 2021).

Agricultural productivity is crucial for overcoming these challenges. Integrated farming systems, combining crop and livestock production, enhance resource efficiency and reduce waste. Promoting organic farming and agro-forestry can conserve soil fertility, protect biodiversity, and mitigate climate change impacts. Supporting smallholder farmers through cooperative farming, microcredit, and capacity-building programs is vital for achieving sustainability and inclusivity (Eze et al., 2020).

Government policies, such as Nigeria's Agricultural Transformation Agenda (ATA) and the Anchor Borrowers' Program (ABP), have been pivotal in addressing these challenges. The ATA focuses on increasing the production of staple crops, reducing post-harvest losses, and promoting agro-industrial development, while the ABP provides credit facilities to buy inputs and expand operations. With continued government support, private sector involvement, and international partnerships, these initiatives have the potential to significantly enhance agricultural productivity in Nigeria (Nwafor et al., 2021).

Access to Education

Access to education is a critical aspect of individual and societal development, with implications for economic progress, innovation, and social mobility, especially in developing countries like Nigeria. However, various challenges limit equitable access to advanced education, hindering its potential to drive socioeconomic progress (Okebukola, 2021).

Inadequate infrastructure is a major challenge in Nigeria, with many public universities and colleges facing shortages of lecture halls, libraries, laboratories, and accommodation facilities. This leads to overcrowded classrooms and outdated facilities, compromising the quality of education. Substantial investments in physical and digital infrastructure are needed to address these limitations and improve access to education (Oyetunji & Uche, 2022).

Financial barriers also pose significant obstacles, making education unaffordable for many low-income families. Expanding scholarship programs and developing sustainable funding mechanisms would alleviate the financial burden on students and their families, improving access to advanced education. Geographical disparities further exacerbate inequalities in access to education, with urban areas generally having better access to educational resources and opportunities, while rural regions lack adequate primary and secondary education to prepare students for higher learning (Adamu, 2023).

Geographical disparities further exacerbate inequalities in access to education. Urban areas generally have better access to educational resources and opportunities, while rural regions lack adequate primary and secondary education to prepare students for higher learning. This urban-rural divide limits opportunities for rural students, restricting their ability to pursue advanced education. Establishing more institutions in underserved areas and offering preparatory programs could help bridge this gap and promote inclusivity (Afolabi et al., 2023).

Limited capacity of institutions creates a bottleneck in access to higher education, with the number of qualified candidates often exceeding available spaces, leading to brain drain and many students

seeking education abroad. Promoting gender-sensitive policies, offering scholarships for female students, and raising awareness about the importance of educating women are essential steps to addressing this disparity (Okebukola, 2021).

Frequent disruptions to the academic calendar, such as strikes by academic staff unions and political instability, also impede access to education in Nigeria. Ensuring stability in the academic calendar through collaborative efforts between governments and educational stakeholders is crucial for improving access and outcomes. To enhance access to education, governments and stakeholders must prioritize policies that address these challenges. Expanding financial aid programs, leveraging technology to promote online and distance learning, and curriculum reforms and ongoing professional development for educators will ensure that the education system meets the needs of modern society (Oyetunji & Uche, 2022).

Health Care Service Delivery

Healthcare accessibility refers to the ability of individuals and communities to obtain healthcare services that meet their needs without being hindered by financial challenges, geographical barriers, or inadequate healthcare resources. In many sub-Saharan African countries, including Nigeria, inadequate healthcare infrastructure presents a significant challenge. Healthcare services are predominantly concentrated in urban areas, leaving rural and remote communities underserved. Expanding healthcare infrastructure to rural and underserved areas is critical to improving access and equity (WHO, 2020).

Financial barriers significantly impact healthcare accessibility, with financing predominantly out-of-pocket, making it unaffordable for many low-income households. The urgent need for

universal health coverage (UHC) systems to provide financial protection and ensure access to essential healthcare services without undue hardship is essential for reducing reliance on out-of-pocket payments and increasing equitable healthcare access. This financial strain is worsened by limited health insurance coverage in the country (Bloom et al., 2018).

The shortage of healthcare professionals further exacerbates challenges in accessing quality healthcare, especially in developing countries. Strengthening the healthcare workforce through enhanced training, competitive compensation, and supportive working environments is essential to addressing this challenge. Oladipo (2021) highlighted that retaining healthcare professionals within Nigeria is a key step toward achieving a robust and accessible healthcare system. Healthcare accessibility in Nigeria is influenced by various cultural and social factors, including traditional beliefs, stigma, and discrimination. Public awareness campaigns and community engagement are crucial in addressing these barriers, as they educate communities about the importance of healthcare, dispel myths surrounding modern medicine, and reduce stigma associated with specific health conditions.

Cultural and social factors also influence healthcare accessibility. In many Nigerian communities, cultural beliefs and practices affect healthcare-seeking behaviors. Some individuals prefer traditional medicine over modern healthcare services, believing it to be more effective or culturally appropriate. Furthermore, stigma and discrimination associated with certain health conditions, such as HIV/AIDS or mental illnesses, deter individuals from seeking care. Adeloje et al. (2022) pointed out that public awareness campaigns and community engagement are crucial in addressing these cultural barriers. Such

initiatives can educate communities about the importance of healthcare, dispel myths surrounding modern medicine, and reduce stigma associated with specific health conditions.

Policy reforms and targeted interventions play a critical role in improving healthcare accessibility. Governments have increasingly recognized the need for robust strategies to expand healthcare financing and improve service delivery. Strengthening the National Health Insurance Scheme (NHIS) and other healthcare financing models can improve access to healthcare, especially for underserved populations. Additionally, increasing investments in healthcare systems and infrastructure is crucial for achieving equitable distribution of resources and services (WHO, 2020).

Technological advancements offer immense potential to overcome barriers to healthcare accessibility. Telemedicine enables patients in remote areas to consult healthcare providers without the need to travel long distances, while mobile health applications and digital platforms can provide health education, facilitate appointment scheduling, and support disease management. The integration of digital solutions into Nigeria's healthcare system could revolutionize access, especially in rural areas where physical healthcare facilities are sparse (Bloom et al., 2018)

Partnerships between the public and private sectors, as well as collaboration with civil society organizations, are essential for achieving sustainable improvements in healthcare accessibility. These partnerships mobilize resources, drive innovation, and strengthen healthcare delivery systems. Integrated health systems that combine public and private sector efforts are more efficient and can reach underserved populations effectively (WHO, 2020).

THEORETICAL FRAMEWORK

Infrastructure-led Growth Theory

The infrastructure-led growth theory, advanced by scholars such as Aschauer (1989) and Calderón and Servén (2004), underscores the essential role that infrastructure investments, particularly in transportation, play in driving economic growth and development. The theory is centered on the idea that improving infrastructure—such as road networks—can enhance productivity, reduce transaction costs, and foster economic activity across various sectors. Aschauer (1989) highlighted how government investment in infrastructure, especially public capital, has a direct impact on national economic performance. He argued that infrastructure improvement leads to increased productivity by reducing operational costs and improving market access for businesses. Calderón and Servén (2004) extended this view, asserting that investments in infrastructure promote economic growth by facilitating trade, improving connectivity, and creating a more efficient economic environment. According to them, infrastructure reduces logistical constraints and boosts the movement of goods, services, and people, fostering regional and international economic integration.

The relevance of the Infrastructure-led Growth Theory to the study of road infrastructure and socio-economic development in Akwa Ibom State, Nigeria, is evident. Akwa Ibom, like many developing regions, faces significant challenges in infrastructure development, particularly in the area of road transportation. Improving road infrastructure in the state is expected to lower transportation costs, improve market access, and enhance overall economic efficiency, all of which are central tenets of the Infrastructure-led Growth Theory. For

example, better road networks will enable local businesses to reduce logistical costs, facilitating easier access to both local and international markets. This could be particularly beneficial for industries such as agriculture and manufacturing, which are heavily dependent on efficient transportation. Improved connectivity between urban and rural areas can also foster more inclusive development by enhancing access to essential services such as healthcare and education, promoting a higher quality of life, and reducing poverty.

EMPIRICAL REVIEW

Abiodun (2016) explored the impact of road infrastructure on economic development in Nigeria. The study focused on the relationship between road infrastructure, economic activities, employment, and regional development. Using a mixed-methods approach, it combined surveys and interviews with stakeholders. The study found that better road infrastructure boosted trade, reduced transportation costs, and increased market accessibility, leading to higher employment and economic growth. The study recommended increased investment in road infrastructure and maintenance, with community involvement in planning to address regional disparities.

Adebayo and Alabi (2022) examined the impact of road infrastructure on socioeconomic development in Lagos State. The study focused on employment generation, poverty reduction, and agricultural productivity. It used a mixed-methods approach, combining quantitative surveys with qualitative interviews. The findings showed that improved road infrastructure positively impacted employment, reduced poverty, and supported the growth of SMEs. The study recommended continuous investment in infrastructure, inclusive urban planning, and

policies to support SMEs and entrepreneurship.

Aderamo and Magaji (2021) assessed the impact of road infrastructure on economic development in rural Nigeria. They focused on agricultural production and local trade. Using a mixed-methods approach, including surveys and interviews, they found that improved roads reduced transportation costs, facilitated market access, and attracted investment. Rural areas with better road networks saw higher incomes and improved living standards. The study recommended prioritizing rural road infrastructure, enhancing maintenance, and fostering public-private partnerships for sustainability.

Ibem and Amole (2023) explored the impact of road infrastructure on poverty alleviation in Ondo State, Nigeria. The study focused on the social and economic impacts of road infrastructure on rural communities. Using a mixed-methods approach, they found that improved roads contributed to increased agricultural productivity, reduced transportation costs, and enhanced access to social services. The study recommended sustained investment in infrastructure, along with targeted poverty alleviation programs to improve socioeconomic outcomes and reduce poverty levels.

Musonda and Chansa (2021) studied the impact of road infrastructure on health outcomes in Zambia. They focused on how road quality affects healthcare access and the distribution of medical supplies. Using a combination of surveys, GIS tools, and focus group discussions, the study found that better roads improved healthcare access, reduced emergency response times, and ensured timely medical supply delivery. The study recommended prioritizing road improvements in areas with limited healthcare access and integrating road infrastructure planning with health sector strategies.

Ogun (2010) examined the link between road infrastructure and poverty reduction in Nigerian urban areas, focusing on improved access to jobs, healthcare, and education. Using infrastructure-led growth and transportation cost theories, the mixed-methods study combined surveys, interviews, and econometric analysis. Findings showed that better roads reduced transportation costs and time, increasing income levels and lowering poverty rates. The study emphasized upgrading road networks to sustain these benefits and recommended prioritizing infrastructure investments, fostering public-private partnerships, and involving communities in planning for sustainable urban development.

Ogunsanya (2022) assessed the economic effects of road infrastructure on Nigerian businesses, focusing on trade and logistics. Through surveys in cities like Lagos and Abuja, findings showed reduced transportation costs, faster deliveries, and increased profitability for businesses with improved road access. Enhanced connectivity also attracted foreign investments and stimulated local economies. Recommendations included sustained road development, public-private partnerships for maintenance, and streamlined transportation policies to maximize benefits for urban businesses and economic growth.

Olaseni and Alade (2022) explored challenges to achieving Vision 20:2020's infrastructure goals in Nigeria. Using a qualitative approach, the study highlighted inadequate funding, corruption, poor governance, and weak institutional frameworks as barriers to development. Recommendations included alternative financing like public-private partnerships, improved governance, stronger institutions, and better stakeholder collaboration. The study stressed aligning policy implementation with development

objectives to overcome challenges and drive Nigeria's infrastructural growth.

Olufemi (2020) investigated road infrastructure's impact on urban development in Ibadan, Nigeria, focusing on land use, property values, and economic activities. Using spatial analysis and qualitative data, findings revealed that better roads enhanced connectivity, increased property values, and spurred local agricultural productivity. Recommendations included sustained infrastructure investment, equitable urban planning to manage growth, and policies to prevent congestion. The study emphasized balancing development with governance for inclusive urban progress.

METHODOLOGY

Research Design

Survey research design, a quantitative method involving questionnaires or interviews, efficiently gathers data from a representative sample (Creswell, 2014). This study adopted this design to explore the impact of road infrastructure on socio-economic development in Akwa Ibom State, Nigeria.

Population of the study

The population of the study refers to the entire group of individuals or entities that a researcher is interested in examining (Creswell, 2014). In this study, the population consists of the estimated 7.2 million residents of Akwa Ibom State, Nigeria, as projected by the National

Population Commission in 2022 (National Population Commission, 2022).

Sample Size Determination

The sample size of the study is the proportion of individuals drawn from the population in order to examine the relationship between road infrastructure and socioeconomic development in Akwa Ibom State. The sample size for the study was determined at 5% level of significance using Taro Yameni's Formula.

DATA PRESENTATION / ANALYSES

This section presents the demographic characteristics of respondents and the questionnaire responses aimed at achieving the study objectives. Out of the 400 copies of questionnaire administered, 343 were usable, while 57 were either not returned or incorrectly filled, representing a response rate of 85.75%. The high response rate provided reliable data to analyze the impact of road infrastructure on the socioeconomic development of Akwa Ibom State. The demographic characteristics covered aspects such as age, gender, educational background, and occupation to ensure that the sample represented a cross-section of the population affected by road infrastructure issues. This was followed by responses to questions directly related to the study's specific objectives, including how road infrastructure influences agricultural productivity, educational access, and healthcare service delivery in Akwa Ibom State.

Descriptive Statistics

Table 1:

Influence of road infrastructure on agricultural productivity in Akwa Ibom state

Statement	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	Standard Deviation
Road infrastructure has aided farmers' ability to access markets in Akwa Ibom State.	127	91	65	60	2.68	1.13
Good road infrastructure reduces the cost and simplifies the transportation of agricultural products in Akwa Ibom.	119	97	68	59	2.65	1.11
Efficient roads enable timely market access, ensuring that farm products reach their destination without delays.	125	89	68	61	2.67	1.12
Improved road conditions enhance agricultural productivity by facilitating access to farming inputs and technology.	123	93	69	58	2.67	1.13
Farmers in Akwa Ibom can easily obtain modern farming tools thanks to adequate road networks.	121	95	66	61	2.66	1.12
Better road access minimizes food waste by enabling the swift transport of produce immediately after harvest.	118	98	67	60	2.64	1.10

Source: Author (2024)

Table 1 analyzes the impact of road infrastructure on agricultural productivity in Akwa Ibom State, focusing on mean and standard deviation values. The mean values range between 2.64 and 2.68, indicating a general agreement among respondents about the positive impact of road infrastructure on various aspects of agricultural productivity. The small range suggests a consistent perception across different dimensions examined. The highest mean value of 2.68

indicates a stronger agreement on the importance of road infrastructure in improving market access. The standard deviation values range between 1.10 and 1.13, indicating moderate variability in responses, possibly reflecting personal experiences or geographic location. The lowest standard deviation (1.10) indicates the closest consensus, while the highest value (1.13) suggests slightly more diverse perspectives.

Tale 2:

Relationship between road infrastructure and standard of education

Question	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	Standard Deviation
Good roads make it easier for students to commute to school in Akwa Ibom	155	123	43	22	3.67	0.71
Road infrastructure impacts the quality of education by improving school attendance in Akwa Ibom	162	131	30	20	3.75	0.64
Improved road access leads to better educational resources in Akwa Ibom	140	149	37	17	3.62	0.75
Roads facilitate quicker and easier access to higher education institutions in Akwa Ibom	149	133	34	27	3.67	0.72
Good road infrastructure encourages students from enrolling in schools in Akwa Ibom	168	124	29	22	3.74	0.68
Road infrastructure plays a role in reducing drop-out rates in schools in Akwa Ibom	158	129	36	20	3.70	0.70

Source: Author (2024)

The study reveals a strong consensus on the significant impact of road infrastructure on various aspects of education in Akwa Ibom State, particularly in terms of accessibility, attendance, resource availability, and student retention (as captured in Table 2). The majority of respondents agreed that poor road conditions affect students' ability to reach schools, particularly in rural areas. Improved roads directly contribute to better school attendance, with a mean score of 3.75, indicating a high level of agreement. The

importance of road access in ensuring the availability of educational resources was also highlighted, with a mean score of 3.62, suggesting that other factors might also affect resource availability. Participants also agreed that road infrastructure plays a vital role in reducing student drop-out rates and facilitating access to higher education institutions, with mean values of 3.70 and 3.67, respectively, highlighting the critical role of roads in fostering academic continuity and educational opportunities.

Tale 3:

Influence of road infrastructure on healthcare service delivery

Question	Strongly Agree	Agree	Disagree	Strongly Disagree	Mean	Standard Deviation
Better road access allows faster response times for ambulances in Akwa Ibom	133	122	54	34	3.57	0.93
Improved roads reduce the time it takes for patients to reach healthcare facilities in Akwa Ibom	141	127	49	26	3.63	0.89
Road infrastructure plays a role in the accessibility of medical supplies in Akwa Ibom	138	121	57	27	3.57	0.91
Good road infrastructure reduces the risks of healthcare delays in Akwa Ibom	145	112	52	34	3.64	0.87
Roads facilitate access to a greater number of healthcare centers in Akwa Ibom	136	119	55	33	3.58	0.92
Good road infrastructure positively affects emergency healthcare services in Akwa Ibom	142	125	49	27	3.64	0.89

Source: Author (2024)

The data in table 3 reveals strong agreement on the importance of road infrastructure in improving healthcare delivery in Akwa Ibom. The mean score for faster ambulance response times was 3.57, indicating that road conditions directly affect emergency medical responses. The mean score for reducing the time it takes for patients to reach healthcare facilities was 3.63, indicating that better roads reduce travel times to healthcare centers, a critical factor for timely treatment. The mean score for the accessibility of medical supplies was

3.57, indicating that good roads facilitate timely deliveries of essential medical goods. However, the mean score for increasing healthcare delays was 3.64, indicating that inadequate roads contribute to service interruptions. The high mean scores of 3.58 and 3.64 for facilitating access to a greater number of healthcare centers and positively affecting emergency healthcare services further emphasize the significant role of roads in broadening access to medical facilities and emergency care.

Hypothetical Analysis

Testing Hypothesis One

H₀: There is no significant relationship between road infrastructure and agricultural productivity in Akwa Ibom State.

H_i: There is significant relationship between road infrastructure and agricultural productivity in Akwa Ibom State.

Table 4:
Correlation result of hypothesis one

		Agricultural Productivity	Road Infrastructure
Agricultural Productivity	Pearson Correlation	1	.615**
	Sig. (2-tailed)		.002
	N	343	343
Road Infrastructure	Pearson Correlation	.615**	1
	Sig. (2-tailed)	.002	
	N	343	343

*. Correlation is significant at the 0.01 level (2-tailed).

Source: Author (2024)

The correlation result in Table 4 indicates a positive relationship between road infrastructure and agricultural productivity in Akwa Ibom State, with a Pearson correlation coefficient of 0.615. Wahua and Fekadu (2025) support the use of correlation to measure association. This demonstrates that improved road infrastructure significantly enhances agricultural productivity in the region. Specifically, as the quality of road infrastructure improves, the efficiency and effectiveness of agricultural activities are greatly enhanced. The significance of this relationship ($p = 0.002$) confirms that good road conditions play a crucial role in boosting agricultural productivity in the state. Consequently, the null hypothesis (H_0), which posited no significant relationship, is rejected, and the alternative hypothesis (H_i) is supported. These findings affirm that road infrastructure positively and significantly impacts agricultural productivity in Akwa Ibom State, emphasizing its importance in ensuring effective transportation of agricultural products and access to farming inputs.

Testing Hypothesis Two

H₀= There is no significant relationship between road infrastructure and access to education in Akwa Ibom State.

H_i = There is significant relationship between road infrastructure and access to education in Akwa Ibom State.

Table 5:
Correlation result of hypothesis two

		Access to Education	Road Infrastructure
Access to Education	Pearson Correlation	1	.548*
	Sig. (2-tailed)		.041
	N	543*	343
Road Infrastructure	Pearson Correlation	.348	1
	Sig. (2-tailed)	.041	
	N	343	343

Source: Author (2024)

The correlation result in Table 5 reveals a significant relationship between road infrastructure and access to educational facilities in Akwa Ibom State, with a Pearson correlation coefficient of -0.548. This indicates that improved road infrastructure enhances access to educational facilities for both students and teachers. The significance of this relationship ($p = 0.041$) highlights the critical role that well-maintained roads play in facilitating easier access to educational institutions. Consequently, the null hypothesis (H_0), which posited no significant association, is rejected, and the alternative hypothesis (H_i) is supported. These findings affirm that road

infrastructure significantly influences the accessibility of educational facilities in Akwa Ibom State, underscoring its importance in ensuring seamless movement to and from schools.

Testing Hypothesis Three

H_0 : There is no significant relationship between road infrastructure and accessible health care delivery in Akwa Ibom State.

H_i : There is significant relationship between road infrastructure and accessible health care delivery in Akwa Ibom State.

Table 6:
Correlation result of hypothesis three

		Healthcare Services	Road Infrastructure
Healthcare Services	Pearson Correlation	1	.461**
	Sig. (2-tailed)		.034
	N	343	343
Road Infrastructure	Pearson Correlation	.461**	1
	Sig. (2-tailed)	.034	
	N	343	343

** . Correlation is significant at the 0.05 level (2-tailed).

Source: Author (2024)

The correlation result in Table 6 reveals a moderate relationship between road infrastructure and the accessibility and delivery of healthcare services in Akwa Ibom State, with a Pearson correlation coefficient of -0.461. This suggests that improved road infrastructure enhances access to healthcare services, facilitating better healthcare delivery. The correlation is significant at the 0.05 level, with a p-value of 0.034, indicating the importance of road quality in ensuring effective healthcare access. As a result, the null hypothesis (H_0), which stated no significant impact, is rejected, and the alternative hypothesis (H_i) is supported. This finding underscores that road infrastructure plays a vital role in

improving the accessibility and quality of healthcare services in Akwa Ibom State.

Discussion of Findings

The study done in Akwa Ibom State indicated a substantial positive link between road infrastructure and agricultural productivity and trade. The research suggests that enhanced road infrastructure positively influences corporate operations and trade efficiency, resulting to decreased operational costs, streamlined supply chains, and more efficient movement of goods and services. This has important consequences for Akwa Ibom State's economic development, as it decreases transportation costs, improves timely product delivery, and gives greater market access, leading to

business expansion and improved tax revenues for the government. This study's findings align with those of Folarin et al. (2021) and Nwachukwu and Ogechukwu (2022), who also found that road infrastructure in Nigeria supports local business growth, improves market accessibility, and facilitates efficient distribution of goods.

The second hypothesis suggested that road infrastructure lacks a substantial correlation with access to educational facilities in Akwa Ibom State. However, the study indicated a positive connection with a Pearson value of 0.548 ($p = 0.041$), demonstrating that enhanced road infrastructure greatly boosts access to educational facilities for both students and teachers. Enhanced road conditions facilitate commuting to educational institutions, resulting in elevated school attendance and enhanced academic performance. This has enormous ramifications for the educational system in Akwa Ibom, particularly for kids in remote regions, which results in fewer absenteeism and improved academic achievement. These findings support the work of Nwosu et al. (2019) and Amadi and Ogbodo (2020), who highlighted that good road networks improve school enrollment rates and enhance educational access, particularly in rural Nigerian communities.

The third hypothesis examined the influence of road infrastructure on the provision of healthcare services in Akwa Ibom State. The results showed a positive association of 0.461 ($p = 0.034$), showing that enhanced road infrastructure promotes access to healthcare services. Properly maintained highways enhance prompt emergency medical assistance, guarantee effective movement of medical supplies, and minimise travel time for patients pursuing healthcare services. Efficient road infrastructure is essential for guaranteeing prompt access to healthcare facilities,

especially during emergencies. These findings are consistent with those of Ajibade et al. (2020), who noted that inadequate road infrastructure in rural areas worsens health outcomes and limits access to healthcare.

Conclusion

The study reveals that road infrastructure is crucial for the socioeconomic development of Akwa Ibom State, influencing key sectors like business operations, education, and healthcare delivery. Maintaining well-maintained roads reduces transportation costs, ensures efficient supply chains, and expands market access, promoting economic growth. Good roads also improve access to schools, boost academic performance, and enable timely emergency responses and efficient delivery of medical supplies. These findings underscore the importance of road infrastructure in fostering sustainable development and improving quality of life in the state.

Recommendations

Based on the findings, the following recommendations were made:

- i. That the Akwa Ibom State government should continue to invest in improving road infrastructure to enhance access to agricultural markets and services, boosting agricultural productivity and supporting rural development.
- ii. That the Akwa Ibom State government should prioritize upgrading road networks leading to educational institutions, ensuring reliable transportation for students and teachers, thereby increasing access to education and improving academic outcomes.

- iii. That the Akwa Ibom State government should focus on maintaining and improving access roads to healthcare facilities, particularly in rural areas, to ensure timely medical care and strengthen overall healthcare delivery.

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