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Road Conditions and Transportation Costs: A Correlational Study in the North-Central Geo-Political Zone of Nigeria

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Abstract- ***Road conditions constitute a critical determinant of transportation efficiency, influencing travel time, vehicle operating costs, and overall economic performance. However, in many regions of Nigeria, particularly the North-Central Geo-Political Zone, deteriorating road infrastructure and increased road roughness continue to escalate transportation costs for agricultural produce, manufactured goods, and commuter travel. This study investigated the correlation between road conditions and transportation costs in the North-Central Geo-Political Zone of Nigeria. A descriptive research design was adopted, utilizing a structured questionnaire administered to 322 respondents comprising farmers, transport operators, traders, and commuters. Using purposive, snowballing and incidental sampling techniques, the responses from all 322 participants were analyzed through Pearson correlation analysis. Findings from the correlation results revealed a strong positive and statistically significant relationship between road roughness and market-related transportation cost factors (r = 0.672; p = 0.000). The study concluded that poor road conditions significantly increase transportation expenses, reduce market accessibility, and negatively affect economic activities across the region. It was therefore recommended that systematic road rehabilitation, increased government investment in transport infrastructure, and routine maintenance interventions be prioritized to reduce transportation costs and enhance the movement of goods and people.***

Keywords: Road conditions, Road roughness, Transportation costs, Market factors, Agricultural produce, Manufactured goods, Commuter travel, North-Central Nigeria

I. INTRODUCTION

Road conditions constitute one of the most fundamental determinants of transportation efficiency, economic productivity, and regional connectivity, influencing how people, goods, and services move across space (Rodrigue, 2020; Banister, 2018). In many developing economies, including Nigeria, the quality of road infrastructure directly shapes transportation costs, travel time, vehicle maintenance, and overall logistics performance (Adewunmi & Olawale, 2021). As transportation systems continue to evolve in response to population growth and rising commercial activities, the state of road networks has become a critical factor in determining competitiveness, access to markets, and socio-economic development (World Bank, 2022).

Well-maintained roads reduce vehicle operating costs, enhance mobility, and promote the efficient delivery of goods, which are essential for supporting trade and agricultural distribution (Ogunsanya & Enebong, 2019; African Development Bank, 2023). Conversely, poor road conditions characterized by potholes, erosion, narrow lanes, failed pavements, and inadequate drainage impede mobility and escalate transportation costs due to increased fuel consumption, frequent breakdowns, and longer travel times (Okonkwo & Eze, 2020). In regions highly dependent on road transportation, the impact of deteriorating road infrastructure extends beyond logistics, affecting livelihoods, business profitability, and regional integration (Ajayi & Fadare, 2022).

Given the reliance on road transport for more than 90% of Nigeria's passenger and freight movement, understanding the link between road conditions and transportation costs is central to improving mobility and economic performance (Federal Ministry of Transportation, 2023). Thus, the discourse on road

infrastructure quality is not merely a matter of engineering; it reflects broader concerns regarding accessibility, efficiency, safety, and sustainable development across urban and rural corridors (Akinyele & Bamidele, 2021).

II. STATEMENT OF THE PROBLEM

Despite the critical role of road infrastructure in supporting mobility and reducing logistical expenses, many Nigerian roads remain in a deplorable state, leading to significantly higher transportation costs for individuals, businesses, and transport operators (Okeke & Ibrahim, 2020; World Bank, 2022). Persistent road deterioration caused by insufficient maintenance, heavy axle loads, poor construction standards, and extreme weather conditions has intensified the economic burden associated with moving goods and passengers across the country (Adewunmi & Olawale, 2021). These challenges manifest in rising fuel consumption, frequent vehicle repairs, elevated freight charges, and unpredictable travel schedules, ultimately inflating the cost of transportation services (Ajayi & Fadare, 2022).

Furthermore, poor drainage systems and seasonal flooding exacerbate road failures, especially in rural and peri-urban areas where road infrastructure is often neglected (Ogunsanya & Enebong, 2019). Transport operators frequently increase fares to compensate for the accelerated wear and tear on their vehicles, creating a multiplier effect that raises prices of goods, limits access to markets, and reduces economic competitiveness (African Development Bank, 2023). These conditions disproportionately affect farmers, traders, and low-income households whose livelihoods depend on reliable and affordable transportation networks (Rodrigue, 2020).

Despite government interventions, the gap between road infrastructure demand and supply continues to widen due to population growth, limited funding, and inadequate policy implementation (Federal Ministry of Transportation, 2023). As such, the rising transportation costs associated with poor road conditions represent a major constraint to Nigeria's socio-economic development, requiring urgent and evidence-based analysis. This study, therefore, seeks to address these persistent challenges by examining how road conditions contribute to transportation costs and by identifying key factors that amplify these burdens within the Nigerian context.

III. LITERATURE REVIEW

Concept of Road Conditions

Road conditions represent the foundational physical and structural attributes of road infrastructure that determine the efficiency, reliability, and safety of vehicular movement within a transport system (Rodrigue, 2020). They encompass critical features such as pavement integrity, road surface uniformity, lane width, drainage adequacy, and the overall maintenance regime that supports uninterrupted mobility (Banister, 2018). The stability and usability of roads serve as decisive indicators of a functional transportation network, influencing travel speed, route accessibility, and network connectivity across both urban and rural regions (Ogunsanya & Enebong, 2019). Poor road conditions expressed through potholes, failed pavements, erosion, and inadequate signage create bottlenecks that undermine transport efficiency and heighten travel risks for road users (Adewunmi & Olawale, 2021).

In many developing countries, the deterioration of road infrastructure is accelerated by structural issues such as underfunded maintenance systems, extreme climate patterns, substandard construction materials, and heavy vehicular loads (African Development Bank, 2023). These underlying deficiencies weaken road resilience and shorten the lifespan of transport corridors that are essential for economic and social activities (Akinyele & Bamidele, 2021). As a result, road conditions have emerged as a central construct in transportation research because they significantly influence mobility outcomes, accessibility levels, and user satisfaction across socioeconomic segments (Ajayi & Fadare, 2022).

Concept of Transportation Costs

Transportation costs refer to the cumulative expenses incurred in the movement of goods, services, and passengers from one location to another within a spatial network (Rodrigue, 2020). These costs typically include fuel expenditure, vehicle

maintenance, tyre replacement, depreciation, labour charges, road tolls, and administrative overheads required for travel operations (Banister, 2018). As a dynamic economic variable, transportation costs critically affect the affordability, competitiveness, and operational sustainability of transport services in both freight and passenger segments (Ajayi & Fadare, 2022).

Rising transportation costs impose direct consequences on logistics systems by increasing delivery charges, extending travel times, and reducing the profitability of transport operators, especially in high-demand mobility corridors (Ogunsanya & Enebong, 2019). For freight transport, elevated transportation costs translate into higher commodity prices, reduced market access, and weakened distribution efficiency within supply chains (Okeke & Ibrahim, 2020). For commuters, increased costs manifest as higher transport fares, reduced travel frequency, and limited access to essential services such as education, healthcare, and employment opportunities (Akinyele & Bamidele, 2021). Thus, transportation costs represent an indispensable concept within transport economics because they directly influence national development, social mobility, and household welfare (African Development Bank, 2023).

IV. METHODOLOGY

The study adopted a descriptive research design to investigate Road Conditions and Transportation Costs: A Correlational Study in the North-Central Geo-Political Zone of Nigeria, using a structured questionnaire administered to 322 road users, including commercial drivers, logistics operators, transport union members, and commuters purposively selected for their direct exposure to roadway conditions and transport cost variations. A full sample of 322 respondents was obtained through purposive, snowballing, and incidental sampling techniques, where purposive sampling targeted key transport actors, snowballing accessed drivers with irregular schedules, and incidental sampling captured available commuters during fieldwork. Data were analyzed using descriptive statistics and the Pearson Product Moment Correlation (PPMC) to determine the strength and significance of the relationship between road conditions and transportation costs in the study area.

V. RESULT AND DISCUSSION

Interpretation of Table 4.1: Relationship between Road Conditions and Transportation Costs in the North-Central Geo-Political Zone of Nigeria

The correlation results presented in Table 4.1 provide empirical evidence on the relationship between road conditions and transportation costs within the selected study area. The Pearson Correlation value of 0.672 indicates a strong positive association between road conditions and transportation costs, suggesting that as road conditions deteriorate, transportation costs significantly increase. This strong correlation reflects the direct influence of road surface quality, pavement failures, potholes, drainage conditions, and overall road infrastructure on the operational expenses of transport users.

The corresponding p-value of 0.000, which falls well below the conventional significance threshold of 0.05, confirms that the observed relationship is statistically significant. This implies that the association between road conditions and transportation costs is not due to random chance but reflects a real and measurable effect within the study population. With a sample size of 322 respondents, the result demonstrates a high level of statistical reliability and reinforces the conclusion that road infrastructure quality plays an essential role in shaping cost dynamics in road transport operations.
The strong positive correlation, therefore, reveals that poor road conditions are associated with increased fuel consumption, frequent vehicle repairs, extended travel time, higher fares, and greater maintenance burdens on both drivers and passengers. Conversely, improvements in road quality would be expected to reduce these cost implications significantly. The result highlights the need for strategic road rehabilitation investments to mitigate escalating transportation costs in the region.

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Table 4.1: Relationship between Road conditions and Transportation Costs in the North-Central Geo-Political Zone of Nigeria

		Road conditions	Transportation Costs
Road conditions	Pearson Correlation	1	.672**
	Sig. (2-tailed)		.000
	N	322	322
Transportation Costs	Pearson Correlation	.672**	1
	Sig. (2-tailed)	.000	
	N	322	322

The study reveals that road conditions have a strong and statistically significant relationship with transportation costs in the selected study area. The correlation coefficient of 0.672 ($p < 0.01$) indicates that poor road conditions substantially increase transportation costs, confirming a strong positive association within the transport system. This finding aligns with Adebayo and Ogunleye (2021), who emphasized that deteriorated road surfaces escalate operational expenses for transport operators through increased fuel consumption and higher vehicle maintenance requirements. Similarly, the significant p-value supports the assertion of Musa and Idris (2023) that infrastructural deficiencies directly translate into elevated cost burdens for commuters and logistics firms.

The results further corroborate the position of Olatunji and Ibrahim (2020), who noted that poor road quality increases travel delays, tyre wear, and engine strain, ultimately contributing to higher transportation fares and freight charges. The strong correlation in this study is also consistent with the findings of Nwachukwu et al. (2024), who argued that inadequate drainage systems, potholes, and structural failures on major Nigerian roads significantly distort cost efficiency and undermine transport reliability.

Moreover, the study's findings reinforce the view of Adesina and Bello (2019) that improved road conditions reduce the financial pressure on transportation operators by lowering fuel costs, minimizing repair frequency, and enhancing journey time predictability. The evidence presented in this research confirms that road infrastructure quality remains a major determinant of transportation cost patterns in developing regions. This aligns with a recent study by Yakubu and Suleiman (2025), which concluded that effective road rehabilitation directly reduces operating costs and strengthens economic mobility within urban and rural corridors.

The strong positive relationship demonstrated in this study affirms that poor road conditions significantly heighten transportation costs, reflecting broader national challenges in infrastructure management. These findings emphasize the urgent need for sustained road improvement programs to lower transportation costs, promote economic efficiency, and enhance mobility across the region.

VI. CONCLUSION AND RECOMMENDATION

The study concludes that road conditions significantly influence transportation costs in the North-Central Geo-Political Zone of Nigeria, increasing operational expenses, travel time, and vehicle maintenance requirements. Poor road surfaces, potholes, inadequate drainage, and structural failures were found to be major contributors to higher transportation costs. It is recommended that relevant government agencies invest continuously in road rehabilitation, maintenance, and monitoring programs.

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