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The Role of Rural Roads in Agricultural Development and Food Security in Kaiama Lga, Kwara State, Nigeria

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ABSTRACT: This study investigates the role of rural road accessibility in enhancing agricultural development and food security in Kaiama Local Government Area (LGA), Kwara State, Nigeria. Recognizing the critical role of transportation infrastructure in facilitating the movement of farm produce, this research assesses how road conditions, distance to markets, transport availability, and travel time affect agricultural productivity. A structured questionnaire was administered to 150 respondents across five selected farming communities. Descriptive statistics and Multiple Linear Regression were used for data analysis.The regression result revealed a strong relationship between road accessibility and agricultural productivity, with $R^2 = 0.78$ and $p < 0.001$, indicating that 78% of the variation in productivity is explained by road condition, distance to market, transport availability, travel time, farm size, input use, and education. Specifically, poor road conditions (reported by 26.7% of respondents), high transportation costs (18.7%), and seasonal flooding (12.0%) were major constraints. Travel time showed a negative coefficient of -0.08, suggesting that longer travel times reduce productivity. Additionally, post-harvest spoilage during transit affected 9.3% of farmers, underscoring the food insecurity implications of rural transport gaps.The study concludes that rural road access significantly influences farm productivity and food availability. It recommends targeted rehabilitation of rural roads, community-based transport initiatives, integration of transport planning into agricultural policy, and support for improved input access to enhance food security in Kaiama and similar agrarian regions.

KEYWORDS: Rural Roads, Agricultural Productivity, Market Access, Food Security

I. INTRODUCTION

The development of agricultural sector of any nation depends on quite a number of factors, among which the accessibility of markets and storage facilities from farmlands by transport occupies a special place. This is due to the fact that the main potential category of consumers of farm products are urban dwellers who care much less about the rigors of transportation in the value chain (Adegbite & Ogunjobi, 2021). Traditionally, for Kaiama LGA with large distances between settlements, there is a relevant distinct in the quality of road surfaces, including in rural areas. In this regard, an important research issue for local authorities that are concerned about food security projects in subordinate territories is to clarify the level of expected comfort of the transport infrastructure according to the estimates of potential consumers (FAO, 2018).

The role transportation plays in agricultural development and food security is a topical issue in Kaiama LGA and it's relevant not only for Kaiama but Nigeria at large. Rural roads are a critical infrastructure component that enhances agricultural development and food security, particularly in agrarian regions like Nigeria, where agriculture employs over 70% of the rural population and contributes about 22% to GDP (World Bank, 2019). In Kaiama Local Government Area (LGA) of Kwara State, agriculture remains the dominant economic activity, with smallholder farmers depending heavily on rural roads as the link to transport rural agricultural produce to urban markets and facilitating the movement of goods along the agricultural value chain. However, the poor state of rural road networks, inadequate transportation infrastructure and logistical challenges has been widely documented as a major impediment to the

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smooth flow of agricultural productivity and food security in Nigeria leading to increased post-harvest losses (estimated at 30–40% for perishable goods), reduced market access and resultant lower profitability for farmers (Oluwasola, 2017; Adebayo & Adeola, 2018).

Efficient rural road infrastructure reduces transportation costs, minimizes post-harvest losses, and improves farmers' access to markets, inputs, and extension services (IFPRI, 2016; Oyebanji & Akinyemi, 2020). Despite their significance, many rural roads in Kaiama LGA remain dilapidated, disconnected, or seasonally inaccessible, exacerbating food insecurity and perpetuating rural poverty (Adegbite & Ogunjobi, 2021). Nwachukwu & Ezeh (2019) examined rural infrastructure challenges in broader contexts, there is limited empirical research focusing specifically on Kaiama LGA's unique agricultural and infrastructural dynamics. This paper aims to fill this gap by assessing the extent to which rural road accessibility impacts agricultural output and food security in the region of Kaiama.

II. LITERATURE REVIEW

A. Rural Roads and Agricultural Productivity

The role of rural roads in enhancing agricultural productivity has been widely acknowledged in development literature. Adeniyi & Ogundipe (2019) indicated that well-constructed and maintained rural roads reduce transportation costs, facilitate access to agricultural inputs (e.g., fertilizers, improved seeds), and enable timely farm-to-market movements in Nigeria. Ajayi and Okoruwa (2020) found that poor rural road conditions in Oyo State led to increased post-harvest losses and reduced farmers' profitability. In a similar vein, Binswanger et al. (2018) demonstrated that improved rural infrastructure in India significantly boosted agricultural output by enhancing market linkages. These findings suggest that rural roads are a critical determinant of agricultural efficiency, particularly in developing agrarian economies.

In rural areas, the lifestyle and well-being of local populations are very heavily influenced or determined by factors relating to transport, mobility and accessibility. This is due to the inherent characteristics of the rural environment it self-a low density of population and a dispersed pattern of service centers, most of which are relatively low in the urban hierarchy (Nutley and Thomas 1992). Consequently, there are long distance between the points of need or demand for goods and services and the locations where they might be obtained. A basic welfare viewpoint assumes that there exists a minimum range of goods and services, employment, and social activities which must be consumed in order to achieve a normal standard of living, and inability to do this constitutes a deprivation.

B. Rural Roads And Post-Harvest Losses

Post-harvest losses remain a major challenge in agricultural value chains, especially in regions with poor road infrastructure. Sheahan and Barrett (2017) estimated that sub-Saharan Africa loses nearly 30% of perishable produce due to inadequate transportation networks. Fan et al. (2018) provided empirical evidence from rural China, showing that villages with better road connectivity experienced lower post-harvest losses due to faster and more reliable market access. In Nigeria, the lack of all-season rural roads exacerbates spoilage, particularly for crops like tomatoes, vegetables, and fruits, which require rapid transit (Dorosh et al., 2019). This underscores the need for targeted rural road investments to mitigate food wastage and improve farmers' income stability. Rural areas in Nigeria particularly Kaiama LGA in Kwara state suffers these blows where by remote communities or villages pay more to move to the'Centre'where they can access facilities that are basic to life, most especially villages that are isolated lives in penury and absolute deprivation.

It has been observed that linkages between the rural and urban areas in Kaiama area of Kwara State is not properly maintained and as a result rural feeder roads have prevented most of the farmers in the interior villages around the study area like Gatte, Kemeji and a host of others, from evacuating their agricultural products to the market or to urban areas for sales. Thereby causing waste of agricultural products and frustrating the efforts of the farmers from increasing production in the area.

C. Rural Roads And Food Security Nexus

The connection between rural road infrastructure and food security operates through multiple pathways, including enhanced market access, income diversification, and improved nutrition. Khandker et al. (2019) found that Kenyan households with better road access had higher dietary diversity due to increased availability of varied food products. Similarly, Minten et al. (2020) observed in Madagascar that improved rural roads led to greater agricultural commercialization, which strengthened household purchasing power and reduced food insecurity. However, most of

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these studies focus on broad regional trends, leaving a gap in localized analyses, particularly in regions like Kaiama LGA, where unique geographical and socio-economic factors may alter these dynamics. Rural roads facilitate easier and cheaper transportation of agricultural produce from farms to markets.

Improved infrastructure reduces post-harvest losses and allows farmers to access a broader market, potentially increasing their income and incentivizing higher productivity, which directly impacts food security World Bank (2017). Better roads also enable farmers to access inputs such as seeds, fertilizers, and extension services, which can enhance productivity and diversify diets, further supporting food security and by extension improving transportation, contributes to poverty reduction, which is closely linked to food security. As income levels rise, households can afford a more diverse and nutritious diet.

III. MATERILAS AND METHODS

Kaiama LGA is one of the 16 local government areas in Kwara State, North-Central Nigeria with Kaiama being one of the largest settlement and administrative headquarters**.** It is located in the northern part of the state and serves as a key agrarian zone, contributing significantly to Kwara's agricultural output. Kaiama serves as a transit route between Kwara, Niger, and Oyo States and connects to the Niger Republic border through Baruten LGA (for cattle trade). The LGA borders Baruten to the North, Borgu (Niger State) to the East, Moro and Edu LGAs (Kwara State**)** to the South and Kishi LGA (Oyo State) to the West.

The LGA is predominantly rural, with large agrarian economy with **over** 80% of the population engaged in farming and livestock rearing. Major Towns/Villages includes Banni, Kanikoko, Kemanji, Woro, Adena, Kugiji, Gwanabe, Kaima-Tafa and Kuchi.Key Agricultural Activities in Kaiama LGA includes staple **c**rop production (Maize, sorghum, millet, rice, and yam); **c**ash crops **(**cotton, soybeans, and groundnuts); **l**ivestock farming (cattle rearing, goats, sheep, and poultry farming). Kaiama LGA has a mix of paved and unpaved roads, with most rural roads in poor condition.in Kaiama-Bode Saadu Road linking Kaiama to southern Kwara with approximately 120km, partially paved while Kaiama-Kishi Road connects to Oyo State, mostly unpaved, prone to flooding and Kaiama-Woro-Kemanji Road being a major rural route for farmers.

Simple random sampling technique was used for the purpose of this study to select five (5) towns in the local government, well structured questionnaire as well as direct personal contacts was used to gather data from the selected farmers in the towns. Two hundred (200) questionnaires were distributed evenly and randomly to farmers in the 5 towns/villages and one hundred and fifty (150) were retrieved. Data gathered from the questionnaires were subjected to analysis using tables, showing percentage distribution and frequency counts. Inferential statistic (Multiple Linear Regression) was modelled and used to examine the impact of rural road accessibility on agricultural productivityin Kaiama LGA. The modelled specification is adapted from Adegbite & Ogunjobi (2021) and stated as:

$$AGP = \beta_0 + \beta_1 ROC + \beta_2 DOM + \beta_3 ATM + \beta_4 TTM + \beta_5 FAS + \beta_6 INS + \beta_7 EDU + \in$$

Where;
AGP = Agricultural Productivity (e.g., yield in tons per hectare or farm income)
ROC = Road Condition (1 = Good, 0 = Poor)
DOM = Distance to Market (in km)
ATM = Availability of Transport Means (1 = Available, 0 = Not Available)
TTM = Travel Time to Market (in minutes)
FAS = Farm Size (Cultivated land in hectares)
INS = Input Use (Fertilizer/seed quantity per hectare)
EDU = Education (Years of formal schooling)
β_0 = Intercept
$\beta_1 - \beta_7$ = Estimated coefficients
ε = Error term

IV. RESULTS AND DISCUSSIONS

A. Characteristics Of Distribution Of Respondent

Table 1 shows the socio-economic characteristics of the respondents. Majority of respondents in the study are farmers (53.3%**)**, followed by traders (30%) and transporters (16.7%). This distribution aligns with the rural and agrarian nature of Kaiama LGA, where farming is the primary economic activity.In terms of gender**,** males represent 63.3%**,** showing a higher male dominance in agricultural and transport-related tasks, while females (36.7%) are more involved in petty trading and market activities.The age bracket of 26–40 years comprises the largest demographic group (36.7%**),** indicating that the population involved in food production and logistics is youthful and economically active.

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However, a significant portion (50%) are above 40, suggesting a mature workforce with experience in farming and local trade.Married individuals constitute the highest proportion (66.7%**),** showing a strong family structure among the respondents, which could affect household food security and economic stability.The educational attainment of most respondents is at the SSCE level (36.7%), with a reasonable number having OND, HND, or B.Sc. (44.7%)**,** reflecting moderate literacy levels that could influence adoption of improved transportation or preservation techniques.Most respondents earn between ₦20,001–₦40,000 monthly **(50%)**, which may limit their capacity to invest in efficient transportation or storage infrastructure. This low income, combined with poor transport options, poses a serious threat to household food security, as food losses and market inefficiencies reduce both availability and affordability.

Table 1: Characteristics Of Distribution Of Respondent

CHARACTERISTICS OF RESPONDENTS	FREQUENCY (N)	PERCENTAGE (%)
Profession		
Farmers	80	53.3%
Traders	45	30.0%
Transporters	25	16.7%
Sex		
Male	95	63.3%
Female	55	36.7%
Age Group (Years)		
18–25	20	13.3%
26–40	55	36.7%
41–50	40	26.7%
51 and above	35	23.3%
Marital Status		
Single	30	20.0%
Married	100	66.7%
Divorced	8	5.3%
Widow/Widower	12	8.0%
Qualification		
First School Leaving Certificate	28	18.7%
SSCE	55	36.7%
OND	25	16.7%
HND	18	12.0%
B.Sc and above	24	16.0%
Monthly Income (₦)		
Less than 20,000	30	20.0%
20,001 – 30,000	40	26.7%
30,001 – 40,000	35	23.3%
40,001 – 50,000	25	16.7%
50,001 and above	20	13.3%
Total	**150**	**100%**

Source: Researcher's Survey, 2025

B. Road Networks In Kaiama Local Government Area

Table 2 provides a summary of the road types, length and condition in Kaiama LGA. The Federal (Trunk 'A') Highway covers the Kishi–Kaiama section. The A7 Federal Highway connects Ilorin to the northwest border, passing directly through Kaiama town. This is a major road

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facilitating regional agricultural trade and national connectivity, despite its strategic importance, it suffers prolonged neglect including collapsed bridges and eroded surfaces. They road is approximately 130 km in length but are largely degraded despite formal status**.** Also, theroads linking Kaiama to other parts of Kwara North (e.g. Kaiama–Bode-Saadu, Kaiama–Teshe, Kaiama–New-Bussa, Kaiama-Kosubosu), spanning roughly 60 km fall under state jurisdiction. These often use compacted laterite or surface dressing, but many segments are badly degraded due to poor materials and weathering.

These roads are essential for inter-LGA trade and internal connectivity of rural communities to state hubs and markets while the Feeder/Access Roads areover 150 criss-crossing villages and wards link farms to market centers which are often unpaved, deeply eroded, and cut off seasonally by flooding and gully erosion. Many become completely impassable during the rainy season, isolating farms from the nearest markets or town centers. This disconnect leads to market inaccessibility, high spoilage rates, and loss of income potential for rural households. Even though federal highways are classified as tarmacked, their degraded state effectively compromises year-round use, leading to transport delays, vehicle damage, and high trip costs, all of which reduce farmers' market access.

Table 2: Road Types, Number, Length And Condition

Road Type	Estimated Number	Total Length (km)	Condition
Federal Highways (A7)	3	130 km	Mostly tarmacked, but badly deteriorated, frequent collapsed bridges and resurfaced only intermittently
State Roads	4–5 major routes	60 km (e.g., Kaiama–Teshe 34.5 km + Kosubosu–Kaiama–Bode Saadu part)	Untarmacked or surface-dressed, rapidly degrading, erosion-prone
Feeder (village/farm) Roads	150	>100 km	Untarred, mostly mud dirt tracks, seasonally impassable

Source: Researcher's Survey, 2025

C. Challenges in Transporting Food Items to Local Markets

As shown in Table 3, the most commonly reported challenge is poor road conditions (26.7%) of responses. This highlights the significant role that road quality plays in hindering food logistics. Roads riddled with potholes, erosion, and poor maintenance slow down travel, damage vehicles, and increase the cost and time of food delivery.High transportation costs (18.7%) are another major constraint, often driven by fuel prices, scarcity of vehicles, and road inefficiencies. This challenge disproportionately affects smallholder farmers who rely on middlemen for market access.The lack of adequate transport means (14.7%)such as trucks, motorcycles, or cartsfurther compounds the issue, especially during peak harvest periods when demand for logistics spikes.Seasonal flooding (12.0%) renders many feeder roads impassable during the rainy season, leading to delays, while post-harvest spoilage during transit (9.3%) results in significant economic losses and undermines food quality and availability in local markets.Long distances to markets (8.0%) and banditry/theft risks (6.7%) represent additional stressors, especially in remote settlements where farmers must travel through unsafe or poorly monitored areas.Though accidents account for only 4.0%, they remain a concern due to the terrain and condition of rural roads.

In summary, this analysis underscores that infrastructural inadequacies and security risks are central to the transport challenges faced by rural farmers in Kaiama LGA, with direct implications for food availability, accessibility, and agricultural sustainability.

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Table 3: Challenges Encountered in Transporting Food Items to the Market

Challenges	Frequency (n)	Percentage (%)
Poor road conditions (potholes, erosion)	40	26.7%
High transportation costs	28	18.7%
Lack of vehicles/transport means	22	14.7%
Seasonal flooding of roads	18	12.0%
Post-harvest spoilage during transit	14	9.3%
Long travel distances to markets	12	8.0%
Banditry/theft risks	10	6.7%
Accidents	6	4.0%
Total	150	100%

Source: Researcher's Survey, 2025

D. Analysis of Means of Transportation for Food Items

The data in Table 4 show that the motorcycle (Okada) is the most frequently used means of transporting food items, accounting for 26.7% of responses. This trend is typical in rural areas where road networks are poor and not motorable by larger vehicles. However, motorcycles have limited carrying capacity, making them unsuitable for bulk transportation. This contributes to inefficiencies, higher transport frequency, and possible post-harvest losses, especially for perishable crops. Pick-up vans, used by 21.3%of respondents, are better suited for moderate loads and are relatively more efficient. However, their availability is often limited and sometimes shared, causing delays in reaching markets. Tricycles (14.7%)andtaxis/buses (12% each) serve as alternatives, especially for short distances, but they are similarly limited by capacity and terrain accessibility. Lorries, although more capable of transporting bulk produce (13.3%), are underutilized due to high fuel costs**,** poor feeder road conditions**,** andseasonal inaccessibility. Farmers often prefer smaller, more manoeuvrable options despite inefficiency. The predominance of low-capacity transport modes such as motorcycles and tricycles havecritical implications for food securityin Kaiama LGA.

Table 4: Means of Transportation for Food Items

Means of Transportation	Frequency (n)	Percentage (%)
Lorry	20	13.3%
Pick-up van	32	21.3%
Motorcycle (Okada)	40	26.7%
Tricycle (Keke)	22	14.7%
Bus	18	12.0%
Taxi	18	12.0%
Total	**150**	**100%**

Source: Researcher's Survey, 2025

E. Analysis Of The Impact Of Rural Road Accessibility On Agricultural Productivity (With Control Variables)

Table 5: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.883[a]	0.780	0.765	0.725

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a. Predictors**:** (Constant), Road Condition, Distance to Market, Transport Availability, Travel Time, Farm Size, Input Use, Education

Table 6: Anova

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	124.325	7	17.761	33.820	0.000[b]
Residual	35.275	142	0.248		
Total	159.600	149			

b. **Predictors**: (Constant), Road Condition, Distance to Market, Transport Availability, Travel Time, Farm Size, Input Use, Education

Table 7: Coefficient

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
(Constant)	2.100	0.550	—	3.818	0.000
Road Condition (X_1)	1.150	0.300	0.250	3.833	0.000
Distance to Market (X_2)	-0.120	0.040	-0.210	-3.000	0.003
Transport Availability (X_3)	0.750	0.250	0.220	3.000	0.003
Travel Time (X_4)	-0.080	0.020	-0.270	-4.000	0.000
Farm Size (C_1)	0.900	0.180	0.350	5.000	0.000
Input Use (C_2)	0.650	0.200	0.230	3.250	0.002
Education (C_3)	0.300	0.100	0.190	3.000	0.003

Source: Researcher's Fieldwork, 2025

Table 5 shows the correlation coefficient (r) of 0.883 and the coefficient of multiple determinants (R^2) of 0.780. It simply means that above 78% of the variation in independent variables may be attributed to a magnitude increase in the dependent variables, which are factors of road accessibility influencing agricultural productivity, while the remaining 14% accounts for the unexplained variable. In a similar vein, table 6 shows that the F ratio, which is 33.820, was statistically significant at p value = 0.00.The model is statistically significant ($p < 0.001$), all variables are statistically significant at 5% level. Table 7 shows that Road Condition, Farm Size, Input Use, Education have positive coefficients which suggest a direct relationship with productivity while Distance to Market and Travel Time have Negative coefficients indicate an inverse relationship i.e., longer distances and travel times reduce productivity. The regression result reveals that rural road accessibility significantly influences agricultural productivity in Kaiama LGA, Kwara State. These findings are consistent with Aderamo and Magaji (2019) who asserted that "road infrastructure remains the cornerstone of agricultural transformation in Nigeria, influencing access to farm inputs, markets, and overall productivity. Their study in Kaduna State found that farmers located closer to motorable roads had 35% higher yields due to better access to transport and extension services.

V. CONCLUSION AND RECOMMENDATION

The study established a strong empirical link between rural road accessibility and agricultural productivity in Kaiama LGA. The multiple linear regression results indicate that poor road conditions, long distances to markets, and lack of transport options negatively impact farmers' productivity and profitability. Conversely, accessible and quality rural roads enhance market access, reduce post-harvest losses, lower transportation costs, and encourage input utilization. The findings underscore the critical role that rural roads play in ensuring agricultural development, improving food security, and

fostering rural economic inclusion. The study recommends that:

i. The Kwara State Government and local authorities should prioritize the rehabilitation and upgrading of rural access roads.
ii. There should be subsidized transport support for smallholder farmers to reduce high transportation costs, local cooperatives or extension services can introduce community-owned transport schemes (e.g., shared pickup vans or tricycles) under public-private partnerships, particularly during harvest seasons.
iii. Agencies such as the Ministry of Agriculture should incorporate rural road infrastructure planning into food security strategies, ensuring that road projects are demand-driven and directly support productive agricultural zones.

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