

Rural Transportation and the Distribution of Public Facilities in Nigeria: A Case of Edu Local Government Area of Kwara State

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ABSTRACT The paper examines the role played by road transport in the distribution of public facilities in a rural environment in Nigeria. Development of rural transport networks has suffered neglect in comparison with urban road networks in the country. This has in no small measure affected the provision of essential public facilities to rural dwellers. The data used were collected through mapping and surveys of the nature of road network and available public facilities in the study area. The results of data analysis showed that the area has a poorly connected road network characterised by poor surface condition, narrow bridges and many bends. The level of provision of public facilities is also low. In order to establish empirical relationship between road network development and distribution of public facilities in the area, regression technique was used. The analysis showed a strong relationship. The study concludes by making recommendations for the federal and state governments' intervention in road network development in the area and providing more facilities to make life better for the people.

INTRODUCTION

Transportation plays an important role in the political, economic and social development of any society and whether in rural or urban societies, transportation constitutes the main avenue through which different parts of the society are linked together. As a society grows in terms of population and functions, the need for interaction among its various components also grows thereby requiring quality and effective transportation systems. In the words of Munby (1968) "there is no escape from transport even in the most remote and least developed of inhabited regions". Also, Hailey (1957) opined that "there seems to be no other types of development which can effect so speedily a change in the economic and social conditions of backward nations except transport".

In recognition of the role transport plays in the overall development of any society and the desire to promote rapid socio-economic development particularly in the rural areas, the federal, state and local governments in Nigeria have been working towards the improvement and development of transportation system in the country. In the First, Second, Third and Fourth National Development plans, 19%, 23%, 22% and 15% respectively of the total capital outlay went to the transport sector (Adeyemi 2001). These investments on the transportation sector, are not only aimed at increasing the level of rural-urban movement but also to improve rural-urban accessibility particularly as it relates to accessi-

bility of rural people to the various public facilities that are located at different parts in the rural landscape.

A major problem with the pattern of distribution of public facilities in Nigeria however, is that it exhibits an urban rather than a rural location bias which further helps to increase rural poverty. While some areas are heavily served with public facilities such as health centres, schools, electricity, water and postal services, others are either underserved or not served at all (Ikporukpo 1987). Another problem with the distribution of public facilities in Nigeria particularly in the rural areas, is the lack of coordination in their distribution so as to make them more relevant to the population they are meant to serve.

THE RURAL ACCESSIBILITY PROBLEM

Poor transportation in the rural areas poses a great challenge to rural development efforts in Nigeria as it has continued to make most of the rural areas isolated from the main stream of the modern societies (Aloba 1986; Stutz 1976). This has resulted in low productivity, low income and a fall in the standard of living of rural residents and high rate of poverty. The rate of poverty in most rural communities in Nigeria has progressively increased over the years. Poverty is at a higher level in the rural areas in Nigeria than in the urban areas. In 1980, the poverty level was 29.3%; in 1985 it went up to 51.4% and in 1992 the figure came down to 46.1% while in 1996, the rural

population in poverty had increased to 69%. In respect of urban areas, poverty levels were 17.6% in 1980, 37.8% in 1985; 37.5% in 1992 and 55.5% in 1996 (FOS 1999).

Adesanya et al. (2000) had observed that, rural travel and transport in most rural areas in Nigeria still take place with great difficulties thereby compounding and worsening the problem of rural productivity and rural poverty. Several studies have been conducted on the nature and characteristics of rural roads which lead to the problems of rural accessibility. Adeniji (1983) identified the problem of low volumes of traffic on rural roads coupled with periodic variations and sharp seasonality in the demand for transport as factors which contribute to the apparent neglect of roads in the rural areas by most of the state governments in Nigeria.

Ogunsanya (1987) and Filani (1993) found in their different studies that where motorable roads exist in rural areas, in Nigeria, they are mostly of unpaved surface, narrow width, circuitous alignment and with low quality bridges. In most cases, they are either clad with potholes or characterised by depressions and sagging. Such unsurfaced roads are hardly passable during the rainy season when vehicles get stuck in mud or when the improvised bridges of cut-free trunks get swept away by flood.

Ogunsanya (1988) also identified a strong relationship between transportation, under-development and rurality. He argued that the greater the degree of rurality, the lower the level of transport development. These consequently have been responsible for low transport development in rural areas of Nigeria which houses 70 per cent of the nation's population. Efforts have however been made in recent times to address the rural transport problem in the country in order to proffer solutions. The Association of Local Governments of Nigeria (ALGON) recently initiated a proposal to the Federal Government that would boost rural transportation in the country (Adeyanju 2009). To actualize this, a tripartite arrangement between the country's 774 local governments, the federal government, and private sector operators will be put in place to ease rural transportation in the country.

Also, the Federal Government through the Federal Ministry of Agriculture and Water Resources adopted the Rural Travel and Transport Programme (RTTP) of the Sub-Sahara Africa Transport Programme (SSATP) in 1999 with the

aim of using it as a collaborative framework for rural transport sub-sector reform as well as one of the tools for its poverty alleviation programme (FMAWR 2009). While the Federal Government coordinates and supports the states for the implementation of the project, the Local Government Areas are key stakeholders that have to be consulted on the choice and the implementation of the interventions (The World Bank Group 2009). The objective of this study is to assess the effect of the problem of rural transportation on the distribution of public facilities in Edu Local Government Area with a view to ameliorating the situation.

THE STUDY AREA

The study area is Edu Local Government Area of Kwara State in Nigeria. It is located between latitudes 4° 30'E - 5° 30'E and longitude 8° 30'N - 9° 30'N with a total land area of about 2,236 sq. km (Kwara State Statistical Year Book 2007). The population of the study area was put at 201,624 in 2006 (NPC 2006) and is inhabited predominantly by Nupe-speaking people whose major occupation is fishing and farming.

The sparse population and absence of major cash crops made the colonial Authority and the post-independence governments to pay little attention to the provision of public facilities in the area and particularly the development of modern transport networks. As noted by Onokerhoraye (1977), transportation was poorly developed in this zone during the colonial period and the early parts of the post independence period. This condition has made accessibility in the study area very difficult and consequently militated to some degree, against the level of infrastructural development of the study area. Figure 1 shows the ward map of the local government while Figure 2 shows the road network.

DATA COLLECTION STRATEGY AND METHODOLOGY

The study used both primary and secondary data. The primary data consisted of number, nature and condition of selected roads in the area. The number of bridges on these roads were also found. In all, 40 roads were identified in the Local Government and used for the survey. These roads were mapped from topographical sheet covering the study area.

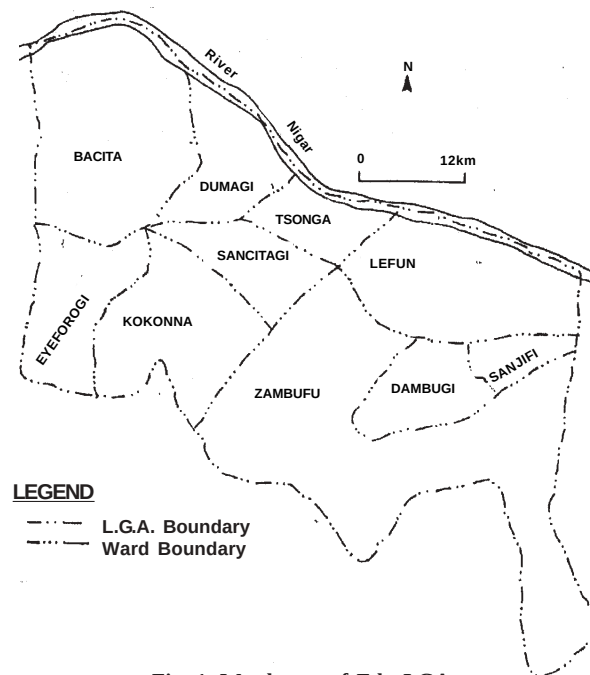


Fig. 1. Ward map of Edu LGA

Source: Peas associates

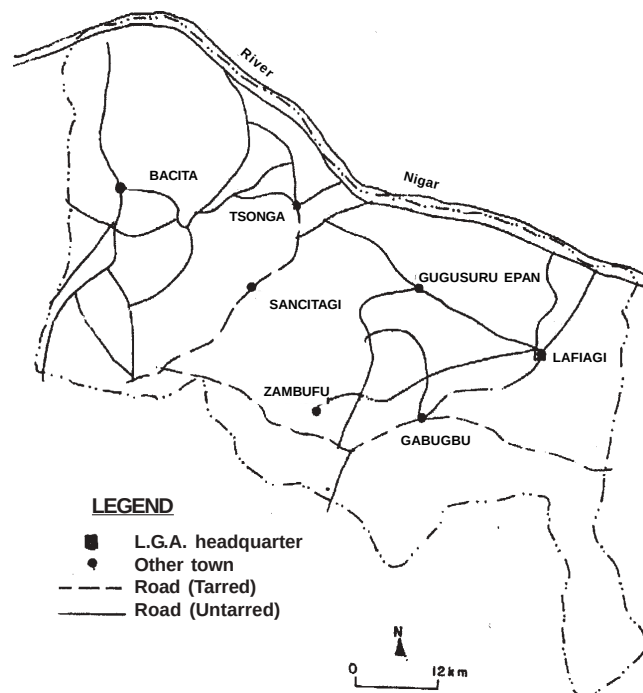


Fig. 2. Road network map of Edu LGA

Source: Peas associates

Secondary data were also collected on the number, types and location of public facilities in the 10 wards of the Local Government. The wards are Bacita, Dambuji, Dumagi, Eyeforogi, Kokonna, Lefun, Sancitagi, Sanjifu, Tsonga and Zambufu. The Report of the National Inventory of Community – Based infrastructural facilities in Edu Local Government Area prepared in 1991 for the Federal Government was the source of data. The Report provided information on water supply, health centres, educational services, power supply and markets. The report was updated to 2008 by supporting it with data from records of the local government on facilities distribution in the local government.

The data collected were analysed and presented using tabulation and cross tabulation. Graph theoretic technique was used to analyse the road network of the settlements in order to determine the degree of network development of the study area (see Kansky 1963). Road network density of the study area and each of the 10 wards in the area were also determined and used for further analysis. In order to assess the form of the relationship between road network development and the level of provision of public facilities in the local government, multiple regression technique was used.

RESULTS AND DISCUSSION

Nature of Roads

The indices used in assessing road quality in the study area are road surface condition, road width, number of bends, number of bridges and road motorability (Aloba 1977; Ogunsanya 1987; Aderamo 1998). Table 1 is the summary of road

quality in the local government. The table shows that only 2 roads representing 5% of the 40 roads studied are tarred while 38 roads representing 95% are untarred. Similarly, only 2 roads representing 5% are of 2 lanes while 38 roads representing 95% are single-lane roads. As for the number of bridges in the study area, only 2 roads have bridges wide enough to accommodate 2 vehicles at a time while 38 roads have bridges wide enough to take only a vehicle.

As for the roads response to floodings, only 5% of the roads are not liable to floodings while 38 roads representing 95% are liable to floodings. Also 5% of the roads are motorable throughout the year while 95% of the roads are either partly or completely seasonal in nature. The seasonal nature of these roads is a by-product of poor drainage, poorly constructed culverts and absence of modern drainage systems along the roads.

Road Network Connectivity

The structure of the road network in the study area was analysed using the graph-theoretic technique. This was done in terms of the topological or geometric components of the network. Such topological indices are very useful indicators of economic and technological development of an area as shown in the works of Garrison (1960), Berry (1961), Kansky (1963), Leung (1982).

The topological graph of the road network of Edu Local Government shows a total of 54 vertices and 73 edges (Fig. 3). In order to determine the level of road network connectivity of the study area, three structural indices were used. These are the alpha index (α), Beta index (β) and Gamma index (γ).

Table 1: Summary of rural road quality in Edu Local Government

<i>Variables</i>	<i>Attributes</i>	<i>Number</i>	<i>Percentage</i>
1. Surface Condition	(i) Tarred	2	5.0
	(ii) Untarred	38	95.0
2. Number of Lanes	(i) 4 lanes	-	-
	(ii) 2 lanes	2	5.0
	(iii) 1 lane	38	95.0
3. Average number of bends per Km	(i) 0 – 5	40	100.0
	(ii) 6 – 10	-	-
	(iii) Above 10	-	-
4. Nature of Bridges	(i) Wide enough for one vehicle	38	95.0
	(ii) Wide enough for two vehicles	2	5.0
5. Response to flooding	(i) Roads liable to flooding	38	95.0
	(ii) Roads not liable to flooding	2	5.0

Source: Authors' Survey

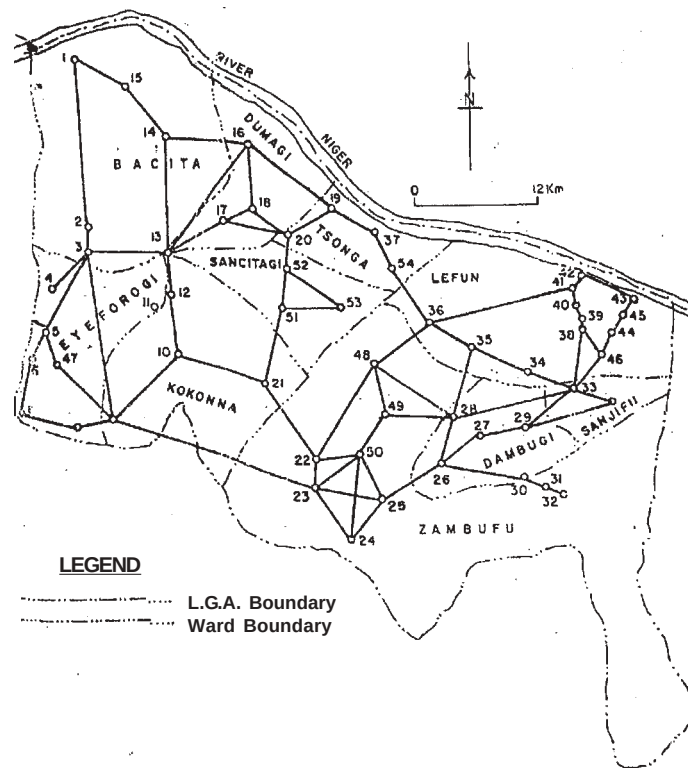


Fig. 3. Topological Graph of Road Network of Edu Local Government Area of Kwara State.

By definition;

$$\alpha = \frac{e - v + p}{2v - 5}$$

where e is the number of edges, v the number of vertices and

p the number of subgraphs of the network

The alpha index is the ratio between the observed number of circuits and the maximum number of circuits in a given graph. For completely interconnected networks, the α index will equal to 1, whereas networks with a decreasing degree of connectivity will have a value approaching zero.

The Beta index is given by

$$\beta = \frac{e}{v}$$

The beta index measures the relationship between two individual elements of the network, i.e. the number of edges over the number of vertices. Higher β values are produced by more sophisticated network structures especially by those with a greater number of edges in relation

to the number of vertices.

The gamma index (γ) is given as

$$\gamma = \frac{e}{3(v-2)}$$

The gamma index is a quotient of the observed number of edges to the maximum number of edges. The gamma index is bounded by 0 on the lower circuit and 1 on the upper limit. The value of 1 describes completely connected networks and lesser values indicate various degrees of connectivity.

Using the above formulae, the alpha index for the road network of Edu Local Government is 0.2; the beta index is 1.346 while the gamma index is 0.466. In order to understand the nature of the road network of the study area in detail, the structural indices of the network for each of the 10 wards in the local government were also determined. In addition, the network density of the local government was determined and those of the 10 wards were also determined. Network density is used to determine the level of compactness of the network and show how closely

Table 2: Road network connectivity indices in Edu Local Government Area

Wards	Road network density km/sq.km	Alpha Index	Beta Index	Gamma Index
1. Bacita	0.148	0.2	1.2	0.67
2. Dambuji	0.714	0.5	1.67	0.6
3. Dumagi	0.097	0.33	1.25	0.83
4. Eyeforogi	0.16	0.29	1.166	0.58
5. Kokonna	0.179	0.19	0.8	0.44
6. Lefun	0.105	0.133	1.2	0.38
7. Sancitagi	0.108	1	1.33	0.75
8. Sanjifu	0.065	0.4	1.4	0.78
9. Tsonga	0.066	0.33	1.25	0.5
10. Zambufu	0.155	0.89	2.14	1

Source: Authors' Survey

knitted is the network. Table 2 shows the structural indices of the network for the 10 wards in the local government and the values of network density.

The table shows that Sancitagi ward ranks first with 100 per cent connectivity when using the alpha index to explain the level of network connectivity in the study area. This is followed by Zambufu ward with 89% connectivity while Dambuji ward ranks third with 50% connectivity. The other wards in order of their ranks are Sanjifu, Dumagi with Tsonga, Eyeforogi, Bacita, Kokonna, Lefun.

Using the beta index to explain the level of network connectivity in the 10 wards, Zambufu ward ranks first with a value of 2.14, followed by Dambuji ward with a value of 1.67. Sanjifu ward ranks third with a value of 1.40. The other wards in order of their ranks are Sancitagi, Dumagi, Tsonga, Bacita, Lefun, Eyeforogi, Kokonna.

In terms of the gamma index, Zambufu ward also ranks first with a value of 1.0 while Dumagi ward ranks second with a value of 0.83. Sanjifu ward also ranks third with a value of 0.78. The other wards in order of their ranks are Sancitagi,

Bacita, Dambuji, Eyeforogi, Tsonga, Konkanna, Lefun.

Analysis of the network density for the 10 wards shows that Dambuji ward has the most compact network in the study area with a value of 0.714 km per square km. This is followed by Kokonna ward with a distant value of 0.179 while Eyeforogi ranks third with a value 0.160 km per square km. The other wards in order of their ranks are Zambufu, Bacita, Sancitagi, Lefun, Dumagi, Tsonga, Sanjifu. The values show that the wards generally have sparsely connected networks with a range of 0.714 – 0.065 km per square km.

ROAD NETWORK DEVELOPMENT AND THE DISTRIBUTION OF PUBLIC FACILITIES

The relationship between road network development and distribution of public facilities can be examined through the use of regression analysis (Ikporukpo 1987). The multiple regression model takes the form.

$$Y = b_0 + b_1X_1 + b_2X_2 + \dots + b_nX_n + e.$$

where Y represents the dependent variable, $X_1, X_2, X_3 \dots X_n$ represent the independent variables; $b_0, b_1, b_2 \dots b_n$ represent the regression constants and e is the error term which explains the effects of the unspecified variables (see Draper and Smith 1981).

Choice of Variables

In order to assess the nature of rural infrastructural development in the study area, appropriate variables were chosen as measures of development. Many scholars have identified different indices as measures of socio-economic development at both rural and urban scales (Abumere 1985; Ikporukpo 1987).

In this study, six variables regarded as indicators of development were selected and used

Table 3: Variables and the corresponding methods of measurement

Variables	Surrogate Measures
1. Educational Facilities (EF)	Primary school enrolment per thousand population.
2. Healthcare Services (HS)	Number of beds per thousand population.
3. Security Services (SS)	Number of police per thousand population
4. Water Supply (WS)	Gallons of water supplied per day from bore holes
5. Commercial Activities (CA)	Number of periodic markets available per ward
6. Communication Services (CS)	Number of viewing centres available per ward

Source: Authors' Surveys

as independent variables in the multiple regression analysis. They are Educational Facilities (EF); Healthcare Services (HS); Security Services (SS); Water Supply (WS); Commercial Activities (CA) and Communication Services (CS); Surrogate Measures were used for these variables (Table 3).

Primary school enrolment per thousand population was used to measure Educational Facilities (EF) while the Number of Beds per thousand population in the Health centres was used to measure Healthcare Services (HS). In the case of Security Services (SS) the number of policemen per thousand population was used and Water Supply (WS) was measured by the quantity of water supplied in gallons per day by the boreholes provided in the wards. In the case of Commercial Activities (CA) and Communication Services (CS), the number of periodic market per ward and the number of television viewing centres per ward respectively were used. The above measures were considered appropriate because according to Abumere (1985), the multi-component nature of economic development means that it can only be appropriately measured by many variables indicating the social, economic, cultural and other aspects of development.

Empirical Validation of the Regression Model

The regression model for our specific case is of the form

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6)$$

where Y = Road density (see Addo 1979)

X_1 = Education Facilities, X_2 = Healthcare Services, X_3 = Security Services, X_4 = Water Supply; X_5 = Commercial Activities; X_6 = Communication Services.

This can be operationalised in the form

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + e$$

where b_0 is the intercept; $b_1 - b_6$ are the regression coefficients and e is the error term.

Table 4: Matrix of correlation between the independent variables

	EF	HS	SS	WS	CA	CS
EF	1.000					
HS	0.316	1.000				
SS	0.031	0.760	1.000			
WS	0.059	-0.136	0.905	1.000		
CD	0.301	-0.250	0.441	0.662	1.000	
CS	0.179	-0.358	0.524	0.562	0.389	1.000

Source: Computer output

The model assumes that road network density in the study area influences the distribution of public facilities in the local government. Table 4 is the matrix of correlation between the independent variables. The table shows that there is no problem of collinearity in the data set. Except for Water Supply (WS) which has a correlation coefficient of 0.905 with Security Services (SS), there are no other pairwise variables with a correlation value ± 0.8 (see Leung 1982; Ikporukpo 1987). The high value of the correlation between Security Services and Water Supply may not be unconnected with the need to ensure that safe drinking water is always available to the communities to forestall outbreak of diseases and breakdown of law and order.

An a-prior inspection of the variables assumes that provision of educational facilities, security services and communication services will have positive signs while the other independent variables will have the reverse sign. This is because the distribution of those facilities heavily depend on road network facility to ease movement.

Table 5 shows the regression summary of the dependent and independent variables. The summary shows that out of the six explanatory variables, only Security Services is highly significant at 0.05 level of significance. The coefficient of correlation for the model is 0.902 implying that the combined independent variables explain 81.36 per cent of the total variation in road network development in the study area. The unexplained 18.64 per cent may be due to political and technological factors. Further, except for communication services, the parameter estimates assume the expected signs.

The regression equation obtained is $Y =$

Table 5: Regression summary of the dependent and independent variables

Dependent variable	Independent variables	Regression coefficients	Standard error of estimate	T-values
Road Density RD	Constant	0.0486	0.0813	0.598
	EF	0.2981	0.1542	1.934
	HS	-0.345	0.0178	-1.938
	SS	0.286	0.0699	4.096*
	WS	-5.93	5.0023	-1.185
	CA	-2.409	1.485	-1.622
	CS	-1.056	1.1403	-0.926

Coefficient of Determination $R^2 = 0.8136$

*Significant at 0.05 level

Source: Computer Output

$$0.04859 + 0.2981X_1 - 0.3450X_2 + 0.2860X_3 - 5.9302X_4 - 2.4085X_5 - 1.0558X_6$$

In all, the results of the analysis of the effect of road network development on the distribution of public facilities in Edu Local Government Area of Kwara State show that all the six independent variables are important, although of varying degrees, in the explanation of road network development in the area. The model obtained can therefore be reliably used to predict the distribution of public facilities in the study area.

RECOMMENDATIONS

The study tried to examine the effect of road network development in Edu Local Government Area on the distribution of public facilities in the area. This was done by assessing the nature of road network provision in the area and the available public facilities provided in all the 10 wards of the local government. The results show that most of the roads have been constructed and are being maintained by the local government. This entails huge expenditure far above what the local government can shoulder. Consequently there results a very poor level of road development in the area.

The level of provision of public facilities in the area is also low. Besides, there is an over-concentration of public facilities in the major towns of the study area while the predominantly rural parts of the local government are neglected. In order to ensure an enviable and sustained rural development in the area, there is the need to increase the level of provision of road network facilities. All over the world, poverty reduction in the rural areas is tied to rural transport and it remains the central goal of global development efforts (Olukotun 2007). A well maintained transport route promotes socio-economic and infrastructural development. Furthermore, roads should be constructed to link up the numerous villages to each other and to their various district and local government headquarters.

To improve the provision of public facilities in the study area, there is the need to take an inventory of existing public facilities in the local government from time to time. This will enable the policy makers and planners identify areas within the local government that need more attention in terms of improvement in the provision of public facilities.

The state and local governments should

encourage public participation in the provision of public facilities. Since it is not possible for any government to provide everything for its citizenry, towns and villages should be encouraged to imbibe the spirit of self-help so as to ensure rapid development of the local government.

CONCLUSION

This study has examined the relationship between road network development and the distribution of public facilities in Edu Local Government Area of Kwara State, Nigeria. The study has shown that rural road network has significant effect on the distribution of facilities in rural areas and has the potential of reducing poverty. Improved rural accessibility and mobility are capable of reducing the level of poverty of rural people because the basic necessities of life such as healthcare delivery, education, postal services and customary courts will be closer to them (Howe 1981; Levy 1996). Appropriate recommendations have therefore been made to improve the level of road network development in the local government so as to ensure more equitable distribution of public facilities in the study area. If this can be achieved, the level of poverty in the Local Government will be drastically reduced.

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