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ANALYSIS OF ROAD CONNECTIVITY AND DENSITY INDEX IN SABON SARKI DEVELOPMENT AREA, KADUNA STATE

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Abstract

This research analyzed road connectivity and density index in Sabon Sarki Development Area, Kaduna State. The study is aimed at assessing the road connectivity and density index as basis for making proposals on how to enhance intra and inter regional communication in the study area. A sample size of 0.05% was drawn from a sample frame of 42,520 household heads (projected from 2006 census) amounting to 212 sample size, which were administered in a systematic random sampling. Descriptive statistics was used for data analysis. The location and linkages between settlements was established using google imagery. Results revealed that farming is the predominant economic activity in the region, yet the income of the people is low. State roads constitute the highest regional roads in the study area amounting to 56.7% of the total existing roads. Many settlements (53%) were identified not to be accessible by vehicles and are about 4- 6km distances from vehicular roads. The road connectivity index of settlements of 37% was considered low. The road density index of 0.106 (106m) is also considered low; only 24 out of 50 settlements are connected with motorable roads. There is an urgent need to embark on massive construction of feeder roads to open up settlements that are inaccessible by car in order to better harness the economic potentials of the region. There is the need for the local government to increase road construction to improve connectivity and density index of roads in the study area, as this will enhance intra and inter regional communication of the study area.

Keywords: *Road Network, Condition, Connectivity Index, Density Index, Sabon Sarki*

1.0 Introduction

The condition of rural areas of Nigeria is more pathetic since they are highly deprived of infrastructural facilities, especially when compared to urban areas (Akinola, 2007). According to Adesanya (1997) only about 5 percent of rural roads in Nigeria could be said to be in good condition, despite the contribution of rural

areas to the Gross Domestic Product (GDP). He further explained that the bad condition of these rural roads is compounded by the poor response to repairs and delays in rehabilitation by the responsible government agencies. Oni and Okanlawon (2006) reported that the neglect of roads in the country multiplies the cost of repairs at the end of every rainy season and also, sharply increases the cost of vehicle maintenance. It is further established that inadequate transport route imposes a great constraint on mobility and access to facilities like markets, hospitals and schools (Adesanya, 1997).

Omolaran (2006) established that, rural travel and transport in Nigeria remain difficult due to the poor condition of roads and transport services, which have continued to aggravate the problem of low productivity and high level of poverty in rural areas. In a study of rural roads Usman (2014) identified poor condition of roads as reasons for greater restriction on mobility with attendant negative effects on the rural economy and general wellbeing in rural communities of Kwara State.

1.1 The Study Area

The creation of Development Areas by the Kaduna State Government in 2002 has the objective of promoting grassroots development. Sabon Sarki Development Area is one of the created Development Areas in Kachia Local Government. The area was carved out as a new administrative region due to its homogeneity in terms of culture, tribe, and economic potentials. As a rural region, Sabon Sarki's needs are peculiar to rural area requirements of physical, social and economic facilities (Damina, 2006).

The study area is characterized with dispersed settlements, poor linkages and bad roads that make accessibility impossible during the rainy season. This forms the focus of this paper, which sets out to assess the connectivity and density indexes of the region. This becomes an advantageto the extent that growth can be guided and effectively controlled for development to occur.

This study is aimed at assessing the road connectivity and density indexes of Sabon Sarki development area as basis for making proposals on how to enhance intra and inter regional communication in the study area. This study provides the basis for establishing the intra and inter communication within any given region. The study is limited to Sabon Sarki, a rural region with vast potentials for agricultural development. Other aspects of the regional characteristics are not covered by this study as it is restricted to connectivity and density index of the study area.

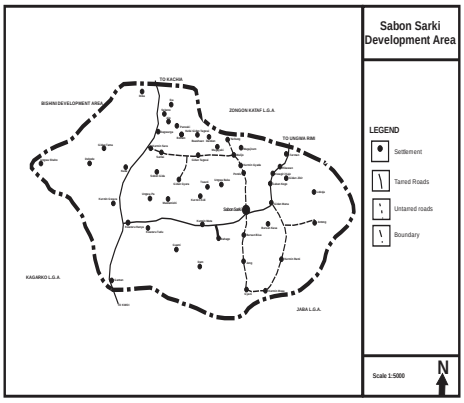

Fig.2. 1: The study area

The settlements that constitute Sabon Sarki Development Area are called "Ngar Ham" Kwaturu and Kurmin Gwaza wards were created in 1999. This gave the agitations by the people of the area for Local Government creation in 1998. The

agitations continued, until 2002 when an attempt was made by the Kaduna Governor State to create local government areas, which failed, and such areas were converted to development areas, because the created local governments were not recognized by the constitution of the Federal Republic of Nigeria, as such has no financial allocation from the federation account (Damina, 2006).

development area a number of four political wards and brought about – meaning other Jaba people that are not located in Jaba Local Government Area. The initial grouping of these settlements was in 1985 where a traditional district was created with its headquarters in Sabon Sarki. The growth continued where Gidan Tagwai District was carved out of Sabon Sarki district in 1995 and subsequently, the creation of Kurmin Musa, Jaban Kogo, Gidan Jibir, Kurmin Gwaza, Kwaturu and Gidan Gyara districts in 2002 (Damina, 2006). The old Sabon Sarki district was made a political ward in 1983, which was followed by the creation of Gidan Tagwai ward in 1992. Thereafter, Kurmin Musa,

As it is in other cases, the rural areas of Sabon Sarki have grown without Regional Planning intervention. This accounts for low development and uncoordinated growth with implications on standard of living. Sabon Sarki Development Area is endowed with fertile land for agricultural production of Ginger, Soya beans, Sugar cane, Millet, Sorghum, Maize, Rice Yam, Banana and Oranges (Damina, 2006; David *et al* 2009; Ajiboye and Adesanya, 2009; Muktar, 2011). Preliminary study revealed that poor transportation network and road condition have great negative impact on the agricultural activities of this rural region as it relates to movement of farm inputs and transportation of farm produce after cultivation.

2. Methodology

The primary data required for this study include identification of settlements and their linkages; socio-economic characteristics and; the types and condition of roads in the study area. The data required for this study were collected, from primary and secondary sources.

2.1 Primary Sources of Data

This includes; reconnaissance survey, interviews and questionnaires administration to get firsthand information from the Development Area.

2.2 Secondary Data and Sources

These include information sought from textbooks, journals, unpublished materials, maps and other appropriate literatures on regional planning and development. The data collected from field survey and questionnaires' administration were analyzed and presented using tables, bar charts, pie charts, pictures and maps.

2.3 Sample Frame and Size

A projected population of household heads from 2006 census gave 42,580 households in the study area, which forms the sample frame. A sample size of 0.05 % of 42,580 from the projected population of 2018 was taken.

$$\frac{0.05}{100} \times 42{,}580 = 212.9 = 212 \text{ approximately}$$

Systematic random sampling was adopted and was conducted as follows: The development area was divided into four quarters having equal number of districts. A district was selected from each quarter randomly. A village was randomly selected from each of the four districts. A sample size of 212 persons came from the selected villages. 212 /4= 53 persons/village.

Questionnaires were administered to the head of each family until the 212 Questionnaires were exhausted.

Table 3.1 Employment Status of Resppondents

Employment status	Number of Respondents	Percentage
Employed	63	35
Self-employed	77	36
Unemployed	72	40
Total	**212**	**100**

Source: Field survey, 2018.

3.0 Result and Discussions

3.1 Economic Characteristics

The dominant economic activity in the area is farming which is the major source of income of the people in the area. Ginger is the predominant cash crop that is produced in all the settlements. The soil is rich for ginger production but farming inputs are lacking to boosts the production of this cash crop. Below are some economic variables of the area;Farming constitutes 58% of the respondents' occupation in Sabon Sarki Development Area; civil servants make up 28%, trading covers 11% while others constitute 8% (i.e. people who do not have a defined occupation). It can be deduced from the above data that the economy of the area is dominated with primary production, which require good transportation system for transportations of goods out of the rural areas. This finding agrees with the outcome of Okoko, (2011); Dosunmu and Gegeleso, (2018); Abubakar, (2015); Adedeji, *et al* (2014) where they established the expediency of transportation to transforming the economic fortunes of rural areas.

Data from Table 3.1 reveals that the greater percentage of the respondents are self-employed constituting 35%. Those who are employed and are on monthly income make 35%. Those who are unemployed constitute 40%. This indicates the need to enhance the employment opportunity of the area, which has the potential of transforming the fortunes of the study area.

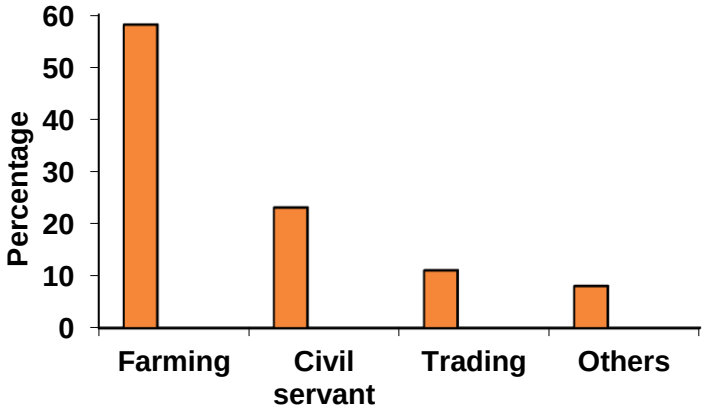

Figure 3.1: Occupational characteristics of the respondents

Source: Field survey, 2018

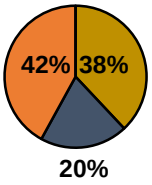

Fig. 3.2: Type of farm Output
Source: Field survey, 2018

The survey reveals that 38% of the respondents engaged in subsistence agricultural production, only 20% that are engaged in pure commercial farming of Ginger, Soya beans and sugarcane, while 42%are into both subsistence and commercial cultivation.

Table 3.2: Monthly Income Level

Income class (₦)	Number of Respondents	Percentage
<5000	56	26
6000 – 10,000	103	49
11,000 – 15,000	26	12
21,000 and above	27	13
Total	**212**	**100**

Source: Field survey, 2018.

Table 3.3: Hierarchy of Regional roads

Road Type	Area (km)	Percentage
Federal road	38	28.5
State roads	75.6	56.7
Local Government roads	19.6	14.7
Total	**133.2**	**100**

The predominant problem facing the area is that of poor linkages. This problem is worsened in the rainy season, where most settlements become inaccessible by vehicles and hinders the transportation of goods and humans.

The survey reveals that the most respondents (49%) earned between ₦ 6000 – 10,000 constituting 49%. A considerable proportion of 26% earned less than ₦ 5000, 13% earned ₦ 21,000 and above and only 12% that earn between ₦ 11,000 –15,000 Naira monthly. The income of the people improves during the harvest season and usually drops during the cultivation season.

3.2 Regional Roads in Sabon Sarki Development Area

3.2.1 Transportation Linkages

The transportation network serving most settlements in the area is poor and in a deplorable state. This is worsened in the rainy season, where most roads become non-motorable and hinders the flow of goods and humans. Various hierarchy of roads were identified within the study area, they include Federal, State and Local Government roads (Table 3.3). Below is the analysis of the transportation network of the area.

The Federal road constitutes 28.5% of the total area network in the area, state road has the highest percentage of 56.7%, while local government roads are the least having 14.7%. *See* (Table 3.3) *and (Plate. 1 and plate 2).*

3.2.2 Problem of Road Linkages

Table 3.4: Condition of Regional Roads

Variables	Attributes	Percentage
Condition of surface	Tarred	40.4
	Un-tarred	50.6
Surface of un-tarred	Smooth	50.8
	Rough	49.2
Surface of tarred	Laterite	42.5
	Asphalt	57.5
Number of lanes	Two	87.4
	One	12.6
Motorability	All seasons	66.8
	Dry season	33.2

Source: Field survey, 2018.

Table 3.4 shows that 50.6% of regional roads in the area not tarred and 49.2% have very rough surface. The tarred roads constitute 40.4% of the total roads in the area. 87.4% of the roads in the area have two lanes, which are motorable in all season and 12.6% have only one lane, which are not motorable in the rainy season.

Plate 1: Connectivity problem between Kurmin Musa and Kurmin Rami
Source: Field Survey, 2018

Plate 2: Poor road condition connecting Gidan Tagwai and Magayaki
Source: Field Survey, 2018

The Kaduna State policy for the construction of rural roads stipulates a distance of two (2km) of settlements away from the road as the convenient distance. Therefore, a distance that is beyond 2km indicates a need for the provision of road or linkage to that particular settlement. See *(plate 2) and Table 3.4.*

Table 3.5: Settlement Distance from the road

Group	Distance (KM)	Number of settlements	Percentage
1	0 – 2	5	23.8
2	3 – 4	2	9.5
3	4 – 6	12	57.2
4	7 - 8	2	9.5
Total		**21**	**100**

Source: Field Survey, 2018.

The survey reveals that motorable roads located within the acceptable distance of 2km by the Kaduna state government serve only 23.8% of the settlements in the study area and the remaining 76.2 are located outside the acceptable distance, which indicates the need for road construction to be extended to the affected settlements

i. Road Connectivity Index

Here we examine how well interconnected nodes (settlements) are. The network is abstracted as a set of Vertices (linkages) that are related to a set of edges (nodes). The computation of the network connectivity is based on the *Gamma* and *Alpha* index formulae. *(see appendix 1).* Gamma index is simply the ratio of the number of edges in a network to a maximum number of possible nodes in the network. *(Appendix 1).* The formula is given below;

Y_1 = Actual edges $\frac{e}{e_{max}}$

$= \frac{e}{\text{Maximum edges}}$

$3(V-2)$

While the alpha index is given as

$Y_2 = \frac{e - V+1}{2V+5}$

Where:

e = Edges

V = Vertices

Vertices = 27

Edges =28

Total number of edges = 50

Gamma Index

$Y_1 = 28 = \frac{28}{75} = 0.37 = 37\%$

$3(29-2)$

Alpha Index

$Y2 = e-V + 1 = 28-27+1 = 2$

$= 2 = 0.04 = 4\%$

$2V – 5 \quad 2(27)-5 \quad 54 –5 \quad 49$

From the above calculations, the maximum road connectivity is 37%, which shows that the level of connectivity among settlements in Sabon Sarki Development Area is low.

The alpha index is used to determine circuitry in a network. A circuitry means the establishment of additional or alternative patterns among nodes in the network. The calculation of the alpha index for Sabon Sarki development area gave a figure of 4%, it shows that the development area has a low connected road network.

ii. Road Density Index

The simplest measure of road construction is road density (linear units of roads per unit area). The density of a network is the total network divided by the total areas it covers *(see appendix 1).*

$D = \frac{L}{A}$

Where:

D = Network density

L = Length of network

A = Area under study

This measure is employed to determine the existing road density in Sabon Sarki Development Area. The Development area has a total land area OF 1,269km^2 and a road length of 133.2km.

$D = \frac{133.2}{1,269} = 0.106$km (106m) approximately

The existing road density in Sabon Sarki Development Area is 106m per/km^2. The

density is low because 21 settlements out of 50 settlements are not linked with road network; they are only accessible through footpath. Also the level of circuitry is low (37% and 4%) respectively. *(See Fig. 4.1).*

4.0 Conclusion

It has been revealed that Sabon Sarki Development Area despite its agricultural potentials does not have good transportation network. The existing roads in the area are in deplorable condition. This has the potential of negatively affecting agricultural production of the people as it would be extremely difficult for farm inputs to be transported to farms. Transportation of farm produce to market is also hampered when road condition is poor and motorable roads are not provided in other cases. This suggests the need therefore for a robust intervention on the part of both State and Local governments in the area of rural accessibility in the study.

5.0 Recommendations

i. There is the need to increase road construction to improve connectivity and density index of roads in the study area. This is the responsibility of the local government

ii. There is an urgent need to embark on massive construction of feeder roads to open up settlements that are inaccessible by car in order to better harness the economic potentials of the region.

iii. The Sabon Sarki Development area accessibility should be reorganized using Regional Planning strategies for maximum connectivity and interaction within and outside the area.

References

Abubakar, A. A. (2015). Influence of Rural Roads on the Patronage of Rural Markets in Kudan Local Government Area, Kaduna State.http://kubanni.abu.edu.ng/jspui/bitstream/123456789.

Adedeji, O.A; Olafiaji, E.M; Omole, F.K; Olanibi,J.A; and Yusuff, L. (2014). An assessment of the Impact of Road Transport on Rural Development: A Case Study of Obokun Local Government area of Osun State, Nigeria. *British Journal of Environmental Sciences* Vol.2,(1), pp.34-48.

Adesanya, A. (1997) "Transportation Development" in Adedotun, A. O. and Titilola, S. J. (Eds) Nigeria 2010. *Nigerian Institute of Social and Economic Research (NISER), Ibadan*. Pp 181- 193

Ajiboye, A. O. and Adesanya, A. (2009). The Impact of Rural Transportation on Agricultural Production in a Developing Country: A Case of Kolanut Production in Nigeria. *International Journal of Agricultural Economics and Rural Development. Vol.*2(2): 49 -5. https://www.academia.edu/3484842

Akinola, S. R (2007) Coping with Infrastructural deprivation through collective action among rural people in Nigeria. Nordic *Journal of African Studies* 16(1): 30-46. https://www.africabib.org/htp.php?RID=P00001594

Damina, B. G. (2006) Regional Planning Proposals for Sabon Sarki Development Area, Kachia Local Government, Kaduna State. An unpublished B.URP dissertation, Department of Urban and Regional Planning, Ahmadu Bello University, Zaria

David, R. L., Bernardete N., Keith W., Leslie. L., & Monika Z. (2009) Rural Poverty and Natural Resources: *Improving Access and Sustainable Management*. http://www.ifad.org/rural/rpr2008/background.htm

Dosunmu, V. A. and Gegeleso, O. M. (2018). Analysis of Transport Services as an Antidote to Rural Economic Development. *Transport & Logistics: The International Journal*. Vol.18 (44), p77-85.http://ulpad.fberg.tuke.sk/transportlogistics/wp-content/uploads/9_Dosunmu_Gegeleso.pdf

Muktar, M. (2011) Determinant of Food Insecurity in Nigeria: Application of Binary Choice Modelling Technique. https://www.researchgate.net/publication/234840808

Okoko, E . (2011). Rural transportation and rural development: The instance of Akwapim South district in Ghana. International Journal of Economic Development Research and Investment Vol2(3).https://www.mcser.org/journal/index.php/ajis/article/download/9263/8943

Omalaran, A. A. J. O. I. (2006) Accessibility Problem and the incidence of poverty in Nigerian Rural Environment: a Case of Offa Local Government Area of Kwara State.

Oni, S. I. and Okanlawon, K. R. (2006) "Nigeria's Transport Infrastructural Development: An Integral Part of National Empowerment and Development Strategy (NEEDS." *Journal of Social and Policy.* Vol. 3(2): 7 – 13pp.https://www.researchgate.net/publication/265922984

Usman, A. B. (2014) Analysis of Condition of Rural Road Transport in Kwara State, Nigeria. *European Scientific Journal* 10(5) eISSN:1857 – 7431. https://eujournal.org/index.php/esj/article/view/2726