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## **Accessibility and Flow of Agricultural Commodity in Orire Local Government Area of Oyo State, Nigeria**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Author IM designed the study, performed part of the statistical analysis, wrote the protocol and wrote the first draft of the manuscript and managed literature searches. Author AJA managed the analyses of the study and literature searches. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

The study examined accessibility and flow of agricultural commodity in a rural area of Nigeria with a view to determining the effect of transportation on agricultural development in the area. The data used were collected from one hundred randomly selected farmers from five major market centres in the Local Government Area. The road network of the study area was also mapped to determine the level of connectivity of the area. The study showed that settlements in the area are poorly connected. This factor coupled with the deplorable condition of the rural roads have hampered steady evacuation of agricultural produce to the market centres. Movement of agricultural commodities to urban centres was concentrated on the few good roads available using lorries as the main mode. The study therefore recommends that in order to improve the flow of agricultural commodity in the local government, good roads and transport facilities should be provided.

**Keywords:** *Rural roads; agricultural commodity; farmers; market centres; transport facilities.*

## **1. INTRODUCTION**

The role of transport in promoting overall national development cannot be overemphasized. Transportation is one of the most important factors in the development process in any society [1]. It provides the arteries through which the economic life stream of communities flows. This includes the people, information, raw materials and finished products [2]. There is hardly any aspect of a nation's development in which transport is not an essential ingredient since there is always the need to collect, assemble, move or transfer and distribute people and things. Perhaps this is what [3] had in mind when he declared – “there is no escape from transport”. Improvement in transport improves mobility. Transport is crucial in the development and growth process of any nation. Good transportation generates additional economic activities and makes existing ones more efficient. In an earlier study on Nigeria and Ghana [4] recognised that in the economic growth of underdeveloped countries, a critical factor has been the improvement of internal accessibility through the expansion of transportation network. In particular, rural roads are helpful in enhancing rural productivity as well as strengthening the socio-economic, cultural and political fabrics and processes of the rural community [5].

In the White paper on European Transport Policy for 2001, the Commission for European Communities observed that transport is a key factor in modern economies and a country's transport system needs to be optimized to meet the demands of enlargement and sustainable development [6]. India, in formulating its national transport policy, observed the overriding importance of transport in its national development [7]. Also, in South Africa, development in transport is seen as a major catalyst to social and economic development in the country [8]. In Nigeria, although the Rolling Plans of 1993 to 1998 appeared to have neglected investment in the transport sector, the first, second and third National Development Plans gave the transport sector the largest share of revenue allocation (an average of about 22.4 per cent), while in the fourth National Development Plan, transport received 15.2 per cent in the nation's public sector investment programme [9].

The special characteristics of agricultural products such as perishability, seasonality and bulkiness depend on a flexible transportation system [10] have opined that efficient transport system is critically important to agricultural marketing. They assert that if transport services are infrequent of poor quality or expensive, then farmers will be at a disadvantage when they attempt to sell their crops. An expensive service will naturally lead to low farm gate prices (the net price the farmer receives from selling his produce).

Seasonally impassable roads or slow and infrequent transport services, coupled with poor storage can lead to losses as certain crops such as vegetables and milk deteriorate over time. If the journey to market is made over rough roads, then crops such as bananas and mangoes may suffer losses from bruising which may result in lower prices to the farmer. Where efficient and high volume of transport and marketing system exist, a consistent high urban and international demand of agricultural products will result. If the margin between what the farmer receives from the sale of his produce and what the urban consumer pays for his produce is high, then the effective demand transferred to the farmer will be correspondingly reduced. Indeed the pattern of flow of agricultural commodity in any area is strongly influenced by the nature of transport services [5].

The problem of production and flow of agricultural commodity in Nigeria is worsened by the fact that in many parts of the country, most of the rural settlements are not well connected by roads.

A lot of the settlements are connected by bush paths which are in some cases not large enough for motor transport. Where motorable roads exist, the problem is further compounded by the poor quality of the roads. They are mostly with untarred surface, narrow width, circuitous alignment and impermanent bridges [11].

Most of the rural areas in Nigeria do not have adequate feeder roads either both within rural to farm camps, rural-rural or rural-urban. Where access roads exist they are mostly untarred and heavily eroded during the rainy season. In some cases, the bridges/culverts linking the rural areas have been damaged. All these constraint the production efforts of farmers and bulky movement of farm produce from rural to urban markets [12].

The rural populace constitutes more than 70 per cent in Nigeria and rural resources if properly tapped will lead to a buoyant rural economy. Evidently, if there is no provision for transport to convey the farm products from the rural to urban centres, the cost of farm products in urban centres will be high. The objective of this paper is to examine the transport factor in the flow of agricultural commodities in a rural environment of Nigeria.

### **1.1 Statement of Hypotheses**

In order to determine the association between quantity of commodities transported to the markets and market locations, a set of hypotheses were formulated. The formulation of hypotheses helps to streamline and guide the researcher in his problem of investigation. The following null hypotheses were tested:

H<sub>0</sub>: There is no significant association between the quantity of commodities transported to the markets by the farmers and the market locations.

H<sub>1</sub>: There is no significant association between the quantity of commodities transported from the markets to the urban centres and market locations.

### **1.2 Accessibility Problem and Agricultural Development**

Transportation is a key component of agricultural development. Transportation is important because it is the means of bringing products from the rural areas to the urban centres. Even if a farmer grows enough agricultural items to sell, if there is no way to transport these products to the market, the farmer cannot sell the crops and make money.

In many parts of the developing world, problems with roads and infrastructure interfere with farmers' ability to sell their goods.

For economic reasons most rural dwellers do not own any form of transportation because they cannot afford the cost of purchase. Studies in Nigeria's economies suggest that transport costs form a significant proportion of the final price of most goods – agricultural, manufactured and mining products. On the average, transport accounts for more than 30% of the value of the delivered product. This high cost is attributable to the inadequacy and inefficiency in Nigeria's transport infrastructure [13].

## **2. MATERIALS AND METHODS**

The study examined the characteristics of the road network of Orire local government of Oyo State and the flow of five major agricultural commodities in the study area. The five

commodities selected through purposive sampling are yam, yam-flour, garri, guinea corn, maize being the predominant crops grown in the study area. Road networks connecting 20 towns were selected for the study. The towns, also selected through purposive sampling on the basis of their population, are Adafila; Ahoro Dada; Ajinapa; Alaropo; Alafori; Baba-Eko;

Dawodu; Eseke; Igbori; Ikoyi-Ile; Iluju; Ipekun; Isepo; Odo-Oba; Oko-Ile; Oloka; Olokoto; Olorunda; Oolo; Tewure. Fig. 1 shows Orire Local Government within Oyo State while Fig. 2 shows the road network of the study area.

Both primary and secondary data were used for the study. The map of the Local Government was collected from Oyo State Ministry of Lands and Housing and the road networks connecting the 20 selected settlements were extracted. This formed the source for the collection of data for network analysis of the study area with the 20 settlements taken as nodes and the roads connecting them as the links.

The representation of the topological characteristics of road networks in graph form has become a widely accepted procedure in the analysis of transportation networks. In such an approach, the network is abstracted into set of nodes (vertices) and set of edges (links) connecting the nodes. Based on this, it becomes possible to enumerate the relationships between the nodes. The information thus derived is used in constructing a set of graph theoretic indices which serve as a standard for comparison of networks [14]. The analysis of such transport network in various countries has revealed a strong correlation between levels of economic development and topological connectivity indices [15,16, 11].

In Orire Local Government, the road network has been abstracted in form of a graph Fig. 4. In the graph, there are 35 edges (e) or links and 20 vertices (v) or nodes.

In this study, the indices used are the Alpha index ( $\alpha$ ); Beta index ( $\beta$ ) and Gamma index ( $\gamma$ ). The alpha index ( $\alpha$ ) is a ratio based on the number of circuit in a network rather than on the number of edges. The measure is most ideal for connectivity measure because its range of definition is a closed interval with the limit of 0 and 1.

The Beta index ( $\beta$ ) expresses the number of edges in the network in relation to the number of vertices. Therefore, it may be regarded as indicative of the average number of links leading into and out of a node. The Beta index indicates that every node in the network is linked with at least two routes. The Gamma index ( $\gamma$ ) which is usually expressed in percentage shows the ratio of the number of edges to the maximum which may exist between the number of vertices. The gamma index is bounded by 0 on the lower limit and 1 on the upper limit. The value of 1 describes completely connected networks and lesser values indicate various degrees (or percentages) of connectivity.

In respect of data on the flow of agricultural products, five major functional periodic markets in the Local Government Area were selected. These markets are at Adafila; Eseke; Iluju; Odo-Oba; Tewure Fig. 3. The markets operate at intervals of five days. Because of the numerous items of produce taken to the markets, the five major items were selected. It is important to note that information about the flow of these products are not available on ordinary days except on market days. This is because of the rurality of the area. On the market days in question, routes in the towns leading to the markets were stayed by the survey teams employed. Information collected from the markets included (a) quantity of goods taken to the market (b) mode of transportation (c) origin of such goods. In the case of

goods living the market for urban centres information were collected on the quantity of goods; mode of transportation; destination of goods.

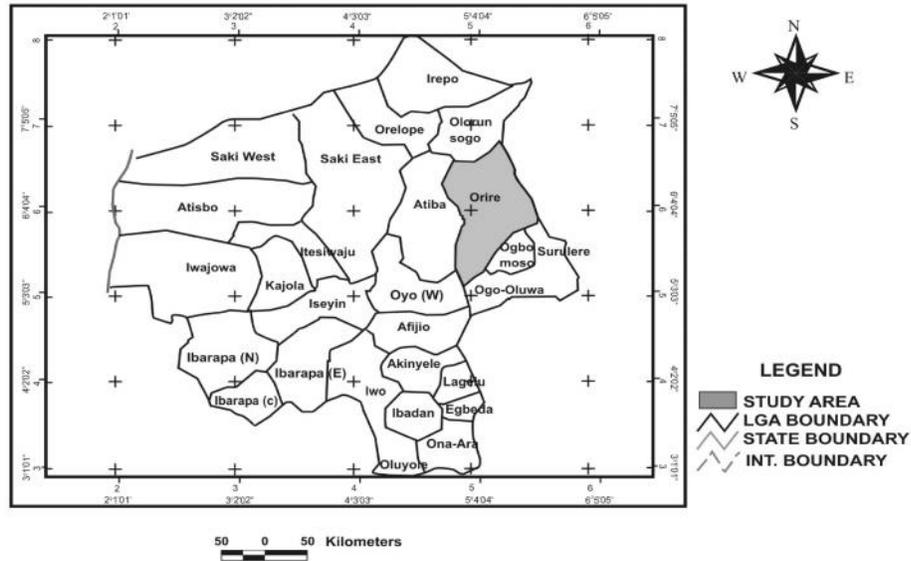


Fig. 1.0: Map of Oyo State Showing Orire LGA  
Source: Ministry of Lands and Surveys, Oyo State

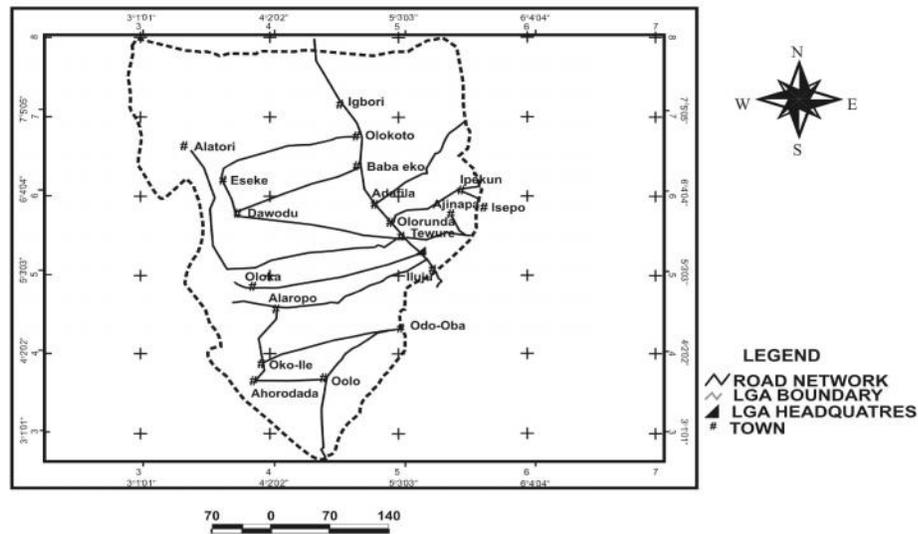


Fig. 2.0: Map of Orire LGA showing Road Network  
Source: Ministry of Lands and Surveys, Oyo State

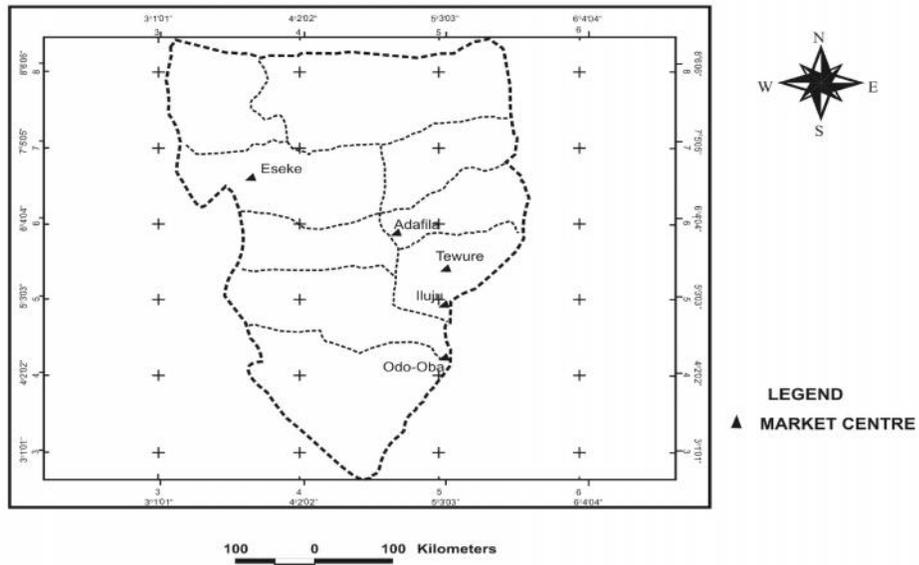


Fig. 3.0: Map of Orire LGA showing the Market Centres  
Source: Authors' Field Survey, 2010

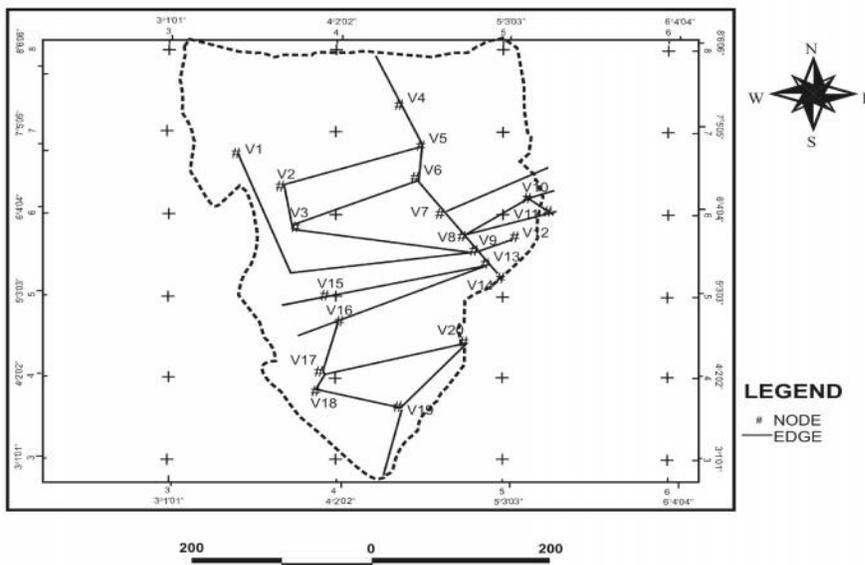


Fig. 4.0: Map of Oyo State Showing Orire LGA  
Source: Authors' Field Survey, 2010

The goods of interest were counted numerically and translated into weights. Yams were counted in tubers and an average weight of 1.2kg attached to each tuber; yam flour were counted in bags of 80kg. They are normally sold in small bowls. These bowls were counted and total weights calculated. Garri was counted in bags of 50kg; guinea corn was counted in bags of 80kg and maize was also counted in bags of 80kg each Table 1.

**Table 1. Conversion table for five selected agricultural produce**

Commodity	Unit Weight (kg)	Count Weight
Yam	1.2	Tubers
Yam-flour	80.0	Bags
Garri	50.0	Bags
Guinea-corn	80.0	Bags
Maize	80.0	Bags

Source: Orire L.G.A. marketers

In all, 100 questionnaires were administered. Twenty questionnaires each for the five major markets selected. On this basis, ten questionnaires were designed for the rural farmers who transported their produce from farm to the markets. Ten questionnaires were also administered to the middlemen who transported the produce from markets to the urban centres. The age of the people interviewed ranged from 17 – 60 years. The farmers and middle men were selected through simple random sampling. The appropriate test statistics used is the chi-square technique defined by  $\chi^2 = \sum_{i=1}^k \sum_{j=1}^l \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$  where  $O_{ij}$  = observed frequency in category  $i$  of sample  $j$ ;  $E_{ij}$  is expected frequency in category  $i$  of sample  $j$ . For the required level of significance ( $\alpha$ ) the number of degrees of freedom is given by  $N = (k - 1)(l - 1)$ .

Where  $k$  is the number of categories and  $l$  are the number of samples. For the usual test, where one is looking for significant differences, a  $\chi^2$  value is deemed significant when it is larger than the table value (i.e. when  $\chi^2 \geq \chi_{\alpha}^2$ ). The chi-square test to determine the association between the quantity of commodities transported to the market by the farmers and the market locations showed that

The  $\chi_{tab}^2$  with 16 degrees of freedom at  $\alpha = 0.05$  is 26.296.

The calculated value of  $\chi^2$  however is 495.69 which is greater than the table value at 0.05 level of significance. We therefore reject the null hypothesis. Consequently, a significant association exists between the quantity of commodities transported to the markets by the farmers and the market locations.

### 3. RESULTS AND DISCUSSION

#### 3.1 Road Condition

Roads in the Local Government can be categorised into four. These are highways, surface roads; earth roads and footpaths. These roads are used for transporting agricultural commodities in the Local Government. The highways are urban-urban routes that link important agricultural areas or big urban centres. They are of 12 metres in width, tarred and motorable throughout the seasons. This category of roads constitute 2 per cent of the total road network in the study area Table 2. It can accommodate trailers, lorries, buses and other types of vehicles. The second category of roads is the surface road with a width of 8.0 metres. They are mostly untarred and constitute about 30 per cent of the road network in Orire Local Government. They are maintained by the Local Government. They provide rural-rural and rural-urban link connecting big villages with each other or with urban centres. This

category of roads is usually muddy and not motorable during the rainy season. It can accommodate automobiles.

**Table 2. Measure of Road quality in the local government**

Categories	Road Width (m)	Period of Motorability	Surface Condition	Percentage
1.	12.0	All seasons	Tarred	2.0
2.	8.0	All seasonal	Untarred	30.0
3.	6.0	Seasonal cut-off	Untarred	15.2
4.	3.0	Seasonal cut-off	Untarred	52.6

Source: Authors' fieldwork

The third category of roads is the earth road and is of untarred but not motorable during the raining season. It connects mainly the rural settlements and mostly maintained by the local councils in conjunction with the rural communities. This category of roads constitutes about 15.2 per cent of the total road network in the Local Government. The fourth category of access is bush paths which also provide rural-rural links. The bush paths are numerous with an approximate width of 3.0 metres and they are the least developed. They are generally constructed to link villages, hamlets with their farmlands and markets. Typically, these link paths can only permit two people walking abreast. So only bicycles and motorcycles can use these roads. They constitute the dominant proportion of 52.6 per cent of the road network in the study area.

### 3.2 Pattern of Network Accessibility

Table 3 shows the alpha, beta and gamma values obtained for the road network of Orire Local Government. The indices show that roads in Orire Local Government are poorly connected. These indices have however only assisted us in assessing the effort of the communities and Local Government Council in the construction of low-grade access roads within the Local Government Area.

**Table 3. Connectivity indices for orire L.G.A. road network**

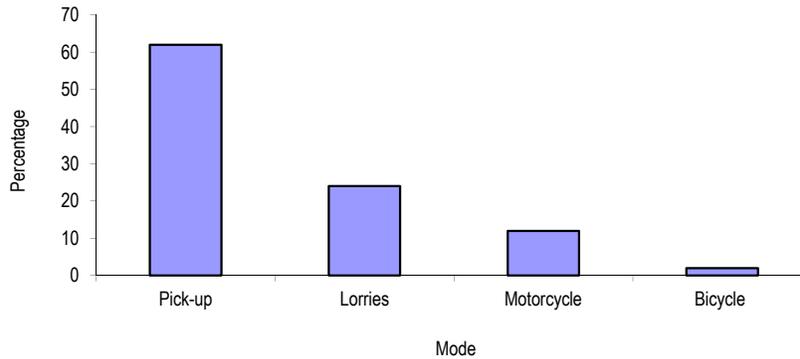
Index	Formula	Connectivity Value
Alpha ( $\alpha$ )	$e^{-v+1}/2v-5$	0.4
Beta ( $\beta$ )	$e/v$	1.75
Gamma ( $\gamma$ )	$e/3(v-2)$	0.64

Source: The authors

### 3.3 Mode of Transportation

The farmers used four different modes to transport their produce to the markets. These are (i) Bicycles (ii) Motorcycles (iii) Pick-up vans (iv) Lorries. The road types dictated the mode of transport used. While 2.0 per cent of the farmers interviewed used bicycles to transport their produce to the markets; 12.0 per cent were found to use motorcycles. This was possible on Earth roads constructed by the Local Governments. The problems with these roads, however are that the bridges and culverts along them which were constructed manually were washed away during the rainy season. Examples include Alatori and Tewure roads.

Another mode of transporting agricultural produce is by pick-up vans. This constituted 62.0 percent of the mode of transportation by the rural farmers and used mainly along Ikoyi-Ogbomoso road Fig. 5. For the middlemen, the mode of transporting produce from the market to the urban centres are by lorries, (66.0 per cent) and pick-up vans 34.0 per cent.

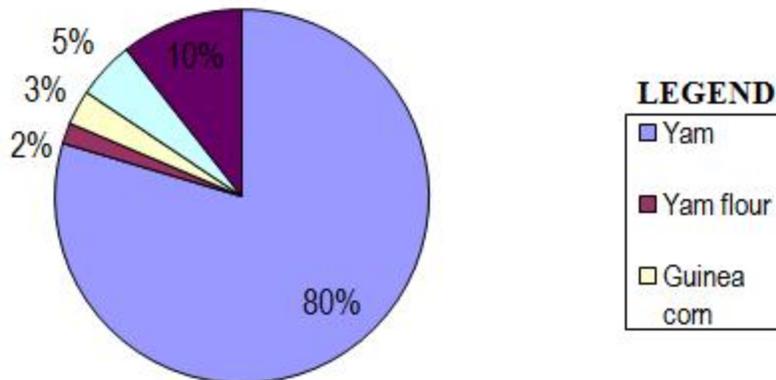


**Fig. 5. Mode of transportation**

### 3.4 Pattern of Commodity Flow to the Markets

Agricultural commodity movement in Orire Local Government of Oyo State shows that movement is from the areas of surplus to areas of demand. Farmers move their produce from the rural settlements and farmsteads to the markets from where they are transported to the urban centres.

The pattern of flow of agricultural commodities in Orire Local Government is as shown in Table 4. The table shows that out of the five commodity types, yam ranks first constituting 79.6 per cent of the total commodities transported to the markets in the region. This is followed by maize which constitutes 10.6 per cent. Garri, Guinea corn and yam flour rank third, fourth and fifth in that order constituting 5.0 per cent, 3.0 per cent and 1.8 per cent respectively Fig. 6.



**Fig. 6. Quantity of commodities transported to the markets by the farmers**

**Table 4. Quantity of commodities transported to the markets by the farmers (tonnes)**

Market Locations	Yam	Yam Flour	Guinea Corn	Garri	Maize	Total	Percentage	Rank
Eseke	850	5	11	15	48	929	35.7	1
Iluju	150	6	15	40	112	323	12.4	5
Tewure	300	3	10	15	35	363	14.0	4
Odo-Oba	500	4	10	21	63	598	23.0	2
Adafila	270	29	31	39	18	387	14.9	3
Total	2070	47	77	130	276	2600	100.0	
Percentage	79.6	1.8	3.0	5.0	10.6	100.0	-	
Rank	1	5	4	3	2	-	-	

Source: Authors' survey

### 3.5 Pattern of Flow of Commodities from the Market to the Urban Centres

The pattern of flow of agricultural types from the markets to urban centres outside the producing region is as shown on Table 5. The table shows that among the five commodity types transported from the markets to urban centres, yam ranks first constituting 72.1 per cent, maize ranks second constituting 12.1 per cent while guinea corn, garri and yam flour rank third, fourth and fifth in that order constituting 6.5 per cent; 5.7 per cent and 3.6 per cent respectively.

In terms of aggregate flow of agricultural commodities from the markets to urban centres, Iluju market ranks first supplying 31.9 per cent of the flow. This is followed by Odo-Oba which supplies 26.8 per cent while Adafila, Tewure and Eseke rank third, fourth and fifth supplying 17.6 per cent, 11.9 per cent and 11.8 per cent of the total flow respectively. Commodities from Eseke market are transported outwards through Igbeti road while those from Adafila, Tewure and Iluju are transported to Ilorin, Osogbo and Ife. Similarly, commodities from Odo-Oba market are distributed through Ogbomoso and Oyo roads to different urban centres.

**Table 5. Quantity of commodities transported from the markets to the urban centres**

Market Locations	Yam	Yam Flour	Guinea Corn	Garri	Maize	Total	Percentage	Rank
Eseke	200	7	33	10	78	328	11.8	1
Iluju	650	9	70	35	120	884	31.9	5
Tewure	250	5	17	30	27	329	11.9	4
Odo-Oba	600	10	14	40	80	744	26.8	2
Adafila	300	70	45	45	30	490	17.6	3
Total	2000	101	179	160	335	2775	100.0	
Percentage	72.1	3.6	6.5	5.7	12.1	100.0	-	
Rank	1	5	3	4	2			

Source: Authors' survey

The chi-square test to determine the association between the quantity of commodities transported from the markets to the urban centres and market locations showed that the  $\chi^2_{tab}$  for  $(5 - 1)(5 - 1) = 16$  degrees of freedom at  $\alpha = 0.05$  is 26.296. The calculated value of  $\chi^2$  is however 526.67 which is greater than the table value at 0.05 level of significance. We reject the null hypothesis. Hence, a significant association exists between the quantity of commodities transported from the markets to the urban centres and the market locations.

#### **4. CONCLUSION**

The study has shown that the level of road development in Orire Local Government of Oyo State is generally low. This has affected the flow of agricultural commodities in the Local Government. The pattern of movement of commodities from rural settlements to urban centres has also been dictated by the level of road network development. Commodities are generally transported to locations where they can easily be distributed to urban centres outside the Local Government. The conclusion from the results of this study is that poor road network development in the Local Government has affected the flow of agricultural commodities in the area.

#### **COMPETING INTERESTS**

Authors have declared that no competing interests exist.

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## **QUESTIONNAIRE**

**Instruction:** Any information given will be kept strictly confidential and will not be disclosed to anybody. It is purely for research purpose. This questionnaire covers two sections.

### **SECTION A**

The Rural Farmers who bring their Produce from farm to the Market

1. Age: (a) 19-25 years (b) 26-40 years (c) Above 40 years
2. Sex: (a) Male (b) Female
3. Where do you reside? (a) Village (b) Ward
4. Do you own a farm? Yes / No
5. What is the size of the farm? \_\_\_\_\_ Acre / Hectare
6. What type of crop(s) do you normally grow? \_\_\_\_\_
7. What is the average ton of your farm produce that you normally take to the market at once \_\_\_\_\_
8. How do you interact with people around you?
  - a. Market days
  - b. Occasional day
  - c. None at all
  - d. Others (specify)
9. Where do you sell your agricultural products?
  - a. Market
  - b. Within settlement
  - c. Others (specify)
10. How long does it take you from your farm to the market?
  - a. Less than an hour
  - b. More than two hours
  - c. More than three hours
11. What mode of transportation do you use in transporting your products to the markets?
  - a. Head portrage b. Bicycle c. Motorcycle
  - d. Pickups e. Lorries

## SECTION B

This Section concerns the Traders who Transport these Goods in bulk to Urban Centers

1. Location \_\_\_\_\_
2. Age (a) 19 – 25 years (b) 26 – 40 years (c) Above 40 years
3. Sex \_\_\_\_\_
4. What is the average ton of farm products that you normally buy for sale in urban center? \_\_\_\_\_
5. What is the distance of the market to the urban center where you dispose off your products \_\_\_\_\_ in kilometers.
6. Mention main items traded with  
(1) Yam (2) Tam flour (3) Maize (4) Guinea corn  
(5) Garri (6) Others (specify)
7. How long does it take you from market to urban center?
  - a. Less than an hour
  - b. More than two hours
  - c. More than three hours
  - d. Above four hours
8. What mode of transportation do you use in transporting your products to urban centers?  
(a) Car (b) Pickups (c) Bus (d) Lorries

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