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Impact of rural accessibility on yields and income of cassava farmers in a part of North Central, Nigeria

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ABSTRACT

Poor rural transport impedes accessibility, livelihood and development in agrarian populations. This study examined the conditions of roads, farmers' modes of transport and transport services; determined annual yields and income from cassava and, assessed the impact of transport on both in Kwara South Senatorial District, Kwara State, Nigeria. Questionnaire was administered to1373 farmers systematically selected from thirty-six rural settlements in the study area. Descriptive and inferential statistics were used for the analysis. Results showed that 44.4% of the settlements were connected by tarred roads, 51.8% of respondents regularly trekked to farm, 51.6% patronized commercial motorcycle transport' services. 15.8% realized 201-300 bags and16.4% of the respondents realized N 100,000 – N 150, 000 annually. Cassava output inversely varied significantly with transport services (b= -210, p = 0.00). While, cassava income indirectly and significantly correlated with transport services (r = -0.226, p <0.05). The study concluded that transport services impacted significantly on spatial distributions of crop's yield and income. Therefore, improved transport services influenced farmers' livelihoods. The study recommended provision and rehabilitation of rural roads, creation of market centers and use of few passengers' vehicles to improve transport services and step-up yields and income and, promote the livelihood of farmers in the area.

Keywords: Distance to farm, Transport facilities Transport modes, Transport services

1. INTRODUCTION

Agriculture has been identified as the main engine of growth, development and poverty reduction in rural areas (Dorward et al., 2007). This paper focuses on the indispensability of rural transport as a catalyst for the advancement of agriculture as a rural socio-economic activity. Transport is an integra part of all agricultural activity. It also bridges the gaps between areas of surplus and deficit (Cox, 1972). Transportation plays an unparalleled role in connecting rural areas with urban areas; this enhances effective supply of farm outputs and demands for farm inputs.

Inefficient rural transport is known to constitute significant constraints on agricultural activities both by denying the sale of harvested crops and raising the cost of production.

Specifically, rural transport infrastructures and transport services determine the mobility potential of rural farmers and effective transportation of farm inputs and outputs to and from desired destinations. Although, rural roads connectivity has been described as a key component for efficient marketing of agricultural produce due to its ability to promote mobility; the provision of rural road is only a necessary but not sufficient condition for mobility (Gachassin and Raballand, 2015). Consequently, it is equally necessary to consider the condition of transport services; the volume of traffic of freight and passengers, level of competition and cost of transport; adjudged to be grossly inadequate and inefficient in many parts of Africa (Porter, 2014).

This unsatisfactory state of rural transport infrastructures and services has to be improved upon for the achievement of food security, agricultural development and rural development; this is particularly critical for the timely and gainful transportation of farm output majority of which are bulky, low valued, consumable, perishable. Additionally, the unsatisfactory state of rural transport infrastructures and services has to be improved upon to spatial interaction between and within rural and urban areas. Although, argued that areal differentiation was a necessary factor of spatial interaction; complementarity, absence of intervening opportunity and transferability have also been overwhelmingly recognized as factors influencing spatial interactions. Transferability is transport inclined.

It connotes provision of access physically; good road (tarred) and economically; good transport services (affordable, reliable, fast and competitive) capable of stimulating effective spatial interaction for optimal mobilization of man and material resources for increased level of agricultural and other rural economic production; resulting to the realization of higher income level. Accessibility is the ease with which passengers and, or goods reach other places measured in terms of time, cost and distance (Rodrigue, 2013). Accessibility may be influenced by seasonality and transport services provided (Van-de-Walley, 2002). Accessibility is season's dependent. It was observed to be 70% more expensive in wet season than dry season in Madagascar (Ninnin, 1997). This occurred because untarred roads typically depreciate in quality in wet season; it becomes rough, slippery, flooded and sometimes impedes vehicular movement.

Road's roughness was found to have increased by 50% in Tanzania (Starkey, 2001). This ultimately increases time, cost and stress expended on journeys and lessens the ease of getting to desired destinations. Distance decay model of states that "all things are related, but near things are more related than far things". This depicts that the farther apart a farm is located from farmers' residence, the less the interaction between them and the less the level of yield and income unless there is a better access to motorized modes of transport which overcome the friction of distance. Specifically, rural roads are the wealth of a nation, a tool for social inclusion and economic development through marketing of agricultural produce. A rural road provides access to other rural settlements and the nearest urban settlements through which delivery of farm inputs and output are guaranteed.

Improved rural roads enhances effective access to farm input, increases farmers' outputs, makes farmers' output accessible to higher market potentials and increases the level of agricultural income accruable to farmers (Jacoby, 2000; Tunde and Adeniyi, 2012; Emran and Hou, 2013; Inoni, 2009). Access roads to most rural areas which are headquarters of farming in developing countries are largely in deplorable and unsatisfactory state (Blimpo et al., 2013). The poor condition of roads connecting rural areas is major contributor to the isolation of rural areas (Akinola, 2007; Fafchamps and Shilp, 2009). Poor road network makes mobility difficult and discourages farmers from expanding their level of production.

This has been responsible for the generally high cost of transport. For instance, specifically observed that transport cost in SSA is one of the highest in the world, reaching as high as 77% of the value of export. This explains why large-scale agricultural production is ungainful and uncommon among farmers in developing countries (Jacoby, 2000). For instance, Stifel and Minton, (2008) have shown that isolated communities in Madagascar had low agricultural yields due to poor road quality and this militates against the livelihood of farmers in the isolated communities. In addition, poor condition of rural roads makes farming unprofitable due to difficulty in eliciting adequate market potential for agricultural produce arising from the poor quality of roads connecting most of the rural settlements. This occurs to the relatively higher transport's fare obtainable on poor quality roads than obtainable in roads of high quality.

For instance, empirical findings have associated relatively higher transport charges with untarred road settlements (Ninnin, 1997; Hine and Ellis, 2001; Paul et al., 2009; Raaballan et al., 2010). Another study also affirmed that transport charges was three times higher on poor quality road than high quality road in Amuro District, Kogi state Nigeria. In addition, transport charges have been observed to

vary with seasons. For instance, motorcycle operators were noticed to have inflated transport's fare due to scarcity of other transport services especially in wet season in nine selected rural settlements connected by earth surfaced road in Tanzania (Gina et al., 2013). Generally high transportation cost allows people to be relatively immobile (Golling and Rogerson, 2014). It prohibits or reduces effective mobilization of human, natural and other socio-economic resources for optima production levels especially in rural areas.

It accounted for the deprivation of most cattle farmers from selling their cattle at local market and made them relied only on farm gates sales with a reduction in their income level Kyeyamwa et al., (2008); a scenario that impacted negatively on the amount of profit accruable to the farmers. In Nigeria, most rural roads are in deplorable condition (untarred, dusty, circuitous and rugged, with fragile bridges), this makes effective mobilization of labour and other farm inputs for achievements of food security, agricultural productivity, agricultural and economic development in rural areas difficult (Ojetola and Ogunsanya, 1993; Ajiboye and Afolayan, 2006). The poor conditions of rural roads pose significant constraint on spatial interactions between farm sites and farmer's residence on one hand and between rural areas where agricultural outputs are produced and urban areas where agricultural produce are largely sold.

The poor condition of roads is attributed to corruption, poor fund management, inadequate attention for rural development Aderamo and Magaji, (2010) and political clienteism (Burgess et al., 2015). Several studies have been embarked upon on transport and agriculture within and outside Nigeria. For instance, observed in parts of Nigeria that road qualities (good, moderate and poor) have produced different levels of accessibility which in turn affects farmer's level of output in three communities in Fika Local Government Area of Yobe State, Nigeria. Escobal and Pons, (2002) observed in Latin America in a review of 25 documents relating to various countries that improvement of small rural roads promoted agricultural production, employment, living standards and poverty reduction.

More so, Dercon et al., (2009) observed that access to all-weather roads increases the level of consumption by 16% and reduces the incidence of poverty by 6.7%. Jacoby, (2000) observed in Madagascar that, higher transport cost is usually associated with poor rural roads. Also, observed that improvement in road access contributed to the expansion of farm size in Nicaragua. Also, upheld the negative effects of poor road quality on agricultural productivity of food farmers in Oyo using inefficiency analysis. Similarly, villages connected with all weathered roads in Indian were noticed to have recorded increase in the use of fertilizers, agro-chemicals and 'improved' crop varieties; the long-term effects include the attainment of increasing level of output and income from such crop.

In addition, access to motorized and non- motorized means of transport improves the level of farmers' productivity. For instance, observed that, the use of IMT (Intermediate Means of Transport) contributes to the attenuation of the negative effects of distance by positively impacting on agricultural productivity of food farmers in Oyo north, Oyo state, Nigeria. This implies that the use of bicycles, motorcycles and other motorized modes of transport has a capacity to enhance cultivation of bigger farms, utilization of remote but fertile land for crop cultivation, increased utilization of fertilizer, transportation of bulky crops, reduction of time spent on transit, reduction of spoilage and, ultimately increase rural agricultural production and livelihood. Cassava (*Manihot esculenta* Crantiz) is a major food crop in tropical and Sub tropical Africa, Asia and Latin America. Cassava is a highly significant root crop and a popular staple food for both rural and urban households in Nigeria.

In Nigeria, harvested Cassava root are usually processed in to several food items such as toasted granules (*gari*), chips/flour, fermented pastes, cassava flour, starch, among others; most of which are given traditional names as garri, fufu, starch, abacha and lafun Oriola et al., (2019); which are major source of Carbohydrate and makes significant contribution to food security. Also, cassava leaves are eaten as vegetables by some people and dried to feed livestock (Oriola et al., 2019). Cassava is usually propagated by stem cutting. Nigeria has consistently been ranked as the world's largest producer of Cassava; producing around 45 million tonnes in 2009 (Kolawole et al., 2010). Although, Cassava can give reasonable yield with some level of drought and low soil fertility, Salami and Tilakasiri, (2020), planting of high yielding varieties could result in higher income, especially in areas with access to improved technology and market.

The relevance of transport in the study of Cassava production is not unconnected with the fact that harvested root crops are usually bulky; hence, good transport system plays noticeable roles in determining the profitability of Cassava production. Studies have indicated the impact of transport on both yields and income of crops generally, but information is lacking on the impact of transport facilities on yields and income of specific crops in the region. Although, using principal component analysis observed that Guinea corn output varied significantly with transport mode (b=0.262, p 0.00) and road condition (b =0.03, p =0.002). While guinea corn income was directly and significantly correlated with transport mode ($r = 0.266$, $p < 0.05$) but inversely correlated with distance to farm ($r = -0.047$, $p > 0.05$).

However, information is lacking on the specific impact of rural transport on cassava yield and income considering its importance as a popular staple food in Nigeria, hence this study. Consequently, this study identified the conditions of roads and modes of transport accessible to cassava farmers, examined perceptions of cassava farmers on seasonal variations of transport charges, examined the annual yields and income from Cassava and assessed the impact of transport facilities on yields and income from Cassava in Kwara South Senatorial District, Kwara State – a part of the northcentral Nigeria.

Study Area

Kwara South Senatorial District, Kwara State is situated between latitude 8º 0' 7'' N - 9º 4' 29'' N and Longitude 4º 29' 48'' E - 5º 32' 37'' E in the North Central part of Nigeria by geo-political division (Figure 1). The area consists of seven Local government areas; Ekiti, Ifelodun, Irepodun, Isin, Offa, Oke Ero and Oyun with populations of about 48212, 197208, 173539,47,880, 158181, 48550 and Oyun 71004, respectively. The study area has tropical wet and dry climate (Olanrewaju, 2009). The dry season is experienced from late October/early November to late March/early April with harmattan in December and January, while the wet season starts from early March/early April to late October/early November. Annual rainfall ranges from 1000 to 1500 mm, and mean temperature ranges from 25º C to 30º C (Oyegun, 1983; Olaniran, 2002).

The vegetation type largely consists of guinea and derived savanna **(**Oyegun, 1983). Common trees in the area are locust bean (*parkia biglobosa*), shear butter (*vitellaria paradoxa*) and acacia tree are among the woody materials obtainable in the region (Oriola et al., 2019). The major soil types are ferrasols and ferruginous soils which offer tremendous support for Cassava cultivation. The most popular means of transport in the area is road transport. The poor quality of most roads and the low traffic of freight and passengers however impaired the efficiency of road transport in the area. Motorcycle is a common mode used for transport services in the area despites its associated high transport charges; this occurs because of its flexibility and ability to safe time.

The selection of Kwara Southern Senatorial District for this study was due to the large size of the area and ability to offer support for the cultivation of a wide range of crops including cassava tubers, cereals, vegetables Cashew, among others. Skeletal Cocoa and oil palm cultivation also occurs in the wetter parts of Oke Ero, Isin, and Irepodun local government areas. Free range Livestock farming and pastoral nomadism is also practiced in the area. Three prominent Federal government-owned agricultural institutions; National Center for Agricultural Mechanization (NCAM), Agricultural and Rural Management Training Institute (ARMTI) and Nigerian Stored Product and Research Institute (NSPRI) are located close to the study area around Ilorin.

2. METHODOLOGY

This methodology encompasses data sources, sampling procedures, data gathering methods and methods of data analysis used. Data for this study were obtained from primary and secondary sources. Primary data was extracted through questionnaires, administration to selected experienced farmers in the study area while secondary data; especially map showing the local government areas and population figure were obtained from the office of Surveyor General and National Population Office, respectively. Additional secondary data were obtained from relevant literatures. Multi-stage sampling technique was used for the selection of settlements and respondents for this research.

Firstly, all the settlements in each of the seven Local Government Areas (LGAs) which constitutes the Senatorial District were arranged in the order of their population size (based on the projected 2017 population estimate); subsequently, 309 rural settlements emerged; these were settlement with maximum of 19,999 people; these were categorized to three population strata; X (1-6500), Y (6501–13000), and Z (13001–19,999); which resulted to 293, 12 and 4 settlements from population group X, Y and Z, respectively. Secondly, 10%, 30%, and 45% of settlements in groups X, Y and Z, respectively were selected so as to ensure the selection of at least one settlement from each group.

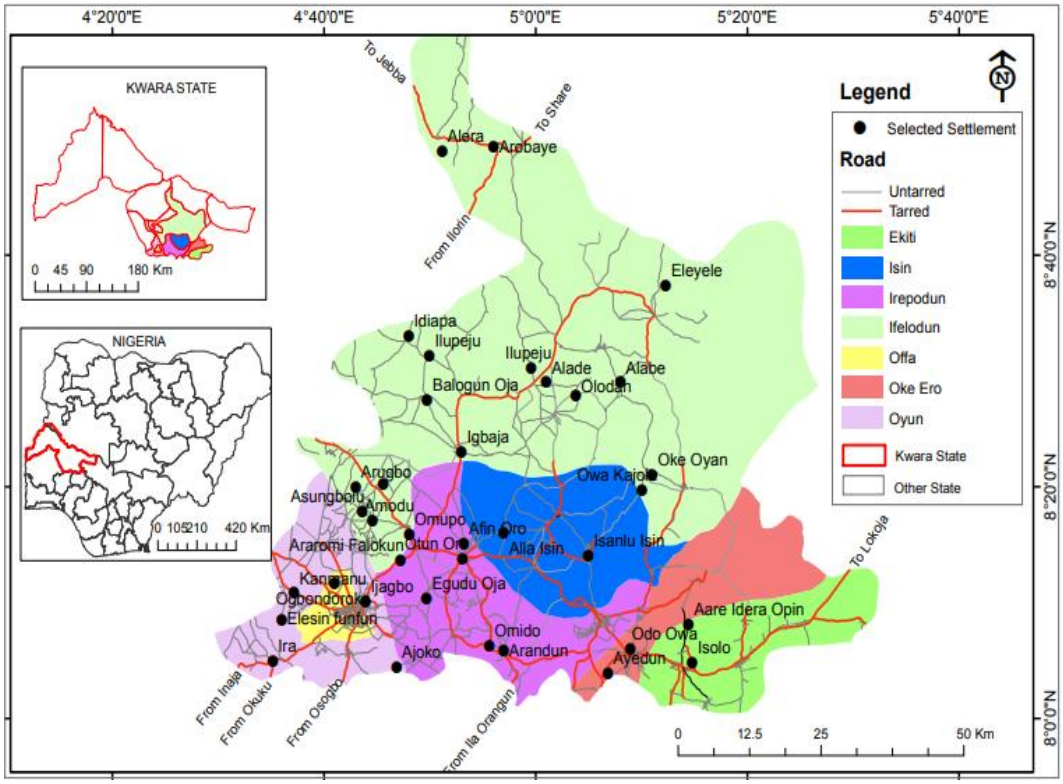

Figure 1 The study area, Kwara South Senatorial District in Kwara state, Nigeria
Source: *Digitized from the Office of the Surveyor General of the Federation (OSGOF)*

At the end of the day, 30, 4, and 2 settlements were selected from population groups X, Y, and Z, respectively. The projected 1991 population figure (used for being the only population figure of the area on settlement by settlement's basis) was divided by five; average household size in Nigeria as a criterion for the selection of the number of households in selected settlements. The average household size in each was then calculated using the 1.03 percent; growth rate for rural areas in Nigeria. Thirdly, 10% of the households were sampled from settlements in group X (1-6500); this sample proportion has been considered appropriate for rural research. Additionally, it enhanced researcher's ability to come up with reasonable sample that might not be too large to manage given the time and financial resources available for study. Also, because the number of highly populated areas were few in the study area, a sample of 5% of households was chosen from settlements in both population groups Y (6,501-13,000) and Z (13,001-19,999) categories in order to enable representations of all population groups in each LGA.

Furthermore, all households in each of the selected settlements were numbered and listed to achieve objectivity in the choice of the households in the settlements. Also, simple random sampling technique was used especially to guide in the selection of the initial sample and, systematic sampling was used to select subsequent samples from the list at regular intervals of "K" until the number of households desired for selection was exhausted. The value derived from the sample household size percentage of either 10% or 5% per settlement was divided by the total number of households listed in each settlement to determine the interval "K". Eventually, the samples from each LGA were Ekiti (36), Ifelodun (407), Irepodun (327), Isin (113), Offa (6), Oke-Ero (263), and Oyun (221); a total of 1,373 copies of questionnaire were distributed to heads of households who had least 2 years Cassava farming experience on the premise that they have the ability to furnish reliable and adequate information necessary for achieving the objective of the research.

Both descriptive and inferential statistics was used in the data analysis. The descriptive statistics especially, percentages. While the inferential statistics (principal component analysis, correlation analysis, regression analysis and Leven test Statistics were used for the analysis and to test hypotheses. Analysis and interpretation of findings were largely based two categories of settlements (settlements connected by tarred road and settlements connected by untarred road), because many (36) rural settlements were selected for this study. This has the attendant advantage of clearly exhibiting the impact of transport; especially from the transport infrastructure perspective on Cassava production as the crop is largely cultivated in settlements connected by the two categories of road network.

3. RESULTS AND DISCUSSION

Conditions of Roads to Sampled Settlements

The study revealed that the majority (55.6%) of the settlements were connected by untarred roads (Figure 2). This is in consistent with the findings of Ajiboye and Afolayan, (2006) who upheld poor condition of most rural roads. This promotes poor transport services in form of high transport's fare, delay and or inability to move freights (farm inputs and outputs) and passengers to desired destinations. This justifies earlier description of transport services as grossly inadequate and inefficient in many parts of Africa (Porter, 2014). Also, it is pertinent to note that the distribution of tarred and untarred roads across the Local government areas was uneven; it shows that 100%, 76.5%, 50%, 50%, 40% and 28.6% of the settlements sampled in Offa, Irepodun, Isin, Ekiti Oyun and Ifelodun local government areas, respectively were connected by untarred roads while, 100% of the settlements sampled in Oke-Ero local government area were connected by tarred road as at the time of carrying out this research. Previous studies have shown that poor road quality impedes accessibility and promotes high transport's fare (Tunde and Adeniyi, 2012).

In addition, the positive association between poor road quality and high transport's fare is known to have negative impacts on marketing of farm produce Paul et al., (2009), Raaballan et al., (2010); this is because the rough and rugged condition of untarred road considerably contributes to increase in the operating cost of vehicle operators. Additionally, transport charges have been observed to particularly increase in wet-season due to the slippery, muddy and rough nature of most untarred road which makes it difficult for vehicles' use (Hine and Ellis, 2001). Specifically, high transport's fare has been known to be responsible for to partial immobility of farmers and reduction in the level of profit accruable to agricultural venture (Gollin and Rogerson, 2014). This corroborates the findings that poor transport (poor conditions of roads and transport services) constitutes a major constraint to crop production in Kwara South Senatorial district.

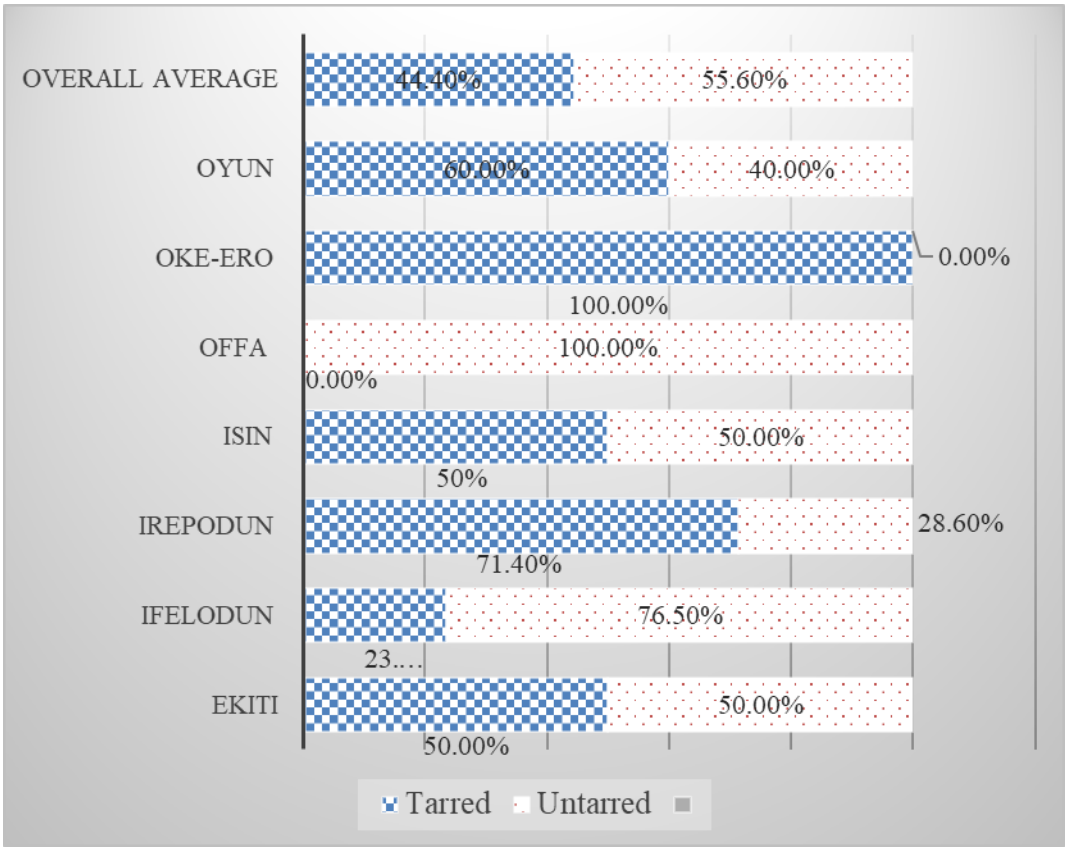

Figure 2 Percentage distribution of tarred and untarred roads to selected settlements in each local government areas in Kwara South Senatorial District, Kwara State

Source: Author's Research, 2021

Farmers' Regular Mode of Transport to and from Farm sites

The results on the regular modes of transport employed by farmers to and from farm sites in the study area shows that 51.8% of the respondents constituting the majority were regularly trekking, 29.6% were using personal motorcycle, 6.6%, were using commercial motor cycle, 6.3% were using personal vehicles (car/buses/lorries) and the remaining 5.8% of the respondents were using commercial motor vehicles to and from their farm sites (Figure 3). The high proportion of farmers trekking to and from their farm may be as a result of the unpopularity of the use of bicycle in the study area. This may be as a result of the socio cultural believe or the ego of the people in the study area; despite the advantage inherent in the use of bicycle. Thus, quality time, cost and energy that would have been otherwise conserved and reinvested in agricultural or non-agricultural productive ventures were expended on transit. The results on vehicle ownership were 6.3% of respondents in the study area; which was higher than the situation in Nigeria as a whole observed to be 24 per 1000. High vehicle ownership may be a coping strategy for the generally poor transport services especially and the usual loss of valuable time.

Further analysis of mode of transport employed by farmers in the two categories of settlements revealed that as high as 53.9% of respondents in settlements connected by tarred road(s) employed trekking mode of transport while 49.9% of the respondents in settlement connected by untarred road employed trekking mode to and from their farm sites in the study area. It was also observed that 26.2% of respondents in settlements connected by tarred road(s) employed personal motorcycles as a mode of transport to and from the farm whereas as much as 32.6% of respondents in settlement connected by untarred road were found using personal motorcycles; the relatively higher proportion of respondent in settlement connected by untarred road could be seen as a mechanism for adapting to the poor quality of road and associated poor transport services with potential negative impact on the smooth and gainful transportation of agricultural inputs and outputs in the area.

More so, while 7.0% of the respondents in settlements connected by tarred road(s) employed personal vehicle, only 5.6% employed personal vehicle in settlement connected by untarred road(s). Furthermore, while 8.0% of respondents in settlements connected by tarred road(s) made use of commercial vehicle only 5.3% of respondents in settlement connected by untarred used it. Also, while 4.0% of respondents in settlements connected by tarred road(s) were found making use commercial motorcycle as high as 6.7% of respondents in settlement connected by untarred road(s) used commercial motorcycle as means of transport to and from their farm sites in the study area; this depicts that the use of commercial motorcycle for farming related journey was higher in settlements connected by untarred road than in settlement connected by tarred roads; which is not unconnected with the fact that commercial motorcycles and motorcycles are generally more flexible than commercial vehicles or vehicles generally.

Types of Vehicles used for Commercial Transport services

The study revealed that 51.6% of the respondents in the study area patronized commercial motor cycle popularly called Okada as their usual mode of transport. A plausible explanation for the popularity of commercial motorcycle was the generally low traffic of people and freight occasioned by the low population most of the rural areas in the study area. The result also showed that 37.7% and 10.6% of respondents patronized commercial cars and commercial buses, respectively (Figure 4). It can be deduced that the larger the passenger capacity of commercial modes of transport, the less its popularity among respondents in the study area. The relatively lower proportion of respondents patronizing buses in the area could be seen as a strategy of avoiding the long wait intime which usually delayed the take-off time to desired destinations, as it can be converted into other gainful ventures.

Also, the popularity of commercial motorcycle might be because of its flexibility and ability to eliminate or drastically reduce the usually long waiting time associated with buses and cars in rural transport services. It is important to emphasize that, as at the time of carrying out this study, the use of tricycle as a commercial mode of transport has not started in the study area. Further analysis in the two categories of settlements revealed that 12.1% of respondent in settlement connected by tarred road contrary to 3.4% of respondent in settlements connected by untarred road(s) patronized commercial busses; 4.4% of the respondents in settlements connected by tarred road(s) compared with 5.9% of respondent in settlements connected by untarred road(s) patronized commercial car.

Of specific relevance is the fact that while only 43.5% of respondent in settlements connected by tarred road(s) were patronizing commercial motorcycle in settlements connected by tarred roads as high as 90.7% of respondents in settlements connected by untarred road(s) patronized commercial motorcycles in that settlement's type. This was not unconnected with the flexibility of commercial motorcycle operators to easily maneuver their movements through many rugged roads which could be difficult for commercial vehicle

operators, ability to eliminate or considerably reduce the usually long waiting time associated with buses and cars used in rural transport services as occasioned by the low traffic of passengers and freight due to the low population of the area.

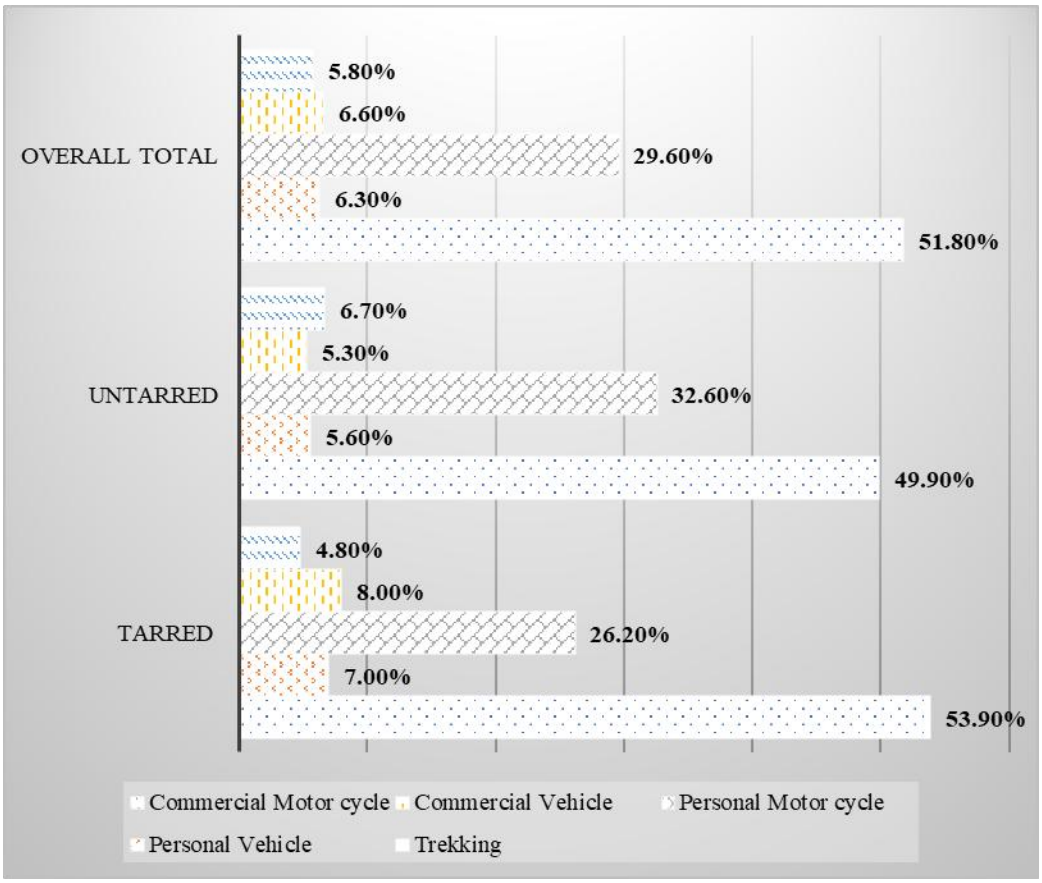

Figure 3 Farmers regular modes of transporting Farm input and output
Source: Author's Research, 2021

Furthermore, the local government by local government analysis of the modes of transport used for transport services showed that the highest proportion (83.3%) (Figure 5) of respondents using commercial motorcycle was observed in Offa LGA; where 100.0% of the respondents were from settlement connected by untarred road, this may be an adaptation to cope with the predominantly poor quality (untarred) of the road leading to Ogbondoroko (the settlement sampled in the LGA). This was closely followed by Isin LGA (62.8%); where about 62.4% of the respondents were making use of untarred road.

The popularity of commercial motorcycle is not unconnected with the poor condition of road, the low traffic of people and little or no waiting time for vehicle loading in selected connected by untarred roads in LGAs. The highest proportion (62.4%) of respondent patronizing car as a commercial mode of transport was observed in Oke-Ero; where 100% of the respondents were selected from settlements connected by tarred road. Also, the highest proportion (27.4%) of respondent patronizing bus as their commercial mode of transport was observed in Isin LGA; where about 62.4% of the respondents were using untarred road.

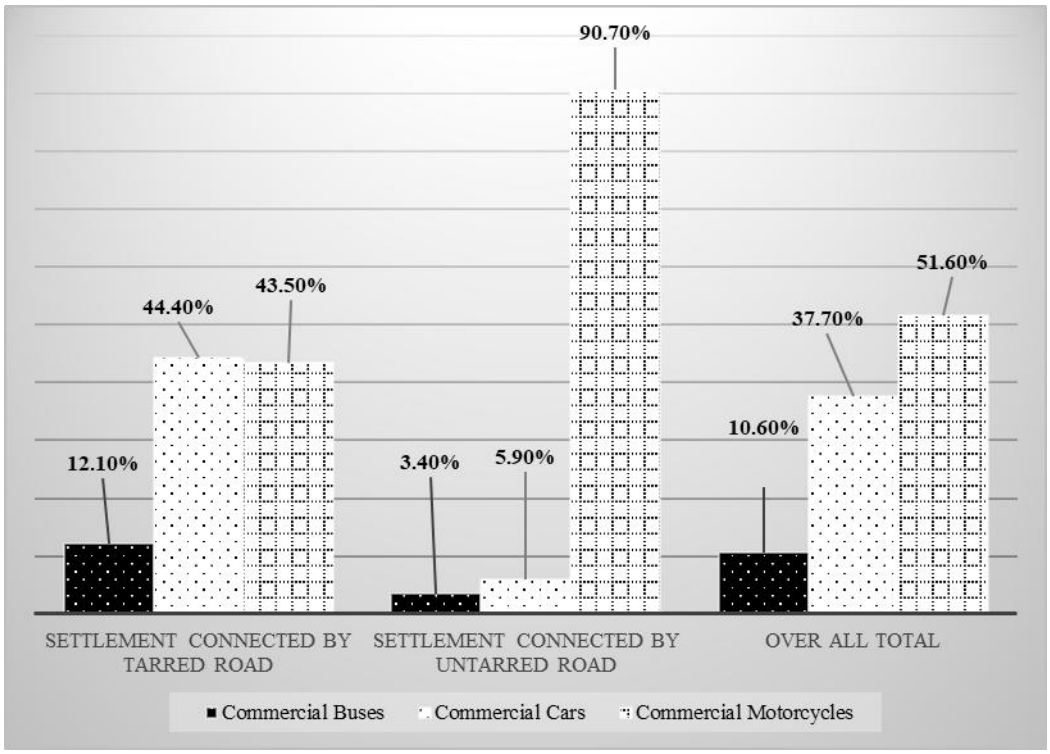

Figure 4 Types of Vehicles used for Commercial Transport Services
Source: Author's Research, 2021

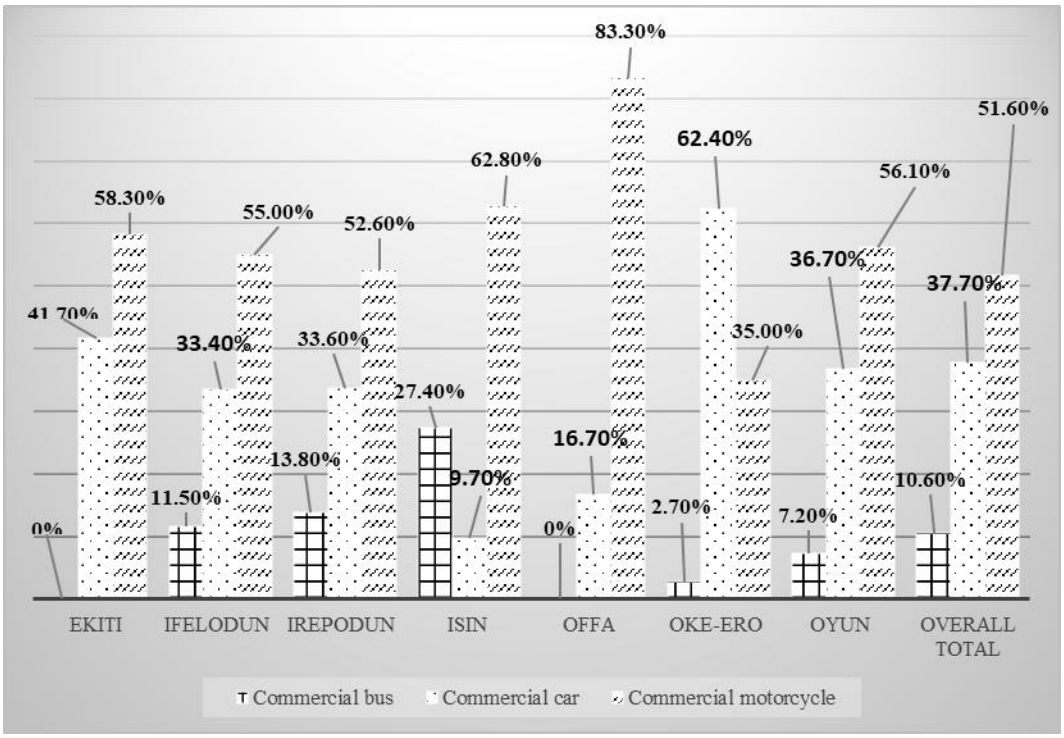

Figure 5 Vehicles used for Commercial Transport Services across LGAs
Source: Author's Research, 2021

Annual Output of Cassava

The study further shows that 15.6% of the respondents in the entire study area constituting the majority realized 4-6 tons annually. The remaining 7.1%, 8.5%, 11.2%, 14.6%, 12.8%, 3.3% and 0.1% of the respondents realized 1-2 tons, 2-4 tons, 6-8 tons, 8-10 tons, 10-12 tons, 12-14 tons and 14-16 tons (Figure 6). However, 26.8% of the sampled farmers were not cultivating cassava and so recorded no output. Analysis of the annual output of Cassava in the two categories of settlement revealed that 6.1% of respondents in settlements connected by tarred road(s) compared with 8.4% of respondents in settlements connected by untarred road(s) realized 1-2 tons, 7.1% of respondents in settlements connected by tarred road(s) compared with 10.5% of respondents in settlements connected by untarred road(s) realized 2-4 tons, 14.6% of respondents in settlements connected by tarred road(s) in opposition to 17.0% of respondents in settlements connected by untarred road(s) realized 4-6 tons, 10.2% of respondents in settlements connected by tarred road(s) against 12.6% of respondents in settlements connected by untarred road(s) realized 6-8 tons, 13.2% of respondents in settlements connected by tarred road(s) as opposed to 16.6% of respondents in settlements connected by untarred road(s) realized 8-10 tons per annum, 11.80% of respondents in settlements connected by tarred road(s) as opposed to 14.2% of respondents in settlements connected by untarred road(s) realized 10-12 tons per annum, 3.9% of respondents in settlements connected by tarred road(s) as opposed to 2.5% of respondents in settlements connected by untarred road(s) realized 12-14 tons annually, 0.1% of respondents in settlements connected by tarred road(s) as opposed to 0% of respondents in settlements connected by untarred road(s) realized 14-16 tons per annum, 33% of respondents in settlements connected by tarred road(s) as opposed to 18.2% of respondents in settlements connected by untarred road(s) did not have any record of Cassava output; possibly due to non-involvement in the cultivation of Cassava.

Generally, the result showed a higher proportion of respondents in settlements connected by untarred road(s) realized nearly all categories of output levels investigated than were observed in settlements connected by tarred road. This contrasts with the findings of Ajiboye and Afolayan, (2006), Yaro et al., (2014), among others that settlement connected by high quality road are more accessible and promotes higher level of productivity. The relatively higher level of Cassava production in most of the settlement connected by untarred may be as a result of availability of more lands for cultivating Cassava due to lower pressure on land than in settlements connected by tarred road(s) than obtainable in settlement connected by good road. Additionally, majority of the settlement connected by untarred road are smaller; the radius of the circle forming the central cities of that settlement or the respective distances between them and their farm sites becomes shorter because of the smaller sizes, this makes farm more accessible and transiting to such becomes less expensive. Earlier, settlements connected by untarred roads were described as inaccessible settlements (Yaro et al., 2014).

The implication of the poor quality of the roads connecting such locations is the inability of the farm produce to attract reasonable price especially in the producing settlements or at the farm gates Yaro et al., (2014) and constant payment of high transport's fare to convey farm inputs from urban market and convey farm output to urban market; which ultimately impact negatively on the farmer's profit from his or her investments in Cassava cultivation. On the other hand, the result shows a lower level of output for all categories of output investigated in settlement connected by tarred road (accessible) than in inaccessible (untarred road); which happens to contradict contradicts previous studies (Yaro et al., 2014). This might have occurred because most the settlement are gradually attaining high order centers with reduced proportion of people in farming, less access to farm land and increasing distance from the center of the city to farm land due to settlement's expansion. In addition, transportation is a distance-decay altering technology Rodrigue, (2013); which means, with increase in the size of the central cities, the radius of the circle forming the central cities or the respective distances between them becomes extended, but relative position of each remains the same (Thoman and Corbin, 1974).

Also, in view of the fact more fertile farm lands are located farther away from the center of the city, most of the farmers without their personal means of transport travel father distance in settlements connected by tarred roads (relatively larger settlements); which invariably impacted negatively on their level of productivity. Analysis across the Local Government Areas (LGAs) presented in Table 1 revealed that the highest proportion (39.8%) of respondents realizing 1-2 tons of Cassava was observed in Isin LGA, the highest proportion (29.2%) of farmers realizing 2-4 tons of Cassava was observed in Isin LGA, the highest proportion (25.0%) of farmers realizing 4-6 tons 201-300 bags of Cassava was observed in Ekiti LGA, the highest proportion (20.5%) of farmers realizing 8-10 bags of Cassava was observed in Irepodun LGA, the highest proportion (25.0%) of farmers realizing 12-14 tons of Cassava was observed in Ekiti LGA and the highest proportion (0.2%) of farmers realizing 14-16 tons of Cassava was observed in Ifelodun LGA.

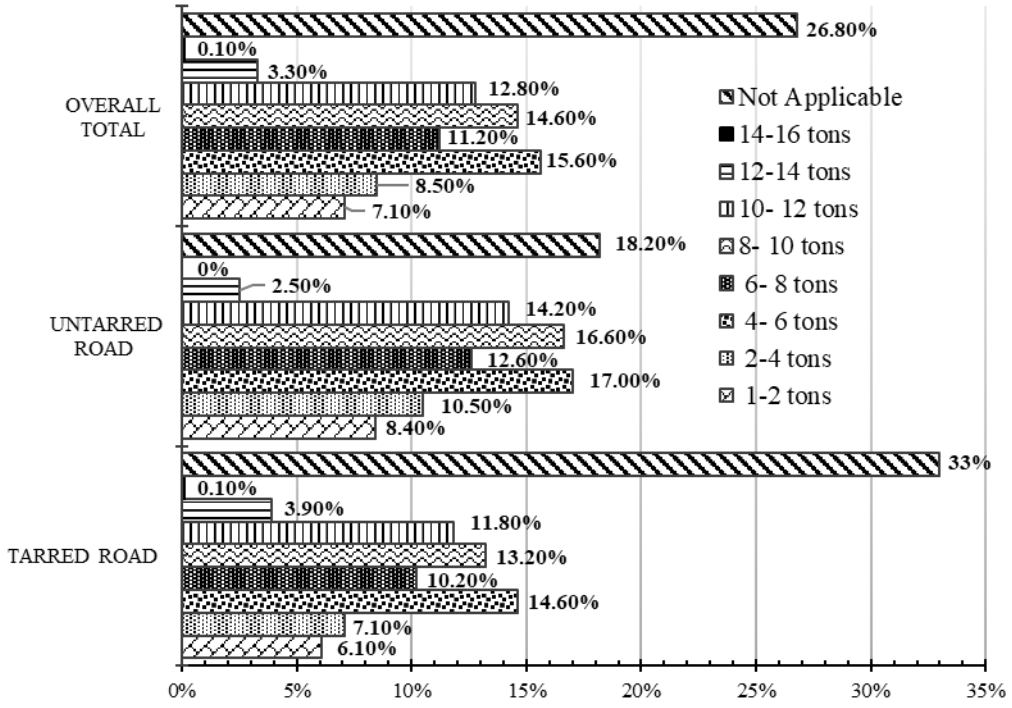

Figure 6 Annual Output of Cassava across categories of roads in the Study Area
Source: Author's Research, 2021

Table 1 Cassava output in bags by Local Government Area

Number of bags	Ekiti	Ifelodun	Irepodun	Isin	Offa	Oke-Ero	Oyun	Overall Total
1-2 tons	0%	4.2%	3.1%	39.8%	0%	5.7%	4.5%	7.1%
2- 4 tons	0%	5.7%	3.7%	29.2%	0%	3.4%	18.1%	8.5%
4- 6 tons	25.0%	12.3%	9.5%	14.2%	0%	17.9%	27.6%	15.6%
6- 8 tons	16.7%	9.6%	8.3%	6.2%	0%	14.1%	17.2%	11.2%
8- 10 tons	19.4%	17.2%	20.5%	4.4%	83.3%	0.4%	20.8%	14.6%
10- 12 tons	8.3%	9.3%	20.5%	0%	16.7%	0%	3.6%	12.8%
12-14 tons	25.0%	1.5%	11.0%	0%	0%	0%	0%	3.3%
14-16 tons	0%	.2%	0%	0%	0%	0%	0%	.1%
Not Applicable	5.6%	40.0%	7.3%	6.2%	0%	58.6%	8.1%	26.8%

Source: Author's Research, 2021

Hypothesis on Cassava Output

Ho There is no significant relationship between transport facilities and crop output (Cassava output)

H1 There is a significant relationship between transport facilities and crop output (Cassava output)

Table 2 shows the result of the regression analysis used to investigate the impacts of transport facilities on Cassava output in Kwara South Senatorial District. Six variables were examined. Only one of the factors significantly influenced farmers output of Cassava. An examination of the standardized coefficient presented in Table 2 shows that Cassava outputs varied significantly with transport

services (b= - 0.21, p = 0.00). Therefore, we accept H1 and reject Ho *but Road condition, Transport Cost, Transport Mode, Distance to Farm and Distance to major market* are not significant since their p values are greater than 0.05 (*p>0.05).* Therefore, we accept Ho and reject H1. Table 2 also shows a positive but weak relationship between Cassava output and independent variables as the R2 = 0.048, suggesting that the regression model accounts for about 4.8% of the variance in perception on the impacts of transport facilities on Cassava output/yield.

Table 2 Coefficients of regression for Cassava Output

Model	Unstandardized Coefficients		Stand. Coef.	T	Sig.	Remark on Ho	R2
	B	Std. Error	Beta				
Constant	272.04	5.806	-	46.858	0.000	-	0.048
Transport Mode	-3.221	5.806	-0.015	-0.555	0.579	Not Supported	-
Road condition	9.453	5.806	0.043	1.628	0.104	Not Supported	-
Transport Cost	7.321	5.806	0.033	1.261	0.208	Not Supported	-
Transport Services	-46.129	5.806	-0.210	-7.943	0.000*	Supported	-
Distance to Farm	-.2.709	5.806	-0.012	-0.466	0.641	Not Supported	-
Distance to major market	4.362	5.806	-0.020	-0.751	0.453	Not Supported	-

a* p<0.05 Dependent Variables for Cassava outputs

Author's computation

Note: *Transport Services is the highest contributing (-0.210) predictor to explain the impact of transport facilities on output of Cassava.*

Annual Income from Cassava

The result presented in Figure 7 on the income realized by respondents from the cultivation of Cassava per annum revealed that 2.3%, 3.7%, 8.7%, 16.4%, 11.6% and 30.4% of the respondent realized ≤ N 20000, N 20001- N 50000, N 50001- N 100000, N 100001- N 150000, N 150001- N 200000 and > N 200000, respectively. The result also showed that, 26.9% of the respondents did not respond; possibly because they were not involved in the cultivation of the root crop. Cross tabulation of the analysis of the income realized from the cultivation of Cassava revealed that, 5.5% of respondents in settlements connected by tarred road(s) compared with 8.7% of respondents in settlements connected by untarred road(s) realized ≤ N 20000 – N 50000 from the root crop annually. Also, 56.3% of respondents in settlements connected by tarred road(s) compared with 68.4% of respondents in settlements connected by untarred road(s) realized N 100001 – > N 200000 from the harvested root crop per annum in the study area; this may probably be because of availability of more farmlands and farmers for the cultivation of Cassava in settlement connected by untarred road than in settlements connected by tarred road(s).

On the other hand, 8.8% of respondents in settlements connected by tarred road(s) compared with 8.4% of respondents in settlements connected by untarred road(s) realized N 50001- N 100000, from Cassava's cultivation in the study area; the observed higher proportions of respondents in 'Settlements connected by tarred road(s)' may be attributed to more favourable transport situation in settlements connected by tarred road(s). Also, the analysis shows that, only a small proportion of respondents realized high income level from the cultivation of Cassava. This is as a result of the constraints of individual farmers. Analysis on local government area basis

presented in Table 3 revealed that the highest proportion (9.7%) of farmers who realized ≤ N 20000 and the highest proportion (30.1%) of farmers who realized N20001- N50000 from the cultivation of Cassava were observed in Isin LGA.

The highest proportion (28.3%) of farmers realizing N 50001- N 100000 from the cultivation of Cassava was observed in Ifelodun LGA. The highest proportion (27.1%) of farmers realizing N100001-N1500000 from the cultivation of Cassava was observed in Offa LGA. The highest proportion (19.4%) of farmers realizing N 150001-N 20000 from the cultivation of Cassava was observed in Ekiti LGA and the highest proportion (67.5%) of farmers realizing N 150001-N 20000 from the cultivation of Cassava was observed in Irepodun LGA. This may not be unconnected with the facts that majority of respondents in these LGAs were from settlements connected by tarred roads.

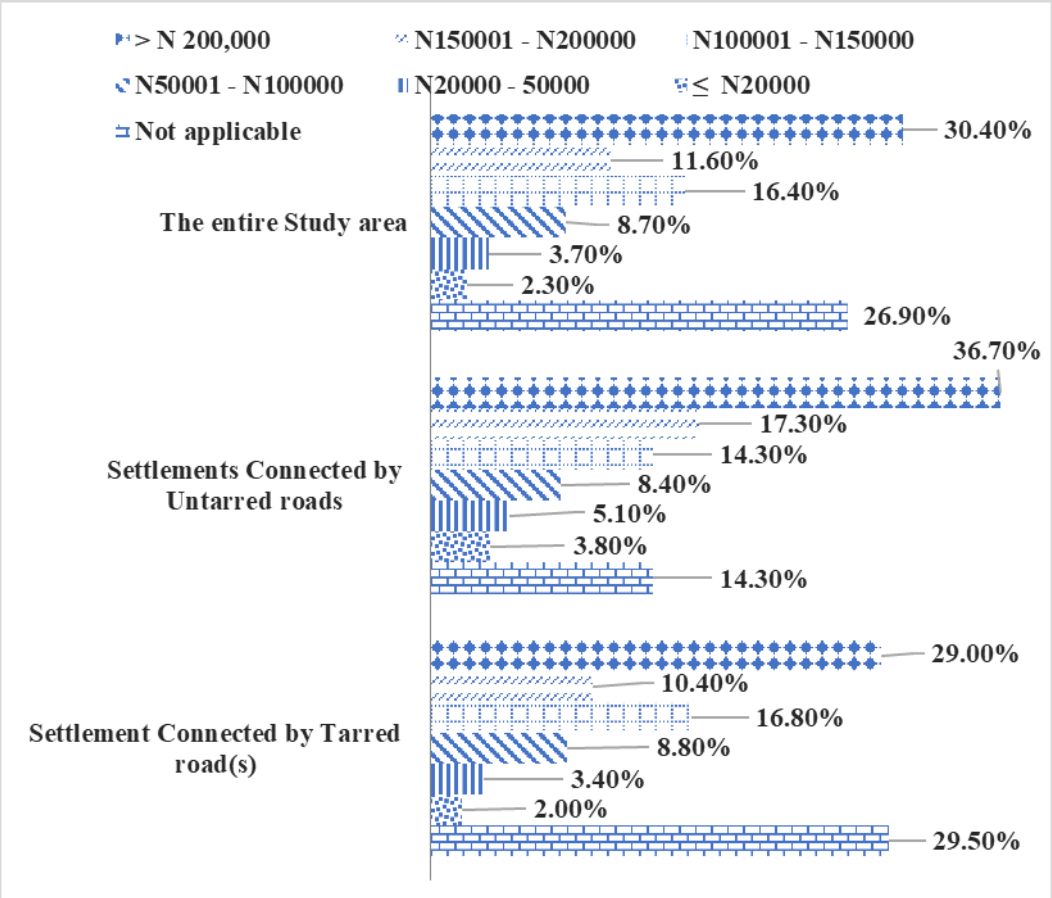

Figure 7 Annual Income from Cassava in the Study Area
Source: Author's Research, 2021

Table 3 Cassava Income in Naira by Local Government Area

Amount in Naira	Ekiti	Ifelodun	Irepodun	Isin	Offa	Oke-Ero	Oyun	Overall average
Not Applicable	5.6%	40.0%	7.3%	6.2%	100.0%	58.9%	8.1%	26.9%
Less than 20,000	0%	1.0%	2.4%	9.7%	0%	2.3%	1.4%	2.3%
20,001-50,000	0%	1.7%	.6%	30.1%	0%	0%	3.6%	3.7%
50,001-100,000	2.8%	5.7%	4.0%	28.3%	0%	4.2%	18.1%	8.7%
100,001-150,000	22.2%	14.0%	9.2%	15.9%	0%	19.8%	27.1%	16.4%

150,001-200,000	19.4%	9.8%	9.2%	5.3%	0%	14.4%	17.2	11.6%
Above 200000	50.0%	27.8%	67.5%	4.4%	0%	0.4%	24.4%	30.4%

Source: Author's Research, 2021

Hypothesis Testing on Income from Cassava

Ho There is no significant relationship between transport facilities and income from Cassava

H1 There is a significant relationship between transport facilities and income from Cassava.

Table 4 shows the result of the correlation analysis used to investigate the impact of transport facilities on income derived from Cassava in Kwara South Senatorial District. Six variables were examined. Furthermore, the result of the relationship between transport facilities and income from Cassava exhibited significant but very weak and inverse relationship with transport services ($r = - 0.0226$ $p > 0.05$). Consequently, the null hypothesis which states that there is no significant relationship between transport facilities and income from Cassava can be accepted for all the variables of transport facilities, except 'transport services'

Table 4 Correlation between transport facilities and income generated from Cassava

		Transport Mode	Road Condition	Transport cost	Transport Services	Distance to Farm	Distance to major market
Cassava Income	Pearson Correlation	-0.009	0.024	0.039	-0.226	-0.014	0.008
	Sig. (2-tailed)	0.735	0.366	0.146	0.000*	0.596	0.766
	N	1373	1373	1373	1373	1373	1373

* Correlation is significant at the 0.05 level (2-tailed)

Source: Author' Computation

Furthermore, this implies that there is no significant relationship between transport mode, road condition, transport cost, distance to farm, and distance to major market and, income generated from cassava. Although, in practical terms, obtainable transport services in a given area is usually influenced by transport mode, road condition, transport cost, distances covered to farm, major market or desired destinations. Earlier, disparity in the level of road development have accounted for disparity in the level of income in Fika, Mazanwu and Zamba of Yobe State and in Obokun Local Government area of Osun state. Similarly, Tunde and Adeniyi, (2012) observed that poor road quality in Ilorin East LGA was responsible for high transport's fare militates against good transport services and impacts negatively on the level of income accruable to farmers in the area.

4. CONCLUSION AND RECOMMENDATION

This study examined the condition of transport facilities (roads and modes of transport and transport services accessible to farmers), annual yields and income from Cassava and assessed the impacts of transport facilities on Cassava yield and income in Kwara South Senatorial District. The study observed that majority of the farmers had access to rudimentary modes of transport and costly transport services that makes it difficult for them to easily transform their production level and improve their livelihood. Although, spatial variations existed in road quality accessible to farmers in the sampled settlements, it did not necessarily translate to variation in the level of yield and income accrued from cassava production. Specifically, both cassava yield and income only exhibited significant but very weak and inverse relationship with only transport services among all the six transport facilities investigated while no significant variations were experienced with others (transport modes, transport cost, road conditions, distance to farm, distance to major market).

However, the study observes that transport services influenced the outputs and income generated from the cultivation of cassava in the study area and therefore concludes that improvement in the quality of rural transport (rural roads and rural transport services) will increase the yields and income generated from various crops in any geographic space. The study therefore recommends that government and other relevant stakeholders should improve road condition to various rural settlements and major market centres so as

to improve access of rural farm produce, better market potentials and increase farmers livelihood and further production. The need to create an enabling environment for acquisition of motorized modes of transport such as motor cycle through giving out of loans or subsidizing the price of motorcycle to make it more affordable to Cassava farmers and other food farmers in the area and Nigeria at large is also recommended. This will improve farmers productivity, food security and livelihood and considerably hasten the achievement of sustainable development goal numbers 1 (end poverty) and 2 (end hunger and achieve food security) in Nigeria and beyond.

Implication

The implication of this study is that the wide spread of poor road quality generally leads to high transport's fare and poor transport services; with negative impacts on high yields and income from cassava; a scenario that militates against the achievement of the first (ending poverty) and second goal (ending hunger) of sustainable development in most rural areas in sub-Saharan Africa. Therefore, the study hereby recommends the need to give adequate attention to the provision of adequate access roads, regular rehabilitation of existing roads; through the formation of rural road maintenance agency at community and local government area levels to ensure that the roads are motorable all-year round; enhancement of rural transportation services by introduction tricycles and other fewer passengers' vehicles, offering soft loan for their purchase, and setting up market centers in additional communities to facilitate the movement of people and goods and to increase accessibility of rural farm produce to higher market potentials, productivity levels and financial well-being of rural farmers.

Limitation

The study's limitation stems from the observation of weak relationships between cassava income and transport facilities ($r \leq 0.226$) and cassava output and transport facilities ($R2 = 0.048$). The study's restriction of the evaluation of transport services to cassava farmers only, without taking into account the perspective of transporters-the primary players in the transportation industry-represents another significant limitation.

Future Research

The study suggests more investigation to clarify other factors other than transportation that influence differences in cassava yields and income realized in the two categories of settlements.

Informed consent

Not applicable.

Ethical approval

Not applicable.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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Data and materials availability

All data associated with this study are present in the paper.

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