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Article

Rural Transportation and its Impact on the Output and Income Generated from Cashew Production in Selected Rural Settlements in Kwara State, Nigeria

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Abstract: Rural transportation plays a crucial role in agricultural production and livelihood of farmers in developing countries. Information on its impact on cashew's outputs and income is not clearly documented in the literature. Consequently, this study identified the types of roads and transport modes of cashew farmers, assessed the transport services patronized by cashew farmers, examined the annual outputs and income from cashew; and assessed the impact of transport on both in Kwara South Senatorial District Kwara State, Nigeria. Data used were obtained from 1,373 farmers systematically selected from thirty-six rural settlements in the study area. Responses were analysed using principal component analysis, regression analysis and correlation analysis. Results showed that tarred roads connected only about 44.4% of the settlements in the area. About 56.4% of respondents rated the transport services as good. Significant relationships were found between cashew output and; road condition ($b = -0.151$, $p = 0.000$) and; transport services ($b = -0.097$, $p = 0.000$), while, income from cashew was directly and significantly correlated with transport mode ($r = 0.059$, $p < 0.05$), road condition ($r = -0.153$, $p < 0.05$) and, transport services ($r = -0.096$, $p < 0.05$). The study concluded that variations in transport facilities only accounted for some level of spatial variations in both cashew's output and income in the study area and, recommended improvements of transport facilities to enhance increase in farmers' crop output and income to achieve improved rural livelihood.

Keywords: road conditions; rural transport; transport costs; transport service

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1. Introduction

Transport entails the transformation of the geographic attributes of freight and people from an origin to a destination and, adding to their values (Rodrigue, 2013). Transport creates enabling environment for the movement of freight and passengers from one place to another and facilitates exchange of goods and services in rural and urban areas within and across the countries. Rural transport (rural roads and rural transport services) plays vital roles in the development of agriculture and other rural socio-economic activities in Nigeria and other parts of the world. Basically, transport is an indispensable aspect of all agricultural practices as it encompasses the movement of farm inputs and outputs from supply to demand zones. Studies have shown that investment in transport lessens transport charges along rural roads, facilitates efficient delivery of farm inputs, promotes increase in farmers' outputs, improves accessibility of farmers' output to higher market potentials and enhances farmers' access to higher income from their investment in agriculture (Emran & Hou, 2013; Inoni & Omtor, 2009; Lokesha & Mahesha; 2016; Rodrigue, 2013; Sangwan, 2010; Tunde & Adeniyi, 2012).

Studies have shown that poor level of transport development militates against high level of agricultural outputs and aggravates poverty in most rural areas in Nigeria and other developing countries (Lokesha & Mahesha, 2016; Tunde & Adeniyi, 2012). The studies among others placed greater emphasis on the impacts of the roads leading to farming settlements on agriculture with inadequate attention on the impact that farmers' modes of transport and the transport services available to farmers have on the production of specific crops. Although, road building is important to agricultural development, meaningful and sustainable agricultural development cannot be achieved without the complementary role of rural transport services and modes of transport at the disposal of farmers. The inadequate, inefficient as well as costly transport services and transport modes available to farmers on the several dispersed routes leading to various rural settlements and farms

in developing countries has been contributory to low level of agricultural productivity and low level of development in rural areas. Therefore, the study is poised to provide answers to the following questions: what are the conditions of roads to the sampled settlements? What are the types of modes of transport used by cashew farmers in the study area? What is the condition of transport services to the various settlements of cashew farmers? What are the outputs and income generated from the cultivation of cashews by its farmers in the study area? The main object of the study is to assess the impact of transport (transport modes and services) on both the outputs and income of cashew farmers in selected rural settlements in Kwara South Senatorial District, Kwara State, Nigeria. The remaining part of this paper focuses on the review of literature, study area, methodology, discussion of results, conclusion, and implication of the study.

2. Literature Review

Road transport is the most popular means of transport especially in rural areas of sub-Saharan Africa. Generally, access roads to most of the rural settlements in developing countries with farming as a major economic activity are in deplorable state (Blinpo et al., 2013). This may not be unconnected with poor rural road maintenance. For instance, over 70% of access roads to most rural settlements have been observed to be in deplorable state in Nigeria (Adeniji, 2000; Ipingbemi, 2008; Oyesiku, 2002). Rural roads maintenance in Nigeria is largely in the jurisdiction of various local governments (Central Bank of Nigeria, 2002). The poor implementation of the third tier of government typical of true federalism has contributed to the epileptic performances of the existing local government areas and impaired negatively on local government administration; this ultimately deprives the people at the grass roots to adequate access the developmental impact of the government as exhibited in high prevalence of deplorable rural roads in the country.

Earlier, poor rural roads development has been attributed to; the dispersed nature, low population and low income of rural areas as they slow down the time for the recovery of money spent on road construction (Abumere et al., 2002); inadequate finance (Aderamo & Magaji, 2010; Ajiboye & Olaogun, 2006; Ipingbemi, 2008); lack of continuity in government (Akunna, 2015); poor governance, high cost of road construction, substandard equipment and little or no competition among construction companies (Sperling & Claussen, 2004; Estache & Limi, 2009; Lall et al., 2009). Other factors in support of high prevalence of poor rural roads are corruption and lack of political will (Ipingbemi, 2008); poor fund management (Burgess et al., 2015) as well as ethnic favoritism and political clientelism (Ullman, 1956). The poor condition of rural roads negatively impacts on spatial interaction and effective mobilization of man and material resources necessary for attaining optimum agricultural and other rural socio-economic activities.

Although, areal differentiation is a necessary factor for spatial interaction (Creightney, 1993), complementarity, absence of intervening opportunity and transferability are other factors to be reckoned with. Transferability is highly instrumental to the economic and physical transferability of farm input and output from surplus to deficit locations. As a concept of spatial interaction, it connotes provision of access, especially good road (tarred) and 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 productivity in agricultural and other rural socio-economic activities for the realization of higher income level and satisfaction. Accessibility is the ease with which passengers and, or goods reach other places measured in terms of time, cost and distance. Accessibility may be influenced by seasonality and transport services provided (Lebo & Schelling, 2001; Van de Walle, 2002; Rodrigue, 2013). Accessibility varies with seasons; it specifically depreciates in wet season on earth's surfaced roads as it becomes slippery, flooded, wet and rough; which increases the time, cost and stress expended on journeys along such roads and, ultimately lessens the ease of getting to desired destinations.

Rural mobility largely depends on good rural transport infrastructure (roads and the likes) and low-cost transport services (Hettige, 2006). This explains why provision of good rural transport infrastructure is regarded as a necessary but not sufficient condition for accessibility to farm, market centers or other locations; it must be complemented by efficient, reliable and affordable rural transport services for accessibility to be achieved (Ajiboye & Afolayan, 2009; Gachassin & Raballand, 2015). In other words, rural transport (rural roads and rural transport services plays crucial role in agricultural production. Generally, poor rural roads promote poor rural transport services. Poor roads are known to have undesirable effects on agricultural production (Ipingbemi, 2008) as it limits adequate access to farm inputs and militates against providing basic access of farm output to adequate market potential; this reduces profit from agricultural investment and, discourages high level of agricultural productivity (Dorosh et al., 2010).

Empirical findings have attributed relatively higher transport charges with untarred road settlements (Dorosh et al., 2010; Teravaninthorn & Raballand, 2008; Raballand et al., 2010). For instance, Ahmed and Rustagi (1987) associated the receipt of only 30–50% of the final market price by African farmers compared with 70–80% received by Asian farmers to the lower quality of road

in African relative to roads in Asian countries. According to Jacoby and Minten (2009), intensive land cultivation is not economically rational in Africa due to high transport charges which heighten delivery price and almost eliminates the profit envisaged by farmers. High transport charges are associated with poor roads with negative impacts on the level of income accruable to farmers in Ilorin East, Kwara State, Nigeria (Tunde & Adeniyi, 2012). Although, the use of Intermediate Means of Transport of (IMT) has been adjudged to have contributed to the attenuation of the negative effects of distance and impacted positively on agricultural productivity of food farmers in Oyo north, Oyo state, Nigeria (Kassali et al., 2012). But, some Intermediate Means of Transport are known to have negative impacts. For instance, some motorcycle operators were observed to have inflated transport's fare due to scarcity of transport services especially in wet season in nine selected rural settlements linked by earth surfaced road in Tanzania (Porter et al., 2013). High transportation' fare allows people to be relatively immobile (Gollin & Rogerson, 2014), high transport' fare is associated with poor road quality. It has deprived most cattle farmers from selling their cattle at local market but relied only on farm gates sales with a reduced income level (Kyeyamwa, 2008), and negative impacts on profits accruable to the farmers. Several studies have been carried out on transport and agriculture within and outside Nigeria. For instance, in Nigeria, variations in road qualities have translated to farmers' accessibility to different levels of output and income from agricultural ventures in Osun state (Adedeji et al., 2014) and Ondo State (Olagunju, 2022). In a review of twenty-five documents relating to selected countries in Latin America and elsewhere, it was observed that improvement of small rural roads promoted agricultural production, employment, living standards and poverty reduction (Escobal & Ponce, 2008). Also, improvement in road quality was found responsible for the expansion of farm size in Nicaragua (Laird et al., 2023). Similarly, villages connected with all weathered roads in India were noticed to have recorded increase in the use of fertilizers, agro-chemicals and "improved" crop varieties due to better access afforded by the road (Aggarwal, 2018); the long-term effects are the attainment of increasing level of output and income from such crop.

Recently, Aboyeji & Aguda (2024), associated variation in outputs and income derived from cassava to spatial variations in the quality of roads connecting selected settlements in Kwara South Senatorial District, Kwara State in north central, Nigeria. The authors using principal component analysis specifically observed that the output Cassava varied significantly with transport services, while income from Cassava exhibited significant but weak inverse relationship with transport services. However, information is lacking on the specific impact of rural transport on outputs and income of cashews as a tree and important cash crop in the region. Consequently, this study identified the types of roads and modes of transport accessible to cashew farmers, assessed the transport services available to cashew farmers, examined the outputs and income from cashew farmers, and assessed the impacts of transport on both outputs and income of cashew farmers in Kwara South Senatorial District, Kwara State, Nigeria.

Cashew (*Anacardium occidentale L.*) is a tropical evergreen tree crop that originates from Brazil in South America. Cashew thrives in Latitudes 15° North and South of the Equator. It is of high economic relevance to the Benin Republic, Mozambique, Nigeria, Philippines, Sri Lanka, Tanzania, Ghana, India, and Vietnam (Adeigbe et al., 2015), The cashew tree has an irregular trunk and can grow as tall as 14 meters. The tree produces wood useful in making boats and charcoal gum and serves some medicinal value. Mature cashew trees have big, juicy apples hanging from their branches, to which the cashew nut is attached. The resin found in fruit shells is utilized to make plastics and as an insecticide. Juicy apples have a high reddish to yellow color and their pulp and juice can be fermented and distilled into liquor or processed into a variety of (astringent) fruit drinks. The cashew nut, or seed is usually consumed raw or processed to make cashew butter and cheese. Medicinally, cashew nuts lower blood pressure, lower cholesterol, enhance weight loss, improve skin, add fibers, promote shiny, healthy hair, and protect the eyes.

The significance of the study is based on the fact that it is a major source of food, income, industrial raw materials, and foreign exchange for many countries including Nigeria; which commenced its commercial cultivation around 1972. Only about 5% of the produce is processed locally. As at 2015, cashew trading amounted to 24 billion naira (160 million dollars) and over one million people depend on the cashew industry in Nigeria (Adeigbe et al., 2015). This study focused on Kwara South Senatorial District Kwara State, Nigeria because the ecological zone supports the cultivation of cashew.

3. Materials and Methods

3.1. Study Area

Kwara South Senatorial District, Kwara State is situated between latitude 8º0'7" N – 9º4'29" N and Longitude 4º29'48" E – 5º32'37" E in the North Central Geo-political zone of Nigeria (Figure 1). Seven Local Government Areas are included in the area: Ekiti, Ifelodun, Irepodun, Isin, Offa,

Oke Ero, and Oyun. The populations of these Local Government Areas (LGAs) are approximately 48,212, 7,208, 173,539, 47,880, 158,181, 48,550, and 71,004, in that order. The best way to characterize the climate of the study area is tropical, with harmattan occurring from December to January and distinct wet and dry seasons. Late March or early April marks the start of the wet season, which ends in late October or early November. Mean temperature ranges from 25°C to 30°C, and annual rainfall spans from 1,000 mm to 1,500 mm (Oyegun, 1983; Olaniran, 2002). There is neither severe drought nor excessive rainfall in the study area because it is located in a zone of transitional vegetation and climate. Guinea and derived savannas make up the majority of the vegetation type (Oyegun, 1983). Shear butter, acacia, and locust bean trees are common in the area. *Milicia excels* is a common tree in the region's wetter areas; in particular, it provides space for some sawmilling and lumbering operations in certain parts of the study area.

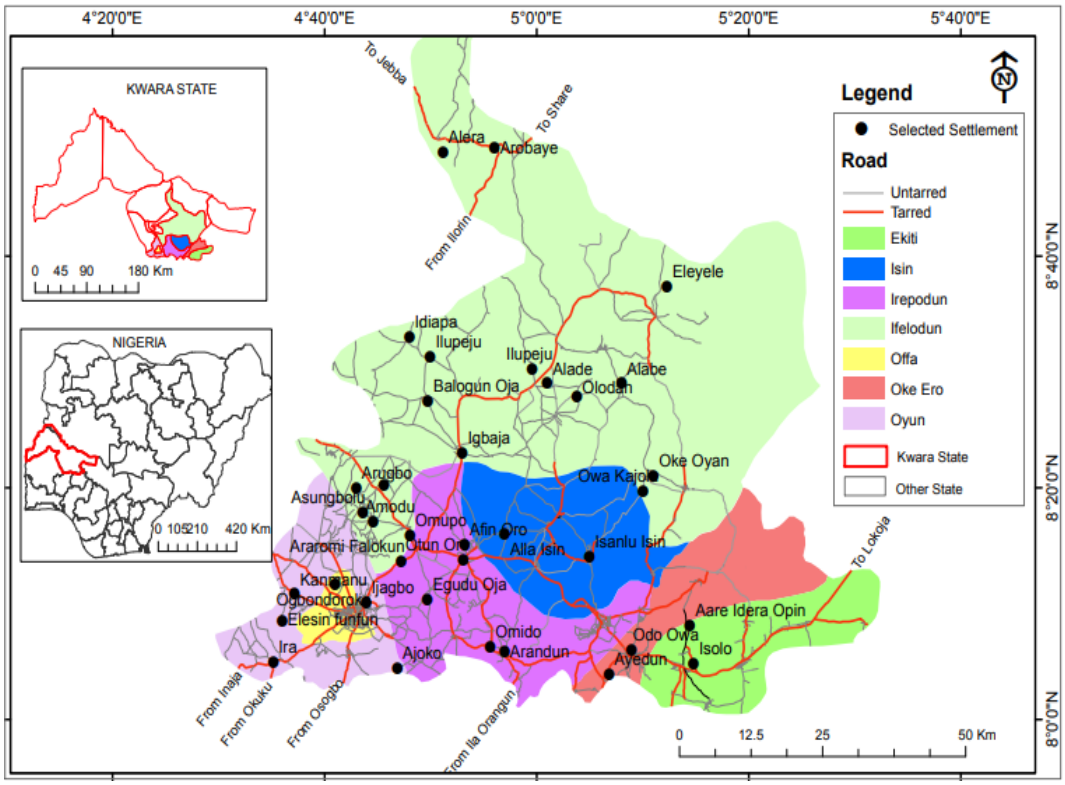

Figure 1. The study area, Kwara South Senatorial District in Kwara state, Nigeria (*Digitized from the Office of the Surveyor General of the Federation*).

Road transportation is the most widely form of transportation in the region. The majority of the settlement's roads are in terrible condition. The popularity of commercial motorcycle transport services in the area was largely due to the area's poor-quality roads and low freight and passenger traffic (Aboyeji, 2021). The vast area and great potential for growing a variety of crops make Kwara South Senatorial District an ideal study subject. In addition, food crops, particularly vegetables, cereals, legumes like groundnuts and cowpeas like beans and soy beans, are actively farmed by the farmers in the area. The area has a significant cashew crop as well. Its high returns on investment for farmers, resistance to drought, and capacity to flourish on a wide range of soil types are making it more and more well-known in the area (Aboyeji, 2021). Oil palm and cocoa are grown in wetter parts of Oke Ero, Isin, and Irepodun Local Government Areas. Additionally, prevalent in the region are livestock farming and nomadism. Agricultural and Rural Management Training Institute (ARMTI), Nigerian Stored Product and Research Institute (NSPRI), and National Center for Agricultural Mechanization (NCAM) are three federal government-owned agricultural institutions that are situated near the study area in the vicinity of Ilorin.

3.2. Materials and Methods

Data were obtained from primary and secondary sources. Primary data was derived through direct observations of conditions of roads to sampled settlements and administration of questionnaires to selected farmers in the study area while secondary data including map showing the local

government areas and population figure were obtained from the office of Surveyor General and National Population Office, respectively.

Multi-stage sampling technique was employed for the choice of both settlements and respondents for the study. First, all the settlements in each of the seven LGAs in the Senatorial District were arranged according to their population sizes; obtained through the projection of 1991 population figure (used for being the only population figure of the area that presented the population of the study area on settlement's basis) to 2017 using the 1.03 percent growth rate for rural areas in Nigeria (World Bank Group, 2016). Subsequently, settlements with population of at most 19,999 categorized as rural settlements (Madu, 2010) were selected, this led to the emergence of 309 rural settlements; which were categorized to three groups; A (1−6,500), B (6,501–13000), and C (13,001–19,999), the population's group A, B, and C consisted of 293, 12, and 4 settlements, respectively. Second, in order to ensure the selection of at least one settlement from each group; 10%, 30%, and 45% of the settlements in population's group A, B and C, respectively were selected; which eventually resulted in the selection of 30, 4, and 2 settlements from population's group A, B, and C, respectively. In order to determine the number of households in each of the selected settlements. Projected 2017 population figure was divided by five which is the average household size in Nigeria (National Population Commission & ICF International, 2014). Third, from settlements in group A (1−6,500) residents, 10% of the households were sampled; having been suggested as suitable for rural research (Ogunsanya, 1987; Olawole, 2013). It additionally prevented selection of a large sample that might not be easy to manage given the time and financial resources available for the study. Also, because the numbers of highly populated settlements in the study area were few while a sample of 5% of households was chosen from population's group B (6,501−13,000) and group C (13,001−19,999) to enable representations of all strata in each LGA.

Furthermore, all households in each of the chosen settlements were numbered and listed in order to ensure objectivity in the selection of the households in the settlements. Additionally, the initial sample was selected through simple random sampling technique while subsequent samples were taken through systematic sampling technique from the lists at regular intervals of "K" until the desired numbers of households were fully selected. Also, in order to determine the interval "K," 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. In the end, 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 the questionnaire were distributed to heads of households who had been farmers for at least two years in the hopes that they would be able to supply sufficient and accurate information on the subject matter.

Both descriptive and inferential statistics were used in the data analysis process. Descriptive statistics, in particular frequencies and percentages, are presented using cross tabulation, table and bar graphs. On the other hand, inferential statistics, especially the Leven test statistics, were used to test homogeneity of variance. To avoid the difficulties and complexities involved in interpreting the findings based on the large samples (36 settlements) chosen for the study, settlements connected by the two categories of road quality (tarred and untarred) were used as basis for interpretation of result (Porter, 1995).

4. Results and Discussion

4.1. Types of Roads to Settlements

From major interstate roads to selected settlements, tarred roads connected only 44.4% of the settlements, while 55.6% of the settlements had untarred roads connecting them (Figure 2). It has been earlier observed that most roads to rural areas as headquarters of farming in developing countries are in deplorable state (Adeniji, 2000; Blinpo et al., 2013; Ipingbemi, 2008; Oyesiku, 2002; Aboyeji & Aguda, 2024). The persistently low quality of rural roads could not be dissociated from inadequate attention by local government administration saddled with the responsibility of rural road maintenance (Aderamo & Mogaji, 2010). This implied that the movement of both passengers (farmers and buyers and sellers of agricultural inputs and outputs) and freights (agricultural inputs and outputs; especially cashew in this case) largely occurred on low quality roads (Figure 2). Poor road and transport access makes it difficult for farmer to increase their farm sizes promote high level of agricultural productivity (Jacoby & Minton, 2009; Dorosh et al., 2010). This is because the associated high transport's fare in all geographical space (Teravaninthorn & Raballand, 2008; Raballand et al., 2010; Porter et al., 2013) as well as delays in the delivery of passengers and freights are known symbols of poor transport services. This buttresses earlier description of the grossly inadequacy and inefficiency of transport services in many parts of Africa (Porter, 2014).

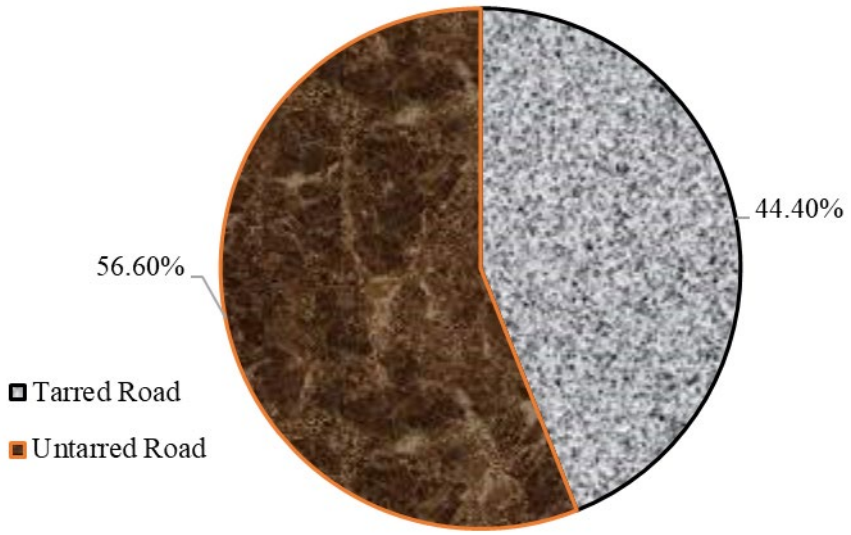

Figure 2. Percentage distribution of tarred and untarred roads to selected settlements in Kwara South Senatorial District, Kwara State.
Source: Author's survey, 2021.

Furthermore, local government area analysis showed that untarred roads connected 100%, 76.5%, 50%, 50%, 40%, and 28.6% of the selected settlements in Offa, Irepodun, Isin, Ekiti Oyun, and Ifelodun Local Government Areas, respectively (Figure 3). While at the time this research was conducted, all the settlements (100 percent) sampled in the Oke-Ero Local Government Area were connected by tarred roads. lack of attention to rural road maintenance is an important contributing factor to Nigeria's terrible rural road conditions (Aderamo & Magaji, 2010). High transport fares are associated with road of poor quality. The rough and rugged conditions of untarred roads potentially increase the operation cost of vehicle operators, which they in turn use to determine the charges on respective distances covered on such roads. For example, it has been observed that the fare of transportation is three times higher on untarred roads than on tarred roads (Ipingbemi, 2010). Also, previous studies have attributed seasonal variation in transport charges; especially hike in transport fare to the depreciating condition of roads especially in wet season; particularly because, during the rainy season the roads become muddy, slick, and challenging for cars to navigate in most of the untarred roads (Porter et al., 2013). Aikins and Akude (2015) stated in an identical manner how awful rural roads in Ghana are. Poor rural roads usually result in the receipts of low returns from farming's investment (Morgan et al., 2019). In other words, the high percentage of poorly maintained roads in the selected settlements in the study area has impacted negatively on both productivity and income of cashew farmers. Furthermore, it has been observed that 97% of the population affirmed the presence of seasonal variation in transport fare and 47.7% of the respondents constituting the majority of the population further affirmed 21−30% variation in transport charges with season in a part of Kwara State, Nigeria (Aboyeji, 2021).

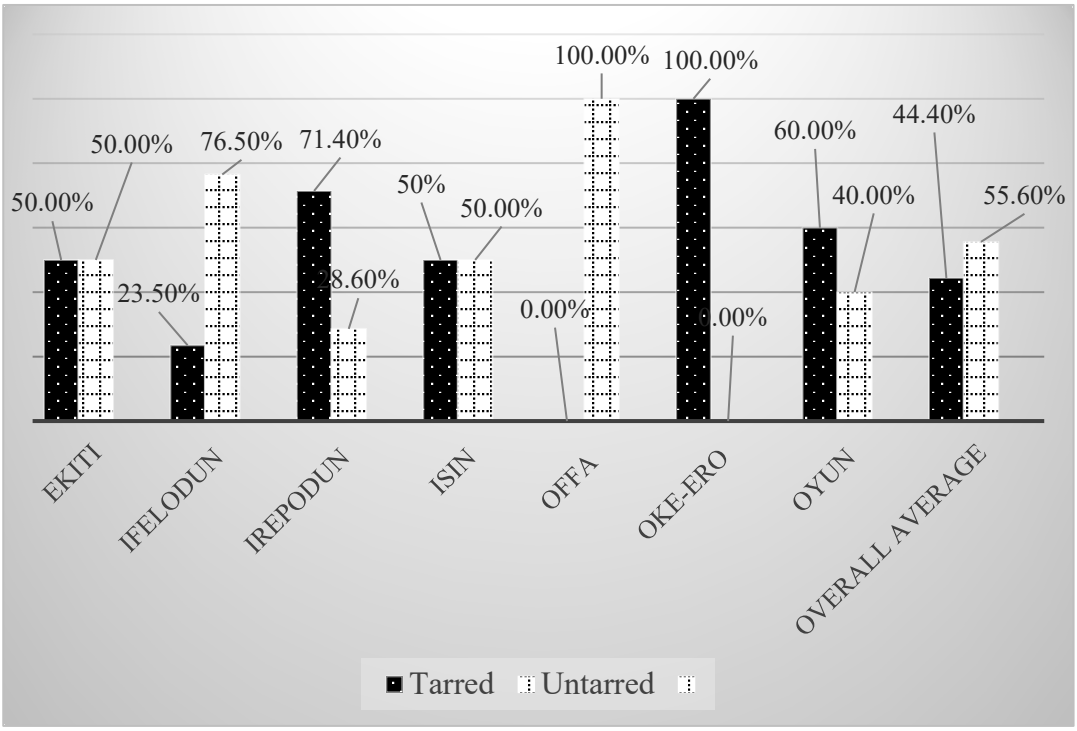

Figure 3. Percentage distribution of tarred and untarred roads in selected settlements in each local government area in Kwara South Senatorial District, Kwara State.
Source: Author's Survey, 2021.

4.2. Farmers' Regular Mode of Transport to and from Farm Sites

The results on the modes of transport that cashew farmers regularly used to transport themselves to and from the farm sites in the study area showed that the majority (51.8%) of the respondents were regularly trekking to and from their farm sites, 29.6% of the respondents used personal motorcycle, 6.6%, of the respondents employed commercial motor cycle, 6.3% of the respondents regularly used personal vehicles (car/buses/lorries) and the remaining 5.8% of the sampled farmers made use of commercial motor cycles for transport to and from the farm (Figure 4). The higher proportion of cashew farmers trekking to and from the farm were exposed to avoidable stress, tiredness and heat scourge earlier observed (Ogunsanya, 1987) with access to modes of transport. The end result is its negative impact on farmers' productivity. The study clearly shows that farmers in the region are yet to adequately appreciate the use of Intermediate means of Transport (IMT) and its attendant advantage in saving time and energy as observed by food farmers in Oyo North, Oyo state, Nigeria (Kassali et al., 2012). The use of bicycles by farmers was conspicuously absent in the study area. This may be as a result of their inability to appreciate the importance of bicycles as an intermediate means of transport as observed by Starkey et al. (2002) and Porter (2002). Earlier studies in the South western part of Nigeria also confirmed the unpopularity of bicycle as a mode of transport (Adeniji et al., 2000; Olawole, 2013); this might be due to their socio-cultural belief. On the other hand, it is pertinent to emphasis that the accessibility of 6.3% of the respondents to personal vehicles is a good development, especially because it is higher than the rate of vehicle ownership in Nigeria, which is 24 per 1,000 (Nairametrics, 2017) Nigeria's vehicle per population ratio is 0.06 per population (Federal Road Safety Corps, 2010).

The study examined the modes of transportation employed by farmers in the two categories of settlements and found that, while 49.9% of respondents in settlements connected by untarred roads traveled by foot to and from their farm sites, 53.9% of respondents in settlements connected by tarred road(s) did so. Furthermore, 26.2% of respondents in settlements connected by tarred roads compared with 32.6 percent of respondents in settlements connected by untarred roads reported using personal motorcycles as a means of transport to their farm and for the conveyance of agricultural input and output. In addition, 7.0% of respondents in settlements connected by tarred road(s), as opposed to 5.6% of the respondents in settlements connected by untarred road(s), employed personal vehicles, 8.0% of respondents in settlements connected by tarred road(s) compared with 5.3% of respondents in settlements connected by untarred road(s) employed commercial vehicles, and 4.8% of respondents in settlements connected by tarred road(s) compared with 6.7% of respondents in settlement connected by untarred road(s) employed commercial motorcycles as a means of transportation to and from their farm sites in the study area. These data indicate that

a higher percentage of respondents used commercial motorcycle for farming related journeys in settlements connected by untarred roads than in settlements connected by tarred road; this perhaps served as a recompense for the subpar quality of the roads connecting their settlements.

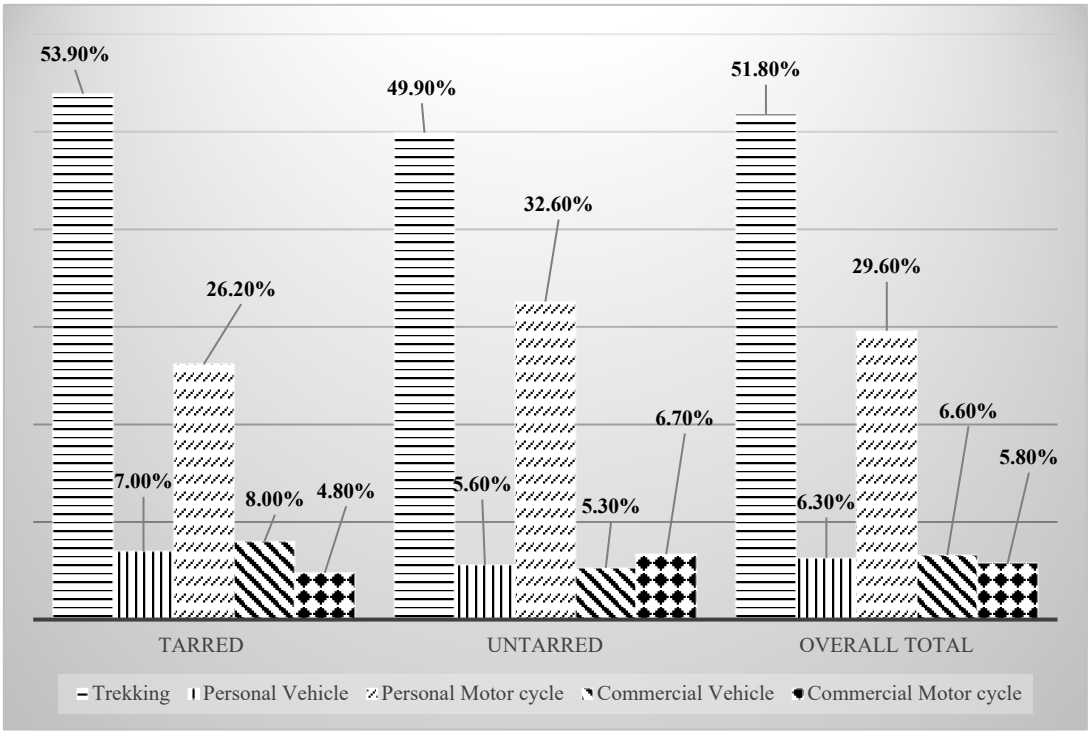

Figure 4. Farmers' regular modes of transporting farm input and output.
Source: Author's survey.

4.3. Farmers' Assessment of Conditions of Transport Services to Selected Settlements

The result on the perception of respondents on the condition of transport services to selected settlements revealed that 56.4% of respondents in the entire study area rated the transport services as good (Figure 5). The highest proportions (78.3%) of respondents who gave a "good" rating to the transport services were observed in Oke-ero LGA. The fact that tarred roads connected every settlement sampled in Oke-ero LGA may not be unrelated to this. On the other hand, only 10.9% of the respondents in the entire study area perceived the transport services to their respective settlements as very poor, the result further revealed that the highest proportion (33.3%) of those who gave a "very poor" assessment of the transport services was from Offa LGA; It should be reiterated 100% of the selected settlement (Ogbondoroko) in the LGA was connected by untarred road. Furthermore, 14.2% of the respondents in the entire study area rated the transport services to their respective settlements as poor, the highest proportion (17%) of respondents who gave a fair rating was observed from Ifelodun LGA, where 76.5% of the settlements were connected by untarred road. This depicted a positive correlation between high quality (tarred road) and good transport services and vice versa. The relatively higher transport cost associated with untarred road settlements (Teravaninthorn & Raballand, 2008; Raballand et al., 2010) considerably reduces the quality of transport services, increases the cost of conveying farm inputs and inputs, and impact negatively on gains from agricultural investments especially (Aboyeji & Aguda, 2021). It has been asserted that good transport services must be efficient, regular, reliable, and affordable (cheap) to promote growth in agricultural output (Porter, 2014). Besides, a situation where 100% of respondents in Ogbondoroko rated the transport services as poor was not unconnected with the fact that the road to that settlement was untarred. Untarred roads usually have difficulties in amalgamating buyers and sellers of agricultural output and inputs, respectively, and by so doing unnecessarily cheapens the price of agricultural produce and increases the cost of farm inputs; this ultimately reduces the proportion of gains from farming investments (Calmette & Kilkenny, 2011; Aboyeji, 2021; Aboyeji & Aguda, 2021).

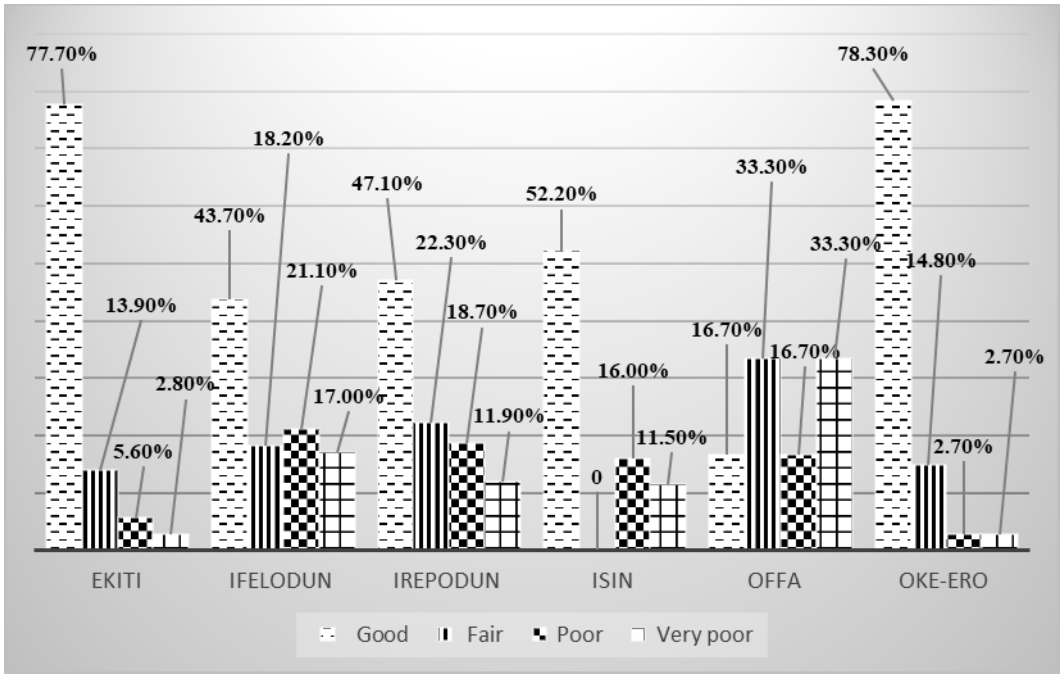

Figure 5. Assessment of conditions of transport services in selected settlements.

4.4. Annual Output Derived from Cashew

The result of the survey revealed that 40.3% of the respondents realized 1−10 bags of cashew per annum. The remaining 10.5% and 0.9% of the respondents annually realized 11−20 bags and 21−30 bags, respectively, while 48.3% of the respondents did not record of any output of cashew (Figure 6). The lack of records for cashew output could likely be attributed to the fact that the selected cashew farmers have just started the cultivation of the crop in the area. After analyzing cashew output in the two settlement categories, it was found that 20.2% of respondents in settlements connected by tarred road(s) and 20.1% in settlements connected by untarred road(s) respectively realized 50–500 kg of cashew on yearly basis. Furthermore, 66% of respondents in settlements connected by tarred road(s) as opposed to 39% of respondents in settlements connected by untarred road(s) reported realizing 550–1,000 kg of cashew annually. Remarkably, the majority of the respondents (27.4%) in settlements connected by tarred road(s) compared with 20.9% of respondents in settlements connected by untarred road(s) did not have a record of any cashew output on an annual basis.

Also, 6.6% of respondents in settlements connected by tarred road(s) as opposed to 3.39% of respondents in settlements connected by untarred road(s) realized 550–1,000 kg annually and the minority; 0.51% of respondents in settlements connected by tarred road(s) compared with 0.39% of respondents in settlements connected by untarred road(s) realized 1,050–1,500 kg of cashew. Interestingly, a majority (27.4%) of respondents in settlements connected by tarred road(s) compared to 20.9% in settlements connected by untarred road(s) did not have record of any output of cashew) annually. The result generally reveals that higher proportions of farmers in settlement connected by tarred roads realized the various output levels than those in settlements connected by untarred roads. Similar positive relationship between road quality and crop yields and income was observed in Ilaje, Ondo State, Nigeria (Olagunju, 2022) and in Kwara, State, Nigeria (Aboyeji & Aguda, 2024). However, the fact that higher proportion (6.6%) of respondents in settlements connected by untarred roads as against lower proportion (3.9%) in settlements connected by tarred roads had 1,050–1,500 kg of cashew may have occurred because most of the settlement connected by untarred road have relatively smaller population in the region. Therefore, it can be inferred that the observed higher proportion of cashew output in settlement connected by untarred roads is connected with access to larger farmland in the affected settlements. For instance, it has been asserted that as a settlement tends towards urban, proportion of available farmland near the city reduces as such settlement assumes residential, industrial and commercial functions (Beddington, 2010; Pham et al., 2011). The implication is that the farmers in the affected settlements connected by untarred roads with high output of cashew faces the additional challenge of payment of high transport's fare as observed in Amuro District, Kogi State, Nigeria (Ipingbemi, 2010); with negative impacts on gains accruable to cashew farmers. Earlier study in Ilorin also affirmed that poor road quality has negative impact on profit accruable to farmers (Tunde & Adeniyi, 2012).

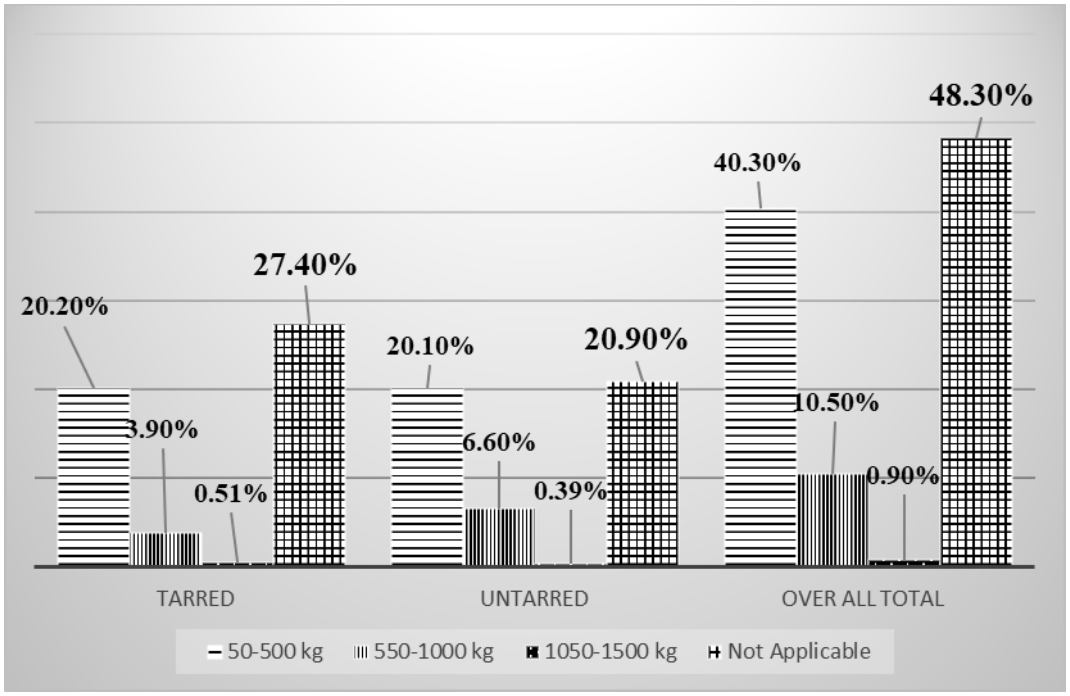

Figure 6. Annual output of cashew in kilograms along tarred and untarred roads in the study area.

Furthermore, local government by local government analysis of cashew output revealed that the highest proportion (59.3%) of cashew farmers realizing 50−500 kg was observed in Isin LGA, the highest proportion (30.1%) of cashew farmers realizing 550−1,000 kg was also observed in Isin LGA and the highest proportion (1.7%) of cashew farmers realizing 1,050−1,500 kg bags was also observed in Isin LGA (Figure 7).

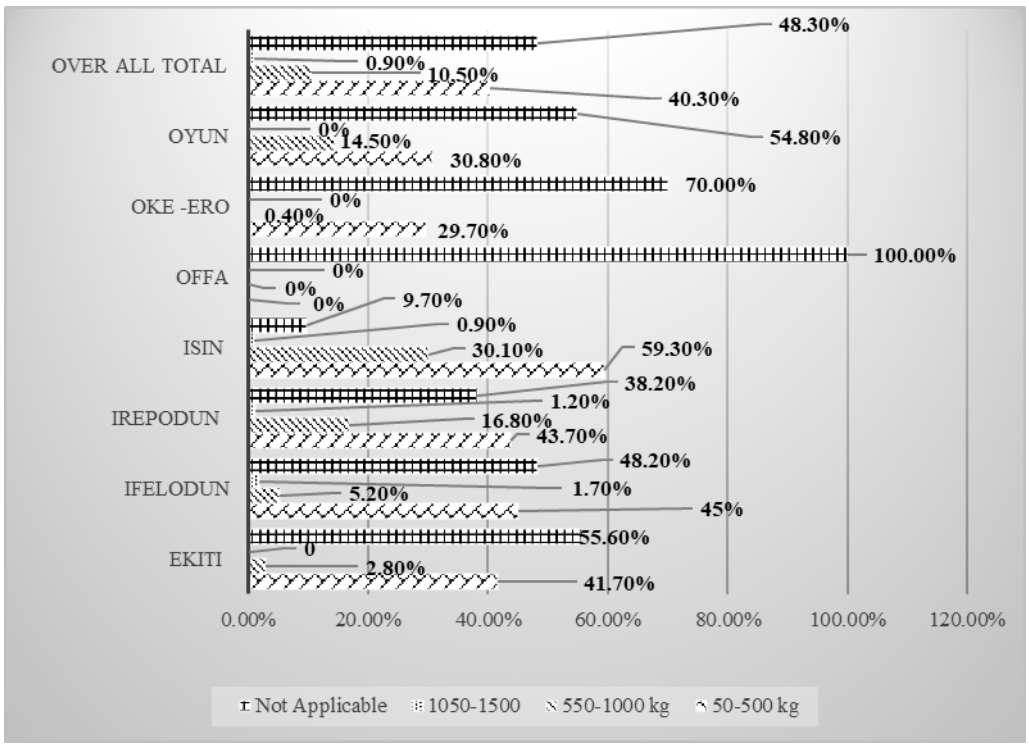

Figure 7. Annual output of cashew across local government area in the study area.
Source: Author's survey.

4.5. Hypothesis Testing on Output of Cashew

Table 1 shows the result of the regression analysis used to investigate the impacts of transport facilities on cashew output in Kwara South Senatorial District. Six variables were examined.

Table 1. Coefficients of regression for cashew output.

Model	Unstandardized Coefficients		Stand Coef.	T	Sig.	Remark on H_0	R^2
	B	Std. Error	Beta				
Constant	4.160	0.142		29.267	0.000		0.046
Transport Mode	0.383	0.142	0.071	−.555	0.579	Rejected	
Road Condition	9.453	0.142	−0.151	−5.706	0.000*	Accepted	
Transport Cost	0.379	0.142	0.070	2.665	0.008*	Accepted	
Transport Services	−0.520	0.142	−0.097	−3.660	0.000*	Accepted	
Distance to Farm	−0.195	0.142	−0.036	−1375	0.169	Rejected	
Distance to Major Market	250	0.142	−0.046	1.756	0.079	Rejected	

Source: Authors' computation.
Note: Road Condition and Transport Services are the highest contributing (−0.151) predictors to explain the impact of transport infrastructures on crop production/output of cashews. a. *p<0.05: Dependent Variables for cashew outputs.

An examination of the standardized coefficient presented in Table 1 showed that the main influencing factors for cashew outputs were road condition, cost of transports, and transport services (b = −0.151, p = 0.00; b = 0.070, p = 0.008; b = −0.097; p = 0.00, respectively). Therefore, we accept H_1 and reject H_0 but Transport Mode, Transport Cost, 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 H_0 and reject H_1.

Table 1 also shows a positive but weak relationship between cashew output and independent variables as the $R^2 = 0.046$, suggesting that the regression model accounts for about 4.6% of the variance in perception of the impacts of transport facilities on cashew output/yield. However, disparity has earlier been observed in the level of income accrued to farmers connected with good and bad transport conditions in Obokun Local Government Area of Osun state (Adedeji et al., 2014) and Ilaje, Ondo State, Nigeria (Olagunju, 2022), among others. In this particular study however, a significant inverse relationship has been observed between road condition and cashew output. Also, Kassali et al. (2012) observed that transport modes (Intermediate Means of Transport) significantly attenuated the negative effects of distance and impacted positively on productivity of food farmers in Oyo North, Oyo state, Nigeria. This study affirmed a positive relationship between transport modes and cashew outputs. The implication of the findings showed that increased farmers' access to more sophisticated/automobile modes cashew output increased; although this was not significant as depicted in Table 1. Therefore, it can be inferred that, the hypothesis that says "there is a significant relationship between transport facilities and cashew output (main hypothesis)" is rejected. Therefore, the null hypothesis that there is no significant relationship between transport facilities and cashew output is accepted. However, this study recommends the need for further studies on the factors responsible for the spatial variations between transport facilities and output levels where transport facilities accounted for less than 10% of spatial variations in output level. In this case, it is approximately 0.5% (see Table 1). Therefore, further explanations are needed.

4.6. Annual Income from Cashew

The surveyed result on the income derived by respondents from the cultivation of cashew per annum revealed that 2.6%, 2.2%, 10.1%, 14.6%, 10.6% and 11.6% of the respondent realized ≤ N 20,000, N 20,001−N 50,000, N 50,001−N 100,000, N 100,001−N 150,000, N 150,001−N 200,000 and > N 200,000, respectively; while 48.4% of the respondents did not respond (Figure 8) due possibly to non-involvement in the cultivation of cashew. The examination of the cashew income realized in the two categories of settlements showed that 1.7% of respondents in settlements connected by tarred road(s) compared with 0.9% of respondents in settlements connected by untarred road(s) realized ≤ N 20,000, annually; 1.6% of respondents in settlements connected by tarred road(s) compared with 0.6% of respondents in settlements connected by untarred road(s) realized

N 20,001–N 50,000; 5.9% of respondents in settlements connected by tarred road(s) compared with 4.2% of respondents in settlements connected by untarred road(s) realized N 50,000–N 100,000 and 9.9% of respondents in settlements connected by tarred road(s) compared with 1.5% of respondents in settlements connected by untarred road(s) realized N 100,001–N 150,000 per annum. Furthermore, the result additionally revealed that 5% of respondents in settlements connected by tarred roads in contrast with 5.6% of respondents in settlements connected by untarred roads, realized between N 150,001 and N 200,000 annually, and 8.9% of respondents in settlements connected by tarred roads, as opposed to 2.7% of respondents in settlements connected by untarred roads, realized more than N 200,000 annually from Cashew cultivation in the study area.

Generally, settlements connected with tarred roads had the highest proportion of farmers with various level of income range except with farmers realizing N 100,001–N 150,000 per annum where farmers from settlements connected by untarred had the highest proportion. Farmers there were certainly prone to payment of high transport fare transport their cashew product. This must have impacted negatively on their profit from cashew growing investment. The result equally revealed that the highest proportion of non-cashew grower was found in settlements connected by tarred roads; this may probably be because of availability of more farmland and farmers for producing cashews in settlements connected by untarred road(s) than in settlements connected by tarred road(s) and vice versa. Previous studies have observed a reduction of farmland with the expansion of settlements (van Vliet et al., 2017; Bercke et al., 2020). However, it is pertinent to state that the poor quality of road connecting settlements connected by untarred road(s) must have impacted negatively on the profit accruable to farmers in the area; especially due to the payment of relatively higher transport fare to convey cashew to the urban market.

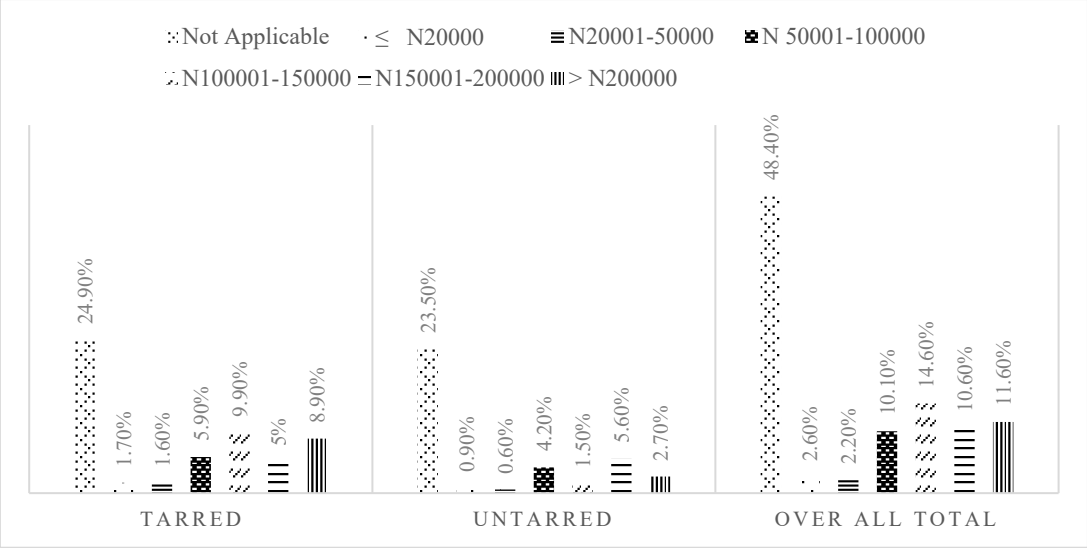

Figure 8. Annual income from cashew from settlements connected by tarred and untarred roads in the study area.
Source: Author's survey.

Furthermore, local government based analysis revealed that the highest proportion (4.1%) of farmers who realized ≤ N 20,000 from the cultivation of cashew was observed in Oyun LGA, the highest proportion (6.2%) of farmers who derived N 20,001−N 50,000 from the cultivation of cashew was observed in Isin LGA, the highest proportion (27.4%) of farmers that obtained N 150,001−N 20,000 and the highest proportion (31.0%) of farmers that got N 150,001−N 20,000 from the cultivation of cashew were observed in Isin LGA. The highest proportion (16.7%) of farmers who earned N 50,001−N 100,000 from the cultivation of cashew was observed in Ekiti LGA, the highest proportion (17.0%) of farmers realized N 100,001−N 150,000 from the cultivation of cashew was observed in Ifelodun LGA (Figure 9).

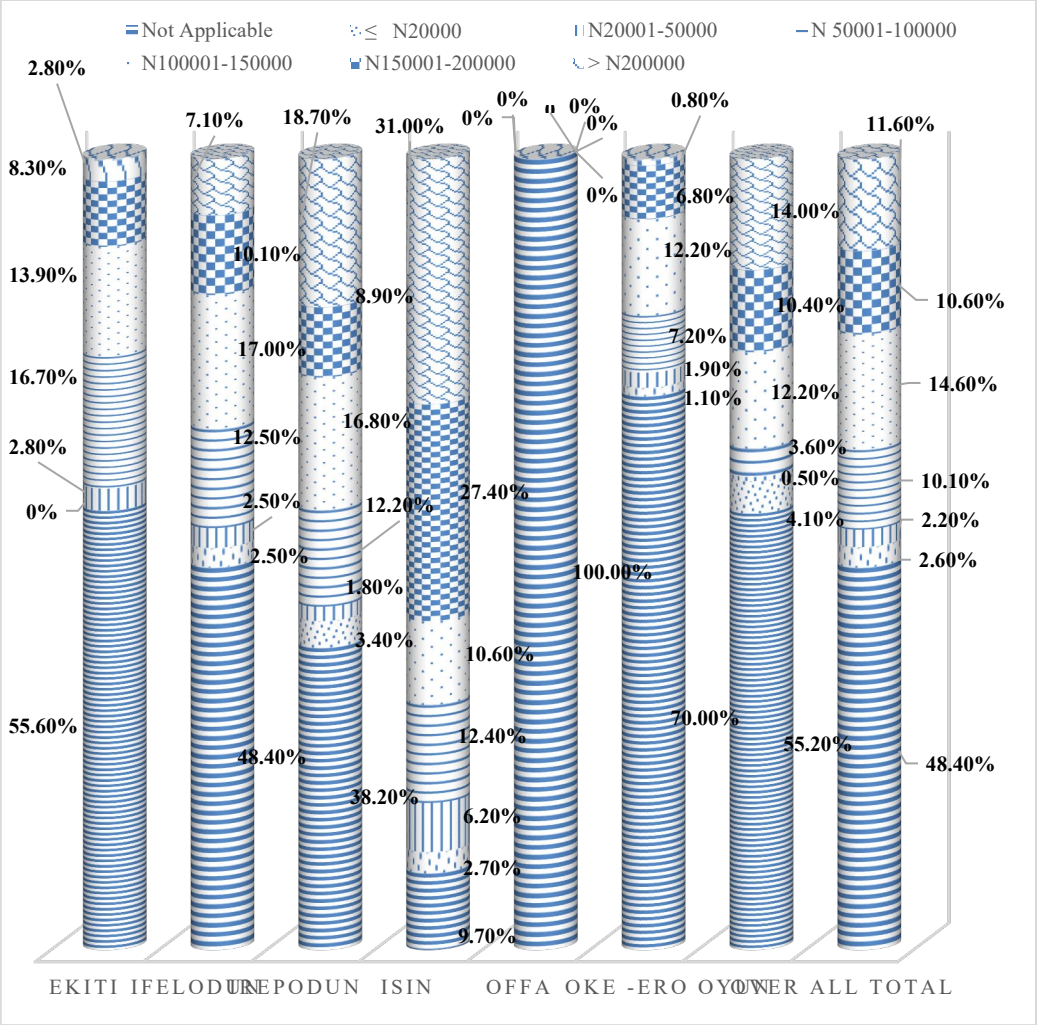

Figure 9. Annual income of cashew across local government area in the study area.

4.7. Hypothesis Testing on Income from Cashew

H_0: There is no significant relationship between transport facilities and income from cashew.

H_1: There is a significant relationship between transport facilities and income from cashew.

Table 2 shows the result of the regression analysis used to investigate the impacts of transport facilities on income derived from cashew in Kwara South Senatorial District. Six variables were examined.

Table 2. Correlation between transport facilities and income generated from selected crops.

		Transport Mode	Road Condition	Transport Cost	Transport Services	Distance to Farm	Distance to Major Market
Cashew Income	Pearson Correlation	0.059	−0.153	0.051	−0.096	−0.040	0.053
	Sig. (2-tailed)	0.029*	0.000*	0.060	0.000*	0.143	0.050*
	N	1,373	1,373	1,373	1,373	1,373	1,373

Source: Authors' computation.
Note: * Correlation is significant at the 0.05 level (2-tailed).

Lastly, whereas the relationships between income from cashew (cashew income) and each of the selected indices of transport facilities were weak ($r \leq 0.096$), the relationship between the income from cashew was directly and significantly correlated with transport mode ($r = 0.059$, $p = 0.029$) and distance to major market ($r = 0.053$, $p = 0.050$) but inversely correlated with road

condition (r = −0.153, p = 0.000) and transport services (r = −0.096, p = 0.000) (Table 2). Income from cashew was significantly related to transport mode, road condition, distance to major markets, transport services, and distance to major markets but not with transport cost and distance to farm. Consequently, the null hypothesis that states that there is no significant relationship between transport facilities and income from cashews is accepted for "Transport Cost" and "Distance to Farm" while the main hypothesis that there is a significant relationship between transport facilities and income from cashew is accepted for "Road Conditions," "Transport Modes," "Transport Services," and "Distance to Major Market."

Furthermore, specific transport facilities were significant for specific crops. For instance, road conditions were significant for income generated from cashew. Earlier studies have associated farmers' access to higher income in locations having access to improved transport facilities as exhibited in Obokun Local Government Area of Osun state (Adedeji et al., 2014) and in Ilaje, Ondo State, Nigeria (Olagunju, 2022). Similarly, Aderamo and Magaji (2010) observed that poor road quality in Ilorin East LGA was responsible for high transport charges which in turns impacts negatively on the level of income accruable to farmers in the area.

4.8. Implication

The implication of the study is that high prevalence of poor road promotes high transport's fare and poor transport services generally; these impact negatively on impressive outputs and income from cashew and hinders the achievement of SDG 1 (ending poverty). By extension, prevailing rural roads militate against massive output of food crops and by so doing makes achievement of goal 2 (ending hunger) elusive in most sub-Saharan Africa. Therefore, it is hereby recommended that utmost attention should be given to construction of more access roads, rehabilitation of existing roads; through the formation of rural road maintenance agency at the local government area and community levels to encourage interconnectivity of rural roads, improvement of rural transport services through; introduction of tricycles and other fewer passengers' modes of transport, provision of soft loan for their procurement as well as establishment of market centers in more communities in order to improve the flow of passengers and freights traffic and improve accessibility of rural farm produce to better market potentials; which ultimately improves productivity level and economic fortunes of rural farmers.

5. Conclusion and Recommendations

The study investigated the condition of roads and transport services and assessed its impact on both outputs and income realized from cashew in selected rural settlements in Kwara South Senatorial District. The study observed that transport (rural roads and rural transport services) is a major determinant of the outputs and income realized from the cultivation of any given crop in any geographic space. The limitation of this study was finance and time inadequacy which informed the restriction of the assessment of transport services to the views of cashew farmers alone without the consideration of transporters' view who are the main actor in the transport business. The study recommends inclusion of transporters' view in further investigations on the topic in order to get a holistic assessment of the impact of transport on both outputs and income generated from cashew or other crops. Additionally, there is the need to shed light on other factors affecting variations in both output and income realized from cashew production in the two categories of settlements other than transport.

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