Heterogeneity of Agricultural Land Use Systems and Poverty in Sub-Saharan Africa: Relationship and Evidence from Rural Nigeria

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Abstract

Several factors influencing rural-poverty in sub-Saharan-Africa, for all the factors, agricultural-land access/management and "culture of poverty" are quite dominant in literature. This study examines socio-cultural/economic factors influencing poverty and establishes linkages of heterogeneity of land-use systems. Farm-level cost–route surveys of cross-sectional national-data of 800 respondents were used for analysis. Data were analyzed by descriptive-statistics, trans-logarithmic model, and poverty-measures. Descriptive statistics depict land-ownership structure, farmer's socio-cultural practices, and exploits of government intervention programs influenced agricultural-poverty. Trans-logarithmic coefficients results of short-run sustainability-index (SRSI), land-policy intervention variables and household-sizes are dominance factors. Also, SRSI indicated 0.69, suggesting that 69% of the farmers made unsustainable use of agricultural-land. Moreover, 92% of extremely poor respondents with large household-sizes (61.2%) seek their agricultural-land ownership by rentage, while those with land-titled documents constitute 78.6% of the non-poor. Public-policy interventions must take into account formalization of land-property rights in order to facilitate its transferability and boosting investment.

Keywords

Introduction

Efforts by African governments and international benefactors in the last decades to eradicate rural poverty have not translated to the desired results (Dillon and Barrett, 2017). Africa has profited from unparalleled growth but a sizeable part of its population (especially those in rural areas) remains trapped in economic poverty (Bandeira and Sumpsi, 2009; McCullough, 2015). These articles identified 55% of sub-Saharan Africa's (SSA) population estimated to be in poverty lived in rural areas and derived livelihood from agriculture. Hence, high numbers of Africans living in poverty were established. This concern calls for attention of governments, international donors, and researchers toward development strategies that are "pro-poor". There are several

documented factors influencing rural poverty, such as inadequate access to productive resources, poor infrastructure-developments, and poor/no access to credit, among others (Nkonya et al., 2008). For all factors considered influencing poverty in the literature, agricultural land management and "farmer's sociocultural/economic factors" are quite dominant (Cervantes-Godoy and Dewbre, 2010, Deininger et al., 2017; Kansiine et al., 2018).

Heterogeneity of agricultural land use systems refers to conditions in which land is held, used, and transacted especially for agricultural purposes. Heterogeneity of land use systems and agricultural activities in Africa has gone through a complete cycle (Abdelhak et al., 2012, Chamberlin and Ricker-Gilbert, 2016, Stein and Ghebru, 2016). After being central for decades, land use systems

and policies in Africa have witnessed a pro-market view. In measuring the return to land used for agricultural purposes, it is important to account for the high degree of heterogeneity across rural households. In recent years, programs of access to land have returned high on the agenda of poverty reducing strategies programs of governments, NGOs, and international development agencies with minimum impacts (Sheahan and Barrett, 2014). Poverty-trap has been argued to be "set of factors or events by which poverty, once begun, is expected to continue unless there is outside intervention" (Hardin, 1968; Deininger et al., 2015, Davis et al., 2017). Literature has indicated that access to land can alleviate rural poverty by offering households a fruitful and relatively dependable way to make an income (FAO, 2015; Garner and Campos, 2014).

Though this article is not exclusive, there are various appraisals of factors influencing poverty and inequality that have been published (Gowing and Palmer, 2009; Gerber et al., 2014; Barbier and Hochard, 2016a). There is evidence of more of substantial frontier of knowledge on the causality of land access and inequality in Africa (Harder, 1968; Barbier and Hochard, 2016b). This contribution, however, diverges from these previous studies in that the article uses land use systems as major indicator of poverty and the influence of socio-cultural factors. This paper contends that significant discussions of land use and poverty must be grounded within the context of prevailing farmland fragmentations and socio-cultural factors. However, few studies have provided scant information of this causality (Gollin, 2014; Hollinger and Staatz, 2015).

Several factors influencing rural poverty in sub-Saharan Africa, for all the factors, agricultural-land access/management and "culture of poverty" are quite dominant in the literature. Hence, the main aim of this is to examine socio-cultural/economic factors influencing poverty trap and to establish linkages of heterogeneity of land use systems. It is known that sustainable land use management and resource use efficiency enhances agricultural productivity. Consequently the assumptions of the model guiding sustainable land use management and resource use efficiency were stated to examine factors influencing unsustainable land use management and resource use inefficiency.

Theoretical Considerations of Land Use System in Nigeria and Historical Evidence

Land use for agriculture in developing economies has been a source of developmental concerns (Stein and Ghebru 2016). In most communities in Nigeria, land is regarded as a revered institution bestowed to mankind (the living and coming generations) by God for use. Land use systems have been a bone of contention in many countries because of the inequities in access that defined usage either for productive or nonproductive activities. The theoretical framework in which this study is conceptualized is New Institutional Economics (NIE) and Access Theory (AT). NIE describes access and usage that different people have to land and also challenges associated with the access (Bandeira and Sumpsi, 2009). Past works argued that those with influence and resources have easier access to land, and people with power can influence access to land. But for the poor with little or no power, access to land can be difficult. The NIE approach holds that the performance of an economy depends on institutions (Sjaastad and Bromley, 1999; Bomuhangi et al., 2011; Udoekanem et al., 2014). Hence, this paper explored NIE and its related property rights theory to comprehend the formation of land use functioning among the constituted structure, and obstacles in land-programs operation. AT highlights that access to resources influences bunch of privileges and property. AT deduces the direction between access to land use and poverty (Feder and Feeny, 1991).

Land ownership system in pre-colonial Nigeria was communal. Land is owned by communities and families in trust for all the family members, of which, many are dead, few are living, and countless numbers' yet unborn (Umeh 1973). However, the State still plays a role in providing framework necessary to regulate land tenure arrangements. The Land and Native Rights Act, enacted in 1916, vested the colonial Governor all rights over all native lands in Northern Nigeria. The Native Land Acquisition Act 1917 had since been the advent of the federal system of government in Nigeria. The Native Land Acquisition Act 1917 was replaced by the Native Land Acquisition Law of 1952 in the Western and Mid-Western states and Aliens Law of 1956 in Eastern states (Ijere 1974). The land acts of 1952 and 1956 allowed occupancy of a right to use land to the exclusion of all other persons except the Governor. Land rights are granted for a maximum holding period of 99 years, subject to the payment of ground rent fixed (Mabogunje 2002).

Literature contended that the customary land tenancy in Northern Nigeria experienced early

interferences by the invasions of Fulani jihadists that manipulated customary old fashioned land tenure to their advantage. Moreover, during the reign of the British colonialist Lord Luggard in 1903, the Lands and Native Rights Ordinances was initiated, which was later modified in 1916 (Famoriyo and Adegboye, 1975). The 1916 Ordinance was also revised and substantially modernized in the Land Tenure Law of 1962. The 1962 Land Tenure Law affirmed that all lands in northern Nigeria as "native lands" and thus bestowed its control and management in the Minister (afterward Commissioner). However, in Southern Nigeria land tenure is controlled by customary law (Oshio 1990). Land is alleged as an "ancestral trust" for the advantage of people and future generations. Land is regarded as mutual for the benefits of all. Land in eastern Nigeria (the Igbos) is venerate and is considered as an earth goddesses. Past study argued that in the southeastern states of Nigeria access to land is governed by both statutory and customary laws (Chukwuma and Asogwa 2017). Customary laws emerge from unwritten social rules derived from shared community values and traditions (Opata and Asogwa 2017). Statutory laws confer on its holder's authority/right to make use of communal lands (Famoriyo, 1976).

The Land Use Act of 1978 was enacted to nationalize land ownership in Nigeria as well as to facilitate effective state control of the use and development of land. Before this Act of 1978, access to commercial farmlands was very difficult. This Act has improved a significant access to commercial farmlands. Currently, 23.1% of households in Nigeria owned titled land and 5% for commercial farmlands (Umeh, 1973). Excessive bureaucracy has made land registration in Nigeria very prohibitive. Countries like Rwanda, Ghana, and Botswana take fewer days to register property titles on land. Land is vested in the state's governor to be held in trust and administered for the use and common benefits of all Nigerians (Fabiyi and Idowu, 1993). This Land Use Act of 1978 make clearer provisions for the indigenous land tenure system and hence used as heterogeneity of land use systems, ownership structure, farm production/productivity and commodity crops found in each region as expressed in Figure 1.

Nolte and Sipangule (2010) noted that there has been an increased interest in agricultural land-use policy in Africa's rural areas. The study deduced that about 45% of the agricultural investments have been taken over by the foreign investments particularly medium-scale farmers. Hence, this interest in agricultural land further increases land pressure and land use competition between commercial interests, local livelihoods and ecosystem services and thus enhances poverty among the locals. Hence, land-use policy needs to focus on raising smallholder agricultural productivity. In the same vein, Nkonya et al. (2016) revealed that Sub-Saharan Africa (SSA) has experienced the most severe land degradation in the world. Hence, there is dire need to design a number of policies and strategies to address land degradation and to enhance agricultural productivity. Results indicated that about 23% of the conversion of grassland to cropland and deforestation are the major factors driving land use/cover change (LUCC) thus facilitating poverty among local farmers. Econometric analysis showed that intervention helped access to productive inputs including land degradation threats. Hence, improvement of government effectiveness on land use policy can reduces cost of land degradation and cropland expansion. These opportunities should be exploited effectively as they lead to win-win outcomes-reducing poverty and achieving sustainable land management.

Moreover, poverty reduction and sustainable land management are two objectives that most African countries strive to achieve simultaneously. In designing policies to achieve these objectives concurrently a clear understanding of their linkage is crucial. Deininger et al. (2015) in their analysis opined that better understand this linkage is sustainable land management and effectiveness of resource use. Results revealed that poverty indicators give credence to the land degradation–poverty trap, although some indicators showed negative association with land degradation. These results suggest that certain poverty reduction strategies being implemented through agricultural modernization in Africa can achieve triumph outcomes and simultaneously increasing productivity, reducing poverty, and reducing land degradation.

Examining the heterogeneity of land use, Land Use System in Nigeria and its Historical Evidence can give an insight on how sustainable land use and management of land being engaged over the decades. It is known that sustainable land use management and resource use efficiency enhances agricultural productivity. What is unknown is that agricultural-land access/management and "culture of poverty" influences rural poverty. Also, can land

use policy provide policy guidance to government to influence land-use sustainability and resource use efficiency among small farmers evidence from rural Nigeria? This is the rationale of this study.

Materials and methods

Area of study

Nigeria comprises of a geographical area of 923,768 square kilometers with a projected population of 180 million (2016 estimate) people (Figure 2). Nigeria lies exclusively within the tropics along the Gulf of Guinea on the western coast of Africa. The country has a favorably diversified agro ecological condition, which makes it possible for the production of a wide range of agricultural products. Less than 50% of the country's cultivable agricultural land is under cultivation. Even then, smallholder and traditional farmers who use rudimentary production techniques, with resultant low yields, cultivate most of these lands. The country is divided into four major regions used as a base of analysis for this study (Table 1).

Method of data collection

Both primary and secondary data were used. A cross-sectional data from 1200 farmers were collected through farm level rigorous cost route surveys, out of which 880 (73.33% response rate) data found useful. The 320 unused data contained incomplete data, questionnaire lost in transit and data that cannot properly be transcribed. However, the secondary data were obtained from the records of various Agricultural

Developments Projects (ADPs), Land records department of various Federal and State Ministries respectively. Data collected include: socio-cultural/economic, agronomic, land use data, environmental, prices on input and output data among others. Cross-sectional data on socioeconomic and environmental attributes of the respondents were collected. Farmers were specifically asked to respond to questions on patterns of change in land use and its influence on their agricultural production.

Sampling techniques and procedures

The survey was distributed using Multistage sampling. This techniques was adopted to divide the country into clusters (four regions: Core North, North central, Southern part and South-south) and from each cluster (region) two States were randomly selected and everyone within the chosen cluster is sampled. Secondly, two locations in each state were identified through secondary sources information about the data on heterogeneity of land-use systems and high intensity of farming operations. In addition, poverty status as provided by secondary sources too inspired the choice of these locations. Thirdly, selection of the farm-households from sixteen identified communities/ towns. Each town produced a representative data of maximum 75 and minimum 55. Hence, 55 data were used across board to provide for uniformity. This give 220 per region and 880 overall (Table 2). Also, assistance of competent scientists/researchers were sought for in the identification of certain land use system, degradation parameters and indices among others.
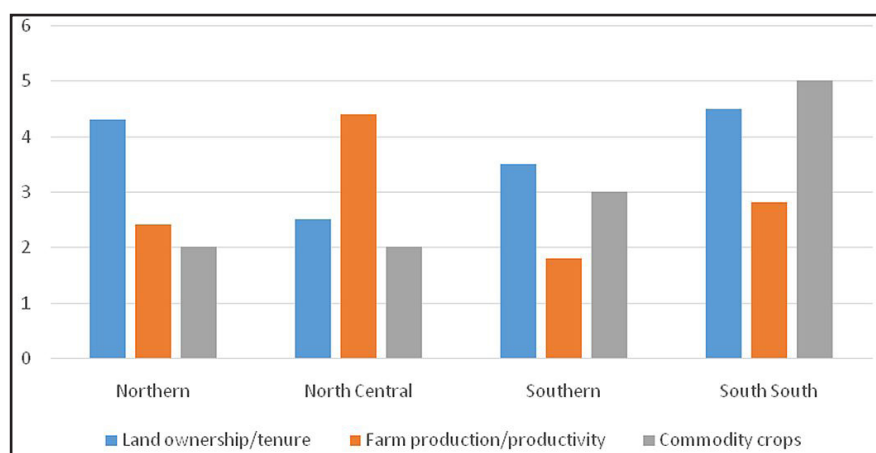
Source: adapted from the revised livelihoods zone map and descriptions for nigeria a report of the famine early warning systems network (fews net) september 2018

Figure 1: Structure of land ownership and major agricultural produce in regions of Nigeria.

Source: Agriculture in Nigeria - Wikipedia

Figure 2: Map of Nigeria.

s/n	Region and Law/Land Use Systems	States	Major Agricultural Activities	Vegetation
1	Northern region/ Primitive and Customary Law	Bauchi, Borno, Jigawa, Kano, Katsina, Kebbi, Sokoto, Yobe, and Zamfara	Cotton, Groundnut, Sorghum, Millet, Maize and Wheat Locust Bean trees (*Parkiafilicoidea*), Tamarind tree (*Tamarindusindica*), and Mango (*Mangiferaindica*).	Low average annual rainfall of 657.3 mm and prolonged dry season (6–9 months)
2	Northcentral region/ Hegemony and Customary	Abuja, Adamawa, Benue, Gombe, Kaduna, Kogi, Kwara, Nassarawa, Niger, Plateau, and Taraba	Grazing livestock such as cattle, goats, horses, sheep, camels, and donkeys. Maize, Cassava, Yam, and Rice	This zone experiences lower rainfall, shorter rainy season and longer dry period
3	Southern region/ Communal and Statutory	Abia, Anambra, Ebonyi, Edo, Ekiti, Enugu, Ogun, Ondo, Osun, and Oyo	Staple crops like, yam, cassava, cocoyam, sweet potatoes, melon, groundnut, rice maize and Oil Palm, (*Elaeisguineensis*), Cocoa (*Theobroma cacao*), Rubber (*Heveabrasiliensis*) banana/Plantain (*Musa spp.*), Cotton and Cola nut (*Cola nitida*). Cowpeas and Beans as well as a number of fruits. A number of timber trees such as the African Mahogany, the scented Sapele wood (*Entandrophragmacylindricum*), and Iroko (*Chlorophoraexcelsa*)	Prolonged rainy season, resulting in high annual rainfall above 2000 mm.
4	South-South region/ Hegemony, Customary and Statutory System	Akwa Ibom, Bayelsa, Cross Rivers, and Delta, Lagos, and Rivers	Oil-Palm, Cocoa, Cassava, Maize, Yam. Various Palm and Fibre plants such as R*aphiaspp*., *Raphiavinifera*, the Wine Palm and *Raphiahookeri*, the Roof-mat Palm.	Prolonged rainy season and lagoons overflow banks in the wet season (8–9 months). Thus longer rains, has led to badly leached soils and severe erosion

Sources: [i] http://soilsnigeria.net; [ii] Oyenuga, V. A. (1967). Agriculture in Nigeria. Food and Agriculture Organization of the United Nations. FAO, Rome, Italy. 308 p.; [iii] Materials from http://www.fao.org; [iv] Sowunmi, F. A. and Akintola, J. O. (2010) Effect of Climatic Variability on Maize Production in Nigeria. Research Journal of Environmental and Earth Sciences , Vol. 2, No. 1, pp. 19–30.

Table 1. Region and land use laws/systems in Nigeria.

Region	State	Local Government/Towns	Questionnaire Distributed	Questionnaire Used
Northern	Kano	Makoda	75	55
		Kura	75	55
	Jigawa	Guri	75	55
		Gumel	75	55
Northcentral	Adamawa	Maiga	75	55
		Mchika	75	55
	Kogi	Yagba east	75	55
		Okene	75	55
Southern	Abia	Abia South	75	55
		Ohafia	75	55
	Ondo	Akoko South	75	55
		Owo	75	55
	Cross rivers	Yakurr	75	55
		Odukpani	75	55
	Rivers	Port-harcourt	75	55
		Ahoda west	75	55
Total			1200	880

Source: Field Survey (2018).

Table 2: Distribution of sampled respondents in the study area.

Method of data analysis

The analytical tools employed in this study are developed to analyze the data in order to fulfill the scope of the paper. Therefore, a combination of analytical tools like descriptive statistics, and econometric procedures were used.

Model estimation and interpretation

Multiple regression model adopted was based on the fulfillment of the assumptions of the functional forms and data availability. This model was used to measure the indices of sustainable land use and management. Consider the production function of

$$Y = h\left(X, L, V, M, \beta\right)\exp(U_i - V_i) \tag{1}$$

where

Y = Output of crops consumed

X = Vector of physical inputs and indigenous status measured

L = Land quality variable measured as a dummy variable

V = Vector of land use variables measured as index

M = Vector of land management practices assumed to have an impact on land quality measured by ranking number and dummy.

U_i = Components of error terms

V_i = Misspecification of the model.

$h\,(.\,)$ = Suitable function to be adopted for the study.

$i = 1, 2, …, n$

The parameters of Equation (1) and the density function of U_i and V_i will be estimated by maximizing the log-likelihood function, given as

$$Lhf = \frac{n}{2}\,Lh\left(\frac{2}{\pi}\right) - Kn\sigma + \sum_{i=1}^{n} Lh$$
$$- F\left[\left(\frac{-\epsilon\lambda}{\sigma}\right)\right] - \frac{1}{2}\sigma^{-2}\sum_{i=1}^{n}\in i^2 \tag{2}$$

where

Lhf = log-likelihood function

Lh = Log-likelihood

K = constant

n = number of observations (880 farming households)

σ = standard deviation error term

λ = $\sigma\,/\,\sigma x$

F = Standard distribution

$\in i$ = component error term

π = 3.145

Basic assumptions of the estimation procedure of the model adopted

The validity of the model adopted was built on the following assumptions and taking a cue from past studies (Aigner et al, 1997; Hassan et al., 2012). These assumptions were used as the conceptual constructs that guide the model adopted for this study:

1. A farmer essentially practices a disparate type of land use management depending on biophysical factors every cropping season.

2. Farmers are confronted with even climatic factors and similar soil type.

3. Farmer practices can either enhance productivity of the soil or depreciate it.

4. A farm-specific land use management index was captured from the result of prevailing environmental indicators

5. Agronomic procedures used have clear carryover consequence on the soil and in the estimated frontier.

6. Farm-specific output level is mutually regulated by input use and agronomic procedure.

The theoretical framework routing most land use management measures and adopted by this study are adapted from past study (Liu, 2006). Past studies have indicated that the estimates of the trans-logarithmic model may be unacceptable because of the defilement of symmetry settings of intense sample values to the additions of the second-order terms, particularly in small samples (Kalirajan and Shand, 1986, Shanmugam and Lakshmanasamy, 2001, Mahesh and Meenakshi, 2006). Hence, this problem is somewhat resolved in this study with the use of large sample size (N = 880) and with enhanced degree of freedom (Hassan et al., 2012). Thus, by means of a stepwise selection approach and consideration of likely interaction relationships between land use attribute and management practices, the model was constructed. Consequently, a full trans-logarithmic specification of land quality use and management practices interaction on farm output was embraced.

$$LUM = a_0 + \sum_{i=1}^{n} a_i \ln X_{ij}$$

$$+ \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij}\left(\ln X_{ij}X_{ij}\right)$$

$$+ \sum_{j=1}^{n} M_j L_{ij} + \sum_{i=1}^{n} L_i \ln Mij + \sum_{i=1}^{n} b_{ij}\left(\ln X_{ij}\right)^2$$

$$+ \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} h_{ij}\left(\ln X_{ij}\ln b_{ij}\right)$$

$$+ \sum_{h=1}^{p} e_i \ln L_{ij} + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} h_{ij}\left(\ln X_{ij}\ln M_{ij}\right)$$

$$+ \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} h_{ij}\left(\ln X_{ij}\ln M_{ij}\right)$$

$$+ \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} L_{ij}\left(L_i L_{ij}\right) + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} V_{ij}\left(\ln M_i L_{ij}\right)$$

$$+ \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} hij\left(\ln M_{ij}\ln L_{ij}\right) + V_i + U_i \qquad (3)$$

where

LUM = Land use and management practices on farm output.

$i = 1,2, …, 880, j = 1,2, …, p$ which are physical inputs.

X, L, V and *M* are as earlier described in Equation (1)

a_0 = parameters of intercepts.

a_i = parameters of physical inputs and indigenous status

b_{ij} = parameters for interactions across the ith and the jth physical inputs

L_{ij} = parameters for dummy variables on land resources quality.

M_j = parameters for land management variables

M_{ij} = parameters for interactions between land management variables and land use variables

h_{ij} = parameters for interactions between the ith physical inputs and land use variables.

X_{ij} = parameters for interactions among land use variables.

V_{ij} = parameters for interactions between the physical inputs and land management variables.

$L_i L_{ij}$ = parameters for interactions between land-use dummy variables and land resource quality.

$M_{ij}L_{ij}$ = parameters for interactions between land management variables and land use resource quality.

$X_{ij}M_{ij}$ is the convectional input that is usually well thought out in the transformation process, but *L,V* and *M* are conditioning variables

whose additions into the model is to capture the consequences of land use and management procedures on the outputs from farm.

U_i = components of error terms

V_i = misspecification of the model.

But *L,V* and *M* are conditioning variables whose additions into the model is to capture the consequences of land use and management procedures on the outputs from farm.

Measurement of Short-Run Sustainability Index (SRSI)

This comprises of 2-step methodology, firstly, valuation of the farm-specific index of sustainable land use and management (FSM). Secondly summing up the index and the farm-specific inefficiency index (SII) give SRSI. FSM was assessed in Equation (3) with reverence to all the agronomic practices (i.e., land use and management practices) which were assessed at different level of input use and resource quality. Hence, this is stated as

$$FSM = \sum_{i=1}^{n} L_i + \sum_{i=1}^{n} \epsilon_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} S_{ij}$$
$$+ \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} h_{ij}(InX_{ij}) + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} V \qquad (4)$$

All symbols/notations are earlier defined in Equation (3) and SII assesses the land use and management index.

Past studies have indicated that if the value of FSM is zero, then land use and management practices do not alter land quality, but, if it is positive, there has been enhancement in the use and management of the land. Also, if the value turns out negative, then land use and management practices have unfavorable consequences on the land resources (Hassan et al, 2012). This study stated that summation of the index of sustainable land use and management results to SRSI and this is stated as

$$SRSI = 1 - [(X_i P)(X_{ij}P)^{-1}]]$$
$$+ \sum_{i=1}^{n} d_i + \sum_{i=1}^{n} \epsilon_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} S_{ij}$$
$$+ \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} h_{ij}(InX_{ij}) + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{p} V_i \qquad (5)$$

All symbols/notations are earlier defined in Equation (3).

Literature have indicated that if SRSI is positive, it shows that the production process methods in terms of input use, land use, and management the farmers adopted is sustainable, but if SRSI is negative, then the production process not sustainable [Pravitasari et al, 2018]. This study used SRSI to reflect the status of the land use and management and its relationship to poverty.

Estimation technique

Past studies argued that relationship between land use management and poverty is complex (Kumbhakar et al., 2007; L'eopold and Van-Keilegom, 2014). Evidence from these studies suggested that the estimation technique to use is likelihood maximum estimation (LME). This method has been found to have the advantage of not imposing any particular functional form to the correlation between the explained and the explanatory variables. Therefore, this study adopts LME as estimation technique. This technique helped to understand the shape of the relationship between land use and poverty.

Estimating the poverty component

In this paper, poverty is quantified by comparing households to a set of poverty threshold (that is a minimum amount of income needed to cover basic needs, that is access to quality food, water, shelter, education, healthcare and clothing) (Aigner et al., 1997). Hence, households whose income falls under this threshold are considered poor. Consequently, the study generated welfare composite index (WCI) as proxy for household wealth which was used as threshold to determine poverty. The study proposes a single composite index, *H*, which composed of a household *I* in form of:

$$H_i = \sum_{k=1}^{k} Y_j I_{ij} \qquad (6)$$

Where I_{ij} is a primary indicator for household and $J(j = 1…k)$ for household $i(I = 1…n)$, and Y_i is the weight of the indicator I_{ij} to be estimated. Many different methods have been used to estimate Y_i. In this study multiple correspondence analyses (MCA) was used, taking a cue from past study (Aigner et al., 1997). This method is particularly suitable for the data generated in this study. This includes a set of binary variables representing the different modalities of primary indicators. Each primary indicator Iij can take J modalities, thus H_i is the composite index for household iand can be rewritten as

$$H_i = \sum_{k=1}^{k} 1 \sum_{nk=1}^{nk} W_{nk}^h / P \qquad (7)$$

where P is the number of primary indicators; nk is the number of indicators k modalities; I is the weight attributed to nk modalities; and a binary variable equal to 1 when household i has modality nk and 0, otherwise

$$W_{jk}^k = \frac{Score}{eigenvalue\ for\ axis\ a}$$

Of the modality obtained from MCA. The WCI, I for a household i, is simply the average of the weight of the binary variables. Hence, the weight was attributed to each composite index I A to give a normalized score.

This poverty status of a household is represented by a binary variable (indicator function) that takes the value of one/two if the household is identified as poor and zero otherwise (Ballon and Apablaza, 2012). To capture the poverty and status of respondents, the study employed the use of Foster, Greer and Thorbecke (FGT) (1984). Past study argued that this method has proven to be ideal in determining poverty status. FGT measures are defined by

$$FGT_\alpha = \frac{1}{n} \sum_{j=1}^{k} I_y (Z - Yi)^\alpha \qquad (8)$$

where Z = poverty line, Y_i = indicator function, n is the size of the population, and α a non-negative parameter. When $\alpha = 0$, i.e $FGT_\alpha = 0$, it simply means that the proportion of the poor in the population usually referred to as headcount (HC) or poverty incidence (PI). When $\alpha = 1$, that is $FGT_\alpha = 1$, this outcome represents the average poverty gap, this expresses the WCI outcome explaining the level of income necessary for an individual to be able to reach the poverty threshold. When $\alpha = 2$, that is $FGT_\alpha = 2$, this reveals the distribution of poverty amongst the poor and places greater weight on those furthest from the poverty line. Past study argued that when this outcome occurs it is signified the severity of the poverty situation (Simar and Wilson, 2007).

Consequently, the study used land access, SRSI, socio-cultural/economic variables, and environmental factors as indicators of poverty among the respondents. This approach helped to explain how land access and sustainable land management practices have influenced the poor and non-poor categories (Racine, 1997). The study presumed that the probability of being in a particular poverty category is determined by an underlying response of variable of land access and SRSI which depicts the true economic status of an individual. In the case of binary poverty status (i.e., being poor or non-poor), let the underlying response variable be defined by the regression relationship

$$Y^\alpha = \sum X_i^j \beta + \mu_i \qquad (9)$$

The interest of this study is Equation (9) and thus, the likelihood function for the Equation (9) is written as

$$L = \Pi_{yi=1} \left[F(-\sum X_i^i \beta_i) \right][1\text{-}F(-\sum X_i') \qquad (10)$$

Where L is the likelihood function that captures the poverty incidence, when this incidence is 1 household is poor and 0 non-poor. This outcome is then used here as a dependent variable. Equation (9) was estimated using Maximum likelihood estimation (MLE) technique as adopted by the study of Ziegelmann (2002).

Results and discussion

Land ownership structures, characteristics of households, and production constructs across different poverty statuses.

Many characteristics concerning rural households in Nigeria can be drawn from Table 3. Table 3 shows poverty status of respondents in the study areas, where 66.4% were categorized poor, out of which 23.2% were extremely poor. Moreover, 92% of those in the category of extremely poor respondents seek their agricultural land ownership structure by rentage, while farmlands with titled documents constitute 78.6% of the non-poor (Table 3). However, the poor category (39.5%) households depend mainly on agricultural livelihoods, whereas, for non-poor, 26.7% augment farm income with nonfarm income (Table 3). In contrast, the poorer have less education, higher families, greater dependency (children and old members), and are more attached to communal and family land.

Table 3 also revealed majority derived livelihood from farming while income received from agricultural production is somewhat insignificant. The non-poor category involved more in nonfarm livelihood and possesses moderate farm size. Moreover, farming households with less than 2 ha of agricultural land are poorer (30.1%) and on family/communal land. This result displays the direct and indirect effects of access to land

as it influenced poverty status. Evidence from Table 3 indicated that government policy intervention program on land use for agricultural purposes constitutes 8.8% but focus more on farmers that uses government land (57.2%) for farming purposes. Likewise, NGO local intervention (36.9%) had more emphasis on family/communal land (28.6%). Whereas, government and NGO (local and international) intervention (6.3%) focuses more on households that owned land titled (3.0%) (Table 3).

Literature on access to land and rural poverty revealed a decisive links. Past study deduce that government intervention/programs should be able to select only those households with practically zero opportunity costs (Ali et al., 2015). This study contended that an average subsidy of one daily 360 Naira (1US$) per capita would influenced majority of the land-poor farmers to a reasonable living (Table 3). The disparities in productivity between poor and non-poor farmers discerned in Table 3 was influenced either by access to productive incentives or capital. The study argued that non-poor farmers have access to productive inputs and augment farm income with nonfarm income. Whereas poor farmers have limited or no access to productive inputs/capital and engaged primarily in agriculture as evidenced by past studies [Jayne et al, 2014]. Hence, results presented on Table 3 and discussed are consistent with other studies in rural areas of SSA (Herrera, 2000; Ali et al., 2015; Kansinne et al., 2018).

Particulars	Extremely Poor *	Poor	Not Poor	Total
Number of households (proportion of total %)	205 (23.2)	380 (43.2)	295 (33.6)	880 (100)
Region				
Northern (core) (%)	51 (23.2)	85 (38.6)	84 (38.2)	220 (25.0)
North central (%)	59 (26.8)	94 (42.7)	67 (30.5)	220 (25.0)
Southern (%)	48 (21.8)	116 (52.7)	56 (25.5)	220 (25.0)
South-south (%)	47 (21.4)	85 (38.6)	88 (40.0)	220 (25.0)
Land Ownership Structure				
Rented (%)	103 (92.0)	7 (6.3)	2 (1.7)	112 (12.7)
Ownership of land with Titled documents (%)	4 (4.5)	15 (16.9)	70 (78.6)	89 (10.1)
Ownership of land with NO Titled documents (%)	23 (14.6)	38 (24.2)	96 (61.2)	157 (17.8)
Family land (%)	52 (24.3)	136 (63.6)	26 (12.1)	214 (24.3)
Communal land (%)	19 (9.0)	170 (80.9)	21 (10)	210 (23.9)
Government land (%)	4 (4.1)	14 (14.3)	80 (81.6)	98 (11.2)
Household Characteristics				
Sex				
Male Head	95	168	135	398
Female Head	110	212	160	482
Marital Status				
Single	12	23	23	28
Married	180	338	249	767
Separated	3	9	12	24
Widowed	10	10	11	31
Household Members				
(1–4)	1	5	4	10
(5–8)	125	318	287	731
(9–12)	66	48	4	118
(13–30)	13	8	0	21

* For illustrative purposes extreme poverty line is set at N360. 00 (US$1) per capita and day of total monetary income. Poverty line is set at 720.00 (US$2). * For each household member 1 = foundation 2 = primary 3 = basic 4 = diversified 5 = university 6 = postgraduate.

Source: Field survey 2016–2018

Table 3. Land ownership structures, characteristics of households, and production constructs across different poverty statuses.

Particulars	Extremely Poor *	Poor	Not Poor	Total
Age in Years				
(15–25)	2	5	2	9
(26–45)	63	137	104	304
(46–60)	134	228	179	541
(61–100)	6	10	10	26
Indigenous head	166	370	275	811
Dwelling Structure				
Rented	116	53	26	195
Family house	36	179	60	275
Owned + Titled Doc.	15	42	137	194
Owned No Titled Doc.	38	106	72	216
Production Characteristics				
Farm Size (Acres)				
(0.5– 2.0)	202	63	7	272
(2.1–3.5)	3	313	254	570
(3.51–5.0)	0	4	29	33
(5.1–10.0)	0	0	5	5
Farming Experience				
(years) (1–5)	13	34	18	65
(6–10)	36	66	58	160
(11–15)	23	52	27	102
(16–100)	133	228	192	553
Farm-specific Resource use Index				
(0.000–0.01)	1	6	8	15
(0.011–0.25)	149	42	8	197
(0.26–0.50)	49	240	7	274
(0.51–1.00)	6	92	274	372
Short-Run Sustainability Index				
(−1.93–0.01)	174	42	0	216
(0.011–0.99)	28	315	16	359
(1.0–2.50)	3	23	215	241
(2.51–6.0)	0	0	64	64
Livelihood:				
Agriculture only	186	209	60	455
Agriculture + Non agriculture	19	171	235	325
Welfare Indicator				
(30,000–65,000)	127	21	0	148
(65,001–90,000)	75	212	11	298
(90,001–125,000)	3	140	76	219
(125,001–1,000,000)	0	7	208	215

* For illustrative purposes extreme poverty line is set at N360. 00 (US$1) per capita and day of total monetary income. Poverty line is set at 720.00 (US$2). * For each household member 1 = foundation 2 = primary 3 = basic 4 = diversified 5 = university 6 = postgraduate.

Source: Field survey 2016–2018

Table 3. Land ownership structures, characteristics of households, and production constructs across different poverty statuses.

Result of analysis of the model adopted

The trans-logarithmic specification model was estimated using Maximum Likelihood Estimation (MLE) method, and the Diagnosis Statistics (Quasi-function coefficient = 0.870, Ln (likelihood) 135; 601 Sigma-square δ^2 = 0.762* (0.041); Gamma (Y) = 0.9026 * (028); Mu (μ) -1.621 * Asterisk indicate significance * 1%, ** 5% *** 10% variance ratio $\gamma = \frac{\delta u^2}{\{\delta u^2 + \delta v^2\}} = 9$)) results generated revealed a large estimate of sigma-square which is statistically significant and different from zero. The Diagnosis Statistics analysis and outcome indicated a good fit for the model and thus specified the correctness of the distributional assumptions of the composite error term. In addition, the variance ratio had a high estimate of 91.04%, signifying that systematic effects that are unexplained by the production function are the leading sources of random errors. In other words, the existence of technical inefficiency among the sample of farm explains 91% variation in the output level on land use systems. The coefficients generated from Equation (3) were then used to interpret the elasticities of output with respect to the inputs. These results were generated from the outputs of the likelihood parameter estimates of Equation (3). Hence, these production elasticities are computed and hereby presented in the table below.

Table 4 revealed the sum of the elasticities of output with respect to the physical inputs and the indigenous status that generates estimated scale elasticity; hence, this indicates the presence of short-run decreasing return to scale (SRD). Past study has indicated that SRD depict a case in which each additional unit of output yield smaller increase in product than in the previous unit (Hassan et al., 2012). These production elasticities computed are of interest in explaining the interactions and the variability in farmer's farm outputs. The estimated elasticities of the set of variables and output with respect to the conditioning variables are of particular interest to the computation of short-run sustainability index (SRSI). Hence, the interaction between land use variable and management variable generated a coefficient of joint action index of 0.417, which is statistically significant at p = 0.05 and is positively related to output level. This result indicated that management employed on land use influenced farm output. This finding is supported by past study (Kansiine et al., 2018).

Computation of Short-Run Sustainability Index (SRSI)

Computation of SRSI takes a 2-step methodology, firstly, valuation of farm-specific index of sustainable land use and management (FSM) using Equation (4). Secondly, summing the index with the farm-specific inefficiency index (SII) using Equation (5) will give SRSI. The distribution of the indices is presented in Table 3. The distribution of farms based on FSM indicates that 46% (mean values = 0.458) of the farmers adopted land use and management practices. Hence, 54% of them adopted practices that improved land quality. Further analysis revealed that 16% of the lower group adopted sustainable land management practices while a higher median were found mostly on non-poor group (Table 3). However, FSM projected in this study may be limited because pertinent management practices that enhanced land quality have not been built-in in the analysis. Hence, within the context of the assumptions used for analysis, the indices used to a large extent captured the effect of land use management practices for farming purposes.

Moreover, the farm-specific index of short-run sustainability is a product of indices of farm-specific inefficiency index (SII) and farm-specific index of sustainable land use and management (*FSM*) (Pravitasari et al, 2018). The distribution of SRSI is presented in Table 3. The results of these analyses revealed that 69% (mean value of 0.6895) of the farmers made unsustainable use of agricultural land coupled with practices of resource use inefficiency. Thirty-one percent

Set of Variables	Estimated Value	Remark
Physical input and indigenous status	0.4102	SR-Decreasing Return to Scale
Land use and management	0.0712	SR-Decreasing Return to Scale
Interaction terms	0.149	SR-Decreasing Return to Scale
Overall	0.417	SR-Decreasing Return to Scale

Source: Computed from Maximum Likelihood Estimation (MLE) of Equation (3)

Table 4. Distribution of production elasticities among the variables.

of farmers improved their land productively, as indicated by the net balance of the resource use inefficiency and agricultural land and management. Hence, only 31% of the farmers undertook sustainable production process. Further analysis clearly shows that the majority (76%) of the non-poor practices sustainable land-use (Table 3). The assumption that both the *FSM* and SII are influenced by different factors, such as socio-cultural/economic and environmental, holds here. Moreover, the trend of the relationship between these indices was examined using a simple linear correlation coefficient (*r*). The result revealed that $r = 0.207$, that is the null hypothesis of no correlation amid the two indices in the farms was consented at $\alpha = 0.05$ level. Hence, each of the indices influences sustainability index differently and at diverse magnitude.

The study used SRSI as a measure of sustainability of agricultural land use and resource use efficiency which is a policy indicator. Hence, a positive SRSI indicated that farmers adopted land use and management practices. Land use policy can be effective for those categories of farmers that made unsustainable land use as reflected in the negative SRSI. Hence, land use policy will provide policy guidance to government to support these categories of people on how to improve land-use sustainability and resource use efficiency.

SRSI were thus used as independent variables in Equation (12) below.

$$y = x\beta + \mu \tag{12}$$

where *Y* is the vector $n \times 1$, *X* is a matrix $n \times k$, $\beta^{\wedge}$ = is a vector $k \times 1$ and *u* is a vector $n \times 1$

$$yi = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \cdots + \beta_{16} X_{16} + \mu_i \tag{12}$$

Yi is the poverty status of respondents

$\beta_0 - \beta_{16}$ are the coefficients of the independent variables

$X_1 - X_{16}$ set of the independent variable

μ_i is the random error (unexplained variation)

Equation (13) will be estimated with ordinary least square (OLS) method expressed below.

$$S = \sum_{i=1}^{n} \acute{u}i^2 = \sum_{i=1}^{n} \{ y_i - \beta^{\wedge}_0 - \beta^{\wedge}_1 Xi_1$$
$$- \beta^{\wedge}_2 X_{2i} - \beta^{\wedge}_3 X_{3i} - \beta^{\wedge}_{16} X_{16i} \} \tag{13}$$

where *S* is the least square method of estimation

Yi is the poverty status of respondents

$\beta_0 - \beta_{16}$ are the coefficients of the independent variables

$X_1 - X_{16}$ set of the independent variable

μ_i is the random error (unexplained variation)

Independent variables used in Equation (13) and their definitions

The study presented 16 independent variables and were hypothesized to influence the dependent variable. From these 16 variables, 10 were continuous and six were discrete. Selection of these independent variables was logically taken from the review of past research and published literature related to the scope of the study (Gerber et al., 2014). Independents variables are Age (years) (X_1), Indigenous (X_2), Farm year (X_3), Marital Status (X_4), Dependent (X_5), Productive adult (X_6), Education of head (years) (X_7), Primary occupation (X_8), Mode of Dwelling (X_9), Land ownership structure (X_{10}), Farm efficiency index (X_{11}), Land-intervention policy index (X_{12}), SRSI (X_{13}), Household income (X_{14}), Household size (X_{15}), Farm size (X_{16}).

Multiple regression (Equation (12) analysis was conducted to investigate factors influencing the poverty status of respondents via a maximum likelihood estimation technique. The estimated results of the model predict the possibility of the poverty status households' ($R^2 = 0.89$). This suggests that 89% of the explanatory variables explained the dependent variables, while the remaining 11% remained unexplained. Based on the estimated results, nine variables were found to significantly influence poverty status: farm year, dependent-ratio, education-year, farm-efficiency index, land policy intervention variables, SRSI, income, household size, and farm size. The significant positive signs of education year, farm efficiency index, and SRSI, income, and farm size variables can be explained from the perspective of access to productive factors and land quality. Also, fairly literate farmers tended to have more investment opportunities, leading to stronger potential need to enhanced prosperity and also not to fall into poverty. However, the significant but negative coefficients such as farm year, dependent ratio, land-policy intervention variables and household sizes enhance poverty (Table 5). This finding is buttressed by past study (Barbier and Hochard, 2016b).

Variable		Coefficients	Standard Error	t Stat	p-Value
	Intercept	0.965469	0.11253	8.57905	4.4×10^6
Age	X_1	0.001736	0.00127	1.36142	0.17373
Indigene	X_2	0.031466	0.03591	0.87623	0.38114
Farm year	X_3	−0.00229	0.00116	−1.96805	0.04938
Marital	X_4	0.014238	0.02009	0.70844	0.47886
Depende	X_5	−0.00911	0.005393	−1.68943	0.091498
Proadult	X_6	0.001395	0.006063	0.230137	0.81804
eduyear	X_7	0.003513	0.00179	1.962812	0.049989
pryoccup	X_8	0.001377	0.007315	0.188295	0.85069
dwelling	X_9	0.006869	0.009693	0.70868	0.478715
landown	X_{10}	0.008216	0.007338	1.119766	0.263125
farmeffin	X_{11}	0.767577	0.052079	14.73863	5.09×10^{-44}
landpol	X_{12}	−0.03664	0.004604	−7.95845	5.47×10^{-44}
srsi	X_{13}	0.189421	0.015478	12.23849	7.16×10^{-32}
income	X_{14}	1.63×10^{-6}	2.3×10^{-7}	7.08658	2.86×10^{-12}
hhsize	X_{15}	−0.03014	0.005225	−5.7681	1.12×10^{-08}
farmsize	X_{16}	0.275053	0.016439	16.73203	1.22×10^{-54}

Diagnostic Statistics
R = 0.93, R^2 = 0.89, Adjusted R^2 = 0.82, Standard deviation = 0.27, No. samples = 880
Source: Multiple regression results (Computer printout).

Table 5: Multiple regression outputs.

Multiple regression results revealed that the significant but negative coefficients of farm year, dependent ratio, land policy intervention variables, and household size enhance agricultural poverty. Large household size tends to influenced high consumption agricultural-outputs and lower income generation. This unexpected result of decreasing returns to land policy intervention could be influenced by poor category of farmers who were exploited (productive factors were diverted by the operators of the prog.) and uses family/communal lands for farming operations. These findings are consistent with other studies in rural areas of SSA (Nkonya, et al, 2008). Households with more children tend to have lower per capita consumption but the presence of elderly members does not have a statistically significant effect. The negative and significant coefficient on the number of working-age adults in a household indicated a widespread underemployment; hence, these issues are important for households' ability to perpetuate poverty.

Examining these variables further using cross-tab analysis revealed that households with large numbers (61.2%) have no formal/primary education and thus poor (41.2%) out of which 14.7% are extremely poor. Moreover, local government intervention programs have focused more on farmers (45.7%) that used family/communal land for agricultural purposes. However, farmers that acquired government land and with titled farmland documents attracted more (28.0%) of NGO (local and international) intervention program. Relating these findings with poverty status, non-poor accessed more (33.5%) of government and NGO intervention program. Linking these outcomes to region, northern region attracts more (23.0%) of local government intervention program, while the southern accessed more (13.3%) of NGO (local and international) intervention program. These findings indicated that government intervention programs focus more on those categories of farmers that acquired government land and has titled documents on agricultural land as evidenced by the past study (McCullough 2015).

The causal association between access to land, location, and other assets evidence the existence of "poverty". This is done to find proof that being a farmer and live in rural areas with fewer economic assets is poor. Evidence from the descriptive and cross-tabulation analyses revealed that being a farmer is directly and causally related to having more household members, less education, and poorer access to productive inputs/factors. Also, the analysis indicated that the sum of direct and indirect links amid the same variables, affirming the links in the longer term, thus, specifying more sign of path dependency (Park et al, 2008).

Policy implication

The study examined heterogeneity of land use systems and its influence on poverty among small farmers in Nigeria. The study improved upon the existing literature by estimating socio-cultural factors influencing poverty path dependency among farming households, taking into account the role of land use management and analyzing the resulting impacts on poverty. The descriptive analysis depicts that land ownership structure, socio-cultural practices of the farmers, and exploit of government intervention programs influenced agricultural poverty. Although no evidence was found for a land-size poverty among households in Nigeria, some communities may be trapped (by location and endowments), but such a "geographic" poverty trap is distinct (an issue beyond the scope of this study). The study finding on path dependence in land holding/land use has important implications for the study of poverty dynamics. Hence, the heterogeneity of land use systems is significant in this case. Past studies have argued that persistent unsustainable land practices reduces the productivity of agricultural systems, on which many rural poor depend, thus trapping them in subsistence-level poverty (Barbier and Hochard, 2016a). Thus, our findings suggest a critical need to ensure more rural people imbibed sustainable land practices. This could be accomplished through a rural development strategy that invests more on rural infrastructures like feeder road, market, and agricultural land quality.

The trans-logarithmic model used here revealed the coefficients that were generated from the likelihood parameter estimation technique. This outcome helped to compute the production elasticities that explained the interactions and the variability in farmer's farm outputs and short-run sustainability index (SRSI). SRSI results revealed that 69% of the farmers made unsustainable use of agricultural land coupled with practices of resource use inefficiency. Moreover, the coefficients of SRSI, land policy intervention variables, and household sizes enhance poverty. Cross-tab analysis also revealed the dominance of these coefficients on farmer's poverty status, hence, emphasizing the need to review land policy intervention and benefits given to small farmers. Analysis of the land ownership structures and it influence on different indicators of income and land-size stratification revealed extraordinary differences in productivity between the poor and non-poor farmers. This evidence must be due to degree of access to productive inputs

or capital by farmers. Consequently, government needed to improve on the channel of distributions of timely productive inputs to small-scale farmers

Evidence from the descriptive and cross-tabulation analyses revealed that being a farmer is directly and causally related to having more household members, less education, and poor access to productive inputs/factors. This implies that possible short term benefits from gaining access to land quality and optimized large household size for labor can however be a way out of poverty, though these benefits can be negative in the long term if sustainable practices are not imbibed. Agricultural land use system and intervention agencies particularly NGOs international like IITA (IITA is International institute of Tropical Agriculture located in Oyo State, Southwest, Nigeria.) enhances access to productive inputs which thus influenced non-poor status in the southern part of Nigeria. While large household sizes, land ownership structures and over reliance on government policies and intervention-program are more dominant in the Northern region. The study observed that some socio-cultural practices termed as "culture of poverty" (a set of beliefs, values, and skills that are socially generated and individually held belief) such as polygamous (ancient customs of marrying more wives and have more children by man using them for labor to work on the farm), betrothal (that is handling of widow to the next of kin/younger brother and children to be cater for), and firstborn to care/trains the siblings influences poverty. This norm is an additional burden which the man cannot reject because it is the custom. Hence, there is a need to revisit this culture of poverty and agricultural productivity, probably learnt from experience of Dutch agricultural development.

Conclusion

Land ownership inequality and landlessness are still a major source of conflict in terms of race relations and economic injustices in Nigeria. Sound land policies can facilitate growth in agricultural productivity via secure land tenure, which enhances opportunities for investment as evidenced in this study. For example, land reforms in China in 1978 dismantled collective farming and conferred land rights to households, unleashing a period of prolonged growth in agricultural productivity that transformed rural China (Calhoun and Wasserstrom, 2003; Herston, 2008; Huang, 2008). In Africa, recent massive land certification

program in Ethiopia and Rwanda have been associated with significant increases in investment in the agricultural sector. Thus, this study suggested that public policy interventions to reduce this long term poverty in the agricultural sector would have to take into account formalization of land property rights in order to facilitate its transferability.

Moreover, the issue of farm-land fragmentations and poverty has gone through a complete cycle as evidenced in this study. This thus limits the research for appropriate land use and agricultural policy and can be a focus of further research. Some of the issues might include (a) examining institutional arrangements for inspiring the development of land markets and fascinating greater long-term land investments; (b) recognizing specific educational skills and investments that make for a mobile labor force that eases structural transformation; and (c) finding the cost-effective public investments to encourage passage into relatively sparingly populated areas in a manner that is helpful of rural productivity growth. Though many of these are not new enquiries, the need to put emphasis on them is given new importance in the face of the empirical evidence presented in this study regarding the variances in access to land within the smallholder sectors in many African countries and the hitches of fostering other possibilities to encourage rural income growth.

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