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Discrete Choice Model of Farmers' Willingness-to-Engage in Agroforestry-Based Farming in Southwest, Nigeria

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Abstract: The study examined farmers' willingness to engage in agroforestry-based farming in Southwest, Nigeria. Data were collected from 224 randomly sampled farmers with the use of structured questionnaire. The questionnaire items focus on socio-economic characteristics of the farmers, methods of land acquisition, relevance of agroforestry-based farming to food security and environmental quality and challenges of farmers in engaging in agroforestry-based farming. Data collected were analysed using frequency, percentage, chart, mean, probit model and factor analysis. The study found that common methods of land acquisition in southwest Nigeria include: inheritance, lease/rent, communal land, gift and purchase. All the 20 identified indicators of relevance of agroforestry to food security and environmental quality have mean values that ranged between 2.97 to 3.75 which are all greater than the cut-off point value of 2.50 on 4-point rating scale. The result of the probit model analysis showed that sex, age, land ownership status, farm income, extension contact, membership of cooperative, labour availability and farmers' access to credit were significant at p<0.01, p<05 and p<0.10 levels of significance. The challenges facing farmers in engaging in agroforestry-based farming in southwest Nigeria include: input/technology, institutional and socio-cultural factor. Based on these findings, the study among others recommended that there should be more proactive campaign for increased participation of farmers in agroforestry-based farming and provision of necessary policies, inputs and institutional supports that will facilitate farmers' engagement in agroforestry-based farming.

Keywords: Agroforestry, Cash Crops, Willingness to Engage, Southwest, Nigeria

1. Introduction

The distress over the food security condition in Nigeria is reflected in one of the eight Millennium Development Goals (MDGs) to reduce the number of food insecure by half by 2015. Given that land plays an important role in the livelihoods of the majority of Nigerians, food security and poverty reduction cannot be achieved unless issues of access to land, security of tenure and the capacity to engage in agroforestry practices in a sustainable manner are addressed. [1] noted that the worldwide interest in tree planting and management gave birth to several popular terms with "forestry" endings such as social forestry, community forestry and agroforestry.

Agroforestry is a collective name for all land-use systems and practices where woody perennial plants are deliberately grown in a management unit as agricultural crops with animals, either in spatial mixture or in temporal sequence [2]. Similarly, [3] described agroforestry as any land-use involving planting of trees or deliberate retention of trees by farmers within the farm or homestead for a variety of purposes which include wood, fodder, fruits, medicine, shade, soil improvement and water conservation. Agroforestry-based farming normally involve two or more species of plants (or plants and animals), at least one of which is a woody perennial and hence with two or more outputs. Growing trees along with crops and livestock enhances crop yields, conserves soil and recycles nutrients while producing fuelwood, fodder, fruit and timber. Agroforestry-based farming have the capacity to mitigate deforestation because it addresses in general, the issues of tree planting; combat land depletion because of its potential

soil conservation capacity and as a result contribute to the alleviation of rural poverty and environmental quality.

Agroforestry practices in south-west Nigeria can be described in two broad categories which are farm-based and forest-based. The farm-based practices focus on the planting of economics trees inter-planted with food crops. The forest-based practices on the other hand deals with agricultural practices of basically collecting forest products such as forest foods, fruits, nuts, firewoods and gums among others. In this study, the farm-based agroforestry practice is the major focus. Agroforestry farming in this respect involves the planting of economics trees (cocoa, coffee, kola nut etc) within gardens or on agricultural fields interplanted with food crops. This does not exclude fruit trees that provide fruit for human consumption such as mangoes, citrus, as well as some nut-bearing trees, such as walnuts among others. Hence, the relevance of agrofrestry-based farming to food security cannot be over-emphasised. For instance, [4] and [5] both confirmed that access to agroforestry trees reduces the impact of food shortage during the hunger periods of the year.

The report of a study by [6] in western Nigeria affirmed that agroforestry fruits had the capacity to reduce rural households' vulnerability to income poverty by 33%. Therefore, investment in agroforestry tree planting, conservation and commercialization constitute a safety-net during the periods of famine and provide income to farm households [7]. Literature evident in [8] suggested that most female-headed households tend to seek small-scale income generating activities like selling agroforestry fruits, nuts and other products for raising cash. [9] supported that agroforestry is an important tool that can bridge up the gap between demand and supply of wood and non-wood forest products. In addition to social and economic benefits, agroforestry also help to address some of the complex and challenging environmental problems such as marginal economics of rural resource management, disruption of natural ecological base, soil erosion, air quality problems, loss of rare and endangered ecosystems among others.

It is imperative to state that, despite the aforementioned importance of agroforestry in food security, environmental quality and sustainable livelihood of rural households in Nigeria, investments in the cultivation and conservation of economic trees by farm communities is quite low [10]. The reducing trend of farmers' investment in agroforestry-based farming could be attributed to socio-economic factors, institutional factors (such as land tenure system), changes in demand for tree products, biophysical environmental factors and change of resource endowment. For instance, [11] observed that access to land for permanent cropping is extremely limited in Ekiti due to land tenure structure and current population growth rates. Moreover, [12] stated that high degrees of uncertainty over tenure security prevail in southwest Nigeria and this according to the author reduces incentives of farmers to involve in tree conservation and agroforestry farming. [13] shared that the overall agricultural situation has deteriorated, creating a wide gap between the supply and demand for food locally, with consequent importation of food items that could as well be produced in Nigeria.

The production of major cash crops such as cocoa, coffee and oil palm that used to earn the country substantial foreign exchange has declined significantly. For instance, the production of cocoa as an important agroforestry crop in Nigeria had witnessed a downward trend, thereby reducing the country's world market share to about 6% and its rank to 5th world largest cocoa producer till 2005 [14]. The institutional arrangements under which a person gains access to land largely determines among other things, what crops he can grow, how long he can till a particular piece of land, his rights over the trees and fruits and his ability to undertake long-term improvements on the land [15]. Hence, this study was carried out to provide answers to the pertinent questions of methods of land acquisition in southwest Nigeria, the perceived relevance of agroforestry-based farming to food security and environmental quality, determinants of farmers' willingness to engage in agroforestry-based farming and the challenges of farmers in practicing agroforestry-based farming in southwest Nigeria.

2. Materials and Methods

2.1. Area of Study

The study was carried out in southwest geo-political zone of Nigeria. Southwest comprises six states which are Ekiti, Lagos, Ogun, Ondo, Osun and Oyo States. The area has a total population of 27,581,632 people comprising 14,049,234 males and 13,532,398 females [16]. Southwest zone falls within Latitude 60°N and 40°S as well as Longitude 40°W and 60°E, covering about 114,271 km². Southwest Nigeria is naturally endowed with rich alluvial soil and suitable climate that support agricultural production; hence, farming constitutes a predominant means of livelihood among the people. Notable food crops cultivated in southwest include: cassava, maize, yam, cocoyam, cowpea, vegetables and cash crops such as cocoa, kola nut, rubber, citrus, coffee, cashew, mango and oil palm among others. Livestock such as goat, pig, sheep and poultry are mostly reared in southwest Nigeria.

2.2. Sampling and Data Collection

Multi stage, random sampling technique was used for selecting 240 farmers for the study. The first stage involved random selection of two states (Ekiti and Osun) in southwest Nigeria. In second stage, two agricultural zones were randomly sampled from each of the two states making four agricultural zones in all. Agricultural zones I and II were randomly selected from Ekiti State while Oshogbo and Iwo zones were randomly selected in Osun State. The third stage involved random selection of two local government areas (LGAs) from each of the sampled four agricultural zones making eight LGAs in all. The fourth stage involved random selection of two communities from each of the eight sampled

LGAs making 16 communities for the study. In the fifth stage, 15 farmers were randomly selected from each of the 16 sampled communities totalling 240 farmers from which data for the study were collected. The lists of farmers in the concerned communities were compiled with the help of key informants who are agricultural extension personnel and also involved in data collection for the study.

Data for this study were obtained from primary source through the use of structured questionnaire. Data were collected with the assistance of four research assistants (agricultural extension agents) between August and September, 2015. Out of the 240 copies of questionnaire administered, 224 copies were considered very good from which data for the study were extracted.

2.3. Estimation Procedure

The data collected were analyzed with frequency, percentage, chart, mean, factor analysis and probit model analysis. The land tenure system practice in southwest Nigeria was presented using frequency, percentage and chart. The perception of farmers in southwest Nigeria on the relevance of agroforestry-based farming to food security and environmental quality was addressed using mean. The socio-economic factors influencing farmers' willingness to engage in agroforestry-based farming was estimated using probit model analysis while the constraining factors undermining farmers engagement in agroforestry-based farming was addressed using factor analysis.

2.3.1. Mean

Mean was used to identify the relevance of agroforestry-based farming to food security and environmental quality in southwest Nigeria. The values attached to the response options of the questionnaire were: Strongly Agree (SA) = 4; Agree (A) = 3; Disagree (D) = 2 and Strongly Disagree (SD) = 1.

The arithmetic mean for the values was computed as:

$$\frac{4+3+2+1}{4} = \frac{10}{4} = 2.50 \text{ (cut off point)} \qquad (1)$$

Using 2.50 as criterion reference point or cut-off point, any item with mean value of 2.50 and above was regarded as "Agree" while items with mean values of less than 2.50 was regarded as "Disagree".

2.3.2. Discrete Choice Model (Probit)

Discrete choice models attempt to analyze decision marker's preferences between alternatives in which the choices are mutually exclusive and exhaustive [17]. Since the willingness to engage in agroforestry-based farming was obtained from a dichotomous (discrete) choice question with Yes = (1) if willing or No = (0) if not willing, binary probit model was employed to estimate the determinants of farmers' willingness to engage in agroforestry-based farming in Southwest Nigeria. The hypothesised determinants of farmers' willingness to engage in agroforestry-based farming are described in Table 1 to include:

Table 1. Description of the Explanatory Variables use in the Model.

Variables	Descriptions
X_1 = Sex of the farmer	Dummy (1 if male, 0 otherwise)
X_2 = Ages of farmer (years)	Continuous (in number)
X_3 = Years of Education (in years)	Continuous (in number)
X_4 = Household size	Continuous (in number of persons)
X_5 = Primary occupation	Dummy (1 if farming, 0 otherwise)
X_6 = Farm size	Continuous (in number of ha)
X_7 = Land ownership status	Dummy (1 if owned land, 0 if otherwise)
X_8 = Farm income	Continuous (in Naira ₦)
X_9 = Extension visits (in number)	Continuous (in number of time per cropping season)
X_{10} = Membership of cooperatives	Dummy (1 if membership of cooperative, 0 otherwise)
X_{11} = Farming Experience	Continuous (number of years)
X_{12} = Availability of planting materials	Dummy (1 if available, 0 otherwise)
X_{13} = Availability of Labour	Dummy (1 if readily Available, 0 otherwise)
X_{14} = Access to Credit	Dummy (1 if having access, 0 otherwise)

The explicit form of the binary probit model is specified as:

$$\Pr(Y = 1/X) = ß0 + ß1X1 + ß2X2 + ß3X3 + ß4X4 + ß5X5 + ß6X6 + ß7X7\ldots + e \qquad (2)$$

Where:

Y = Dichotomous probability estimate with 1, if a farmer is willing to engage in agroforestry-based farming and 0 if not willing.

$ß_0$ = Intercept

$ß_1, \ldots \ldots ß_{14}$ = Coefficients of the independent variables.

$X_1, \ldots \ldots X_{14}$ = Determinants of farmers' willingness to engage in agroforestry-based farming'.

e = the stochastic error term.

2.3.3. Factor Analysis

Principal component factor analysis model was used in identifying the constraining factors undermining farmers' engagement in agroforestry-based farming in south-west Nigeria. The factor analysis model was specified below:

farming in southwest Nigeria.

$$Y1 = a11X1 + a12X2 + * * * + a1nXn.$$

$$Y2 = a21X1 + a22X2 + * * * + a2nXn.$$

$$Y* =   *.$$

$$Y* =   *.$$

$$Yn = an1X1 + an2X2 + * * * + annXn \qquad (3)$$

Where:

$Y_1, Y_2, ... Y_n$ = observed variables/constraints undermining farmers' engagement in agroforestry-based farming in southwest Nigeria.

$a_1 - a_2$ = factor loadings or correlation coefficients.

$X_1, X_2, ... X_n$ = unobserved underlying factors constraining farmers in engaging in agroforestry-based

3. Results

3.1. Methods of Land Acquisition by Farmers in Southwest Nigeria

The present situation of common methods of land acquisition by farmers in Southwest is presented in figure 1. The figure shows that about 59% of the farmers in southwest Nigeria acquire their farm lands through inheritance. This was followed by about 18% of the farmers who acquired their lands through lease/rent. About 10% of the farmers acquired their farm land through communal land while about 8% and 5% of the farmers acquired their farmlands through gift and purchase respectively.
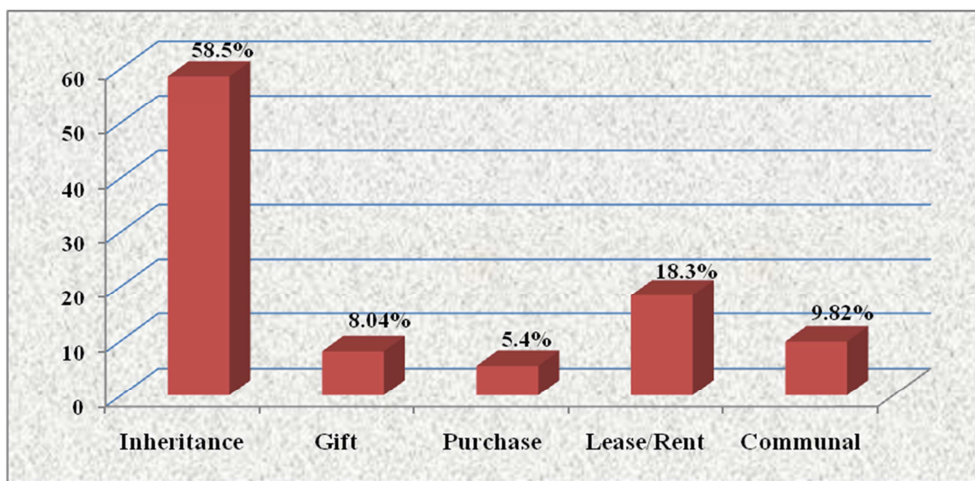
Source: Field Survey, 2015.

Figure 1. Bar Chart Showing Percentage Distribution of Methods of Land Acquisition by Farmers in Southwest Nigeria.

3.2. Relevance of Agroforestry-Based Farming to Food Security and Environmental Quality

The result presented in Table 2 showed the mean ratings of the farmers on 20 identified indicators of the perceived relevance of agroforestry-based farming to food security and environmental quality in southwest Nigeria. The 20 identified indicators in the table had mean values that ranged from 2.97 to 3.75 which are greater than the cut-off point value of 2.50 on 4-point rating scale. This result implied that all the 20 identified indicators in the table are perceived relevance of agroforestry-based farming to food security and environmental quality in southwest Nigeria. Some of the indicators and their corresponding mean values include: planting fruit and nut tress enhance farmers income generation (3.63), agroforestry practice enhance the farmers' access to agroforestry tree

products (AFTPs) (3.71), wood and non wood forest products from agroforestry farming can help farmers cope with food shortage (3.48), the economy of rural areas in southwest Nigeria can be improved with agroforestry farm system (3.62), agroferestry farming is economically sustainable to farming households (3.53), engaging in agroforestry farming is a mean of diversifying farm business by farmers (3.60), access to and control over land is a serious issue in farmers planting of agroforestry tress (3.66), agroforestry tree planting increased the farmers' access to herbs for medicinal purposes (3.40), cases of erosion can greatly be controlled with intensified agroforestry-based farming (3.55), agrofrestry farming enhances social and economic status of farmers in society (3.67) and agroforestry-based farming has the capacity of boosting foreign exchange earning of the country in general (3.75).

Table 2. Mean Ratings of the Responses of Farmers on the Relevance of Agroforestry-based Farming in Food Security and Environmental Quality (n = 224).

SN	Relevance of agroforestry-based farming include:	$\bar{X}$	SD	Rmks
1	Agroforestry-based farm practice increased agricultural productivity of farmers	3.35	0.68	Agree
2	Planting fruit and nut tress enhance farmers income generation	3.63	0.51	Agree

SN	Relevance of agroforestry-based farming include:	$\overline{X}$	SD	Rmks
3	Wood and non wood forest products from agroforestry farming can help farmers cope with food shortage.	3.48	0.45	Agree
4	Agroforestry practice enhance the farmers' access to agroforestry tree products (AFTPs)	3.71	0.53	Agree
5	Agroforestry tree planting increased the farmers' access to herbs for medicinal purposes	3.40	0.49	Agree
6	A well established agroforestry-based farm can be used as collateral for loan collection.	3.14	0.53	Agree
7	Agroforestry-based farming enhance the nutritional status of the farmers households	2.97	0.89	Agree
8	Agroferestry farming is economically sustainable to farming households	3.53	0.50	Agree
9	The harvesting of agroforestry products create job to rural populace	3.04	0.43	Agree
10	The economy of rural areas in southwest Nigeria can be improved with agroforestry farm system	3.62	0.48	Agree
11	Agroforestry-based farming is environmental friendly	3.19	0.81	Agree
12	Engaging in agroforestry farming is a mean of diversifying farm business by farmers	3.60	0.55	Agree
13	Access to and control over land is a serious issue in farmers planting of agroforestry tress.	3.66	0.49	Agree
14	Increased involvement in agroforestry farming is important now due to high rate of deforestation.	3.38	0.49	Agree
15	Agroforesty-based farming improves soil structure.	3.26	0.47	Agree
16	Engaging in agroforestry practice helps in the improvement of soil fertility	3.44	0.47	Agree
17	Planting and retention of agroforestry trees improve environmental sustainability	3.29	0.50	Agree
18	Cases of erosion can greatly be controlled with intensified agroforestry-based farming.	3.55	0.52	Agree
19	Agrofrestry farming enhances social and economic status of farmers in society.	3.67	0.47	Agree
20	Agroforestry-based farming has the capacity of boosting foreign exchange earning of the country in general	3.75	0.46	Agree

Note: $\overline{X}$ = Mean; SD = Standard Deviation.
Source: Field Survey, 2015

3.3. Determinants of Farmers' Willingness to Engage in Agroforestry-Based Farming

The result of the binary probit model analysis presented in Table 3 showed that the explanatory power of the specified variables as indicated by the pseudo R^2 value of (0.6785) was relatively high and seems good. This showed that the hypothesized explanatory variables are responsible for about 68% variation in farmers' willingness to engage in agroforestry-based farming. The overall goodness of fit as reflected by Prob>Chi^2 (0.000) was also good. In terms of consistency with *a priori* expectations on the relationship between the dependent and explanatory variables, the model had behaved well. Out of the 14 explanatory variables specified in the model, 10 were statistically significant at 1, 5 and 10% level of probability.

The coefficient of sex of the farmer is significant (p<0.05) and positively related to the probability of engaging in agroforestry-based farming. This suggests that male farmers are more likely to engage in agroforestry-based farming than their female counterparts. This is expected due to the patriarchy cultural belief in the study area and Nigeria in general where the males have more access and control over land while the females are disadvantaged. The coefficient of age of the farmers was highly significant (p<0.01) but negatively related to the probability of engaging in agroforestry-based farming. This implies that as farmers advance in age, the likelihood of investing in agroforestry farming reduces drastically. The perennial nature of most agroforestry crops could be responsible for this trend because, farmers in their old age will prefer to invest in farming businesses that will yield quick returns. Farm size was highly significant (p<0.01) and positively influence farmers' willingness to engage in agroforestry-based farming in southwest Nigeria.

Table 3. Parameter Estimates of the Probit Model Analysis of the Determinants of Farmers' Willingness to Engage in Agroforestry-Based Farming in Southwest Nigeria.

Variables	Coefficients	Std. Error	z-ratios
Sex (X_1)	0.6798393	0.3212142	2.12**
Age (X_2)	-0.0963471	0.0158382	-6.08***
Education (X_3)	-0.0746889	0.0453947	-1.65
Household Size (X_4)	0.0664652	0.0633751	1.05
Primary Occupation (X_5)	-0.0531004	0.2930379	-0.18
Farm Size (X_6)	0.2467189	0.073519	3.36***
Land Ownership (X_7)	0.8829777	0.2952492	2.99***
Income (X_8)	-5.070106	2.200106	-2.30**
Extension Visits (X_9)	0.3640187	0.1009163	3.61***
Member of Cooperative (X_{10})	1.057079	0.3035311	3.48***
Farming Experience (X_{11})	0.0112613	0.0175336	0.64
Planting Materials (X_{12})	0.9866422	0.5108045	1.93*
Labour Availability (X_{13})	0.8245566	0.3087103	2.67***
Access to Credit (X_{14})	0.8791516	0.4762729	1.85*
CONSTANT	0.089797	0.0224748	3.99***

Note: *** denotes $p \leq 0.01$; ** denotes $0.01 < P \leq 0.05$; *denotes $0.05 < p \leq 0.10$.
R chi^2 = 148.05; Pseudo R^2 = 0.6785
Prob> chi^2 = 0.000
Number of Observation = 224
Source: Field Survey, 2015.

Land ownership status of the farmers was significant (p<0.01) and positively influenced the probability of engaging in agroforestry-based farming. This finding agrees with *a priori* expectation as farmers that own their farmland are likely to engage in agroforestry-based farming than farmers that operate on borrowed or leased land. The coefficient of farm income was negative but significantly (p<0.05) related to the probability of engaging in agroforestry-based farming. This was not expected as high income farmers are presumed to show positive interest in agroforestry farming because of capital intensive nature of agroforestry system.

Extension contact has a positive and significant (p<0.01) correlation with the probability of farmers' willingness to engage in agroforestry-based farming. The coefficient of membership of cooperative has positive and significant (p<0.01) relationship with the probability of farmers' willingness to engage agroforestry-based farming. This implies members of farmers' cooperative are likely to have positive attitude to engage in agroforestry-based farming. Availability of planting materials was positive and significantly (p<0.10) influenced farmers' willingness to engage in agroforestry-based farming. This was expected as increase in extension visits to farmers is assumed to increase farmers' readiness to engage in agroforestry farming. Labour availability was significant (p<0.01) and positively related to the probability of a farmer engaging in agroforestry-based farming. This indicates that increase in labour availability to farmers will equally increase the chances of engaging in agroforestry farming to plant tree crops. The coefficient of farmers' access to credit was positive and significantly (p<0.10) influenced farmers' willingness to engage in agroforestry farming.

3.4. Challenges of Farmers in Practicing Agroforestry-Based Farming

The results in Table 4 present the varimax-rotated principal component factor analysis of the challenges facing farmers in engaging in agroforestry-based farming in southwest Nigeria. Four factors were extracted based on the responses of the farmers. In line with the use of factor analysis, only variables with factor loadings of 0.40 and above at 10% overlapping variance were used in naming the factors. Variables that have factor loading of less than 0.40 were not used while variables that loaded in more than one constraint were also discarded. In naming the factors, the set of variables or characteristics the component is composed of will be considered. This method was equally adopted in this study to group the variables into three major factors as; factor 1 (input/technology factor), factor 2 (institutional factor) and factor 3 (socio-cultural factor).

Variables that loaded under factor 1 (input/technology factor) with their corresponding factor loading include: non availability of labour for farm work (.559), inadequacy of extension services render to farmers (.486), poor technical know-how of most farmers in agroforestry technologies (.565), low income of most of the farmers is a major challenge in adopting agroforestry system (.564), insufficient knowledge of credit source by farmers to engage in agroforestry (.517) and old age of most of the farmers discourages them from (.559).

Table 4. *Verimax Rotated Factors of the Challenges Facing Farmers in Practicing Agroforestry-based Farming in Southwest Nigeria.*

SN	Challenging variables in agroforestry farming	Input / technology factor	Institutional factor	Socio-cultural factor
1	Non availability of labour for farm work	.559	.168	.375
2	**High cost of seedlings and other inputs in agroforestry	.437	-.251	.468
3	Inadequacy of extension services render to farmers	.486	.052	.346
4	Ineffective institutional support to facilitate the engagement of farmers in agroforestry farming.	.311	.420	.302
5	Illiteracy resulting in poor access to relevant information about agroforestry-based farming system.	.318	.118	.584
6	Poor technical know-how of most farmers in agroforestry technologies	.565	.205	-.135
7	Low income of most of the farmers is a major challenge in adopting agroforestry system.	.564	.071	.136
8	Land tenure system in southwest Nigeria discourages most farmers willingness to engage in agroforestry	.242	.312	-.598
9	Insufficient knowledge of supporting facilities to agroforestry farming.	.374	.203	.641
10	High capital intensive nature of agroforestry-based farming undermine farmers involvement in agroforestry	.249	-.580	.072
11	Inadequate awareness by government and related NGOs on the relevance of agroforestry-based farming.	.106	.484	.072
12	The perennial nature of agroforestry crops discourages farmers from planting tree crops.	.302	-.185	.176
13	Insufficient knowledge of credit source by farmers to engage in agroforestry	.517	.215	.282
14	Frequent cases of fire outbreak and bush burning during dry season in southwest Nigeria discourages farmers in agroforestry	.224	.586	.022
15	Inadequacy of land to practice agroforestry farming due to urbanization	.390	.065	-.450
16	Poor access to and control over farmlands among the farmers.	.194	.645	.133
17	Lack of favourable government policies that can stimulate farmers' interest in agroforesty-based farming.	.124	.519	.123
18	Tedious nature of work that are involved in agroforestry based farming activities	.073	-.469	.110
19	Old age of most of the farmers discourages them from engaging in agroforestry farming.	.559	.392	-.134
20	Unwillingness of most farmers in taking risks involved in planting and nurturing agroforestry trees	-.176	.138	.601

Note: Factor loading of 0.40 is used at 10% overlapping variance.
Variables with factor loadings of less than 0.40 were not used.
**Variables that load in more than one factor were discarded
Source: Field Survey, 2015.

Under factor 2 (institutional factor), the specific variable that loaded with their respective factor loadings include: ineffective institutional support to facilitate the engagement of farmers in agroforestry farming (.420), high capital intensive nature of agroforestry-based farming undermine farmers involvement in agroforestry (-.580), inadequate awareness by government and related NGOs on the relevance of agroforestry-based farming (.484), frequent cases of fire outbreak and bush burning during dry season in southwest Nigeria discourages farmers in agroforestry (.586), poor access to and control over farmlands among the farmers (.645), lack of favourable government policies that can stimulate farmers' interest in agroforesty-based farming (.519) and tedious nature of work that are involved in agroforestry based farming activities (-.469).

Variables that loaded under factor 3 (socio-cultural factor) are: illiteracy resulting in poor access to relevant information about agroforestry-based farming system (.584), land tenure system in southwest Nigeria discourages most farmers willingness to engage in agroforestry (-.598), insufficient knowledge of supporting facilities to agroforestry farming (.641), inadequacy of land to practice agroforestry farming due to urbanization (-.450) and unwillingness of most farmers in taking risks involved in planting and nurturing agroforestry trees (.601).

4. Discussion

Indicators of the relevance of agroforestry-based farming include: planting fruit and nut tress enhance farmers income generation, agroforestry practice enhance the farmers' access to agroforestry tree products (AFTPs), wood and non wood forest products from agroforestry farming can help farmers cope with food shortage, the economy of rural areas in southwest Nigeria can be improved with agroforestry farm system, agroferestry farming is economically sustainable to farming households, engaging in agroforestry farming is a mean of diversifying farm business by farmers among others. This finding agreed with the report of [18] that rural people collect food from the forest or trees e.g. mushroom. The authors noted that the quality of forest foods consumed may not be great in comparison with the main food, but they form an essential part of the nutrition and diets. [19] affirmed that trees outside forest represent food sources for rural populace. In addition, [20] reported that products of agroforestry are sold by farmers to earn extra income. Income from agroforestry products serve as safety net for the poor and can also be a significant source of prosperity if intensively managed and produced. The study of [18] showed further that agroforestry trees play major economic role in the livelihood of the rural farmers and their entire family that products got from the agroforestry trees serves as means of income and revenue to rural families.

The result of the binary probit model showed that sex, age, land ownership status, farm income, extension contact, membership of cooperative, labour availability and farmers'

access to credit significantly influenced farmers willingness-to-engage in agroforestry-based farming. [21] in a study found that men dominate production decisions in cocoa-based agroforestry households in Ekiti State. [22] stated that women in Nigeria rarely own land despite their heavy involvement in agriculture. Similarly, [23] also established that sex of farmers was significant and positively influence agroforestry adoption in Lugari district, Kenya. Although, the result of this study contradicts the report of [24] which found that gender of farmers has no significant relationship with adoption of agroforestry technologies. Cultural differences in the areas of studies could be responsible for the contradiction in the results. [25] investigated socio-economic assessment of farmers' participation in agroforestry system in Ekiti State and found that there was negative but not significant relationship between age and participation in agroforestry farming.

The result of the study of [25] also showed a significant and positive relationship between farm size and participation in agroforestry farming. [26] stated that land ownership is widely believed to encourage the adoption of new technologies. The result of this study on effect of extension visit agreed with that of [27] which showed that number of extension visits significantly and positively influenced adoption of soil management practices. [28] found that membership of farmers' club, farming experience and other socio-economic attributes of farmers significantly influenced their participation in improved fallows. The finding of this corroborated the result of [25] which showed that extension visits to farmers significantly and positively influence their participation in agroforestry system. This result disagreed with that of [24] who found that extension contacts with farmers was not significant to the adoption of agroforestry technologies. The result of this study confirmed the report of [29] that labour shortage discriminates against some categories of farmers as tree production requires high input of labour. [13] reported that cocoa-based agroforestry is more capital intensive than food crop production. Hence, steady access to credit will increase farmers' income to engage in capital intensive agroforestry-based farming.

The challenges facing farmers in engaging in agroforestry-based farming include: input/technology, institutional and socio-cultural challenges. The findings of this study supported that of [30] who identified variables of input factors undermining farmers' practice of soil conservation to include poor access to information, high cost of required farm inputs, poor access to and control of farm resources, inadequate farm labour to support in agronomic soil conservation practices and high cost of available farm labour. Inadequate extension contacts, poor awareness by government and NGOs, poor government policies and ineffective supporting facilities are some of the institutional challenges facing farmers as [31] noted that ineffective transfer of agricultural technology through extension agents is a major problem facing agricultural development in Nigeria. [32] reported that on some of the reasons why some

respondents are not willing to plant trees to include non-availability of land as the majority has a small landholding, problems with land tenure, long gestation period of trees, lack of planting materials (seeds and seedlings), lack of technical expertise, lack of incentive and poor government policies.

5. Conclusion

The study specifically identified different methods of land acquisition by farmers in southwest Nigeria, determined the relevance of agroforestry-based farming to food security and environmental quality as perceived by farmers, estimated the determinants of farmers' willingness to engage in agroforestry-based farming and determined the challenges of farmers in practicing agroforestry-based farming in southwest Nigeria. From the findings of the study, common methods of land acquisition in south-east Nigeria include inheritance, lease/rent, communal land, gift and purchase. The relevance of agroforestry to food security and environmental quality as perceived by the farmers include increased agricultural productivity, enhanced farmers income generation, helping farmers cope with food shortage, enhanced farmers' access to agroforestry tree products, increased farmers' access to herbs for medicinal purposes and enhanced nutritional status of the farm households. The result of the binary probit model analysis showed that sex, age, land ownership status, farm income, extension contact, membership of cooperative, labour availability and farmers' access to credit were significantly influenced farmers willingness-to-engage in agroforestry-based farming. The challenging factors undermining farmers' engagement in agroforestry-based farming in southwest Nigeria include: input/technology, institutional and socio-cultural factor.

Recommendations

Based on these findings, the study recommended that:
1. the present land tenure arrangements in the area be revisited to give farmers increased access to land for engaging in agroforestry farming,
2. there should be more proactive campaign for increased participation of farmers in agroforestry-based farming and provision of necessary policies, inputs and institutions that will facilitate farmers' participation in agroforestry-based farming.

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