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DETERMINANTS OF YAM AGRIBUSINESS PARTICIPATION DECISIONS AMONG RURAL HOUSEHOLDS

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ABSTRACT

Research background: Participation decisions in yam agribusiness could be one of the measures to combat hunger, poverty and enhance the income of resource-poor rural households in yam-producing areas.
Purpose of the article: This study examined the determinants of yam agribusiness participation decisions and the factors that influence yam agribusiness export participation in Benue State, Nigeria.
Methods: The sampling technique used to select 385 respondents was multi-stage but 377 responses were used for the analysis in this study. This multinomial Logit and Probit models are employed to achieve the purpose of this study.
Findings & Value: This study reveals that social capital, and literacy ratio influenced participation decision of rural households in input supply sector of yam agribusiness. Household size, age of household heads, literacy ratio and social capital influence the participation decisions in production sector of yam agribusiness. Age and gender of the households' heads and literacy ratio influenced participation decisions in distribution and transportation sector of yam agribusiness while Age of the household heads, access to credit, tenure security, social capital and literacy ratio influenced the marketing component of yam agribusiness in Nigeria. The Probit analysis shows that gender of the household heads, extension contact, dependency ratio and literacy ratio influenced the willingness to participate in yam export agribusiness. Policies on literacy improvement, participation in relevant cooperative societies, provision of extension services, and tenure security that propels rural households to participate in yam agribusiness should be enacted to enhance income and improve the wellbeing of Nigerians.

Key words: multinomial logit; participation decision; rural households; yam agribusiness
JEL Codes: Q12; Q13

INTRODUCTION

West Africa has the largest capacity of about 92% of the production of 67.31 million of yam produced globally on 7.96 million hectatres of land (**FAOSTAT, 2019**). Even with the West Africa production, Nigeria, Ghana and Côte d'Ivoire produced about 66% of the world production. The benefits of yam as income earner and a source of food to versed majority of people cannot be overemphasized. Yam can be stored for a very long period of time because of its peculiar attribute of reduced physiological process that has the potential to cause deterioration unlike in other root and tubers in the tropics. It is very possible to deal with food insecurity largely by farming, processing, selling and distributing yams (**Aighewi *et al.*, 2014**).
Yam is a major food crop that is widely grown in Nigeria. It is a first widely grown tuber crop in the agricultural economy, before cassava and others. The states with the highest levels of production (Taraba, Benue, and Niger) are not those with the highest yields (Nassarawa, Osun, Ekiti, Ondo, Imo). Benue state produces annual average of 60-70 per count of the yam tonnes production in Nigeria (**Bergh *et al.*, 2012**). The farming of yam is largely still produce by smallholder farmers. But there is need to see how the households in the producing areas of Benue State are involved in yam agribusiness from the input supplies to the time the produce gets to the final consumers.
Agricultural Transformation Agenda (**ATA, 2014**) focuses more on agribusiness and farming that is directed towards marketing both at the local and international levels. In order to achieve these, there is need to deal with teething issues impeding the development of agri-food systems on a continuous basis. More importantly, there is need to encourage market participation of crops like root and tubers (**Pingali *et al.*, 2006**).

Benue state produce the largest quantity and better quality of yams in Nigeria. In 2006, the National Bureau of Statistics **(NBS, 2007)** emphasized statistically that Benue State produced 13.017 million metric tonnes. Yams are consumed by humans, and for income generation and social, cultural, or religious events and festivals. Yam is produced, processed, distributed, marketed and considered important by rural households in Nigeria. The

activities involved in yam agribusiness is carried out mainly in rural communities by the resident households.

A rural household participates in agriculture through the head or one of the members of the household to produce for the family and earn income. First, farm households vary both with respect to who constitutes a household (which family members) and with respect to what constitute a farm household (what level of production of land farmers, level of sales, share of household as farm household **(FAOSTAT, 2019**). Not all members of a household necessarily participate in agribusiness decisions. Because some decisions are jointly made, some are made by the heads of the households while some are made by the women in the households. This study emphasizes the identification of factors affecting decisions to participate in yam agribusiness and export by farm households in Benue State, Nigeria.

LITERATURE REVIEW

Despite their relative importance in rural food systems, very little yam is commercially marketed, exported and processed (**Rohrbach, *et al.* 1990**), this happened till very recent. A relatively small proportion of rural households participate in selling yams for those who want to buy, the quantity is often small (**Barrett, 2008**). Thus the main contribution of yams is towards farm household food security. The relative importance of yam in global food systems suggests the existence of substantial opportunities for their commercialization. It is about linking the farm households to the inputs (agrochemicals – pesticide, herbicide, seed yams, etc.) that they need on one side of the chain and exports of the commodity on the other side. **Verter and Bečvářová (2015)** posited that Nigeria produced more than 60% of the global yam production.

Subsidy was introduced on agricultural commodities to be exported in 2003. Recently, strategies were set in motion by the Nigerian Government to encourage larger investment in agricultural production, processing, distribution and marketing even to the extent of exportation. Yam is not left out among the crops of priorities. In the year 2017, the exportation started in Nigeria especially to the developed countries like the United States of America and the United Kingdom. This is encouraged by the Federal Government through favourable policies to agriculture in order to diversify from oil sector to non-oil sector. For increased and sustained production, processing, distribution and marketing system of yam, and participation decisions of farm households for export agribusiness has not been thoroughly defined.

Previous studies conducted in areas of export market that focused on market participation decision (e.g. **Barret, 2008; Bobojonov *et al.*, 2016; Enete and Igbokwe, 2009; Muriithi and Matz, 2014; Osmani and Hossain, 2015**) did not focus on farm households' participation decisions in yam export agribusiness in Nigeria. Some of these studies already conducted used binary choice models (Logit and Probit) and also tobit model. Probit analysis was used by **Bobojonov *et al.* (2016)** to investigate the regressors of participation in export markets, and also a logistic regression model (i.e. Logit model) was used to examine main determinants of commercialization by **Randela *et al.* (2008)** within the transaction costs framework. In Sub-Saharan Africa, Heckman two-stage OLS regression was applied to examine factors of market participation in cereals among by smallholder farmers (**Sizba *et al.*, 2011**). Also, Tobit model was used by **Enete and Igbokwe (2009)** to examine decisions to participate in cassava market by households in Africa, but none of these studies used a polytomous choice model to examine the market participation decisions. **Kyaw, Ahn and Lee (2018)** used Heckman two-stage selection model to examine the factors that affect market participation by small-scale rice farmers. Double hurdle model was used by **Achandi and Mujawamariya (2016)** to examine the market participation among smallholder rice farmers.

The objectives of the study were to: examine the determinants of yam agribusiness participation decisions, and investigate the factors influencing yam agribusiness export participation in Benue State, Nigeria. These objectives were carried out using polytomous and binary choice models (multinomial Logit and Probit models), respectively. This was actually done to know the relevant policy variables that could necessitate vibrant yam agribusiness in Nigeria.

DATA AND METHODS

Data source and sampling procedure

The sampling approach used to conduct a survey to select household respondents was multi-stage method. The major yam-producing areas of Benue State, Nigeria were purposively selected for the study, that is, the Northern and Eastern agricultural zones consisting of 14 local government areas, this marks the stage one. Secondly, two local government areas were randomly sampled in each zone, making four local government areas all together. Thirdly, from each local government, two districts were selected, making eight districts. Benue State Agricultural and Rural Development Authority (BNARDA) office at the zonal level provided the lists of the yam farmers and marketers. This served as the sampling frame. The unit of analysis is farm households. The Equation (1) provided by **Anderson *et al.* (2007)** was adopted to select the households.

$$n = \frac{PqZ^2}{E^2} \quad (1)$$

Where:

n = sample size; P= proportion of the population of the rural households; $q = 1 - P$; Z = confidence level (α = 1.96); E acceptable error (0.05). This formula resulted to sampling 385 respondents. But 377 responses were used for the analysis and discussion after removing the outliers and those questionnaires of incomplete response.

Empirical Model: The Multinomial Logit Model

The application of multinomial Logit model in this analysis is necessitated to estimate the explanatory variables (i.e. determinants) affecting the decisions to participate in the operations of yam agribusiness because of the multivariate nature of the dependent variable. This

determines the odds of a household being in one of the four categories of participation decisions by input supplies, production, processing-storage-distribution or marketing. The dependent variable (participation decision) is quantified numerically as follows: no participation equals 0, 1 for input supplies, 2 for production, 3 for processing-transportation-distribution and 4 for marketing. This categorization is never done following any specific order as in the case of ordered Logit model. Additionally, the participation in the operations by the households was possible but the respondents was categorized by the major operation.

To address the issue of choice that is more than two response outcomes multinomial Logit model was one of the polytomous models to use (**Gujarati, Porter and Gunasekar, 2012**). To effectively apply this model, one of the participation decisions was set to be the reference category (i.e. base outcome), which is assumed to be zero (0). In other words, we compare the case of non-participation (0) in yam agribusiness with other possible operations (1, 2, 3 and 4). The Model is explicitly stated as Equation (2).

$$Y_i^* = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} \quad (2)$$

The description and measurement of the dependent and the independent or explanatory variables, referred to as regressors, for the multinomial Logit analysis are as stated in Table 1.

Empirical Model: The Probit Analysis

For the identification of the factors that influence the decisions of farm household participating in yam export agribusiness, Probit model was applied. This is specified as Equation (3).

$$\pi_i = \Phi(\eta_i) = \Phi(\alpha + \beta_i X_{i1} + \beta_2 X_{i2} + \cdots + \beta_k X_{ik} \quad (3)$$

$$\pi_i = \Phi(X_i^t) \quad (4)$$

Where:

$\Phi(.)$ is distribution function for the Standard Normal Random Variable; α and β_i are parameters to be estimated; π_i conditional probability; β_i coefficients of the independent variables i.e. regressors); X_i the explanatory variables, and ε_i error term. What differentiate Probit model from Logit model is the normal distribution of errors as stated (Equation 5). Logistic regression model assumes logistic distribution of errors.

$$\Phi - 1_{(Y_t)} = \sum_{k=o}^{k-n} \beta_k X_{ik}^2 \varepsilon_i \quad (5)$$

This is implicitly stated as Equation (6).

$$Y_t^* = \beta_i X + \varepsilon_i \quad (6)$$

Where:

Y_i^* the binary dependent variable of willingness-to-participate in yam export agribusiness (if willing to participate =1, 0 otherwise); X_i are the explanatory or independent variables; β_i are parameters of the regressors (independent variables), and ε_i error term.

Logistic regression can be explicitly stated as Equation (7).

$$Y_i^* = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \varepsilon_i \quad (7)$$

The dependent and the independent or explanatory variables considered as determinants of decisions to participate in yam export agribusiness by farm households in the Probit regression analysis are as shown in Table 2:

RESULT AND DISCUSSION

Factors that influence Yam Agribusiness Participation Decisions among Rural Households in Benue State, Nigeria

Non-participation in yam agribusiness is the comparison category. The analytical outcomes of the multinomial Logit model are presented in Table 3. The results presented comprise the coefficients and the standard errors of the regressors are also presented.

The significant strength of the explanation of the multinomial model rests in the likelihood ratio statistics (χ^2) ($p < 0.0000$). The effect of the regressors' coefficients provide direction of the dependent variable in comparison with the base outcome. Marginal effects of the regressors are also taken into consideration. This is necessary because it helps to avoid a misleading results if only the explanation on the coefficients are used. These marginal effects are reported in Table 4.

Household size: The relationship that exists between household size and the probability of participating in production/farming of yam tubers tends to make both of them to move in the same direction as seen in Table 4. This shows that rural households with more people tend to produce yam more than households with few people.

Age of household head: The likelihood of participation of farm households in yam production/farming, transportation-distribution and marketing is related to the age of the head of the households in positive manner. It shows that as the rural households' heads get older they tend to decide to participate not only in the production, transportation and marketing components of yam agribusiness in Nigeria. **Geoffrey *et al.* (2013)** posited that age is an important factor in market participation as revealed in pineapple market in Kenya.

Gender of the household head: The probability of participation in transportation-distribution of yam is positively related to gender of the respondents.

Access to Credit: The probability of participation in marketing of yam tubers and access to credit are significantly related among rural households. This result is in disagreement with microeconomic theory on access to credit. This is may be due to fungibility of credit.

Table 1: Description, measurement and expected signs of the dependent and the independent variables (regressors) in the multinomial Logit analysis

Variable Names	Variable Description and Measurement	Unit of Measurement	Parameters	Variable Notations	Expected sign (a priori expectation)
Yam agribusiness operations	This stands for multivariate choices of five (5) possible values; 0 for non-participation in yam agribusiness, 1 for input supplies, 2 for production/farming, 3 for processing-transportation-distribution and 4 for marketing.	Discreet choice	-	Y_i^*	
Household size	Number of persons in the household	Number of persons	β_1	X_1	+
Age of the household head	The number of years that the household head has been living	Years	β_2	X_2	±
Years of education of household head	This is highest education level the respondent possess.	Years of schooling	β_3	X_3	+
Sex of the household head	The sex category of the household head	Dummy (measured as 1 if male, 0 otherwise)	β_4	X_4	±
Extension contact	The number of extension contact/visit in the year	Number	β_5	X_5	+
Access to credit	Access to credit	Dummy (Measured as 1 if the respondent has access to credit, 0 otherwise)	β_6	X_6	+
Tenure security	The ownership of land used in farming yam	Dummy (1 if land used for farming yam is owned by the respondents, 0 otherwise	β_7	X_7	+
Funded project	The participation in funded agricultural project	Dummy (1 if participated in funded agricultural project, 0 otherwise);	β_8	X_8	+
Social Capital	Memberships in cooperative societies and farmers' associations	Dummy (1 if belong to cooperative societies and farmers' associations, 0 otherwise);	β_9	X_9	+
Dependency ratio	The ratio of the number of people that are depending on the household head living under the same roof divided by the total number of people in the household in the cropping year	Number in ratio	β_{10}	X_{10}	+
Literacy ratio	The ratio of the number of people that can read and write to total number of people under the same roof	Number in ratio	β_{11}	X_{11}	+
Constant	-		β_0	-	

Table 2: Description, Measurement and Expected Signs of the Dependent and the Independent Variables (Regressors) in the Probit Regression Analysis

Variable Names	Variable Description and Measurement	Unit of Measurement	Parameters	Variable Notations	Expected sign (a priori expectation)
Willingness-to-participate in yam export agribusiness	Binary dependent variable, measured as a dummy, 1 if willing-to-participate, 0 otherwise.	Dummy	-	Y_i^*	
Household size	Number of persons in the household	Number of persons	β_1	X_1	+
Age of the household head	The number of years that the household head has been living	Years	β_2	X_2	±
Years of education of household head	This is highest education level the respondent possess.	Years of schooling	β_3	X_3	+
Sex of the household head	The sex category of the household head	Dummy (measured as 1 if male, 0 otherwise)	β_4	X_4	±
Extension contact	The number of extension contact/visit in the year	Number	β_5	X_5	+
Farm size	The size of land cultivated to yam during the cropping year	Hectares	β_6	X_6	±
Tenure security	The ownership of land used in farming yam	Dummy (1 if land used for farming yam is owned by the respondents, 0 otherwise	β_7	X_7	+
Social Capital	Absolute frequency of memberships in the cooperative societies and farmers' association	A count of associations and cooperative societies the respondent belongs to during the cropping year.	β_8	X_8	+
Dependency ratio	The ratio of the number of people that are depending on the household head living under the same roof divided by the total number of people in the household in the cropping year	Number in ratio	β_9	X_9	+
Literacy ratio	The ratio of the number of people that can read and write to total number of people under the same roof	Number in ratio	β_{10}	X_{10}	+
Constant	-		β_0	-	

Tenure security: The likelihood of participating in marketing of yam tubers and tenure security move in the same direction. The implication is that land owners participate more the marketing component of yam agribusiness than their counterparts. Tenants can use lands as collateral, so land ownership influences the rural households' participation decisions in yam agribusiness. This is in agreement with **Oparinde and Daramola (2014)** which posited that land tenure affects participation of the respondents in the market participation. **Otitoju (2013)** and **Enete, Otitoju and Ihemezie (2015)** posited the agreement between tenure security and decisions.

Social Capital: Table 4 shows that membership in social, civil and farmers' cooperative has negative and significant relationship with the three components of yam agribusiness (i.e. input supply/seller, production/farmers, and marketing in the study area. When people are members of a group, there are benefits attributed (**Key and Runsten, 1999**). When people belong to the same group, they pull their resources to solve their problems collectively (**Matungul *et al.*, 2001**). Social capital had negative sign in this study. This looks very strange but it could be due to the formation of Association of Yam Farmers, Processors and marketers, Nigeria newly with the primary aim of promoting yam value chain businesses throughout the country which is different from membership of general cooperative without the primary function of this nature. **Markelova *et al.*, 2009 and Poulton *et al.*, 2010** in their works posited that this finding may mean that when members get subsumed in social groups this may limit their activities in ensuring profitable marketing.

Literacy Ratio: Literacy ratio is the ratio of the number of people that have the ability to read and write to the whole number of people living together under a roof. The results of this study show that literacy ratio and the likelihood of participation decisions of all the components of yam agribusiness among the rural households in Benue State, Nigeria. This relationship tends to make them to move together.

Table 3: The coefficients of the regressors that influence the rural households' participation decisions in yam agribusiness in Benue State, Nigeria

Independent or Explanatory Variables	Coefficients			
	Input Supply	Production/ Farming	Transportation-Distribution	Marketing
Household Size	0.1319	0.09462	-0.0889	-0.0510
(number of persons)	(0.0895)	(0.0509)*	(0.0744)	(0.0750)
Age of Household Head	0.0373	0.221	0.0327	0.432
(years)	(0.0255)	(0.1325)*	(0.0196)*	(0.1867)**
Years of Education	0.0357	-0.0087	-0.0077	0.0434
	(0.0509)	(0.0266)	(0.0373)	(0.0372)
Sex (male)	0.1165	0.3753	2.853	0.0752
(1/0)	(0.7315)	(0.3906)	(1.169)**	(0.535)
Extension Contact	0.0052	0.00402	-0.0461	0.0168
(number of contacts/visit)	(0.0367)	(0.1922)	(0.0287)	(0.0261)
Access to Credit	-0.7384	-0.4541	-0.1804	-1.0259
(1/0)	(0.5507)	(0.2805)	(0.406)	(0.4112)**
Tenure Security	-0.4326	0.02404	0.1202	1.067
(1/0)	(0.5421)	(0.2849)	(0.3985)	(0.471)**
Funded Project (1/0)	-0.272	0.0584	0.1203	-0.457
	(0.5508)	(0.2781)	(0.396)	(0.4117)
Social Capital (1/0)	-0.05831	-0.3251	-0.0189	-0.0489
	(0.0293)*	(0.140)**	(0.0204)	(0.0212)**
Dependency ratio	-0.0849	-0.0236	-0.3483	-0.739
	(0.5679)	(0.3249)	(0.3935)	(0.482)
Literacy ratio	2.005	2.2633	2.686	1.9011
	(1.074)*	(0.7758)***	(0.854)***	(0.941)**
Constant	-4.591	-0.1894	-4.756	-3.120
	(1.868)	(1.037)	(1.914)	(1.495)

Numbers of observation = 377
LR chi2 (44) = 92.95
Log likelihood = -474.45
Prob > chi2 = 0.0000
Psuedo R^2 = 0.0892

Note: The reference category is non-participation in yam agribusiness. Standard errors in parenthesis;
*** denotes P ≤ 0.01, ** denotes 0.01<P≤0.05, while * denotes 0.05<P≤0.10
Source: Computed from field survey, 2018.

Table 4: Marginal effects of the multinomial Logit (mnl) analysis of factors that influence the rural household participation decisions in yam agribusiness in Benue State, Nigeria

Explanatory Variables	dy/dx Non-participation in yam agribusiness	Input Supply	Production/Farming	Transportation	Marketing
Household Size	0.0047	0.0273	-0.0099	-0.0123	-0.00973
(number of persons)	(0.0025)*	(0.0101)**	(0.0096)	(0.0064035)*	(0.0071)
Age of Household Head	0.000847	0.00075	-0.00522	0.001171	0.00245
(years)	(0.00114)	(0.0026)	(0.00214)**	(0.00152)	(0.00165)
Years of Education	0.00173	-0.00500	-0.000380	-0.000887	0.00453
	(0.0254)	(0.00515)	(0.00462)	(0.00302)	(0.00279)
Sex (male)*	-0.0120	0.0164	-0.0957	0.122	-0.0309
(1/0)	(0.0402)	(0.0777)	(0.7325)	(0.0250)***	(0.0475)
Extension Contact	0.00028	0.00217	0.00010	-.00441	-0.0309
(number of contacts/visits)	(0.0186)	(0.0378)	(0.00304)	(0.00188)**	(0.0475)
Access to Credit*	0.0141	-0.0499	0.09015	0.0164	0.00186
(1/0)	(0.0257)	(0.0565)	(0.0504)*	(0.0307)	(0.00242)**
Tenure Security*	-0.0286	-0.0347	-0.0240	-0.00730	0.0947
(1/0)	(0.0291)	(0.0568)	(0.0492)	(0.0299)	(0.0332)***
Funded Project (1/0)*	-0.0118	0.0438	0.00759	0.00406	-0.0436
	(0.0238)	(0.0558)	(0.0492)	(0.0304)	(0.0322)
Social Capital (1/0)*	-0.00164	-0.00318	0.0066	0.00068	-0.00247
	(0.00128)	(0.00294)	(0.00247)**	(0.0018)	(0.0018)
Dependency ratio	(0.00226	0.0520	0.0328	-0.0211	-0.0659
	(0.0206)	(0.0537)	(0.515)	(0.0277)	(0.0427)
Literacy ratio	0.0165	0.2874	-0.425	0.0972	0.0241
	(0.03086)	(0.1385)**	(0.192)**	(0.0471)**	(0.0511)

Note: * dy/dx is for discreet change of the variable that are binary from 0 to 1; Standard errors in parenthesis

Table 5: Probit Analysis of Determinants of the Rural Households' Willingness-to-Participate in Yam Export Agribusiness in Nigeria

Explanatory Variables	Coefficients	Standard Error	Z-Value	P>|Z|
Household Size (number)	0.01616	0.0275	0.59	0.557
Age of Household Head (years)	-0.00316	0.00676	-0.47	0.640
Years of Education	0.00722	0.0131	0.55	0.580
Sex (male) (1/0)	0.3308	0.198	1.67*	0.094
Extension Contact (number)	0.0154	0.00934	1.65*	0.098
Farm size (Hectares)	-0.05099	0.0349	-1.46	0.145
Tenure Security (1/0)	-0.0883	0.1460	-0.60	0.545
Social Capital (absolute frequency of memberships)	-0.00605	0.00729	-0.83	0.407
Dependency ratio	0.748	0.227	3.29***	0.001
Literacy ratio	-0.675	0.328	-2.06**	0.040
Constant	0.161	0.532	0.30	0.762
Numbers of observation = 377				
Wald chi2 (10) = 25.32				
Log pseudo likelihood = -234.159				
Prob > chi2 = 0.0048				
Psuedo R^2 = 0.0830				

Note: *** denotes P ≤ 0.01, ** denotes 0.01<P≤0.05, while * denotes 0.05<P≤0.10
Source: Computed from field survey, 2018.

Determinants of Participation Decisions in Yam Export Agribusiness by Rural Households in Benue State, Nigeria

Sex, extension contact, dependency ratio, and literacy ratio are the determinants of participation in yam export agribusiness as revealed by the results of the Probit model analysis. The estimated Probit regression analysis shows a high level of significance as shown by likelihood ratio statistics (χ^2) at 95% confidence level. This value suggests the magnitude of the strength to explain the Probit regression model.

Sex: Sex and willingness-to-participate in yam export agribusiness are positive and statistically related. Here, it means that male rural households' heads are willing to participate more in yam export agribusiness than their female counterpart. **Schipmann and Qaim (2011);**

Geoffrey *et al.* (2013) attested to this result of positive relation between gender and market participation.

Extension contact: Extension contact and the willingness-to-participate in yam export agribusiness in Nigeria are positively. This means that the more the agricultural extension contacts the more the rural households will be willing to participate in yam export agribusiness. This shows that extension activities have to be geared towards yam agribusiness to help the government in the diversification of Nigeria economy from oil-dependence to agribusiness-led economy. **Bobojonov *et al.* (2016)** reported that age is a critical determinant of export market participation in Armenia but cooperative membership and extension contact are factors that influenced participation of farm households in export markets in Uzbekistan.

Dependency ratio: It is clear in Table 5, that dependency ratio has significant relationship with households' willingness-to-participate in yam export agribusiness. This shows that the more the number of people that are dependent on the households heads the more the households is looking for way to cater for their wellbeing.

Literacy ratio: The negative relationship between literacy ratio and household heads' willingness-to-participate in yam agribusiness is surprising but it shows that the number of literate people in a household is not a determinant of participation in yam agribusiness. This is so because many literate people do not stay in the rural areas.

CONCLUSIONS AND RECOMMENDATIONS

The analysis of this study demonstrates that there are determinants that can enhance the participation decisions in yam agribusiness and also that drive the willingness-to-participate in yam export agribusiness (Selling to the companies that are directly involved in yam export, i.e. off takers) among farm households. Participation decisions in yam agribusiness could be one of the measures to combat hunger, poverty and enhance the income of millions of resource-poor rural households. This multinomial Logit estimation reveals that social capital, and literacy ratio influenced participation decision of rural households in input supply sector of yam agribusiness. Household size, age of households; heads, literacy ratio and social capital influence the participation decisions in production sector of yam agribusiness. Age and gender of the households' heads and literacy ratio influenced participation decisions in distribution-transportation sector of yam agribusiness while Age of the household heads, access to credit, tenure security, social capital and literacy ratio influenced the marketing component of yam agribusiness in Nigeria. The Probit analysis shows that gender of the household heads, extension contact, dependency ratio and literacy ratio influenced the willingness-to-participate in yam export agribusiness. Policies on literacy improvement, participation in relevant cooperative societies, extension services, and tenure security that propels rural households to participate in yam agribusiness should be put in place in order to deal decisively with rural poverty, enhance income and improve the wellbeing of Nigerians.

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FARMERS' ENTREPRENEURIAL COMPETENCIES AND TECHNICAL EFFICIENCY OF RICE FARMS

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ABSTRACT

Research background: Rice (*Oriza sativa*) is a staple food in most homes in Nigeria, its demand has not been able to cope favourably well with the production. Efforts to develop and improve the production of the crop in the country were seriously curtailed due to inefficiency in the use of available resources.
Purpose of the article: The study set to determine the effects of farmers' entrepreneurial competencies (ECs) on technical efficiency (TE) of rice farms in South-west, Nigeria. Also, the study was trying to profile the socioeconomic characteristics of rice farmers and identifying their ECs in order to describe the determinants of technical efficiency of rice farms.
Methods: A multistage sampling technique was employed to select 504 respondents from which information on their socioeconomic characteristics, their ECS' variables and input-output variables were collected. The information gathered were analysed using descriptive statistics and stochastic frontier production (SFP) function (Cobb-Douglas model).
Findings & value added: The results showed that farms were technically inefficient with a mean TE score of 0.6842 with evidence of increasing returns to scale. The results of the Maximum-likelihood Estimation of the SFP model reveals that the quantity of seed planted, farm size and amount of man-day labour used significantly explained the technical efficiency of rice farms. Also, some socioeconomic factors and ECs factors such as organising and commitment were found to be responsible for rice farmers' inefficiency. The study recommends appropriate entrepreneurial training for rice farmers focussing on resource management and training the extension workers on necessary competency knowledge.

Key words: entrepreneurial competencies; farm-level; resource management; rice farms
JEL Codes: C67; D13; D24; D61

INTRODUCTION

Rice (*Oriza sativa*) is a cereal crop of high nutritional value. About 80 per cent of calorie requirements of consumers' need worldwide are derived from rice and consumptions of the product has no cultural, religious, ethnic or geographical boundary (**Inuwa *et al*., 2011**). It is one of the important grains in Nigeria, not only on the basis of the number of farmers that cultivated the crop but also in its economic value. It is a staple food in most homes and its demand has not been able to cope favourably well with production (**Bamiro and Aloro, 2012**). It is cultivated and consumed in all ecological zones of Nigeria (**Bamiro and Aloro, 2012; Ohaka *et al*., 2013; Ohajianya and Onyeweaku, 2003**). It is an important food security crop in both rural and urban areas of the country (**USAID 2009; Chidiebere-Mark *et al*., 2019**). **Food and Agriculture Organisation (2017)** and cited in **Ahmed (2020)** reports that on average, rice consumption per person stood at 24.8kg/annum, signifying 9 per cent of the total calorie of food intake in Nigeria. The annual consumption of milled rice of over 5.5 million metric tonnes surpasses domestic production of 3.3 million metric tonnes (**Federal Ministry of Agriculture and Rural Development (FMARD), 2013; Ogunsumi *et al*., 2013**). The demand-supply gap has been attributed to increased population and urbanisation, and this has resulted in some significant importation of milled rice (**Bamiro and Aloro, 2012; USDA, 2018; Ahmed, 2020**). Given the importance of rice as a food security crop in Nigeria, efforts are being made to ensure that the whole rice food system remains active and efficient (**Oteh *et al*., 2018**). A number of policies were put in place by various governments to boost local production and reduce importation. For instance, in 2004, the Presidential Initiative in Agriculture (PIA) was

launched to increase the production and utilization of rice and three other crops. Other policies include the Agricultural Transformation Agenda (ATA) in 2010 and also in 2015, Agricultural Promotion Policy (APP) aimed at unlocking Nigeria's agricultural potential and solve the underlying challenges in its agricultural system. Despite all these efforts, agricultural productivity in Nigeria was seriously curtailed by inefficiency in the use and allocation of resources (**Balogun and Obi-Ogbedi, 2012**). Efficiency measurement is very vital because it is a determinant in output growth (**Al-Hassan, 2012**). It is referred to as how productive a firm can be, given the minimal resources required to do the job. Across all economic sectors, the business (farming inclusive) the environment provides opportunities for entrepreneurial success (**Kuratko and Audretsch, 2009; Xaba, 2014**). Entrepreneurship enhances the efficiency of people and resources, and ultimately, increases people's income (**Fortunato, 2014; Ataeia *et al.*, 2020**). Entrepreneurship is a new situation for farmers to combine the various available resources in the farms efficiently, which then enables them to be successful (**Bergevoet *et al.*, 2005**). This is because farmers are faced with challenges that require taking decisions and putting his managerial competencies to action (**Norton *et al.*, 2014**). It is therefore evident that ECs are required by farmers to make sound farm decisions that can lead to efficiency in production. The improvement in the performance of family farm enterprises lead to increased food production, raises farmer's income and improves the standard of living of people (**Adofu *et al.*, 2013; Afolami *et al.*, 2015)**

Theoretical framework and literature review

Theoretically, Resource-based view was utilized to explain the effects of ECs on the resource allocation capabilities of farms (**Barney, 1991**). The theory is premised on the value addition which permits entrepreneurs to acquire, develop and mobilize resources more efficiently (**Tehseen and Ramayah, 2015**). Undoubtedly, ECs are interconnected to an entrepreneur's skills' capabilities, and knowledge as intangible and prized resources that can add to enterprise success in terms of output (**Tehseen and Ramayah, 2015**). In the perspective of this study, the resource-based view was relevant in explaining the survival of farm which depends on endowed resources and how it can utilize these endowments to improve production output on a sustainable basis (**Nabiswa and Mukwa, 2017**). According to **Sher *et al.* (2019)** farmers' entrepreneurial skills are the essential elements required for enhanced performance in terms of potential market location and prompt delivery of food commodities. However, **Sinyolo and Mudhara (2018)** opine that some levels of entrepreneurship skills and competencies could possibly improve production output among the farming households and hence impacts food security. As opined by **Nieuwoudt *et al.*, (2017)**, each of the respondent's ECs directly influenced the operating efficiency of the farm as indicated by Data Envelopment Analysis (DEA). Measuring the economic performance of a farm needs an understanding of production decisions and the TE levels. Technical Efficiency which is a prerequisite for economic efficiency secures the economic feasibility and sustainability of a farm (**Ahmadzai, 2017**). Entrepreneurial competencies of farmers are vital in improving farmers' yield for sustainable agricultural development through improved family food and income security. Entrepreneurial competencies empower farmers to have access to better markets with better products that gave them higher prices, resulting in increased incomes (**Opolot *et al.*, 2018**; **Arellano and Delos Reyes 2019**). Various studies (**Jordaan and Grové, 2012; Nieuwoudt, 2016; Ataeia *et al.*, 2020**) in developing countries have shown that entrepreneurial skills impact the TE of smallholder's farms. The realisation of goals of any business (farming business inclusive) depends heavily on the manager's ECs that is translated into efficiency in production (**Nasuredin *et al.*, 2016; Umar *et al.*, 2019**). Presently, the economy of countries worldwide is adversely affected by the COVIDS-19 pandemic; leading to a shortage of food supplies. The situation has led to the need for increased food production especially a staple crop like rice. Thus, this study set to determine the effects of farmers' entrepreneurial competencies on technical efficiency of rice farms in South-west, Nigeria.

DATA AND METHODS

Study Area: The study was conducted in South-west, Nigeria. It is characterized by a usually equatorial climate with distinct dry and wet seasons. The wet season lasts for about seven months all things being equal, with rainfall which ranges between 1200mm and 2600mm. The mean rainfall is 1480mm with an average monthly temperature of 18^0C-24^0C and 30^0C-35^0C during the raining and dry seasons respectively. The planting season usually lasts for nine months with a peak around July and September. South-west is comprised of four distinct sub-ecologies which are moist and dry lowland forest, swamp mangrove forest and savannah, savannah mosaic and woodland forest and all have soil with low to medium productivity potential. Main crops grown in the area include cassava, cowpea, cashew, citrus, cocoa, coffee, kolanut, maize, millet, oil palm, rice, and sorghum. The choice of south-west geo-political zone Nigeria was based on the fact that it is found along forest zones and guinea/derived savannah within the rainforest belt of Nigeria. A multistage sampling procedure was employed for the study. In the first stage, two major rice-producing states were purposely chosen based on the past production records. The second stage of the sampling involved the purposive selection of seven Local Government Areas (LGAs) from selected states known for rice production. The stage that followed was the random selection of villages within the selected LGAs using probability proportionate to the number of villages in each of the selected LGAs. At the fourth stage, 15 farmers were purposely selected from each of these villages based on the proportion of rice production activities. A total of 600 rice farmers were randomly selected from 16 identified villages/communities in the two states. However, 84 percent of the respondents' responses with complete information were analysed for this study. Data were collected on socio-economic characteristics of rice farmers, their ECs' variables

(Opportunity, Relationship, Conceptual, Organising, Strategic and Commitment), input-output variables data such as quantities of land, seed, fertilizer, herbicides, pesticides, labour used (family and hired), the number of production outputs for 2018/2019 farming season. The researchers adopted the ECs instrument earlier developed by **Man *et al.*, (2008**) to examine the ECs levels of rice farmers. This instrument was chosen because of its high level of reliability for measuring ECs from a behavioural standpoint. The instrument consists of six constructs with a varying number of items. In all, there were 53 items related to the abilities of individual respondents, but we considered only 40 of the items which relate to the agricultural sector. The items are answered with a 7-point Likert scale ranging from 1 which represents 'very strongly disagreeing' to 7 which is 'strongly agreeing'. The result of reliability or internal consistency shows that the Cronbach's Alpha coefficients of all the variables were higher than 0.70. The result agrees with **Hair *et al.*, (2014)** that considered Cronbach's alpha value higher than 0.7 as good and reliable.

Method of Data Analysis

Data were analysed with descriptive statistics and principal component (using IBM SPSS version 21 statistical software program) and stochastic frontier production model (using FRONTIER 4.1c). The ECs levels of the rice farmers were determined using a Principal Component Analysis (PCA). The PCA is a statistical data reduction methods employed to examine the linear correlations among a set of variables. It can be used for the detection of underlying dimensions in a set of variables (**Pishie 2009; Mensah and Dadzie 2020**). The value of the i[th] principal component can be compactly calculated using the expression specified by **Field (2005)** and adopted by (**Yankah 2015**). The model is specified as Equation (1-2).

$$PCi = \sum_{j=1}^{p} K_j X_j \quad (1)$$

$$PCi = K_{i1}X_i + K_{i2}X_2 + K_{i3}X_3 + \cdots + K_{ip}X_p \quad (2)$$

Where:

K_{ij} factors and X_j marks received from each of entreprenurial competencies parameters. In this equation, *i*= 1,2,3,..6 denotes each of the entrepreneurial competencies variables while *j*= 1,2,3,4,... p

Stochastic Frontier Production Function (SFP)

The SFP function proposed by **Aigner *et al.*, (1977)** and adopted by **Krasachat (2017)** was used to measure the Technical Efficiency (TE) of farms. The function is stated as Equation (3).

$$Y = f(G_{ij}\beta) + \epsilon_i \quad (3)$$

Where: $\epsilon_i = V_i - U_i$

Y Output in tons/ha

G_i input used $(j = 1,2,3 \ldots . . n)$

β_i is a vector of the unknown parameters

ϵ_i error term which consists of V_i and U_i

The distribution of the two error term components V_i and U_i are assumed to be independent of one another. The error term V_i allows for random variation of the production function between different farms and it also considers factors which are beyond the farmers' control (**Krasachat, 2017**). The error term U_i depicts the TE in relation to the frontier. A U_i of 0, implies that production lies on the frontier, while a $U_i > 0$, signifies production that lies below the frontier which simply means inefficiency. It then follows from Equation (4).

$$\sigma_s^2 = \sigma_u^2 + \sigma_v^2 \quad (4)$$

Where:

$$\Upsilon = \frac{\sigma_u^2}{\sigma_v^2}$$

The TE of a farmer is expressed as the expected values of V_i conditional on $\epsilon_i = V_i + U_i$ (**Jondrow *et al.*, 1982**) (Equation 5).

$$E(U_i/\epsilon_i) = \sigma_{s,} \left\{ \frac{\Phi \frac{\epsilon_i \mu}{\sigma_s}}{1 - \Phi \frac{\epsilon_i \mu}{\sigma_s}} + \frac{\epsilon_i \mu}{\sigma_s} \right\} \quad (5)$$

Where:

E Expectation of the farm owner

Φ Standard normal density function.

Then, TE is measured such that $0 \leq TE \leq 1$ (Equation 6).

$$TE_i = exp\left\{-E\left(U_i/\epsilon_i\right\}\right. \quad (6)$$

The measurement of TE and its underlying factors are of critical significance in production theory. The TE of a farm and the extent of use of inputs, determine the output and capacity utilization. Detecting the various factors influencing it allows stakeholders to take suitable measures to improve on it. The TE model was jointly analysed with stochastic frontier function with a single-stage maximum likelihood estimation technique. The SFP version employed in this study is Cobb-Douglas. The model is capable of estimating both the technical efficiency and technical inefficiency jointly with a single-stage maximum likelihood estimation procedure.

The technical efficiency function (Equation 7).

$$lnY_i = \beta_0 ln + \beta_1 lnH_1 + \beta_2 lnH_2 + \beta_3 lnH_3 + \beta_4 lnH_4 + \beta_5 lnH_5 + \beta_6 lnH_6 + V_i - U_i \quad (7)$$

Where:

ln natural logarithms;

Y_i Output of the rice farm i (ton/ha);

H_1 Quantity of seed in kg;

H_2 Farm size in hectare;

H_3 Quantity of fertilizer in kilogram;

H_4 Quantity of herbicide in litre;

H_5 Quantity of pesticide used in litre;

H_6 Amount of labour (man-days);

β_s Unknown parameters;

V_i Random errors which capture random effect;
U_i Technical inefficiency effect;
i Individual rice farm as earlier defined;

The technical inefficiency function (Equation 8).

$$E(U_i/\epsilon_i) = \sigma_{s,} \left\{ \frac{\Phi\frac{\epsilon_i\mu}{\sigma_s}}{1-\Phi\frac{\epsilon_i\mu}{\sigma_s}} + \frac{\epsilon_i\mu}{\sigma_s} \right\} \quad (8)$$

Where:
U_i Level of technical inefficiency of individual rice farm;
G_1 Age of the farmer (years);
G_2 Sex of farmer (Male = 1, Female =0);
G_3 Years spent in school of farmers (Years);
G_4 Farmer's years of experience in rice farming (Years;)
G_5 Association membership of farmer (Yes = 1, 0 otherwise);
G_6 Opportunity competencies;
G_7 Relationship competencies;
G_8 Conceptual competencies;
G_9 Organizing competencies;
G_{10} Strategies competencies;
G_{11} Commitment competencies;
$\mathcal{E}_i$ Error term.

RESULT AND DISCUSSION

Summary of the descriptive statistics of some variables

Table 1 presents a summary of the descriptive statistics of some variables of interest. The results show that an average of about 1.66 tonnes/hectare of rice paddy was produced per farm, while the average farmland cultivated to rice stood at 1.94 hectares. The result of rice productivity was a little lower than the average national yield of rice which stood at 1.8 tonnes per hectare (**FAOSTAT, 2013**). The result disagrees with **Ajah and Ajah (2014)** that on average, rice farms produce about 1.348 tonnes of paddy rice from 1.84 ha of farmland in the country. The result reveals that the farmers planted approximately 120.5kg/ha paddy rice seed and used 85.21kg/ha of fertilizer in their farms. With regard to the usage of herbicides and pesticides, the results show that an average of 12.14 litres and 1.85 litres respectively were used. The total amount of man-days labour used varied from farm to farm depending on tools used, the land area planted to rice, and the number and quality of labourers and also the type of activities to be done. However, farms utilized an average of 148 man-days of labour in their farms. Farmer's age and his/her productive capability and hence, output, are correlated (**Adeyonu *et al.*, 2019**). It determines the farmer's productive ability and consequently, his output. The mean age of the farmers was 44 years. This result shows that most rice farmers were in their active age and perceived entrepreneurial skills are acquired over time. Furthermore, the result shows that about three-quarter of the respondents are male, while the rest are females. This is an indication that the proportion of females in rice farming is low and this calls for concerted efforts which aim at empowering women to increase their participation in rice farming. The result shows that the mean years of experience of farmers in rice farming was almost 16. The Table 1 depicts that the respondents had attended school for about 14 years on average. Acquisition of education by farmers would enable them to know how to seek new farm practices and subsequently apply them in their farms. About two-thirds of the farmers belong to the rice growers' association and had participated in entrepreneurial training.

Entrepreneurial competencies of rice farmers

Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and Bartlett's test of sphericity is presented in Table 2. Of the 4 items each that were listed under opportunity and commitment competencies only 1 and 2 factors respectively were extracted. Also, 11 and 7 items listed under organizing and conceptual competencies, 3 factors were extracted in each of them while in the relationship and strategic competencies with 6 and 8 items, only 1 and 2 items respectively that loaded significantly on the factors were extracted. All the extracted ECs variables tested for adequacy were significant and used for further analysis. The values of the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) ranged between 0.626-0.887, while the values of the Bartlett test were all significant at P<0.01.

Estimates of the parameters of stochastic frontier production function of rice farms

Table 3 presents the maximum likelihood estimates of the parameters of the SFP model. The SFP model depicted increasing returns to scale. The results reveal that the quantity of seed planted, farm size, and amount of man-day labour were the variables that significantly explained the TE of rice farms. The quantity of seed planted had a positive coefficient which implies that a unit increase in the variable increased the TE of rice production by 22.2 percent. This could be attributed to improved transplanting practice by transplanting bunches of seedlings with the intention of increasing the yield through the population. The result corroborates the submission of **Arellano and Delos Reyes (2019)** who posited that increasing land utilization would increase rice production. The number of labour employed in the rice farm has an indirect association with TE with a coefficient of 0.05. This is a pure case of overutilization of labour in rice production which was already in stage 3. The result is similar to that of **Arellano and Delos Reyes (2019)** who found that many rice farmers depended more on their family labour for farm operation needs because they do not have enough incentives to hire skilled labour, hence; quality and yield of their farm work are adversely affected. Furthermore, the authors found that age and technical inefficiency are directly related, meaning that a unit increase in farmer's age, will increase the likelihood of farms' inefficiency level by almost 6 percent *ceteris paribus*. This result is in consonance with the submission of **Otuaniya *et al.*, (2015)** who revealed that farmer's age and farm's level of inefficiency are positively correlated.

Table 1. Summary of descriptive statistics of some variables of interest

Variable	Mean	Std. dev.	Min.	Max.
Output of rice	1.66	0.97	0.10	3.11
Quantity of seed	120.51	15.89	50.00	200
Farm size cultivated	1.94	0.60	0.19	3.00
Quantity of fertilizer	85.22	81.39	0	300
Quantity of herbicide	12.15	3.02	0	18
Quantity of pesticide	1.85	0.25	0	4
Amount of labour	148.37	30.94	15.01	350.11
Age of the farmer	43.97	8.88	22	66.0
Sex of farmer (Male = 1, Female =0)	0.76	0.34	0	1
Years of schooling	13.52	2.94	0	15
Years of experience in rice farming	15.95	4.57	2	35
Association membership (Yes =1, 0 otherwise)	0.61	0.23	0	1
Participation in Entrepreneurial Training(Yes = 1, 0 otherwise)	6.01	2.21	0	10

Source: Field Survey, 2019

Table 2. Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity

Entrepreneurial competence	No of items	No of Extracted items (factors)	Determinant	KMO	Bartlett Chi square	Sig.
Opportunity	4	1	0.48	0.63	369.22	0.00
Relationship	6	1	0.10	0.80	1131.63	0.00
Conceptual	7	3	0.17	0.64	890.72	0.00
Organizing	11	3	0.00	0.75	3797.27	0.00
Strategic	8	2	0.01	0.89	2338.09	0.00
Commitment	4	2	0.40	0.70	458.05	0.00

Source: Authors' estimates.

Table 3: Maximum likelihood estimates of the parameters of the stochastic frontier production function of rice farmers.

Variable	Parameter	Coefficient	Std. error	t-ratio
Constant	β_0	2.67***	0.25	10.52
$In\ H_1$	β_1	0.22**	0.10	2.35
$In\ H_2$	β_2	1.27***	0.07	18.32
$In\ H_3$	β_3	0.01	0.01	0.77
$In\ H_4$	β_4	-0.01	0.02	-0.37
$In\ H_5$	β_5	0.02	0.02	0.90
$In\ H_6$	β_6	-0.05***	0.02	-2.56
Inefficiency				
Constant	λ_0	0.61**	0.27	2.27
G_1	λ_1	0.06*	0.03	1.96
G_2	λ_2	0.04	0.03	1.43
G_3	λ_3	-0.09***	0.02	-4.80
G_4	λ_4	-0.02	0.04	-0.56
G_5	λ_5	0.07*	0.04	1.93
G_6	λ_6	-0.04	0.03	-1.59
G_7	λ_7	-0.01	0.01	-0.21
G_8	λ_8	-0.01	0.05	-0.02
G_9	λ_9	-0.02**	0.01	-2.35
G_{10}	λ_{10}	0.01	0.01	0.63
G_{11}	λ_{11}	0.26***	0.04	6.85
Sigma-squared	$\sigma_s^2 = \sigma_u^2 + \sigma_v^2$	0.16***	0.01	15.10
Gamma	$\Upsilon = \frac{\sigma_u^2}{\sigma_s^2}$	0.02***	0.10	0.14
Log-likelihood	-254.350			
LR test of the one-sided error	63.325			

Note: *, ** and *** represent 0.1, 0.05 and 0.01 levels of significant respectively.
Source: Field Survey, 2019.

Table 4: Distribution of Technical Efficiency of levels of rice farms

TE Score	Frequency	%
< 0.50	8	1.58
0.50 – 0.59	96	19.05
0.60 – 0.69	196	38.89
0.70 - 0.79	138	27.39
0.80 – 0.89	57	11.31
>0. 90	9	1.78
Total	504	100.0
Minimum	0.42	
Maximum	0.95	
Mean	0.68	

Source: Field Survey, 2019.

A unit increase in the level of organizing competence resulted in a reduction in the level of inefficiency of rice farms by 1.6 percent. This perhaps may be unconnected with the fact that farmers with a high level of organizing efficiency were able to organize their resources through team building which resulted in effective management of those resources, and hence, better management. This submission is in support of those of **Scuotto *et al*. (2017) and Shih and Tsai (2016)** who indicated that good knowledge of resources management in business enables innovation and organizational success. Likewise, commitment competence had a positive influence on rice farms' level of inefficiency. The result indicates that a unit increase in commitment competence led to an increase in the likelihood of the level of technical inefficiency by 26.4 percent. The result supports **Sambasivan *et al*., (2010) and Rajabi *et al*., (2018)** who posited that a high level of commitment and hard and hard work by entrepreneurs determined the achievement of the goal of the enterprise.

Frequency distribution of levels of technical efficiency of rice farms

The distribution of efficiency estimates of rice farms is presented in Table 4. The mean TE score of farms is 68.42 percent is an indication that all the farms operated at moderate levels of efficiency at the given rice production techniques adopted by the farm owners. Howbeit, the value of the average TE is an indication that the output realized can still be increased by about 32 percent through the adoption of the techniques of the most efficient farm.

The year of schooling is another important determinant of farm's inefficiency which stood at 9 percent and significant at 0.01 level. It implies that years of schooling had a reducing effect on rice farms' inefficiency in the south-west, Nigeria. This can be understood because trained farmers are early adopters of improved technology that can increase their productivity. Membership of the association of rice farmers has a positive and significant relationship with technical inefficiency. Rice farmers' membership in the association increased their technical inefficiency by 7 percent. This might be as a result of farmers' devoting more time to association matter to the detriment of their farm work. Also, the analysis shows that organizing competency and technical inefficiency were negatively related.

CONCLUSIONS AND RECOMMENDATIONS

This study focused on the entrepreneurial competencies of rice farmers and the level of technical efficiency of rice farms in the south-west, Nigeria. The study found that efficient use of resource coupled with entrepreneurial competencies (good organisational ability and commitment to success by rice farmers) enhance the level of technical efficiency of farms. The mean technical efficiency score implied that farms are not operating at the optimum production frontier indicating that there is still a substantial potential available to farmers to increase their output given the present technologies and inputs. The stochastic frontier production function depicted increasing returns to scale. The study also identified organisational and commitment competencies as determinants of technical inefficiency among the rice farmers. It is suggested that various stakeholders in the rice value chain (government and private agencies) should design an appropriate training programme that will focus on entrepreneurial training for rice farmers. Also, there is a need for networking by rice farmers as a means of sharing experience and this should be complemented with short term training on resources management by extension agents. Reflecting on the sustainable agriculture and rural development, the study has brought to light, that the future of farmers' can only be guaranteed if they become more entrepreneurial in the way they manage their farms as a business.

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THE AGRIFOOD SYSTEM TRANSFORMATION IN NIGERIA: INSIGHTS FROM A HOUSEHOLD FOOD DEMAND MODEL

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ABSTRACT

Research background: The food system is central to a wide range of outcomes such as food security, nutrition and economic development. In this wise, the food systems must meet the needs of a growing and increasingly urbanized population. However, food system in developing countries is undergoing a rapid transformation towards high value products and food safety. Yet, the consumer demand drive towards the transformation has received much less attention. Hence, improvement in the agricultural and food systems must be viewed in the context of household food consumption patterns.
Purpose of the article: This paper examined household food demand and food choice preferences among urban households in southwest, Nigeria. Understanding Nigeria's Agrofood structure through urban eating pattern will proffer knowledge required for better policy design and implementation.
Methods: The paper applies a quadratic almost ideal demand system (QUAIDS) model to a cross-sectional household survey data from two urban areas, and estimate price and expenditure elasticities as indicators of household sensitivity to market shocks.
Findings & Value added: Analysis of frequency distribution on urban household's preferences shows that convenience, availability, safety were important attributes influencing decisions to purchase foods. Demand estimations show positive expenditure elasticities for food groups with values close to unity. The animal-source foods and cereals were more expenditure-elastic in high urban areas (HUA) and low urban areas (LUA), respectively. All own-price elasticities are negative and LUA are more price-sensitive to most food groups compared to HUA. The price and expenditure results suggest that transformation of agro food products will come in place if convenience and food safety attributes are incorporated in food value chain.

Key words: elasticities; food expenditure; food system; QUAIDS; urban households
JEL Codes: D12; O13; Q11

INTRODUCTION

The world's agrifood system responds to diverse climatic and agro-ecological conditions as well as market forces. Changing contexts such as resource availability, input costs, policy and institutional environment, and consumer preferences influence the structure of agrifood system (AFS). According to **Chen *et al.*, (2014),** climate change, demographic change and economic change is responsible for the widespread changes in agricultural production systems. Possibly, changing climate in Africa countries has a strong impact on agricultural supply, thereby influencing the yields of farm products (**Thornton *et al.*, 2010**). The economic factor in terms of increasing income, per capita gross domestic product (GDP), is another driver of change in many low- and middle-income countries (LMICs) and this is further associated with urbanization (**Chen *et al.*, 2014**). The striking changes in socioeconomic and demographic changes, larger proportion of consumers living in cities, in LMICs of Africa, particularly in Nigeria, result in changing dietary preferences with increased demand for animal-source foods in areas where levels of their consumption have been previously low (**Gerland *et al.*, 2014**). The increasingly affluent urban population affect both supply and demand side of agricultural food products.

The emerging consumption patterns have probably created new opportunities for agro food. Also, food supply chains have lengthened and changed dramatically as the physical distance from farm to fork has increased with striking changes in food distribution. The emerging role of modern retail food outlets, growing preferences for convenience, food safety, quality and health procedures describe these changes (**Mergenthaler *et al.*, 2009; Crush and Frayne, 2011; Berkum, *et al.*, 2017; Dolislager, 2017**). In response to this trend, the rise of retail outlets particularly in urban areas introduced greater variety of foods with quality and food safety guarantees (**Wertheim-Heck *et al.*, 2015; Zhou and Staatz, 2016**). However, **Demmler *et al.*, (2017)** highlighted the nutritional outcomes of retail marketing. On the other hand, **Smith and Vo (2017)** discussed the resulting

difficulties for developing countries in accessing high quality and diverse food products. Despite the growing recognition of the modernised food retails in some urban areas, **Wertheim-Heck *et al.*, (2015)** emphasized that the traditional food markets (wet and farmer markets) still remain the dominant means of supply of mostly fresh foods in developing economies. With poor participation of rural farm populations in the growing urban markets in Africa, the AFS is characterized by the absence of specialization, low level of competitiveness for value addition and poor enabling environment (**Zheng *et al.*, 2015; Metu *et al.*, 2016**). These factors possibly limit availability of high-value agricultural products needed to meet the expanding demand of food by urban consumers. In Nigeria, **Obayelu and Obayelu, (2014)** attributed poor responses from some of the implemented agricultural programmes and policies in food chain to little or no consideration for value addition strategies needed to thrive the emerging urban food system. Also, the inability to rightly appropriate policy implications from household food demand responses towards effective value addition strategies was the stance of **Metu *et al.*, (2016)**. Evaluation of the impact of evolving AFS, in the context of food demand drive, requires an analytical study of food demand pattern that cuts across household demographics and different environments.

With the hypothesized importance of both supply and demand side factors in the food system transformation, most of the empirical studies on supply chain concentrate primarily on technological and chains methods towards future paths of the Agri-Food domain (**El Bilali 2019; Lezoche *et al.*, 2020**). Also, the transformation of food systems through cross-sectoral collaboration (trade, food and nutrition security) and other emerging issues within agri-food markets centred on supply side (**Borsellino *et al.*, 2020**). However, the contribution of the demand-side to AFS transformation which supposedly represents the feedback mechanism from other food chain has received much less attention. Besides, **Pingali (2007) Tschirley *et al.* (2015)** emphasised the importance of unfolding food demand patterns in driving the agrifood system transformation. Relatively few empirical studies have responded to issues of consumer demand, often with specific focus on some food products (e.g fruits and vegetables by **Mergenthaler *et al.*, 2009; Ekanem *et al.*, 2020**) and not on entire household diet. This is considered a research gap, because understanding the economic demand parameters of aggregate food is instructive for predictions of future development in agrifood system. This article addresses this gap empirically for urban Nigeria. Nigeria presents an interesting case study as a result of the pace and scale of transformation in economy and urbanization. Nigeria is considered as the Africa's next urban giant (**UN, 2019**). The economic performance in Nigeria has experienced a substantial economic growth, particularly in the food retail economy in sub-Saharan Africa due to its large consumer base. The point that food transformation is potentially demand-driven, household food demand response patterns remain a prerequisite for food and agricultural policies towards better contribution of local food economy to economic development.

In order to estimate household demand parameters for food, quadratic almost ideal demand system (QUAIDS) was employed. Most demand analyses generally produce demand parameters for highly aggregated urban and rural dichotomy, this study focus on two urban areas with different level of economic and urbanization processes. The cross sectional analysis builds on a survey of 445 households in southwest zone urban areas in 2017. Understanding what consumers want will allow food marketers offer products that meet these demands, which will help improve sales revenues and profits for producers. This is expected to lead to a vibrant Nigerian food sector while offering safe and healthy food for the populace.

DATA AND METHODS

Study Area

The study was conducted in Southwest Nigeria. It is one of the six geopolitical zones in the country which comprises of six states, Ondo, Oyo, Ekiti, Lagos, Ogun and Osun. Southwest zone is noted for its rapid level of urbanization owing to high concentration of urban activities (**Ikwuyatum, 2016**). Major urban cities have manufacturing sectors, financial institutions, trading corporations, food processing companies, organised food distribution and retail sectors (hyper and supermarkets and other essential grocery). The main occupation in this zone ranges through agriculture-related jobs, trading, manufacturing and white-collar jobs. The area is noted for its rapid infrastructural development combined with higher literacy rate than other zones as most of its urban areas had higher number of educational facilities (**National Population Commission, NPC, 2006**). These factors characterised the extent of urbanisation and rapid urban growth in the study area.

Data

A cross-sectional data from 445 households randomly selected through a multi-stage sampling procedure from two randomly selected urbanising states in southwest, Nigeria was employed. The two states namely Ekiti and Oyo are representative of the low urban area (LUA) and high urban area (HUA), respectively (**National Population Commission, NPC, 2006**). The grouping was based on respective states population size, economic activities and other administrative activities (**Ikwuyatum, 2016; NPC, 2006**). The most urbanized location within each of the sampled states was purposively selected on the basis of the administrative process and level of urbanisation. Households were randomly sampled from Enumeration Areas (EAs) mapped by National Population Commission which represented the primary sampling units used for 2006 population census in Nigeria. Following previous studies on food demand **(Rizov *et al.*, 2015; Van Oordt, 2016; Korir *et al.*, 2018**), information was collected through structured questionnaires at the household level. The data provide information about household head's socioeconomic characteristics, records of the expenditure and quantity of foods purchased by the households in a one-week period. For all the food purchased, information on respondents' perception on food choice attribute was collected.

Methods

Consumer theory involves the procedure through which consumers make consumption decisions. This can be explained by choice of goods as influenced by prices, income and other non-financial attributes. This choice based on preferences likely reflect changing consumer tastes and quality as the income levels change (**Grunert, 2006; Ogundari, 2012**). **Lancaster (1971)** model incorporates the product attributes into the demand function. If z_{ij} represent measure of attribute *i* within good *j*, such that demand for good *q* expressed as a function of this attribute, then *z* (convenience, taste, quality, availability etc.) and price *pi* is given as Eq. 1 –2.

$$\text{Maximise} \quad U = U(z_1, \ldots, z_n) \tag{1}$$

$$\text{Subject to:} \quad P_n X_n \leq Y$$
$$Z = BX,$$
$$\text{for } Z, X \geq 0$$
$$U(BX) = u(X) \tag{2}$$

Where: U utility
P price of goods
X quantity of goods
Y income
Z product attributes,
B matrix of consumption technology,
$u(X)$ new utility function in terms of X.

The descriptive statistics for aggregate responses of urban household's preference for food choices is shown in Figure 1. It revealed that convenience attribute had the most significant influence (about 77 per cent) on choice of food among households. This corroborates **Reardon and Minten (2011)** that demand for convenience is reflected in the strong demand for instant/processed and prepared foods and in the expansion of supermarket and other modern retail outlets. This trend might be as a result of heterogeneity in urban lifestyle as well as changing occupational structure especially for women with respect to time saving food preparation. Appropriating this attribute in food value addition can lead to growth and diversification of agro food economies and further strengthening of rural-urban food linkages. About three quarters of household considered availability as a criterion for food choice which implies that consistent access to food supply would drive more demand for foods in urban areas. The price of food products determines to a greater extent the quantity of foods purchased. This economic assumption still holds as about 73.9 per cent of household considered price attribute in choice of food commodities (**Korir *et al.*, 2020**). About 68 per cent of households indicated quality, taste and variety as a precondition for food choice**. Olawuyi and Adeoye, (2018)** highlighted the importance of these attributes in food safety and health outcomes particularly the prevalence of non-communicable diseases and other diet-related diseases in urban areas of Nigeria. This offers a signal for food value chain actors in response to perceived health outcomes and socioeconomic status from quality measure.

This requires changes in marketing infrastructures such as cold chains, storage facilities and adequate market information along the chain. This would help sustain the shelf life of food products for better availability of food even during the off seasons. The findings established that urban household preferences and food purchase decisions are often not only influenced by price but by other non-price attributes as **Ojogho and Alufohia (2013)** observed. Analysis of frequency distribution shows that convenience, availability, safety were important attributes influencing consumers' decisions to purchase foods. Understanding consumer motivations and knowing the relative importance of various food items consumed in urban areas are essential in improving market efficiency. Also, incorporating the observed food attributes into agrifood interventions would match urban consumer heterogeneity in food demand.

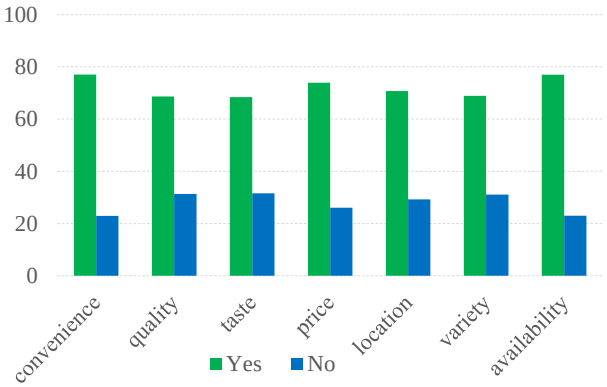

Figure 1: Perceptions of household's food choice

Demand system model

The quadratic almost ideal demand system (QUAIDS) model is a generalization of AIDS model due to the inclusion of the square of the logarithm of expenditure. This allows any given good to be a luxury at one level of expenditure and a necessity at another. This characteristic makes it well suited for household food demand with varying income level and explains the non-linear heterogeneous relationship between price and expenditure. In the extant literature, several studies have confirmed the appropriateness of QUAIDS in modelling food demand preferences (**Garcia-Enriquez and Echevarria, 2015; Van Oordt, 2016; Mottaleb *et al.*, 2017, Korir *et al.*, 2020**). The empirical specification of the QUAIDS budget share equations is given as Eq. 3.

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_i + \beta_i \ln \left[\frac{m}{a(p)}\right] + \frac{\lambda_i}{b(p)} \left\{\ln \left[\frac{m}{a(p)}\right]\right\}^2 + \sum_{i=1}^{n} \delta_{is} Z_s + \varepsilon_i \tag{3}$$

Where w_i is the expenditure share allocated to each food group *i*,
p_i the price of *i*th food group,
m total food expenditure,
α_i average value of budget share in the absence of price and income effects.
β_i parameter that determines the expenditure elasticity
γ_{ij} effects of cross price elasticity
λ_i determine effects of quadratic term,
δ_{is} vector of socioeconomic and demographic variables;

Z_s socioeconomic variables,
ε_i error term

The 89 food items were grouped into seven food categories based on their nutritional content (**Obayelu *et al.*, 2009; Udoh *et al.*, 2013**): cereals, roots and tubers, legumes, meat and its by-products, fruits and vegetables, fats and oils and miscellaneous food products. The miscellaneous group comprises products with some value addition such as bread, refined wheat, semovita, pastas, beverages, processed fruit drinks and confectionary foods. Due to differences in the measures of food acquisition, the physical quantities of food purchased were converted to kilograms following the specification of National Bureau of Statistics (NBS) food composition table. Also, seasonal variability effect may not be significant in this study since urban households are net food buyers.

RESULT AND DISCUSSION

The summary of the mean characteristics of household heads across the two urban areas is presented in Table 1. Majority of the household heads were male with about three quarters of them married. the average age of household heads across the two areas was 47 years. The mean household size for LUC and HUC was 5 and 4 people, respectively. About three-quarters of household heads in both locations had tertiary education while over three-quarters of them were members of a social organization. Average monthly income across urban areas were in the range from 48,848.85 to 53,144.87 Nigerian Naira (NGN) (USD 101.77−110.72). The income differential might likely be the variation in economic opportunities across the two urban areas. From the occupational structure, a larger percentage of household heads were into formal employments. These findings suggest socioeconomic inequality in the status of household heads within urban areas.

Demand elasticities

Price and income elasticities are estimated for seven food groups in order to characterize heterogeneous households' demand behaviour. Expenditure estimates for fat/oil and miscellaneous foods groups confirm the appropriateness of the demand model (QUAIDS) used (Table 2). It revealed the increased Engle flexibility characteristics of these products which further aids the understanding of the demand response to food supply chain as income changes. For example, fat and oil group changed from being a luxury (1.31) in LUA to a necessity good (0.61) in HUA as income level changes. Estimation results of expenditure elasticity from Table 2 revealed that across the urban areas, all the food groups had positive expenditure elasticities value, greater than unity, except the roots and tubers group. The disaggregated expenditure elasticity of cereal groups in the urban areas of Nigeria indicated a rise in consumption with increasing incomes particularly in less urbanised places. Accordingly, the expenditure elasticity for root and tubers was lower and those for more expensive products such as meat and processed food products are somewhat higher. This suggests low consumption of food products in their raw state as income rises which might result to a shift towards high value products due to urban lifestyles. This applies in particular to value addition of food products noted for ease of preparation and greater acceptability.

Further, expenditure elasticities for meat (2.45) and miscellaneous foods (2.11) groups were more elastic in HUA. This is consistent with literature that reported increased consumption of animal rich foods (meat, fish, eggs etc.) as wealthier households can afford more nutrient-rich foods (including animal-based proteins) than poorer households in Nigeria (**Kuku-Shittu *et al.*, 2013; Adetunji and Rauf, 2015; Ogbeide, 2015; Ikudayisi *et al.*, 2019**) and Kenya (**Korir *et al.*, 2020**). Increased expenditure on high valued foods was also reported by **Triphati and Srivastava (2011)** in India attributed to desire for diversity. Increased intake of miscellaneous foods as evident in their high expenditure value in the HUA (2.11) suggests the role of value addition as food items in this category are mainly processed with convenience and minimal time of preparation. This was in line with **de Brauw and Herskowitz, (2018)** study which finds that elasticity of demand for this food group was highest for the relatively wealthy and in the urban South of Nigeria. Similar trend in high intake of processed and packaged foods relative to fresh food items was reported by **Euromonitor (2012)** in Nigeria. This finding corroborates the previously discussed empirical findings (Figure 1) that convenience attribute of foods might increase level of food demand. The expenditure patterns suggest potential market for these demand-led food products with policy tailored towards adding value for better acceptability and quality of locally produced foods.

The AFS sector as a whole would benefit from the expenditure elasticity of foods which was almost at the same level in the two locations. It revealed the quest for freshness, safety and quality to probably for health implication in boosting the micronutrient supply, as Figure 1 indicated. Expenditure elasticities of greater than one indicate that the observed rise in their demand is expected to rise substantially in the further process of economic development and as such supply chains will grow contributing to choice by convenience. In growing economies like Nigeria, substantial future demand growth can be expected for food products with high expenditure elasticities. Goods with high expenditure elasticities could create incentives for farmers and other supply chain actors to harness opportunities in emerging markets. With this evidence and an effort to emphasize value addition benefits within the marketing activities, the desired growth for agrifood chain can be achieved.

All of the own-price elasticities reported in Table 3 have the expected negative signs. This satisfied the negativity property of own-price effects and further confirmed the inverse relationship between price and quantity demanded across food groups. However, this condition did not hold in the compensated values for cereals group (0.18) in LUA and meat group (0.24) in HUA. This might probably be that households in LUA consume more of cereal (rice, maize, sorghum, maize flour, guinea corn, millet) as their preferred diet as observed by **Korir *et al.*, (2020).** The meat intake in HUA could be attributed to changing preference for more protein intake, taste, convenience and quality.

Table 1: Socioeconomic characteristics of Household Heads

Variables	Description	Low Urban Area (LUA)		High Urban Area (HUA)	
		Mean	Standard Deviation	Mean	Standard Deviation
Sex	Household is male headed or otherwise (female headed)	0.67	0.47	0.70	0.46
Age	Age of household head in years	47.25	9.60	47.32	11.99
Marital status	Household head is married or otherwise (single, divorced and widowed)	0.76	0.43	0.74	0.44
Household size	Number of persons in the household	4.70	1.54	4.29	1.56
Membership in social organization	Household head being in a social group (professional, cooperative societies, religious, non-governmental organization) or otherwise.	0.76	0.43	0.79	0.41
Educational status	Household head level of education being formal(primary, secondary and tertiary) or otherwise(non-formal)	0.77	0.42	0.81	0.40
Average monthly income	Income earned by household head on a monthly basis in Naira	48848.85	16794.25	53144.87	18465.58
Occupational status	Occupational type of household head is in formal sector(government, private organizations) or otherwise (traders, farmers, artisans)	0.69	0.46	0.64	0.48

Source: Author's calculation

Table 2: Expenditure Elasticities Estimates for Urban Households

Food groups	Low Urban Area (LUA)	High Urban Area (HUA)
Cereals	2.37	1.37
Roots and tubers	0.45	0.41
Legumes	2.18	1.93
Meat	1.34	2.45
Fat and oil	1.31	0.61
Fruits and vegetables	1.08	1.06
Miscellaneous foods	0.37	2.11

Source: Output from QUAIDS analysis

Table 3: Own-Price Elasticity Estimates of Demand for Urban Households

Food groups	Low Urban Area (LUA)	High Urban Area (HUA)
Uncompensated		
Cereals	-0.40	-0.41
Roots and tubers	-0.85	-0.92
Legumes	-0.18	-0.12
Meat	-0.54	-0.20
Fat and oil	-0.39	-0.41
Fruits and vegetables	-0.27	-0.21
Miscellaneous foods	-0.19	-0.52
Compensated		
Cereals	0.18	-0.11
Roots and tubers	-1.00	-0.85
Legumes	-0.08	-0.07
Meat	-0.35	0.24
Fat and oil	-0.34	-0.39
Fruits and vegetables	-0.09	-0.02
Miscellaneous foods	-0.18	-0.42

Source: Output from QUAIDS analysis.

For instance, rice, a major cereal food item mostly consumed across households in Nigeria particularly the imported type with more convenience attribute and stone-free is often preferred as compared to the locally produced rice with stones despite its taste and nutrient composition. This evidence points to the effect of harnessing food value addition strategies for food system transformation. The own-price effects are price inelastic i.e., households are less affected by price changes across the urban areas with the exception of roots and tubers group (compensated matrix) in LUA. Inelastic food groups suggest households might be unwilling to shift away with an occasion of price change because the preferred foods had relatively low substitute. The lower magnitude of the own-price elasticities may also be related to the relative importance of the food items across areas.

In the compensated matrix, the roots and tubers group were most sensitive (-1.00) in LUA while those in HUA was close to unity. Absolute values of food greater than one which indicated efficiency loss in supply chains, leading to higher prices, will decrease demand over-proportionally as the case of roots and tuber groups. The root and tuber group most affected by changes in their own prices indicated that a percentage increase in the prices would lead to decrease in their quantity demanded by more than one percent, which was in line with their lower expenditure elasticities (Table 2). This finding corroborates those of **Ikudayisi and Omotola (2020)** and **Erhabor and Ojogho (2011).** Strategies that will reduce food prices is important for efficiency gains in supply chains, leading to lower prices, in response to increase demand and avalanche of income for producers. The price elasticities estimates showed that LUA are more price-sensitive to most food groups compared to HUA. The finding also suggests level of food insecurity among the vulnerable is occasioned by price effect.

CONCLUSION AND POLICY IMPLICATIONS

This paper examined household food demand and food choice preferences with implication on value addition in Nigeria's AFS. The results of the empirical analysis present expenditure and price differential effects with possible market-based and value addition interventions that facilitate households access to food. This paper provides empirical insights into identification of different factors responsible for food choice from urban households with possible economic benefits on agro-food sector. Across urban areas, the food groups had expenditure elasticities value greater than one indicating luxury goods, except the roots and tubers group. The income effect suggests potential market for the demand of food products. The price elasticities estimates showed that low urban areas are more price sensitive to high value food groups compared to high urban areas. This price quality effect suggests policies strategies in terms of input costs in animal production, preservation for affordable food products. With this evidence, better integration of household demand responses to food policies and investment would improve affordability and stability of food supply. Improving the food economy hinges on better understanding of the price-income effect in restructuring value chain activities to match urban consumer heterogeneity. These, in turn, addresses the broader infrastructural needs of local food systems for better processing and preservation to meet the divergent needs of both producers and consumers in terms of profit maximization and cost minimization, respectively. Given that consumer preferences drives demand for local foods, it is expected that incorporating the observed attributes into agribusiness structure will improve agricultural sector's contribution to Nigeria's economy.

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CONSUMERS' INTENTION TO BUY BRANDED FRESH LEAFY VEGETABLES AMONG RURAL AND URBAN HOUSEHOLDS

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ABSTRACT

Research background: The intention of consumers to purchase branded goods and services is a building block for purchasing behaviour in agribusiness especially for fresh leafy vegetables with nutritional and health benefits in Africa.
Purpose of the article: To examine the determinants of consumers' intention to purchase fresh leafy vegetables, and to identify the constraints militating against shopping outlet decisions of fresh leafy vegetables by the rural and urban households in the Federal Capital Territory, Nigeria.
Methods: The sampling techniques were employed to collect data from primary source were stratified, purposive and convenience to select 746 respondents (396 of urban and 350 of rural households). But 608 respondents (294 for Urban area and 314 for rural area, which represents 74.2% and 89.7%, respectively) were later used for the analysis. Convenience sampling was used at a point because there is no reliable sampling frame that was existing for the respective places.
Findings & Value: This study reveals that are household size, farming as a primary occupation and distance of the consumers' residence to the point of purchase leafy vegetables among both rural and urban households, with the exception of personal income which only influenced the purchasing intention of urban consumers. Poor storage facilities for fresh leafy vegetables was a major constraint to both rural and urban households in the choice of shopping outlets for fresh leafy vegetables in the Federal Capital Territory, Nigeria. All-inclusive policies should be enacted that has the potential to enhance the storage facilities for fresh leafy vegetables. For branded leafy vegetables to be purchased the shopping outlets must be made closer to the residence of the consumers.

Key words: fresh leafy vegetables; purchasing intention; rural and urban households
JEL Codes: Q12; Q13

INTRODUCTION

In Nigeria, agriculture is greatly evolving into agribusiness where it is expected that agriculture is practiced as a business and not as a development project. It is on this note that agricultural enterprises and firms have been producing largely for the markets. But the market is now evolving to what it is expected to be globally in term of receiving goods that are of better quality, the marketing and promotional tools to enhance the commercialization of agricultural produce are increasing and taking new dimension. Among these are advertising, packaging, labelling and branding. All these are intended to enhance the farmers' income and possibly the welfare. But the consumers have their own perspective about these promotion tools. Therefore, it is of great importance to investigate the determinants of marketing of agricultural produce and in this context, fresh leafy vegetables, to know this, the factors influencing the intention of branded fresh leafy vegetables are to be examined and the constraints affecting the consumer choice of shopping outlets are very essential in both rural and urban areas. To know the purchasing intention of any good or service is a way to know the marketing strategy to employ by the supplier of such goods or service.

Purchasing intention as defined by **Howard (2009)** is a state of mental stand that reflects the decision of the consumer to get or buy a good or service in the foreseeable or recent future. Also **John and Jagsish (1969)** defined consumer purchasing intention as "the attitude of the consumers toward a specific purchasing behaviour and the level of consumer's willingness-to-pay." Consumer purchasing behaviour is primarily rooted in their purchasing intention **(Zhang, Zhou and Liu, 2020).** Consumer intention to purchase goods or services are determined by socio-economic and other factors. The term purchasing intention in this study means the consumer's decision to buy branded fresh leafy vegetables, that is, consumer's willingness-to-buy fresh leafy vegetables with a brand.

Branding is the process of creating brands in order to differentiate the products of an agribusiness firm those of

the competitors by creating a unique impression of product or service in the mind of customers. **Sammut-Bonnici (2015)** defined "brand as a set of tangible and intangible attributes designed to create awareness and identity, and to build the reputation of a product, service, person, place, or organization." American Marketing Association also defined brands as a name, sign, symbol, design or a combination of them that are intended to identify products or services of one seller and to differentiate them from those of another sellers or competitors **(PAR Marketing services, n.d).**

In this study, the decision of the rural and urban consumers to acquire fresh leafy vegetables that are branded in Nigeria context is to be addressed, essentially the factors influencing such intention. It has been also explained by **Ambrose-Oji (2012)** that leafy vegetables (LVs) are species of plant originally native to a particular region, or introduced there for quite a long time either through natural process or growers' selection. In Sub-Sahara Africa, nutrient deficiency has been a serious problem for some time now, this nutrition imbalance can be addressed partly by encouraging the consumption of our locally produced plants and livestock rather than depending solely on imported food products. Among the plants that can address this imbalance are leafy vegetables which have vitamins, minerals, anti-oxidants, and some others are cancer defeating ones. The consumption of some of these plants should be done with less processing so that the presence of the vital minerals would not be lost to overheating. Among these plants are leafy vegetables which are more nutritious when consumed fresh with less heat.

From the foregoing, this paper set to investigate the determinants of purchasing intention of branded fresh leafy vegetables, and to investigate the constraints militating against choice of shopping outlets for unbranded fresh leafy vegetables in the Federal Capital Territory, Nigeria.

LITERATURE REVIEW

Many previous studies have investigated factors that influence market outlets among them are: **Alemu, Abrha, and Teklu (2011)** worked on the factors that have cause-effect relationship on vegetable channel selection in rural Tugray. **Kuma, Baker, Getnet, and Kassa, (2013)** used multinomial logit model to examine the determinants of choice of milk marketing outlets in Wolaita zone of Ethiopia. **Jari and Fraser (2009)** investigated how technical and institutional variables affect marketing choices by smallholder farmers in the Kat River Valley, Eastern Cape Province, South Africa with the application of multinomial logit. In Kenya, **Gido, Ayuya, Owuor, and Bokelmann (2013)** used multinomial probit analysis to evaluate the characteristics (socio-economic, institutional and product) that influence the choice for African indigenous vegetable (AIV) retail outlets among rural and urban households. **Shafiwu, Donkoh and Alhassan (2018)** investigated the preferred purchasing outlet of safer vegetables using multinomial logit. In their study **Okello, Lagerkvist, Hess, Ngigi, and Karanj (2012)** assessed the factors conditioning their choice between open-air markets, roadside markets, supermarkets and specialty markets when buying fresh vegetables by Kale consumers in Kenya using non-parametric analytical method. Using multinomial logit analysis in Kenya, **Mutai, Agunda, Muluvi, Kibet, and Maina (2013)** investigated the determinants of shift in market participation from village to regional market in Vihiga County. **Sharma, Kumar, and Singh (2009**) investigated factors that affect choice of market channels by milk producers in India. But they widely embraced supply-oriented approach in evaluating producers' preferences for market retail outlets. But none of these studies looked into the aspect consumer/buyer side of the marketing. The work of **Mishra and Gera (2016)** revealed that brand awareness and reference group were related directly with consumer purchasing intention. **Zhang, Zhou and Liu (2020)** used revised theory of reasoned action to test and verify the determinants of consumer purchasing intention and the strategy of marketing employed in energy automobile parts in China and found that social norms had a low subjective influence on the consumers' purchasing intention. Social credit system was identified to purchase intention of the consumers. The study of **Frik and Mittone (2019)** found that security, awareness, information collection, and control, and company background and consumer reviews had a strong effect on trust and willingness-to-purchase, while website quality plays only a marginal role. Although the perception of trustworthiness and purchasing intention were positively correlated, in some cases participants were more willing to buy from a website that they judged as untrustworthy with regard to privacy.

Jiang and Rosenbloom (2005) examined consumer intention to return online, and found that satisfaction had influence on customer purchase intention at different stages of shopping in e-retailing sector of marketing. The initial shopping experience showed that convenience of shopping and satisfaction had positive relationship with price perception. In Maharashtra-India, **Banerji, Birol, Karandikar and Rampal (2016)** tested the relationship of branding with purchasing intention of high-iron pearl millet using experimental auctions. And they found out that consumers preferred branding on a global-scale to state ones. **Isa, Annuar, Gisip, and Lajuni (2020)** investigated and tested impulse purchase orientation, brand orientation, and online purchase as factors affecting Millennials and Generation Z's purchase intention in online shopping.

In their reviewed work, **Grunert and Ramus (2005)** posited that experience counts in shopping on the internet, this can also hold through for all product. In their work, **Bigné-Alcañiz, Ruiz-Mafé, Aldás-Manzano and Sanz-Blas (2008)** posited that the relationship that existed between information dependency and online shopping was positive, so also innovativeness had similar relationship.

Ariffin, Yusof, Putit and Shah (2016) investigated the relationship between the green value, emotional value, environment conscious, consumers' perceived quality, and repurchase intention towards green products at Parkson Bandar Utama, Selangor.

Approach used in many studies to a large extent has been supply-side based. This is good but the inability to sufficiently consider the demand-side will make the policy advice deduce from such studies to be not all-inclusive because consumers unlike the producers also take vital purchasing decisions. Knowing fully well that decisions of both the producers/suppliers and the consumers/buyers maybe diverse but intended to achieve their respective goals, which are necessary for a successful agribusiness processes.

In this study we focus on the rural and urban consumers of fresh leafy vegetables for these reasons. First, fresh leafy vegetables are produced largely in the rural and peri-urban communities and some urban people as well produce.

Secondly, agribusiness is much more being pushed recently by Government of Nigeria and some international agricultural partners like International Institute of Tropical Agriculture (IITA) and agribusiness would not be completed without taking branding into consideration.

Thirdly, any agriculture and agribusiness intervention would as a matter of fact factor in advertising, packaging and branding as pillars of agribusiness promotion. And such policy planning and design could leverage on studies like this to properly design the programmes for agriculture partners on the factors of great importance and the likely challenges to deal with for easy execution of branding from the angle of rural and urban consumers of fresh leafy vegetables.

The study will contribute to the literature in these manners. First, there have been studies on marketing of fresh leafy vegetables and other crops but none have looked into the consumer intention to purchase fresh leafy vegetables with brands. Based on the foregoing, this paper contributes to agribusiness and marketing literatures with this study on consumer intention to purchase fresh leafy vegetables with brands. Studies like that of **Meng, Florkowski, Sarpong, Chinnan, and Resurreccion (2014); Okello *et al.* (2012)** embraced in agricultural marketing and agribusiness used consumer-based empirical approach. However, none of these examined the determinants of consumer intention to buy branded fresh leafy vegetables and at the same time investigated the constraints militating against choice of shopping outlets for unbranded fresh leafy vegetables in the Federal Capital Territory, Nigeria.

DATA AND METHODS

Data source and sampling procedure

The sampling techniques employed to collect data from primary source in this study were stratified, purposive and convenience to select the respondents (fresh leafy vegetable consumer households). The Federal Capital Territory was stratified into the rural and urban areas. Two Area Councils were selected from rural area, and two also from urban area. Abuja Municipal and Gwagwalada Area Councils were selected for the Urban area based on certain characteristics, and Kwali and Abaji Area represented the Rural area on the basis of their features. From each Area Council, 50% of the number of wards that made up the Area Council were selected, which represented five wards from each Area Council in the rural area, making 10 wards for the rural area, and six wards were selected from the urban area, making 12 wards in the urban area. Then, thirty-three and thirty-five households were conveniently selected from each ward selected in the urban and the rural areas respectively, making 396 and 350 households for the Urban and the Rural area, respectively as shown in Table 1. We later used 294 for Urban area and 314 for rural area, which represents 74.2% and 89.7%, respectively after the data was cleaned to deal with outliers and incomplete questionnaires were dropped. Also, convenience sampling was used at a point because there is no reliable sampling frame that was existing for the respective places.

Table 1: The Matrix of the Selected Sample from the Rural and Urban Areas

Area council	Wards	Number of respondents selected
Rural Area		
ABAJI	Rimba Ebaji	35
	Nuku	35
	Yaba	35
	Gurdi	35
	Gawu	35
KWALI	Kilankwa	35
	Pai	35
	Wako	35
	Yeba	35
	Yangoji	35
Total for Rural Area	10	350
Urban Area:		
ABUJA MUNICPAL	City Centre	33
	Garki	33
	Wuse	33
	Gwarimpa	33
	Karu	33
	Nyanya	33
GWAGWALADA	Gwagwalada Central	33
	Kutumku	33
	Staff Quarters	33
	Paiko	33
	Zuba	33
	Anagada	33
Total for Urban Area	11	396

Source: Computed by the authors.

Empirical Model Specification: Probit Model

The application of Probit model to achieve the objective on the determinants of consumer intention to purchase branded fresh leafy vegetables was deemed fit because of the qualitative nature of the regressand, that is the dependent variable. The Probit model has been applied for dependent variable that is dichotomous in nature. For this paper, the qualitative variable was dichotomous (discrete) that took 1 if consumer intend to purchase branded fresh leafy vegetables, 0 otherwise. The Probit model was employed to estimate this intention of the consumers.

The model is specified as Equation 1-2:

$$\pi_i = \Phi(\eta_i) = \Phi(\alpha + \beta_i X_{i1} + \beta_2 X_{i2} + \cdots + \beta_k X_{ik} \quad (1)$$
$$\pi_i = \Phi(X_i^t) \quad (2)$$

The distribution function for the Standard Normal Random Variable is $\Phi(.)$; the parameters estimated are α and β_i; π_i conditional probability; β_i coefficients of the independent variables i.e. regressors); X_i the explanatory or independent variables, and ε_i error term. What differentiate the Probit model from Logit model is the normal distribution of errors as stated (Equation 3). Logistic regression model assumes logistic distribution of errors.

$$\Phi - 1_{(Y_t)} = \sum_{k=o}^{k-n} \beta_k X_{ik}^2 \varepsilon_i \quad (3)$$

This is implicitly stated as Equation (4).

$$Y_t^* = \beta_i X + \varepsilon_i \quad (4)$$

Where:
Y_i^* the dichotomous dependent variable of the purchasing intention for braded fresh leafy vegetables (if consumer intend to purchase branded fresh leafy vegetables, 0 otherwise); X_i are the explanatory or independent variables; β_i are parameters of the regressors (explanatory or independent variables), and ε_i error term.
The Equation (4) is explicitly stated as:

$$Y_i^* = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \varepsilon_i \quad (5)$$

The independent (explanatory) variables considered as determinants or factors influencing consumer purchasing intention for branded fresh leafy vegetables by the sampled consumers (both rural and urban) in the Probit regression analysis are as shown in Table 2.

Probit regression analysis was conducted for rural consumers and a separate one was conducted for urban consumers of fresh leafy vegetables.

RESULTS AND DISCUSSION

Consumers' Purchasing Intention for Fresh Leafy Vegetables by Rural and Urban Households in the Study Area

Table 3 shows that majority of the respondents 62.4% and 57.8% did not show intention to purchase fresh leafy vegetables among rural and urban households, respectively, while 37.6% and 42.2% of the sampled respondents showed intention to buy branded leafy vegetables in the study area. This implies that branded leafy vegetables as sold in super markets and organised shops is yet to be known by majority of the households in the study area.

Factors Influencing Consumers' Intention to Purchase Branded Fresh Leafy Vegetables among Rural and Urban Households in the Federal Capital Territory, Nigeria

The result of the Probit models indicated that household size, and farming as primary occupation influenced consumers' intention to buy branded fresh leafy vegetables for both rural and urban households in the study area. Apart from these two aforementioned variables, distance to the nearest market outlets influenced consumers' intention to buy branded fresh leafy vegetables among the rural households, while age of the household head, and personal income had influence on the urban consumer purchasing intention for fresh leafy vegetables in the study area. As shown in Table 4, the Wald chi-square statistic with the values of 15.12 ($P < 0.0569$), and 39.22 ($P < 0.0000$) for rural and urban fresh vegetable consumers, respectively were highly significant suggesting the models for the two categories had strong explanatory powers. Table 4 presents the parameter estimates, coefficients, robust standard errors, and the z-ratios from the Probit models for rural and urban households.

Household Size of the consumers: The result in Table 4 shows that household size of the consumers and the probability to purchase branded leafy vegetables had positive and significant relationship at 10% and 1% levels of probability for rural and urban households, respectively in the Federal Capital Territory. This implies that intention to buy branded fresh leafy vegetables increases with consumer household size in both the rural and urban category. Looking at Table 4 critically showed that large household size is an important factor for intention to purchase branded fresh leafy vegetables irrespective of the setting either rural or urban in Federal Capital Territory, Nigeria. This contradicts the finding of **Slamet, Nakayasu, and Bai (2016**) that posited a negative relationship between household size and purchasing.

Farming as primary occupation of the household head: The results in Table 4 showed that farming as primary occupation of the fresh leafy consumers and the probability of the consumers' intention to buy fresh leafy vegetables had negative significant relationship at 5% and 1% levels of probability among rural and the urban households in the study area. This is in agreement with the theoretical expectation. This implies that consumers that were farmers did not intend to buy branded fresh leafy vegetables probably because they produced fresh leafy vegetables. Farming as a primary occupation has great influence on consumer purchasing behaviour.

Distance to the nearest market outlets: Distance of the consumer's residence to the nearest market outlet of fresh leafy vegetables in the rural area had an inverse significant relationship with consumers' intention to purchase branded fresh leafy vegetables at 10% level of significance (Table 4). This finding agreed with the findings of **Otitoju (2013).** Proximity counts in consumer purchasing behaviour, which means the farther the market outlets to the consumers the more they did not intend to purchase branded fresh leafy vegetables by rural consumer households.

Age of the consumer: Age of the consumer and the probability of the consumer intention to purchase branded fresh leafy vegetables had significantly positive relationship among the urban households at 99% level of precision.

Table 2: Description, Measurement and Expected Signs of the Dependent and the Independent Variables (Regressors) in the Probit Regression Analysis

Variable Names	Variable Description and Measurement	Unit of Measurement	Parameters	Variable Notations	Expected sign (a priori expectation)
Consumer intention to buy/purchase branded fresh leafy vegetables	Binary dependent variable, measured as a dummy, 1 if consumer intend to purchase, 0 otherwise.	Dummy	-	Y_i^*	
Age of the consumer	The number of years the consumer has been living	Years	β_1	X_1	±
Sex of the consumer	The sex category of the consumer	Dummy (measured as 1 for male, 0 otherwise)	β_2	X_2	±
Educational Level of the consumer	The number of years spent in formal schooling	Number of years	β_3	X_3	+
Household size	Number of persons in the consumer's household	Number of persons	β_4	X_4	+
Personal income of the consumer	This is the amount of money earned within a month	Amount in naira	β_5	X_5	+
Occupation of the consumer	The primary occupation of the consumer	Dummy (measured as 1 if farming is the primary occupation, 0 otherwise)	β_6	X_6	-
Fresh leafy vegetable expenditure	The amount of money expended on fresh leafy vegetables in a month	The amount of money in naira	β_7	X_7	-
Distance to the point of purchase in kilometres	The distance in kilometres from the consumer residence to the point of purchase	Distance in kilometres	β_8	X_8	?

Table 3: Frequency Distribution of consumers' intention to buy branded fresh leafy Vegetables among rural and urban households

Consumers' intention to purchase branded fresh leafy vegetables	Rural Households		Urban Households	
	Frequency	Percentage	Frequency	Percentage
No	196	62.4	170	57.8
Yes	118	37.6	124	42.2
Total	314	100.0	294	100.0

Source: Computed from field data, 2019.

Table 4: Parameter Estimates of the Factors Influencing Consumers' Intention to Buy Branded Fresh Leafy Vegetables among Urban and Rural Households in Federal Capital Territory, Nigeria

Explanatory Variables	Parameters	Urban Households			Rural Households		
		Coefficient	Robust Standard Error	z-value	Coefficient	Robust Standard Error	z-value
Age of the consumer (years)	β_1	0.02184	0.0086	2.51***	-0.00837	0.0107	-0.78
Sex of the consumer (Dummy, 1 if male, 0 otherwise)	β_2	0.18187	0.1558	1.17	0.05113	0.1654	0.31
Educational Level of the consumer (years spent in formal schooling)	β_3	-0.00118	0.01866	-0.06	0.02546	0.0172	1.48
Household size (number of persons in the consumer household)	β_4	0.07249	0.02843	2.55***	0.03351	0.01913	1.75*
Personal income of the consumer (Monthly income in naira)	β_5	4.10e-06	1.81e-06	2.27**	-3.96e-07	2.32e-06	-0.17
Occupation of the consumer (Dummy, 1 if farming is the primary occupation)	β_6	-0.00001	5.79e-06	-2.44***	-0.1255	0.05994	-2.10**
Fresh leafy vegetable expenditure (Amount of money expended on consumption of fresh leafy vegetables per month)	β_7	0.00006	0.00007	0.87	-0.00008	0.00009	-0.81
Distance of the consumer residence to the nearest fresh leafy vegetables market outlet	β_8	-0.02527	0.03068	-0.82	-0.05379	0.02895	-1.86*
Constant	β_0	-1.3993	0.41785	-3.35	-0.01936	0.59807	-0.32
Number of observation = 294 Log-Likelihood Chi^2 2(8) = -182.867 Wald Chi^2 (8) = 39.22 Prob > chi^2 = 0.0000 Pseudo R^2 = 0.0865					Number of observation = 314 Log-likelihood = -200.452 Wald Chi^2 (8) = 15.12 Prob > chi^2 =0.0569 Pseudo R^2 = 0.0356		

Note: *, **, ***, 10%, 5%, 1% levels of significance.
Source: Computed from field data, 2019.

Table 5: Frequency Distribution and Mean of Constraints militating against consumers' choice of shopping outlets of fresh leafy vegetables by rural and urban households in the Federal Capital Territory, Nigeria

Constraints	Area	Very Serious	Serious	Not Serious	Not Very Serious	Mean	Standard Deviation
Lack of availability of fresh leafy vegetables in the Market outlets	Rural	26(8.8)	78(26.5)	102(34.7)	88(29.9)	2.14	0.949
	Urban	30 (9.6)	92 (29.3)	154 (49.0)	38 (12.1)	2.36	0.816
Poor storage facilities for fresh leafy vegetables	Rural	102(34.7)	110(37.4)	59(20.1)	23(7.8)	**2.98****	0.929
	Urban	148 (47.1)	86 (27.4)	66 (21.0)	14(4.2)	**3.17****	0.912
Lack of time to go to the known markets outlets of fresh leafy vegetables	Rural	28(9.5)	68(23.1)	124(42.2)	74(25.2)	2.17	0.915
	Urban	36 (11.5)	89 (28.3)	140 (44.6)	49 (15.6)	2.36	0.899
Far distance to go to the markets outlets of fresh leafy vegetables	Rural	48(16.3)	74(25.2)	114(38.8)	58(19.7)	2.38	0.979
	Urban	42 (13.4)	80 (25.5)	144 (45.9)	48 (15.3)	2.37	1.046
Lack of access road to the markets outlets of fresh leafy vegetables	Rural	70(23.8)	62(21.1)	92(31.3)	70(23.8)	2.44	1.097
	Urban	79 (25.2)	68 (21.7)	113 (36.0)	54 (17.2)	2.25	1.04
High cost of fresh leafy vegetables in the market outlets	Rural	62(21.1)	70(23.8)	132(44.9)	30(10.2)	**2.55****	0.936
	Urban	46 (14.6)	70 (22.3)	118 (37.6)	80 (25.5)	2.26	0.999
Inadequate information about fresh leafy vegetables	Rural	72(24.5)	58(19.7)	102(34.7)	62(21.1)	2.47	1.079
	Urban	58 (18.5)	98 (31.2)	96 (30.6)	26 (19.7)	**2.50****	1.008
The quality of the fresh leafy vegetables is not always guaranteed	Rural	48(16.3)	78(26.5)	105(35.7)	63(21.4)	2.37	0.999
	Urban	66 (21.0)	102 (32.5)	101 (32.5)	45 (14.3)	**2.60****	0.974

Note: **Major constraints (mean ≥2.50)
Source: Computed from field data, 2019.

This tallied with the a priori expectation. This agrees with the work of **Jenefa, Kumar, and Kadyan (2013)** that age of the consumer has direct relationship with the buying behaviour. **Roitner-Schobesberger, Darnhofer, Somsook, and Vogl (2008)** also posited that older consumer tend to have higher purchasing intention. This implies that the older consumers showed greater purchasing intention for branded fresh leafy vegetables than their younger counterparts. One of the plausible explanations here is that the younger household heads were not so much interested in branded fresh leafy vegetables in the urban areas of Federal Capital Territory, Nigeria.

Personal income: Personal income has the propensity for purchasing intention. The result in Table 4 showed that personal monthly income had positive relationship with the purchasing intention for branded fresh leafy vegetables in the Federal Capital Territory at 5% level of significance. The higher the personal income of the consumers the more the tendency the intention to purchase branded fresh leafy vegetables by the urban households. This agrees with the work of **Jenefa, Kumar, and Kadyan (2013)** that monthly income has direct relationship with the buying behaviour. **Wekeza and Sibdana (2019)** also established a positive relationship between income and purchasing intention. **Slamet, Nakayasu, and Bai (2016**) posited that income and organic vegetable purchasing were positively related. This result agrees with the work of **Roitner-Schobesberger, Darnhofer, Somsook, and Vogl (2008)**, and **Gracia and de Magistris (2008)** that found high levels of income positively influenced purchasing intention.

Constraints militating against choice of Consumers' Shopping Outlets for Fresh Leafy Vegetables among the Rural and Urban Households

From Table 5, the major constrains militating against the choice of shopping outlets for fresh leafy vegetables were poor storage facilities for fresh leafy vegetables both at rural and urban households with mean scores of 2.98 and 3.17, respectively. This agrees with the findings of **Aminu (2013)** that infrastructure challenge is one of the major constraints militating against online shopping. Also, inadequate information about fresh leafy vegetables, and the quality of the fresh leafy vegetables is not always guaranteed were also identified as major constraints militating choice of shopping outlets with mean scores of 2.50 and 2.60, respectively among the urban households. Furthermore, high cost of fresh leafy vegetables in the market outlets with mean score of 2.55 was also identified as a major constraint facing urban households in the choice of fresh leafy vegetables shopping outlets as shown in Table 5.

CONCLUSION AND RECOMMENDATIONS

The determinants of consumer purchasing intention of branded fresh leafy vegetables are household size, farming as a primary occupation and distance of the consumers' residence to the point of purchase leafy vegetables among both rural and urban households, with the exception of personal income which only influenced the purchasing intention of urban consumers. Poor storage facilities for fresh leafy vegetables was a major constraint to both rural and urban households in the choice of shopping outlets for fresh leafy vegetables in the Federal Capital Territory, Nigeria. All-inclusive policies should be enacted that has the potential to enhance the storage facilities for fresh leafy vegetables. For branded leafy vegetables to be purchased the shopping outlets must be made closer to the residence of the consumers.

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HOUSEHOLDS' WILLINGNESS TO PAY FOR THE CONSERVATION OF NOUG: A CASE STUDY

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ABSTRACT

Research background: Crop genetic resource conservation and management requires farmers' financial and labour contribution. Guizotia abyssinica (locally named as 'Noug') is among the oil crops originated from Ethiopia, but currently neglected and poorly managed resource.
Purpose of the article: The purpose of this research to understand farmers' behaviour for conservation program and identify better policy, by examining factors affecting households' willingness to pay (WTP) for conservation Guizotia abyssinica, and by estimating the aggregate welfare contribution of household for the proposed conservation program in West Shewa, Ethiopia.
Methods: A contingent valuation survey, double bound with an open-ended follow-up question was directed on 160 selected rural households using multi-stage sampling method. Probit model is employed to achieve the purpose of this study.
Findings & Value added: The probit model result showed that factors, such as the amount of credit received, perception of conservation problem, education, frequency of extension contact, proportion of land allocated to Guizotia abyssinica, income from Guizotia abyssinica and income from farm activity have a positive and statistically significant effect on households' WTP. On the other hand, total livestock holding, age of households, and initial bid have a negative and significant effect WTP. The aggregate welfare contribution household was estimated to be 1,718,059 man-days and 23,260,839 Ethiopian Birr per year. Improving farmer's extension contact, training farmers, education and solving financial constraints can increase the farmers Guizotia abyssinica conservation in the study area.

Key words: willingness to pay; contingent valuation method; Probit; Ethiopia
JEL Codes: Q6; Q8; Q19

INTRODUCTION

Ethiopia has been recognised as one of the worldwide diversity hotspots for several crops and medicinal plants (**Engels *et al.*, 1991**). Among these noug (*Guizotia abyssinica*), coffee (*Coffea arabica*), safflower (*Carthamus tinctorius*), tef (*Eragrostis tef*), anchote (*Coccinia abyssinica*), enset (*Ensete ventricosum*) are originated from Ethiopia (**Husen, 2012**). *Guizotia abyssinica* is an oil crop cultivated in Ethiopia as a source of income and livelihood for 800,000 farmers (**CSA, 2019**). It is also an important edible oil crop constituting more than half of the total oilseed production of the country. *Guizotia abyssinica* shares 20% of Ethiopian export earnings next to coffee (**Bickford, 2020**). In addition, it is source of proteins, carbohydrates; vitamins and fibre that significantly contribute to the human diet and food security (**Geleta, 2013**). Conservation of crop genetics has considerable social and economic benefits for humans and animals. A crop genetic resource is very important to realize sustainable agriculture being source of food, income and medicine (**Lipper and Zilberman, 2005; Jiang *et al.*, 2014**). However, sustainable benefit from crop is directly related to conservation and management at community level. Unfortunately, farmers who can get income from Noug seed conserve it in unsustainable manner. Noug seed has been recognized as one of the crop that is not properly conserved in Ethiopia (**Tsehay *et al.*, 2020**). There is a growing recognition that sustainable crop conservation and improvement on farm and gene bank brings long-lasting benefits, but the users and decision-makers are not adequately identified. As a result, the economic contribution of Noug seed in Ethiopia is declining below the potential because it is not significantly cultivated and not properly managed. Some important crops are neglected because gene bank cannot handle all crops. However, farmers and local community take a big share in saving seed loss (**Vernooy *et al.*, 2015**). On-farm resource conservation is increasingly recognized as sustainable conservation method for crop genetic diversity (**Sthapit *et al.*, 2012; Cheng, 2020**). Crop genetic resource conservation and management requires farmers' financial or labour contribution (**FAO, 2012**). However, Noug seed loss and its value as genetic resource

for human-wellbeing is not well valued in conservation and management decisions in Ethiopia. Noug crop is underutilized and neglected in Ethiopia because it is characterized by very low yield (**Tesfaye *et al.*, 2016**). But no comprehensive effort has been applied to systematically conserve and utilize *Guizotia abyssinica*. In addition, currently there is inadequate basic scientific knowledge on *Guizotia abyssinica* conservation. The contingent valuation method (CVM) is an important economic technique for the valuation of non-market goods and services (**Mitchell and Carson, 1989**). The contingent valuation method present hypothetical market scenarios for evaluation of certain intervention or specific program (**Mould-Quevedo *et al*., 2009**). In ecological economics, CVM has been used to estimate rice diversity conservation (Pant et al.2011), wilderness and endangered species (**Bandara and Tisdell, 2005**) and conservation Sinar donkey (**Melak *et al.*, 2020**). Several studies used willingness to pay approach to assess financial and labour contribution in conservation practices. **Gebremariam (2012),** used CVM to estimate value of soil and water conservation practices. **Hundie (2016),** used CVM to measure the value improved water supply services. **Ayenew *et al.* (2019**) and **Teshome (2020**) used CVM for evaluation of improved solid waste management, while **Girma *et al.* (2020),** used it for evaluation of lake restoration. Similarly, **Endalew and Wondimagegnhu** (**2019**) used CVM to estimate economic value of church forest conservation. Studies also show that farmers are willing to contribute 84 million USD dollars for the conservation program of crop varieties (**Tyack and Scasny, 2018**). Different socioeconomic and institutional variables like size of total livestock holding, credit and extension contact affect farmers' willingness to pay for communal land (**Belay *et al.*, 2020**). Furthermore, understanding socioeconomic variables and farmers' behaviours is vital for conservation program and better policy (**Friis-Hansen and Sthapit, 2000**). There is lack of information on farmer's willingness to support conservation contribute of Noug seed. Therefore, a societal preference on the topic is need to identify by conducting study. This can provide significant input for policymakers in support of informed and evidence-based decision-making on crop conservation in developing countries like Ethiopia. Furthermore, there is no study on household willingness to conserve Noug (*Guizotia abyssinica*) in the country. Therefore, this study attempted to empirically analyse factors that affect farmers' willingness to pay for Noug conservation using contingent valuation method.

LITERATURE REVIEW

From stated preference valuation techniques contingent valuation method is a most commonly utilized for valuation of non-market asset (**Cho *et al.*, 2008**). It is a survey-based method often used for setting money related values on ecological goods and services having no market value (**Hanemann, 1994; Carson, 2000**). Due to adaptability and the capacity to estimate total economic value of resources, contingent valuation method is acquiring prevalence in the environmental economics. Economists are interested in total welfare. This measure of welfare is formally expressed in a concept called willingness to pay (WTP). Willingness to pay is defined as the highest price an individual is willing to accept or pay for some goods or services (**Breidert, 2007**). It is a survey technique that gives the interviewees with imaginary situations about a certain mediation or explicit program which is intended to be evaluated (**Mould-Quevedo *et al.*, 2009**). WTP is monetary measures taken at individual level of economic agent, particularly in a simple form for a desired increase in the good, the maximum amount the agent would be willing to pay to obtain the upgrading, and for a loss, the minimum amount the agent would be voluntarily willing to receive in payment in exchange for accepting the loss.

The approach of measuring willingness to pay using contingent valuation methods has been used in many countries for policy evaluation in areas like improved rural water service provision (**Bogale and Urgessa, 2012**); valuing natural forest resource (**Chen and Jim, 2010; Bogale, 2011; Bakaki and Bernauer, 2016**); improved soil conservation practices, conservation on communal lands (**Gebremariam, 2012; Kasaye, 2015; Belay *et al.*, 2020**); water ecosystem services toward forest conservation (**Abdulkarim *et al.*, 2017**); valuation of environmental goods and services (**Yilma, 2019**); forest conservation for water quality protection (**Kreye *et al.*, 2014**); drinking water quality and protection (**Jordan and Elnagheeb, 1993; Lichtenberg and Zimmerman, 1999**); reduced risk of drinking water and ground water pollutants (**Shultz and Lindsay, 1990; Kim and Cho, 2002**); outdoor recreation (**Palmer, 1999; Jim and Chen, 2006; Andrews *et al.*, 2017**); economic value wetlands (**Bergstrom *et al.*, 1990**).

The four major elicitation methods in contingent valuation surveys are bidding game, payment card, and single bounded dichotomous choice and double bounded dichotomous choice. In open-ended question, the maximum willingness to pay asked respondents to value the amenity for which no amounts are given earlier. In bidding game question, individuals are iteratively asked whether they were willing to pay a certain amount or not. The amounts are raised up (or dropped down) based on whether the respondent is willing or not willing to pay the previously offered amount. It ends when the iterations have converged to a point estimate of willingness to pay.

The dichotomous choice asks simple yes or no questions like 'would you be willing to pay x amount?'. The dichotomous choice approach has become the probable method of elicitation for CVM practitioners. This method is usually preferred to enquiring an open-ended question about willingness to pay (**Watson and Ryan, 2007**). The double-bounded dichotomous choice is more efficient than single bounded dichotomous choice **(Arrow *et al.*, 1993)**, since it is helpful to address the strategic bias and improve measurable effectiveness over single-limited. **Haab and McConnell (2002**) stated that yes-yes; no-no response in the double bound dichotomous choice format improves unobservable true willingness to pay. The dichotomous format gained considerable acceptance because of its incentive compatibility and its substantial simplification of the cognitive task faced by

respondents. Double-bounded dichotomous technique is not free from critics and limitations like starting point bias which occurs when the respondent's WTP is influenced by the suggested initial value. It may arise if the product being valued is not well defined or the respondent may think the true value for the service to be around the starting point (**Boyle *et al.*, 1988**). Giving a detailed description of the good being valued and the whole purpose of the study can reduce this bias. Hypothetical bias of respondents is that they are not familiar with the scenario presented, their response cannot be taken as their real WTP. This bias can be dropped by a cautious explanation for the respondents. Entire bias happens when the respondent neglects to recognize between the parts of the good product being evaluated and the total group of the goods products into which that part falls. The dichotomous format elicitation method in contingent valuation survey has been employed. To biases was minimized by a careful designing of the survey, proper training of the interviewer, conducting a pilot survey and monitoring and supervision of the survey.

DATA AND METHODS

The study Area

This study was conducted in West Shewa Zone of Oromia national regional state, Ethiopia. It has 24 districts. Based on the census conducted in 2007 by the Central Statistical Agency of Ethiopia (CSA), this zone has a population of 2 million, of which 50% each were male. About 94% of its population is rural inhabitants. The agroecology of this zone is characterized by 40% mid altitude, 27% highland, and 33% lowland. West Shewa Zone is characterized by mixed crop-livestock farming systems. It's agoecology is suitable for production of crops like tef, *Guizotia abyssinica*, wheat, maize, barley, faba bean, and chickpea.

Sampling Techniques and sample size Determination

The multi-stage sampling procedure was employed in order to draw sample households. First, West Shewa zone, from Oromia was selected purposively due to agro ecological potential for *Guizotia abyssinica* production. Secondly, 4 districts are selected from West Shewa using sample random sampling techniques as shown (Table, 1). Thirdly, using update household list 160 households were selected using Cochran's population correction factors (1977) cited in **Bartlett *et al.*, (2001)** (Equation 1).

$$n = \frac{Z^2 * (p)(q)}{d^2} = \frac{1.96^2 * (0.12)(0.88)}{0.05^2} = 160 \qquad (1)$$

Where:

n desired sample size when population greater than 10,000;

Z standard normal deviation (1.96 for 95% confidence level);

p proportion of population to be included in sample i.e., $p = 0.12$

$q = 1 - 0.12 = 0.88$;

d margin of error (0.05)

Data Types, Sources and Method of Data Collection

Both primary and secondary data was utilized in this study. The primary data was gathered from sample household heads using structured questionnaire through face-to-face interviews in December, 2020. On the questionnaire format, socio-economic characteristics, land use, farmers' attitude and practices in seed conservation and other characteristics were considered. Questionnaire and checklist were prepared and pretested before data collection. Key informants drawn from development agents (DAs) and model farmers were interviewed for in-depth qualitative information and triangulating data from the household survey.

Table 1: Sampled distribution of households

District	Total number of households	Sampled household's
Dano	15,117	43
Bako Tibe	19,531	56
Ilu Gelan	10,689	31
Liben Jawi	10,255	30
Total	55,592	160

Source: West Shewa Agriculture office (2020)

Economic valuation method

To elicit respondents' willingness to pay in cash or contribute a labour CVM was used under a hypothetical scenario of conservation of *Guizotia abyssinica*. The scenario in CVM includes defining the baseline (status quo) and the proposed improvement(s) in a simple, meaningful and justifiable way (**Johnston *et al*. 2017**). First, the current status of *Guizotia abyssinica* genetic resource is defined. Second, a scenario for a hypothetical market was articulated. The hypothesis to the hypothetical market is 'each individual's reply to hypothetically quantified questions is equivalent with the individual response to the actual market'. Finally, the estimation practice begins by asking respondents the amount they will pay in real money or contribute labour to the scenario formulated in the hypothetical market (**Bateman and Willis, 2001; Cawley, 2008**). We formulated a hypothetical market called 'on farm *Guizotia abyssinica* conservation Program'. The hypothetical market has two scenarios: a status quo and an improvement scenario. In the status quo scenario, on farm *Guizotia abyssinica* conservation program' would work to keep on farm *Guizotia abyssinica* crop domestication, constant at current levels rather than having *Guizotia abyssinica* endangering. On the other hand, in the improvement scenario, 'on farm *Guizotia abyssinica* conservation program' would work to increase the *Guizotia abyssinica* domestication permanently and to improve its productivity.

Empirical model specification

The objective of the study is to determine the relationship between the individual characteristics and the probability of household WTP for a randomly offered initial bid values. For a given specified amount of cash payment (financial) and labour that has to be subtracted from a given households' financial and labour endowment for *Guizotia abyssinica* conservation. Farmers have the

choice either to accept the pre specified bid or not to accept for the dichotomous choice question of the CVM survey. Probit model was used for binary response (0, 1), that is whether households are willing to pay or not for the offered bid to improve conservation of *Guizotia abyssinica*. Farmers' willingness to pay decision for proposed conservation program can be modelled in a utility framework following Hahnemann (1984) as (Eq. 2).

$$U_i = U_i(M \text{ or } L,\ Z \text{ and } Q) \quad (2)$$

Where:
U_i utility of the household; M monetary/cash payment;
L total labour endowment of the household in a year;
Z socioeconomic characteristics of the household;
Q improved *Guizotia abyssinica* conservation perceived by the households.

Furthermore, let us assume that Q^* as the improve conservation to Guizotia *abyssinica* and Q as the conservation before the improved conservation practices for Guizotia *abyssinica* was undertaken. Then, according to **Subanti *et al.* (2017),**

$$U_i^1(M - bid, Z, Q^* or\ L - bid, Z, Q^*) + e_i \geq U_i^0(M - bid, Z, Q^* or\ L - bid, Z, Q^*) + e_0. \quad (3)$$

Where:
bid is the initial labour payment per year;
e_i *and* e_0 are the error terms which are with zero means and independently distributed.
Therefore, the probability that a household will decide to pay for the *Guizotia abyssinica* conservation is conditional indirect utility function for the proposed intervention is greater than the conditional indirect utility function for the status quo.
The i^{th} household will be willing to accept the initial bid when $U_i^1 \geq U_i^0$
Therefore, the choice problem can be modelled as binary response variable Y (Eq. 4)

$$Y_i = \begin{cases} 1, if\ U_i^1(M \text{ or } L - bid, Z, Q^*) + e_i \geq U_i^0 \geq \\ (M \text{ or } L - bid, Z, Q) + e_0 \\ 0, \text{otherwise} \end{cases} \quad (4)$$

Following **Hanemann (1984),** the probit model can be specified as Eq (5).

$$Y^* = \beta'\beta x_i + \epsilon_i \quad (5)$$
$$Y_i = 1 \text{ if } Y^* \geq bid1 \text{ and } Y_i = 0 \text{ if } Y^* < bid1$$

Where:
β vector of unknown parameters of the model; x is vector of explanatory variables;
Y^* unobservable households' actual WTP for *Guizotia abyssinica* conservation;
Y_i discrete response of the respondents for the WTP;
bid 1 = offered initial bids assigned arbitrarily to the i^{th} respondents;
ε unobservable random component d distributed N (0, σ).

Estimation of the Mean Willingness to Pay

The most general econometric model for the double–bounded data is: $WTP_{ij} = \mu_j + \varepsilon_{ij}$.
Where: WTP_{ij} represents the i^{th} respondent's willingness to pay, and j=1,2 represents the first and second answer. The mean for the first and second responses are represented by μ_1 and μ_2.

Following **Greene (2012),** a Probit model can be specified as Eq. 6.-Eq. 9.

$$Y_1^* = \beta_I x_i + \varepsilon_1 \text{ and } Y_2^* = \beta_2 x_{2i} + \varepsilon_2 \quad (6)$$
$$E(\varepsilon_1/x_i, x_2) = E(\varepsilon_2/x_i, x_2) = 0 \quad (7)$$
$$Var(\varepsilon_1/x_i, x_2) = Var(\varepsilon_2/x_i, x_2) = 1 \quad (8)$$
$$cov(\varepsilon_1, \varepsilon_2/x_i, x_2) = p \quad (9)$$

Where:
Y_1^* is i^{th} respondents' unobservable true WTP at the time of the first bid?
WTP = 1 if $Y_1^* > bid1$, otherwise zero. Y_2^* is the i^{th} respondent implicit underlying point estimate at the time of the second bid is offered.

RESULTS AND DISCUSSION

Socio demographic characteristics of households

Information on socio-economic, demographic characteristics, knowledge and attitude of the farmers is pertinent to increase in value their WTP to secure biodiversity. As shown in Table 2, out of 160 households interviewed about 97% were male head and 3% were female head. The average age for household head was 41 years. The overall mean of family size of household was found to be 7.7 per household. About 27.5% of the households have no formal education. About 59.38%, 11.25% and 2% attended primary, secondary school and certificate respectively. About 92.5% of 160 households interviewed are willing to pay for *Guizotia abyssinica* conservation. In addition, about 90% were perceived *Guizotia abyssinica* conservation problem. The average livestock holding of household was cows. The mean land owned by household was 3.78 hectare and the mean of land allocated to *Guizotia abyssinica* production was 1 hectare. The mean frequency of extension contact for household was 4 times per annum. On an average household received 2,258 Ethiopian birr credit. However, there is no statistically significant difference among the households willing and not willing to pay for conservation. The average annual income from farm activity of household was 58,783 Ethiopian Birr (ETB). The average income from off-farm activity was 3,062.5 Ethiopian Birr. The mean income of households from *Guizotia abyssinica* production was 9980 Ethiopian Birr. The average distance household from farmer training centre was 4 kilometres.

Willingness to pay for Noug (Guizotia abyssinica) conservation

The economic value of an item is measured by individual willingness-to-pay for the item. Ask for the people whether they would pay anything or not before asking

amount of their contribution is the first step in economic valuation (**Hanemann and Kanninen, 1996**). Subsequently, yes or no inquiries were intended to evaluate the willingness to pay decision of the respondents regarding financial and labour contribution. The study shows that 93.125% of household respondents were able to pay either financial, labour or both for conservation of *Guizotia abyssinica*. Among the households willing to pay for conservation, about 93.4% were able to pay both in cash and in labour, while 2.68%, 3.35% able to pay in cash and in labour, respectively, for *Guizotia abyssinica* conservation program. The result from contingent valuation study showed that the willingness to pay of households ranges from 50 to 2000 Ethiopian Birr (ETB) per hectare every year towards protection exercises of *Guizotia abyssinica*. As shown in Figure 1, the number of households' willing to pay decreases as bid gets higher and higher. This was because of the law of demand, which says that quantity demand for goods and service diminishes as cost increases. Based on the result, the mean of households' willingness to pay (465 ETB) was higher than the median (400 ETB), which implies that respondents were willing to pay less than the average WTP.

In addition to the cash payment, labour was used as a payment mechanism to measure the willingness to pay for the conservation of *Guizotia abyssinica*. After completing the yes-no questions for each formulated bid, the highest contribution of man-days for conservation of *Guizotia abyssinica* was elicited utilizing open-ended questions. The result also shows that the households' ability to contribute labour was from 10 to 70 man-days per year (Figure 2). The mean (33.4 man-days) and median (30 man-days) of their willingness to contribute work indicates that households are able to contribute labour (in man-days) near the mean of willingness to pay.

Reasons for not being willing to pay

According to **Stevens *et al.* (1994),** clarifications behind zero bids should be interpreted and used in decision making. It is possible to recognize the reasons for households not contribute cash or labour for conservation program. Detecting the protest bids is important for misunderstanding of zero value for conservation program. To well understand zero bids and true zero respondents were done through asking the reason for not contribute for improved conservation program. As shown in (Table 3).

Table 2: Socio demographic characteristics of households (n=160)

Variable name	Descriptive statistics (mean and percentage)			
	Total Mean	Willing households	Unwilling households	T-value or Chi- value
Age of household head	41	40.75	39.85	1.3
Sex of household (1 for male)	0.968	0.9	0.068	7.01***
Family size of household	7.7	7.64	6.85	0.1571
Perception of conservation problem (1 for yes)	0.15	0.8	0.68	1.64*
Education of household (1 for yes)	0.725	0.6812	0.044	14.94***
Livestock holding (in TLU)	5	4.34	6.272	1.89***
Land allocated for *Guizotia abyssinica* production in ha	1.02	1.1	0.4	1.45
Total land owned in ha	3.78	3.87	3.0384	1.2
Frequency of extension visit per year	3.987	3.87	5.30	1.12
Amount of credit received in Birr	2,258	2,274	2,076	1.24
Distance from farmer training centre in km	4	3.818	3.185	3.34***
Income from farm activities in Birr	58,783	62,248	19,592	2.46***
Income from off-farm activities in Birr	3,062.5	3,319.7	153.85	1.1
Income from *Guizotia abyssinica* in Birr	9,980	10,721	1,595	2.583***

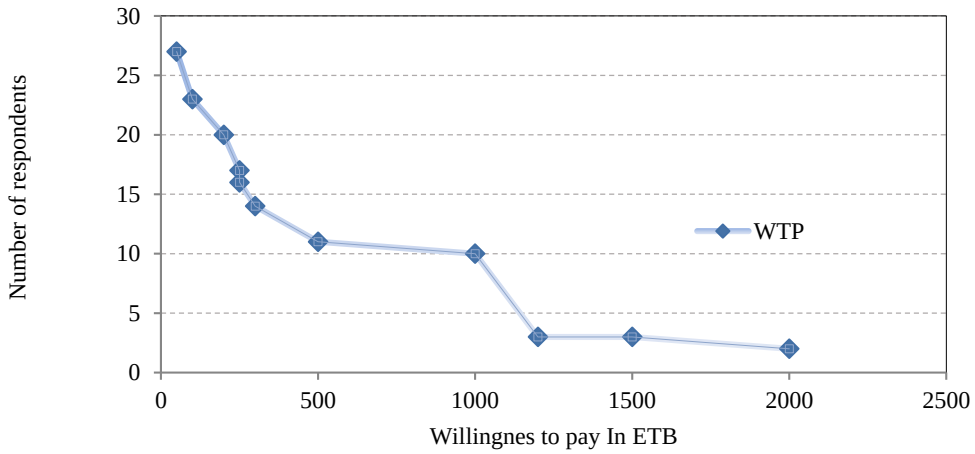

Figure 1. Household willingness to pay in cash (ETB)
Source: Own household survey result (2020)

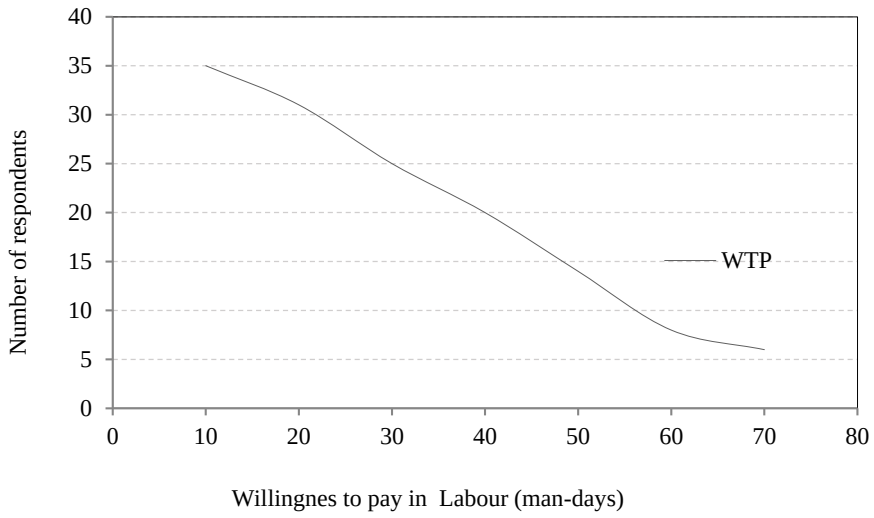

Figure 2. Household willingness to pay in labour (man-days)
Source: Own household survey result (2020)

Table 3: Reasons for being unwilling to participate in *Guizotia abyssinica* conservation

Reasons for not being willing to pay	Numbers of respondent	Frequency
Lack of labour and money	4	36.36
Lack of suitable land for *Guizotia abyssinica*	3	27.27
Lack of trust in conservation	4	36.36
Total	11	100

Source: Household survey result (2020)

These unwilling respondents are supposed to be valid (sensible) zero respondents. The grounds that they demonstrated their willingness to take an interest in the proposed conservation program. However, they couldn't bear the cost of any money for the conservation program. On the other hand, non-willing respondents expressed their justification not being willing to keep seed (27.27%) and Lack of suitable land for *Guizotia abyssinica* and lack of trust in the proposed conservation program (36.36%), respectively and they are supposed to be protest bidders.

Determinants of households' willingness to pay

To envisage determinants of households' ability to pay in cash and labour contribution for *Guizotia abyssinica* conservation fifteen independent variables were incorporated in the probit model (Table 4). The chi-square (χ^2) distribution is used to measure the overall significance of probit model estimation. The result shows that the chi-square distribution is 69.09% for cash, and 59.33% for labour (with 15 degree of freedom) at 1% level of significance. Among the variables in the model, frequency of extension contact, livestock holding, amount of credit received, income from farm activities, income from *Guizotia abyssinica* production and initial bid were statistically significant variables affecting household willingness to pay in cash. While livestock holding, amount of credit received, education of household head, perception of conservation problem sex of household head and initial bid were significantly affects household's willingness to contribute for conservation program in labour and livestock holding, amount of credit received and initial bid significantly affects household's willingness to pay labour and cash for conservation program.

The frequency of extension contacts of household had a positive and statistically significant effect on WTP. The most likely reason for the statistically significant relationship could be receiving enough access extension contact from development agent increase farmer's knowledge on seed conservation program. Studies indicated that access to agricultural extension affect farmers' private valuations of crop variety (**Asrat *et al.*, 2010**) and also farmers with more frequent extension more frequently participate on forest restoration program **(Mezgebo, 2012**). The marginal effect of variable showed that for each additional contact day with extension agents increased the likelihood of farmers WTP for conservation of *Guizotia abyssinica* by 1.4%, other factors being constant. This finding supported **(Belay *et al.*, 2020).** The household income from farm activities had a positive effect on their WTP for *Guizotia abyssinica* conservation. This result may be the household who gain more income from farm sources more management of seed and voluntary pay to conserve the crop. The study showed that amount of money that farmer earned positively affected their choice of any activity **(Asrat *et al.*, 2010).** When farmers are able to obtain high return from farming, they are not look for a supplementary source of income to satisfy at least the basic needs of their family and they will have allocated more time and money for conservation. The marginal effect of the variable indicated for one thousand increases in household farm income there is 33% increase their WTP for *Guizotia abyssinica* conservation, keeping other factors constant. The finding of **Ayalneh, (2012)** and **Mezgebo (2015)** show that household farm income

positively affects willingness to pay for improving of urban and rural water service provision. Income from *Guizotia abyssinica* production had also a positive effect on the household's willingness to pay cash for its conservation program. The more the farmers received profitable income from *Guizotia abyssinica* production; the more they allocate lands and more efforts for its conservation. For one thousand increases in income from *Guizotia abyssinica* production would increase the WTP for *Guizotia abyssinica* conservation by 1.3%, holding other factors constant. Similar findings indicated that income received from irrigation increased households' willingness to pay for improved irrigation **(Alhassan, 2013).** On the other hand, the total Livestock holding has a negative effect on the households' willingness to conserve *Guizotia abyssinica* in both financial and labour contribution. The possession of large numbers of livestock leads to a decrease in households' willingness to pay for *Guizotia abyssinica* conservation at 1% level of significance. The probable reason is livestock. It is considered as a measure of wealth in the rural households, but grazing lands for livestock became very critical in Ethiopia. As a result, farmers with large numbers of livestock (TLU) have allocated more land, budget and labour for livestock, than *Guizotia abyssinica* conservation. For each additional increment of livestock holding (TLU), the probability of households WTP will decrease by 1.2% in cash and 5.7% in labour. Studies indicated that there is low production of *Guizotia abyssinica* production in Guder and Ameya districts of Oromia because they give more focus for livestock production, allocating more land for the production of feed resources **(Tesfaye *et al.*, 2016).**

The proportion of land allocated to *Guizotia abyssinica* production had positive and significant effect on WTP in cash at 1% level of significance. The farm households who have large land were less likely to say no for the offered bid value for conservation program than households with small land. A one hectare allocated for *Guizotia abyssinica* production would increase the WTP for *Guizotia abyssinica* conservation by 54.2%, keeping other factors at constant mean. In addition, the amount of credit received was found to have positive and significant effect on the household's WTP for *Guizotia abyssinica* conservation. As the farmers receive large amount credit they are able to buy seed, labour and rent land for production and conservation of *Guizotia abyssinica.* A one thousand increase in household credit utilization would increase households' willingness pay in cash by 16.6% and 6.4% labour contribution. Farmers' perception about the problem of *Guizotia abyssinica* conservation has positive and significant effect on households' willingness to contribute labour. The awareness of households on the problem of Guizotia *abyssinica* seed endangering and its negative impacts motivated farmers to contribute the conservation program. The result show that household willingness for conservation increases by 54% for perceived farmers than the other counterfactual. This finding supported by **Asrat (2004)** and **Gebremariam, (2012).** The probit model has revealed a negative and significant effect of the initial bid at a 1% and 1% level of significance for both the cash payment and labour contribution respectively. The result is consistent with the economic theory of the law of demand, which says that quantity demand for goods diminishing as price rise up. The marginal analysis indicated that as the initial bid price rise by one unit, the probability of a household's WTP will drop by 7.1%, ceteris paribus. The marginal effect labour indicates that a one person-days increase for the contribution of the proposed project reduces the probability of being willing to pay by nearly 1.6%. This result supported by **Walle (2015), Ayenew and Meride (2015**) and **Ayana (2017).** The education level of the household head had positive and significant relation with household WTP for *Guizotia abyssinica* conservation. For each year additional increment of household education, the probability to contribute labour for *Guizotia abyssinica* conservation will increase by 25%, ceteris paribus. Age of the household head had negative effect on the willingness to pay of households for *Guizotia abyssinica* conservation. The result shows that for 1year increase in farmer's age the WTP to conserve *Guizotia abyssinica* will decrease by 2.9%, keeping other factors at mean. Studies show that there is negative relationship between age and WTP for investment in environmental protection (**Gebremariam, 2012**).

Welfare Measure and Aggregation benefit

The population choice biases, sampling frame bias, sample none response bias and sample selection bias are the four significant issues to be considered with respect to sample design and implementation to have a valid aggregation of benefits (**Mitchell and Carson, 1989**). A protests zero response was omitted from the analysis and probability of protest zeros was accounted in the assessment of the aggregated benefit. Hence, none of the above biases were expected in the analysis as shown in (Table, 5 and 6), the total economic value in cash and man-days were calculated as the mean WTP by the total number of households in 4 districts of West Shewa. As a result, the aggregate value of *Guizotia abyssinica* conservation in the study area was 1,718, 059 man-days and 23, 260, 839.15 Ethiopian Birr (ETB) per year.

CONCLUSION AND RECOMMENDATION

Sustainable development cares for conservation of endangered crops and environmental resources to optimize welfare of present and future generations. Conservation and management of crop genetic resources require farmers' financial and labour contribution. *Guizotia abyssinica* is one of the oil crops originated from Ethiopia, which is underutilized, neglected and poorly managed. This study was conducted to estimate farmers' willingness to pay for conservation of *Guizotia abyssinica* in West Shewa zone of Ethiopia. A probit model was employed to analyse the effect of different variables on farmers' willingness to pay for *Guizotia abyssinica* conservation program.

Table 4: Factors affect households' willingness to pay for *Guizotia abyssinica* conservation

Variable Name	Willingness to pay in ETB			Willingness to pay in day man labour		
	Coefficient	Standard Error	dy/dx	Coefficient	Standard error	dy/dx
Constants	9.3***	2.739	-	7.012	2.455702	-
Age of household	-0.038	0.028	0.032	-0.069	0.023	-0.029***
Sex of households	-1.187	1.022	-0.095	0.426	1.45	0.012
Family size of household	0.197	0.125	0.016	0.141	0.871	0.609
Perception of conservation problem	1.088	0.741	0. 091	1.240	0.599	0.54**
Education of households	0.294	0.378	-0.023	-0.523	0.250	0.023**
Livestock holding	-1.478***	0.642	-0.012	-1.331	0.481	-0.0577**
Proportion of land allocated for *Guizotia abyssinica* production	0.953**	0.542	-0.790	-0.046	0.261	-0.002
Total land owned	0.150	0.293	0.001	-0.022	0.129	-0.093
Frequency of extension contact	0.169***	0.067	0.014	-0.047	0.054	-0.002
Amount of credit received	0.198***	0.092	0.166	0.140	0.076	0.064**
Distance from FTC	0.420	0.233	0.035	0.030	0.164	0.013
Income from off-farm activities	0.060	0.062	0.005	0.034	0.045	0.148
Income from farm activities	0.0392**	0.0201	0.330	0.057	0.76	0.247
Income from *Guizotia abyssinica* production	0.152**	0.832	0.013	0. 024	0.030	0.600
Initial Bid value	-0.02***	0. 01	-0.071	-0.21***	0.010	-0.016
Number of observations			160			160
LR chi2(15)			69.09			59.33
Prob > chi2			0.000			0.000
Pseudo R2			0.668			56.5
Log likelihood			-22.468			-30.62

Note: *, ** and *** represents significance level at 10%, 5% and 1% probability level, respectively.

Source: model output of household survey result (2021); STATA 15

Table 5: Welfare measures and aggregate benefits by households in ETB

Name of District	Households District	Household sampled	Household protest	% of Protest Zeros	Expected protest	Households with valid response	Mean WTP	Total WTP by district in ETB
Dano	15117	43	5	0.1163	1758	13359	465	6211935
Iln Gelan	10689	31	3	0.097	1037	9654.58	465	448937
LibenJawi	10255	30	2	0.667	684	9571.33	465	4450669
Bako Tibe	19531	56	6	0.107	2089	17438.4	465	8108856
Total	55592	160	16	0.1	5559.2	50033		23260839

Source: Own computation from household survey results (2020)

Table 6: Welfare measures and aggregate benefits by households in labour man-days

Name of district	Households in district	Household sampled	Household protest	% Protest Zeros	Expected protest	Households with valid response	Mean WTP	Total WTP by district man labour
Dano	15117	43	2	0.047	710.5	14413.89	33.4	481423
Iln Gelan	10689	31	4	0.13	1390	9310	33.4	310954
Liben Jawi	10255	30	3	0.1	1026	9230	33.4	308282
Bako Tibe	19531	56	3	0.054	1055	18485	33.4	617399
Total	55592	160	12	0.2	11118.4	51423	33.4	1718 059

Source: Own Computation from household survey results (2020)

The result showed that households' WTP for *Guizotia abyssinica* conservation was in cash, in labour, or both. Total livestock holding, amount of credit received, frequency of extension contact, proportion of land allocated for *Guizotia abyssinica* production, income from *Guizotia abyssinica* production and income from farming activities have positive and significant effect on household WTP for *Guizotia abyssinica* conservation in cash, while age of households, farmers perception on problem of *Guizotia abyssinica* conservation, households education and amount of credit received had negative and significant effect on households WTP for conservation in labour contribution. To improve the *Guizotia abyssinica* conservation, policies should aim to improve frequency of farmers' extension contact, farm household education and solve financial constraints of farmers. Providing training for farmers on land use and management, conservation practice and attitude is also recommended to increase farmer's willingness to pay for *Guizotia abyssinica* conservation.

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RETRACTION NOTE: UNDERSTANDING THE LINKAGE BETWEEN SOCIAL CAPITAL AND MAIZE AVAILABILITY EQUIVALENT AMONG SMALLHOLDER MAIZE-LEGUME FARMERS IN KENYA

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We the authors, are retracting the above regular article as we understand that the paper fell short of the ethical requirements as per the project supervisors.
We understand that the acknowledgement of the funding institution was not properly done.

We are retracting the above article, as we address the issues raised by the Principal Investigator. The concerns are very valid especially around how the citation and acknowledgement were done.

We deeply apologize to the scientific community for this failure.

All authors agree to this retraction.

Retracted: 14.7.2021

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WHAT FACTORS ARE INFLUENCING MEMBERS' WILLINGNESS TO CONTRIBUTE EQUITY CAPITAL IN AGRICULTURAL COOPERATIVES?

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ABSTRACT

Research background: In the current competitive agricultural market, where substantial capital investment is required to pursue growth related competitive strategies, agricultural cooperatives' performance mainly relies on members' willingness to contribute equity capital. Members are the single and most important source of investment capital.
Purpose of the article: This study investigated factors influencing members' willingness to contribute equity capital to their agricultural cooperatives in Ethiopia with the intention of providing empirical evidences to decision makers with regard to specific measures to be taken to enhance members' willingness to contribute equity capital, and thereby improve agricultural cooperatives' performance.
Methods: Multi-stage random sampling technique was employed to select the study districts, farmer associations, agricultural cooperatives and respondent households. Semi-structured questionnaire was employed to collect cross-sectional data from randomly selected 214 households. The data were analysed using binary logistic regression model.
Findings & value added: We found that education level; past role as a committee member; trust on other members' commitment and directors' leadership – influence positively and significantly members' willingness to contribute equity capital. While age and perception on the cooperatives' weaknesses affect negatively and significantly members' willingness. The important policy recommendations are developing and fostering trust among members and between members and directors; re-orienting service provisions in line with the needs and interests of their members; assessing agricultural cooperatives' performance depending on the values that their members expect to obtain from membership. This study investigated the influence of trust on members' willingness to contribute equity capital, and hence will add value to better understanding of the role of trust in enhancing members' commitment in cooperative organizations. Lastly, this cross-sectional survey study subjected to limitations associated with this type of study. Hence the generalizability of its results to other areas of agricultural cooperatives needs further investigation.

Key words: agricultural cooperatives; members' willingness; equity capital contribution; binary logit; Ethiopia
JEL Codes: D02, Q13, R20

INTRODUCTION

In developing countries, market participation is one of important strategy which can assist smallholder farmers to earn improved incomes, and consequently come out of poverty (**Grashuis and Su, 2018**; **Verhofstadt and Maertens, 2014**; **WB, 2012**). However, in these countries majority of smallholders are excluded from markets. Markets in these countries are characterized by pervasive failure. According to **Adjemian *et al.* (2016)** and **Nilsson (2001)**, market failures are the results of a business environment generally characterized by difficult or weak contract enforcement, asymmetric information, high risks and high transaction costs. Under such business environment, individual smallholders are unlikely to participate or if so, they fail to realize the full benefits of their participation. As a result, in developing countries, collective action institutions such as agricultural cooperatives are promoted to overcome market failure and facilitate smallholder farmers' participation in modern national and international markets (**Fischer and Qaim, 2012; WB, 2012**).

However, since liberalization of markets through structural adjustment the competitive environment in which agricultural cooperatives operate has been changing. Withdrawal of government, removal of subsidies and the opening-up of national markets to large local and foreign business organizations have been exposing agricultural cooperatives to fierce competitions (**Grashuis and Su, 2018; Benos *et al.*, 2016; Chaddad and Iliopoulos, 2013**). Hence, in order to access to and survive in the current competitive markets, agricultural cooperatives need to invest on growth related competitive strategies such as value adding and processing activities, and brand name development (**Bijman *et al.*, 2016**). However, very few agricultural cooperatives are investing

in growth strategies in developing countries. For instance, it is a common complaint among literature that many, oftentimes most, agricultural cooperatives in developing countries, including Ethiopia, have very weak investment capacity to invest in growth strategies, and hence unable to access to modern markets (**Gashaw and Kibret, 2018; Amene, 2017; Hagos and Geta, 2016; Chaddad and Iliopoulos, 2013**). The problem of investment capital that arise due to members' reduced willingness to contribute equity capital has often been cited as the main reason for agricultural cooperatives' weak investment capacity (**Grashuis and Su, 2018; Emana *et al*., 2016; Delelegne *et al*., 2016; Mojo *et al*., 2016; Dejene and Regasa, 2015**).In this regard, investigating factors influencing members' willingness to contribute equity capital plays important role in overcoming agricultural cooperatives' investment capital constraints.

Nevertheless, prior empirical works on the performance of agricultural cooperative and factors influencing it in Ethiopia focuses on profitability and management efficiency factors, while treating members' willingness to contribute equity capital least. For instance, according to **Amene (2017)** the two important factors influencing agricultural cooperatives' performance are the volume of profit generated and, the management and technical skills of board members. However, agricultural cooperatives' profit generation through efficient business management presupposes that they already have the capital for investments. But as discussed in the previous paragraph, the cooperatives' main performance problem is constraints of investment capital. Thus, it is by far better to focus on their investment capital constraints rather than focusing on profitability and management efficiency. And in agricultural cooperatives, the single most important source of investment capital is member contributed equity capital. It is therefore, paramount important to assess factors influencing members' willingness to contribute equity capital. Identifying such factors will inform decisions with regard to specific measures to be taken to enhance members' willingness, and thereby overcome agricultural cooperatives' constraints of investment capital.

However, to the best knowledge of the authors, factors influencing members' willingness to contribute equity capital are not investigated in Ethiopian agricultural cooperatives context. To fill this knowledge gap, this study investigated factors influencing members' willingness to contribute equity capital, and employed social capital and behavioural theories as its main theoretical perspective. We assume that members' willingness to contribute equity capital is a behavioural decision and influenced by various factors such as the existence of social capital (trust among members and between members and directors) and behavioural traits (attitude towards making equity capital contribution), including resource endowment (such as demographic and socio-economic characteristics).

LITERATURE REVIEW

Members' willingness can be defined as the motivation of a member to make equity capital contribution, in the form of direct investment method (besides membership fee and retained dividend or saving) for his/her cooperative's investment in growth strategies (**Li *et al*., 2015; Nilsson, 2001**). Several literatures highlighted members' willingness to contribute equity capital as the most important factor for improving agricultural cooperatives' performance (**Gelo *et al*., 2017; Bijman *et al*., 2016; Kontogeorgos *et al*., 2014; Wang and hue, 2013; Hao, 2013; Othman *et al*., 2012**). These authors concluded that as gaining investment capital from external sources is a costly affair, and as member contributed equity capital is the single and important option, agricultural cooperative's success highly hinges on members' willingness. **Bijman *et al*. (2016)** found that willingness of members is treated as elements for enhancing the performance of agricultural cooperatives. These authors argued that to retain members' willingness, it is crucial to know influencing factors. Hence, interventions focused on overcoming the performance problems of agricultural cooperatives shows high interest to members' willingness and its influencing factors (**Gelo *et al*., 2017; Alho, 2016**). Thus, it is imperative to investigate factors influencing members' willingness to contribute equity capital.

Various factors could influence members' willingness to contribute equity capital. Theoretical argument such as social capital theory shows the influence of trust (**Putnam, 1993**). In light with social capital theory, where there is trust among members and between members and directors, the likelihood of members' willingness to contribute equity capital increases (**Feng *et al*., 2016; Valentinov, 2007**). **James and Sykuta (2006)** and **Hansen *et al*. (2002)** empirically confirmed this theoretical argument. These authors used hierarchical regression analysis, and found a significant and positive association between members' trusts on other members' commitment and directors' leadership, and their commitment to contribute equity capital.

Another theoretical argument such as planned behaviour theory shows the influence of attitude, such as members' attitude towards making equity capital contribution (**Ajzen, 1991**). In light with this theory, members' positive attitude increases the likelihood of their willingness to contribute equity capital. Members' attitude in turn is the outcome of their perception on the cooperative's weaknesses. Those members who perceived the cooperative's weaknesses will develop negative attitude, and hence will have reduced willingness to contribute equity capital. **Hakelius and Hansen (2016)**, **Kontogeorgis *et al*. (2014)** and **Wang and Hue (2013)** empirically confirmed this theoretical argument. These authors, using binary and ordinal logistic regression analysis respectively, found negative and significant association between members' perception on the cooperative's weaknesses and their willingness to contribute equity capital. Likewise, other behavioural theory, norm activation theory, shows the influence of awareness such as members' awareness on the need of contributing equity capital and their responsibility to make equity capital contribution (**Schwartz and Howard, 1982**). Members could develop such awareness through their membership status, such as through their membership duration, serving as a committee member in

the cooperative, and participation in trainings. **Azmha *et al*. (2012)** and **Minguez – Vera *et al*. (2010)** empirically confirmed this theoretical argument. These authors, using ordinary least square and binary logit respectively, found positive and significant association between members' membership status and their willingness to contribute equity capital.

In their respective studies, the above empirical works had controlled for the influence of demographic and socio-economic characteristics (such as age, education, family size and access to credit). And found statistically significant influence these characteristics on members' willingness to contribute equity capital. In this study, the selection of explanatory variables was guided by the above theoretical and empirical studies.

DATA AND METHODS

Description of Agricultural Cooperatives in the Study Area

East Hararghe Zone is among the pioneer areas in Ethiopia where agricultural cooperatives flourished. However, during the military regime (1974–1991) most cooperatives were disbanded. Moreover, since 1991, under the current government, significant expansion of agricultural cooperatives has been witnessed in the East Hararghe Zone (**Delelegne *et al*., 2016**). According to the Zone's agricultural office, in 2019, there were seven unions and 1157 primary cooperatives that had 240,710 members (74,270 females and 166,440 males) in the Zone. From among the 1157 primary cooperatives, 359 were marketing, 356 were saving and credit, 379 were multipurpose, and 63 were consumer cooperatives, respectively. The information from the Zone also revealed that the unions and the primary cooperatives together had a total asset (saving) of 32,558,080 Eth. Birr (equivalent to 930,230.86 USD; exchange rate: 1 USD = 34.99 Eth. Birr) and a capital worth 91,250,049 Eth. Birr (equivalent 2,607,144.26 USD, exchange rate: 1USD = 34.99 Eth. Birr). However, the same source further indicated that the performance of the agricultural cooperatives in the Zone is not satisfactory with regard to access to modern markets. The number of failing/quitting agricultural cooperative in the Zone was found to be relatively higher than the number in the other Zones in Oromia Regional State. This scenario made the Zone ideal for the purposes of this study and this was why East Hararghe Zone was purposefully selected for the study.

Sampling Method and the Data

Study participants (cooperative member households) were selected using multistage sampling techniques. In the first stage, five districts (Haramaya, Babile, Kombolcha, Jarso and Chelenko) were purposively selected due to the availability of a relatively high numbers of functioning agricultural cooperatives than in the other districts of the Zone. Then, after excluding *kebeles* with non-functioning cooperative, in the second stage, from each of the five districts, one *kebele* with multipurpose primary agricultural cooperatives were randomly selected. A 'kebele' is the smallest administrative unit in Ethiopia. In the third stage, from the target sample of five agricultural cooperatives (which have 1224 members), 301 sample respondents were drawn using the mathematical equation developed by **Yamane (1967).** The authors used the following formula to define the required sample size at 95% confidence level, degree of variability of = 0.5 and with desired level of precision required = 0.5%.

$$n = \frac{N}{1 + N(e)^2}$$

Where:
n the sample size,
N the population size, and
e is the level of precision.

$$n = \frac{1224}{1 + 1224(0.5)^2}$$

$$n = 301$$

In fourth stage, the determined sample size was distributed to each cooperative on the basis of probability proportional to size (PPS) using the following formula:

$$n_1 = \frac{nN_1}{N}$$

Where:
n determined sample size
N target population
N_1 total number of population in each cooperatives
n_1 number of samples in each cooperative.

In the fifth stage, to select respondent households from the member registration lists of the five multipurpose agricultural cooperatives, a simple random sampling technique was applied. We distributed 301 questionnaires, from among which 251 questionnaires were filled and returned. Of these, 37 were dropped as they were improperly answered (filled). Thus, with 71.1% response rate, the final sample was 214 households.

In the five districts, the survey was conducted from August to November, 2019. Data were collected using a semi-structured questionnaire. After preparing the questionnaire, to check whether we included all the necessary questions in the questionnaire, we consulted key informants such as cooperative members, directors and officials working in the districts and the Zone cooperative promotion offices. These allowed us to ensure the inclusion of all the necessary questions in the questionnaire. Further, we pre-tested the questionnaire on non-sampled cooperative member households and made the necessary amendments. The questionnaire was first written in English language then translated to the Afan Oromo language spoken by the people in the region. Finally, data were collected by six enumerators who were fluent in speaking and writing the local language and well acquainted with the method of data collection.

Methods of Data Analysis

In this study, some explanatory variables such as trust (has two types: trust on other members' commitment and directors' leadership) and perception (perception on the

cooperative's weaknesses) were not directly measured through the survey questionnaire. As a result, data analysis preceded three steps.

Measuring trust

It is difficult to measure trust directly by the survey questionnaire using one item with dichotomous response categories (yes and no). In this regard, **Cummings and Bromiley (1996)** suggested the use of multi-item questions with multiple response categories for measuring trust. According to these authors, using multi-item questions with multiple response categories provides a more valid as well as a more substantively detailed measurement. Former empirical study such as **Feng *et al*. (2016)**, **James and Sykuta (2006)** and **Hansen *et al*. (2002)** employed multi-item questions with multiple response categories for measuring cooperative members' trust on other members' commitment and directors' leadership.

Guided by the above empirical works, in this study, we measured trust using four questions with five-point rating scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree) in the questionnaire (see Table 1). To create single trust value, we added the values that respondents assigned to the four items (using the transform and then compute variables command; available in SPSS version 20). Then, to create two levels of trust (high and low), a composite score was computed on the added value. With four items of five response categories, a respondent can score a maximum of 20 points and a minimum of 4 points. The categorization into high and low trust was achieved using a composite score as follows: high trust category = between the mean value to maximum points, and low trust category = between the minimum points to the mean value. However, before adding and computing composite score, the four items were subjected to reliability tests using Cronbach's Alpha coefficient.

Measuring perception

Perception is difficult to measure directly by the survey questionnaire. Hence, the respondents' perception on their cooperative's weaknesses was measured via 10 multi-item questions in the questionnaire (Table 2) whose selection was guided by prior similar empirical works (**Hansen *et al*., 2002; Minguez – Vera *et al*., 2010; Othman *et al*., 2012; Kontogeorgeos *et al*., 2014; Alho, 2016**) and the authors own consult with cooperative members, directors and officials working in the districts and the zone cooperative promotion offices. In the study respondents indicated their perceptions on a five point Likert scale (1 – strongly disagree, 2 – disagree, 3 – neutral, 4 – agree and 5 – strongly agree).

To determine the underlying perception variables, factor analysis was performed on the responses given by respondents to the ten multi-item questions. Factor analysis is a statistical technique for identifying the underlying perceptions (factors) measured by the ten perception questions (**Field, 2005**). Previous empirical studies which employed factor analysis include **Minguez–Vera *et al*. (2010)**, **Othman *et al*. (2012)**, **Kontogeorgeos *et al*. (2014)** and **Alho (2016)**. However, before factor analysed, the ten perception questions were subjected to internal consistence and reliability tests using correlation analysis and Cronbach's Alpha coefficient respectively.

Logistic regression model specification

The dependent variable members' willingness to contribute equity capital is a dichotomous outcome variable: willing to contribute or not-willing to contribute. When the dependent variable has two nominal outcomes, like in this study, the best suiting econometric model is either Logit or Probit regression (**Field, 2005**). The two models (Logit and Probit) are more analogous since both models provide equally efficient parameter estimates. Despite their comparable advantages, however, **Gujarati (2008)** suggested the use of Logit than Probit Model when continuous independent variables are included in the model. Therefore, in this study, since the independent variables are constituted from both categorical and continuous variables Logit Model was selected. Moreover, logistic regression is a known and relatively easily understandable method for most researchers and it is implemented in all basic statistical software such as SPSS, Stata, Statistica, SAS, R, etc. (**Gujarati, 2008**). Prior similar empirical studies such as **Kontogeorgeos *et al*. (2014)** and **Othman *et al*. (2012)** employed logit model to determine factors influencing members' willingness to contribute equity capital.

The binary logistic regression model is a type of generalized linear model that extends the linear regression model by linking the range of real numbers to the range or probabilities 0 – 1. The probability that a respondent household to be in the category of "willing to contribute" (Eq. 1).

$$p[Yes] = \frac{1}{1+e^{-\beta x}} \quad (1)$$

Where:

β is a vector of parameters to be estimated and x is a vector of explanatory variables.

The probability that a respondent household to be in the category of "not-willing to contribute" (Eq. 2-3).

$$p(no) = 1 - p(yes) \quad (2)$$

$$p[no] = \frac{1}{1+e^{\beta x}} \quad (3)$$

Manipulation of Equation (2) and Equation (3) gives Equation 4.

$$1 - p(yes) = \frac{1}{1 + e^{\beta x}}$$

$$\frac{p(yes)}{1-p(yes)} = e^{\beta x} \quad (4)$$

Where:

$e^{\beta x}$ is the ratio of the probability of a "willing to contribute" to the probability of a "not-willing to contribute" category. The logarithm of odds ratio is expressed as the Equations (5-6).:

$$1n\left[\frac{p(yes)}{1-p(yes)}\right] = \beta x \quad (5)$$

$$WTC = \alpha + \beta_1 socio - economic\ and\ demographic\ characteristics + \beta_2\ membership\ status + \beta_3\ trust + \beta_4\ perception + \mathcal{E} \quad (6)$$

Where:
α is intercept, WTC is willingness to contribute equity capital, socio-economic and demographic characteristics (household head's age (AGE), education level (EDU),household size (HHSIZ) and taking credit (CREDIT)), membership status(membership duration (MEMBDUR),present role as a committee member (SRVCMM), past role as a committee member (EXCMM)and participation in trainings (TRANING)), trust (trust on other members' commitments (TRUST1) and trust on directors' leadership (TRUST2)), and perception (perception on the cooperative's weakness, factor analysed (FACTOR)) and Ɛ is the error term which is logistically distributed. Explanatory variables and their expected effects are presented in Table 3.

RESULTS AND DISCUSSION

Trust among Members and between Members and Directors

Composite score was computed to create two levels for respondent households' trust. For this, we calculated the mean, maximum and minimum values on the added trust value. The mean of the whole households' trust on other members' commitment was 12.69, the maximum value was 19 and the minimum value was 4. Then, using these values, two levels of households' trust on other members' commitment was created. Mean value (12.69) to maximum value (19) are categorized into high trust and labelled as 1, and minimum value (4) to mean value (12.69) are categorized into low trust and labelled as 0. The mean of the whole households' trust on directors' leadership was 12.43, the maximum value was 20 and the minimum value was 4. Then, using the same procedure with the above, two levels of households' trust on directors' leadership was created. Accordingly, respondent households' trust on other members' commitment (TRUST1) and directors' leadership (TRUST2) was depicted in Table 4.

As revealed in Table 4, respondent households had more trust on other members' commitment (43.9%) than on directors' leadership (39.7%). This implies that in agricultural cooperatives more members (60.3%) had low trust on directors' leadership. This could be because of members' difficulty to identify the leadership capacity of directors.

Factor analysis

Factor analysis, more specifically, principal component factor analysis was computed on the ten perception questions to identify the underlying respondent households' perception on their cooperatives' weakness. Principal component analysis assumes correlation (internal consistency) between the ten perception questions, and hence the first step was deriving correlation matrix (Table 2). The correlations among the 10 perception questions were substantial, implying that they are appropriate for principal component analysis. We also checked for their reliability using Cronbach's Alpha coefficients. The acceptable value for Cronbach's Alpha coefficient is greater than or equal to 0.7 (**Gujarati, 2008**). The value of Cronbach's Alpha coefficient for all of the ten perception variables was greater than 0.940, indicating that the ten items were reliable to measure households' perception and they are appropriate for factor analysis.

We further checked the adequacy of sampling for factor analysis using Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. KMO value of 0.5 is minimum (barely accepted), between 0.7-0.8 acceptable and above 0.9 are excellent. Our KMO value is0.932 (Table 5), which indicate excellent sampling adequacy. We further checked the Bartlett's test of sphericity. Bartlett's test is another measure for the strength of the relationship among the ten perception questions. The Chi-Square result for Bartlett's test of sphericity was 1712.633 (χ^2(df45) = 1712.633, p < 0.001) (Table 5), which indicate strong relationship among the ten perception questions and their appropriateness for factor analysis.

Then we proceeded to factor analysis, the extraction method was principal component analysis, the number of factors to be retained was determined by eigenvalue greater than or equal to one, and the nature of relationship between factors was uncorrelated (orthogonal). The factor analysis with Kaiser Normalization and Varimax Rotation converged on two factors after three iterations.

Table 1: Measuring trust and reliability test

Variable	Item	Cronbach's Alpha
Members' trust on other members' commitment	1. Other coop. members can be trusted for being committed 2. Other coop. members have a reputation for being trustworthy 3. Most members have no intention to cheat on other members 4. I trust on other members' willingness to cooperate	0.747
Members' trust on directors' leadership	1. Directors can be trusted for being good leaders 2. Directors have a reputation for being trustworthy 3. I implicitly trust the decisions made by directors 4. Most directors have no intention to cheat members	0.823

Note: All are measured with five-point rating scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree
Source: Survey Data (2019)

Table 2: Correlation Matrix

	1	2	3	4	5	6	7	8	9	10
1. Weak member commitment	1									
2. Not responding to members' demand	.621**	1								
3. Decreasing membership	.666**	.731**	1							
4. Weak control over members	.700**	.598**	.739**	1						
5. Weak market linkage	.487**	.593**	.562**	.492**	1					
6. Inability to provide inputs on the right time	.536**	.705**	.604**	.483**	.733**	1				
7. Biased credit provision	.639**	.708**	.674**	.648**	.557**	.639**	1			
8. Difficulty to know about directors' actions	.538**	.659**	.585**	.483**	.698**	.816**	.648**	1		
9. Poor extension service provisions	.730**	.655**	.769**	.728**	.424**	.527**	.651**	.536**	1	
10. Members' poor participation in general assembly	.521**	.598**	.543**	.476**	.487**	.627**	.618**	.675**	.543**	1

Note: ** Correlation is significant at 0.01 level (2-tailed).

Table 3: Explanatory variables, acronyms, measurement and prior expected influence

Variable	Acronym	Measurement (anticipated influence)
Socio-demographic characteristics		
Household head's age	AGE	In number of years (-)
Household head's education level	EDU	Number of years attended in formal edu. (+)
Household size	HHSIZ	Number of persons living in the HH (+)
Taking credit	CREDIT	1 for Yes, 0 otherwise (+)
Membership status variables		
Membership duration	MEMBDUR	Number of years in the cooperative
Present role as a committee member	SRVCMM	1 for Yes, 0 otherwise (+)
Past role as a committee member	EXCMM	1 for Yes, 0 otherwise (+)
Participation in trainings	TRANING	1 for Yes, 0 otherwise (+)
Trust variables		
Trust on other members' commitment	TRUST1	1 for Yes, 0 otherwise (+)
Trust on directors' leadership	TRUST2	1 for Yes, 0 otherwise (+)
Perception variables		
Perception on the coop. weaknesses	FACTOR	Factor analysed (-)

Source: Survey data (2019)

Table 4: Members' trust on other members' commitment and directors' leadership

Trust type	Trust level	Frequency	Percent	Overall mean	Overall Std. Dev.
TRUST1	Low	120	56.1	1.44	0.50
	High	94	43.9		
	Total	214	100.0		
TRUST2	Low	129	60.3	1.41	0.49
	High	85	39.7		
	Total	214	100.0		

Source: Survey Data (2019)

Table 5: Factor analysis on perception variables

Variable	Communalities	Factor loading after Varimax	
		Factor1	Factor2
1. Weak member commitment	0.737	0.795	
2. Not responding to members' demand	0.728		0.615
3. Decreasing membership	0.789	0.784	
4. Weak control over members	0.789	0.853	
5. Weak market linkage	0.711		0.803
6. Inability to provide inputs on the right time	0.853		0.873
7. Biased credit provision	0.709	0.632	
8. Difficulty to know about directors' actions	0.840		0.865
9. Poor extension service provisions	0.823	0.863	
10. Members' poor participation in general assembly	0.603		0.667
Eigenvalue		6.544	1.039
Variance explained		65.436	10.383
Total variance explained		75.822	
KMO measure of sampling adequacy		0.932	
Bartlett's test of Sphericity		$\chi^2(df45) = 1712.633, p < 0.001$	

Note: Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
Rotation Converged in 3 iterations.
Source: Survey data (2019).

The first factor was named as poor extension service provision (FACTOR1) and the second factor was named as inability to provide inputs on the right time (FACTOR2) (the names are arbitrary, taken from the item which has the highest correlation coefficient in each factor). The detail about the ten perception variables, communalities (R^2), factor loadings and the emerged two factors are depicted in Table 5.

We observed in Table 5 that the first factor (FACTOR1) has emerged as the highest households' perception on the cooperatives' weaknesses, explaining 65.44%. Under this factor, five measures (poor extension service provisions, weak control over members, weak members' commitment, decreasing membership and biased credit service provision) were converted into one factor. The second factor (FACTOR2) has emerged as the second highest households' perception on the cooperatives' weaknesses, explaining 10.38%. Under this factor, five measures (inability to provide inputs on time, difficulty to know about directors' actions, weak market linkage, members' poor participation in general assembly and not responding to members' demands) were converted into one factor.

To create two uncorrelated perception scale scores and use them in the logistic analysis, first, we tested for the reliability of the two factors. The Cronbach's Alpha values for the first and second factors were 0.917 and 0.906 respectively, which are acceptable. Then, we set factor scores to be calculated and saved on the data set using Anderson – Rubin method (available in SPSS version 20). Accordingly, the factors of each variable were transformed into two factor scores (FACTOR1 and FACTOR2, with mean = 0E-7 and standard deviation = 1.00) by Anderson – Rubin method. Nevertheless, when we checked correlation, the two factor scores had high correlation. Hence, it was unnecessary to use both in the regression analysis. As a result, we selected FACTOR1 for the logistic analysis, this was because FACTOR1 explained the highest variation in respondent households' perception on the cooperatives' weaknesses than FACTOR2 (see Table 5).

Agricultural cooperatives' weaknesses as perceived by their members

We also generated simple descriptive statistics to summarize the univariate distributions of the rates for each of the ten items, which revealed the prevailing weaknesses of agricultural cooperatives as perceived by respondent households (Table 6).

As shown in Table 6, the means for each of the items appear to be reasonable as each of the items is measured on a 5 – point Likert Scale. No values are above 5 or below 1. The standard deviations did not vary a lot, suggesting that there are no outliers for any of the items. Based on the rating of the last two response categories (Agree and Strongly Agree), the result shows that cooperative's weakness related to market linkage was the highest rated item. The implication is that agricultural cooperatives in

the study area were weak with respect to market linkage. The second highly rated item was difficulty of knowing about directors' actions. The implication is that it was difficult for members to know about their directors' actions in the study area of agricultural cooperatives. The result in Table 6 also shows that the third highly rated item was cooperatives' inability to provide inputs on the right time. The implication is that agricultural cooperatives in the study area were weak with regard to supplying inputs on the right time. In a situation of climate change, in an unpredictable weather conditions, inability to obtain inputs on the right time could have many devastating effects on member farmers, such as exposure to risks related to climate change. Exposure for such risks in turn affects their level of production and profitability. Our result is consistent with the results reported by **Amene (2017)** and **Dejene and Regasa (2015)**. These authors in their results reported agricultural cooperatives' weaknesses with regard to market linkage and input supply on the right-time.

Descriptive analysis

We also computed independent sample t-test on continuous explanatory variables to look at mean difference between willing and not-willing households, and cross-tabulation to look at associations between categorical explanatory variables and the outcome variable. Table 7 and Table 8 show the results of the independent sample t-test and the cross-tabulation respectively.

Independent sample t-test of households' willingness for each of the continuous explanatory variables is shown in Table 7. Compared to non-willing household heads, willing household heads were younger in age. The t-test for equality of means is statistically significant at 1% level of significance. Indicating that, there are differences between willing and not-willing households with respect to the age of the household heads (AGE). The t-test has a negative sign, implying that compared to elder household heads, younger household heads were more willing to contribute equity capital.

Formal education (EDU) is deemed to enhance one's ability to compare the advantages and disadvantages of investment, and quickly reach a decision, like decision on equity capital contribution. If this is the case members' willingness could vary depending on their level of formal education. In our result the t-test is significant at less than 1% significance level, indicating that there is a difference between willing and not-willing households that could be explained by the household head's formal education level. The t-test has a positive sign, indicates that formal education increases willingness. The insignificant t-test result for household size (HHSIZ) implies that there is no difference between willing and non-willing households with respect to their household size. Likewise, there is no difference between willing and non-willing households with respect to their membership duration (MEMBDUR) in agricultural cooperatives.

Members are less likely to contribute equity capital once after they perceived their cooperative's weaknesses. As shown in Table 7, not-willing households than willing household perceived more on the cooperative's weaknesses (FACTOR1). The t-test revealed a significant result, indicating that there is a difference between willing and not-willing households with respect to their perception on the cooperative's weakness. It has a negative sign, indicating that perception on FACTOR1 decreases households' willingness to contribute equity capital.

Cross tabulations of willingness by each of the categorical explanatory variables is shown in Table 8. As the result shows, with regard to taking credit (CREDIT), the proportion of willingness to contribute equity capital was highest among households who took credit (while 59.52% (50 out of 84) of households who took credit were willing, only 41.54% (54 out of 130) of households who did not take credit were willing). The chi-square test of association at 6.608 is significant ($p < 0.05$), implying that there is an association between households taking credit and their willingness to contribute equity capital.

With respect to present role as a committee member in the cooperative (SRVCMM), the proportion of willingness was highest among households who have present role. As seen in the result, while 62.12% of households with present role as a committee member were willing, only 42.57% of households without present role as a committee member were willing. The chi-square test of association at 6.986 is significant ($p < 0.05$), implying that there is association between households' present role as a committee member and their willingness to contribute equity capital. Similarly, the proportion of willingness increases for households who have past role as a committee member (EXCMM). The chi-square test of association at 66.988 is highly significant ($p < 0.001$), implying that households' past role as a committee member and their willingness have association. However, with respect to participation in trainings (TRANING) the chi-square test of association revealed insignificant result, implying that households' participation in trainings is not associated with their willingness to contribute equity capital.

The existence of trust among members, and between members and directors is a sign of reduced opportunistic behaviour both from members as well as directors. Such scenario is more likely to enhance members' willingness to contribute equity capital. With respect to trust on other members' commitment (TRUST1), as shown in Table 8, the proportion of willingness was highest among households who have trust on other members' commitment. While 82.98% of households who have trust on other members' commitment were willing, only 21.67% of households who do not trust on other members' commitment were willing. The chi-square test of association at 79.321 is highly significant ($p < 0.001$), implying that there is an association between households' trust on other members' commitment and their willingness to contribute equity capital. Similarly, the proportion of willingness increases for households who have trust on directors' leadership (TRUST2). The chi-square test of association at 101.435 is highly significant ($p < 0.001$), implying that households' trust on directors' leadership and their willingness to contribute equity capital have association.

To sum up, in the descriptive analysis we observed that most of our explanatory variables, except household size (HHSIZ), membership duration (MEMBDUR), and participation in trainings (TRANING), have statistically significant results. Hence, except HHSIZ, MEMBDUR and TRANING all the explanatory variables were selected for further analysis in the logistic regression model.

Factors Influencing Members' Willingness to Contribute Equity Capital

Before running the model, we first tested for its effectiveness. The model adequately fits our data set (Omnibus Test of Model Coefficient was $\chi^2(8) = 249.020$, $p < 0.001$, and Hosmer and Lemeshow test static was 5.749; ($\chi^2(8) = 0.194$, $p = 0.675$). The model accurately predicts the outcomes for each case (-2 log likelihood = 47.479). The -2 log likelihood or the deviance is a measure of how much unexplained variation exists in our logistic regression model. Accordingly, low value indicates low variation, and hence high accuracy of the model. The model explained 91.7% of the variances (Nagelkerk R^2 = 0.917). Table 9 shows the results of the logistic regression using the enter method.

The logistic regression results in Table 9 show that from among the eight explanatory variables, six variables had statistically significant influence on households' willingness to contribute equity capital. These explanatory variables include age (AGE), education (EDU), past role as a committee member (EXCMM), trust on other members' commitment (TRUST1), trust on directors' leadership (TRUST2), and perception on the cooperative's weakness (FACTOR1).

Household heads' age (AGE) negatively influenced willingness to contribute equity capital at less than 1 percent level of significance. The negative significant coefficient of age indicates that increase in household heads' age is associated with decreasing odds ratio of willingness to contribute equity capital. The Exp (B) column (the odds ratio) indicates that a unit increases in household heads' age by one year, decreases the likelihood of willingness to contribute equity capital by 0.749 units. This implies that compared to elderly household heads, young household heads had more likelihood of willingness to contribute equity capital. This result is contrary to the result reported by **Othman *et al.* (2012)**. These authors indicate a positive and significant influence of household heads' age on their willingness to contribute equity capital. One possible reason for our contrary result could be the time restriction put on members' residual income rights (benefit earning). In agricultural cooperatives members are allowed to earn benefit from their investments only during their membership periods. As a result, old age members may not earn the full benefits of their invested assets, and hence likely to have reduced willingness to contribute equity capital.

Household heads' education level (EDU), years spent in formal education, positively influenced willingness to contribute equity capital at less than 5 percent level of significance. The positive significant coefficient of education indicates that increase in household heads' formal education level is associated with increasing odds ratio of willingness to contribute equity capital. A unit increases in household heads' education level by one year, increases the likelihood of willingness to contribute equity capital by 1.290 unit. This implies that household heads with more formal education had more likelihood of willingness to contribute equity capital than household heads with less formal education. This result is similar with **Kontogeorgeos *et al.* (2014)** who in their result indicate a significant and positive influence of household heads' education level on their willingness to contribute equity capital.

From among membership status, past role as a committee member (EXCMM) positively influenced willingness to contribute equity capital at less than 5 percent level of significance. Compared to households who responded no to past role as a committee member (the reference categories), the odds of willingness to contribute equity capital was 16.352 times higher for households who responded yes to past role as a committee member. This result is parallel with **Minguez – Vera *et al.* (2010)** and **Azmha *et al.* (2012)**. These authors in their results indicate positive and significant influence of past role as a director on members' willingness to contribute equity capital.

Table 6: Descriptive statistics on the ten perception variables (No. 214)

Variables	Mean	Std. Dev.	Response categories				
			SD	D	N	A	SA
1. Weak member commitment	2.785	1.237	28	89	16	63	18
2. Not responding to members' demand	2.991	1.237	18	84	20	66	26
3. Decreasing membership	2.822	1.145	21	89	21	73	10
4. Weak control over members	2.785	1.241	29	89	11	69	16
5. Weak market linkage	3.537	1.120	6	42	44	75	47
6. Inability to provide inputs on the right time	3.252	1.172	13	56	40	74	31
7. Biased credit provision	3.108	1.412	27	71	18	48	50
8. Difficulty to know about directors' actions	3.393	1.128	10	48	36	88	32
9. Poor extension service provisions	2.458	1.309	60	79	5	57	13
10. Members' poor participation in general assembly	3.005	1.028	11	69	52	72	10

Note: SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, and SA = Strongly Agree
Source: Survey data (2019).

Table 7: Independent sample t-test for continuous explanatory variables

Variable	WTC (104)		Not-WTC (110)		Total (214)		t-test
	Mean	SD	Mean	SD	Mean	SD	
AGE	27.89	3.75	34.41	4.63	33.48	7.72	-11.265***
EDU	9.75	1.83	4.82	3.13	6.58	3.49	13.983***
HHSIZ	6.13	2.37	6.52	2.38	6.29	2.23	-1.180
MEMBDUR	6.26	3.56	6.08	4.34	6.17	3.97	0.327
FACTOR1	-0.65	0.49	0.61	0.98	0E-7	1.000	-11.850***

Source: Survey data (2019).

Table 8: Cross-tabulation for categorical explanatory variables

Variable	Resp.	WTC (104)	Not-WTC (110)	Total	Pearson χ^2 value
CREDIT	No	54	76	130	6.608**
	Yes	50	34	84	
	Total	104	110	214	
SRVCMM	No	63	85	148	6.986**
	Yes	41	25	66	
	Total	104	110	214	
EXCMM	No	39	100	139	66.988***
	Yes	65	10	75	
	Total	104	110	214	
TRANING	No	58	49	107	2.694
	Yes	46	61	107	
	Total	104	110	214	
TRUST1	No	26	94	120	79.321***
	Yes	78	16	94	
	Total	104	110	214	
TRUST2	No	25	101	126	101.435***
	Yes	79	9	88	
	Total	104	110	214	

Source: Survey data (2019).

Table 9: Factors influencing members' willingness to contribute equity capital

Variable	B	SE	Wald	P-Value	Exp(B)
Step 1[a]					
AGE	-0.289	0.089	10.499	0.001	0.749
EDU	0.254	0.145	3.083	0.079	1.290
CREDIT(1)	-0.921	0.897	1.052	0.305	0.398
SRVCMM(1)	1.792	1.275	1.976	0.160	6.000
EXCMM(1)	2.794	1.238	5.092	0.024	16.352
TRUST1(1)	1.635	0.836	3.823	0.051	5.127
TRUST2(1)	3.184	0.861	13.662	0.000	24.134
FACTOR1	-2.184	0.613	12.706	0.000	0.113
Constant	2.963	3.489	0.721	0.396	19.348

Note: a. Variable(s) entered on step 1: AGE. EDU, CREDIT, SRVCMM, EXCMM, TRUST1, TRUST2, FACTOR1
Source: Survey data (2019)

The two trust variables, TRUST1 (trust on other members' commitment) and TRUST2 (trust on directors' leadership), positively influenced members' willingness to contribute equity capital at less than 5 and 1 percent level of significance respectively. The positive significant coefficients of TRUST1 and TRUST2 indicate that trusts on other members' commitment and directors' leadership increases the likelihood of willingness to contribute equity capital. Willingness to contribute equity capital 5.127 and 24.134 times favoured by households who had trusts on other members' commitment and directors' leadership respectively, taking those households who do not trust on other members' commitment and directors' leadership as the reference groups. This is consistent with **James and Sykuta (2006)** and **Hanson *et al.* (2002)**. These authors indicate positive and significant influence of trust on other members' commitment and directors' leadership on members' willingness to contribute equity capital.

Finally, as depicted in Table 9, perception on the cooperatives' weakness (FACTOR1) negatively influenced willingness to contribute equity capital at less than 1 percent level of significance. The negative significant coefficient of FACTOR1 indicates that perception on the cooperatives' weaknesses decrease the likelihood of willingness to contribute equity capital. Willingness to contribute equity capital was 0.113 times not favoured by households who had perceived on FACTOR1, taking those households who did not perceive on FACTOR1 as the reference group. This result is consistent with **Hakelius and Hansen (2016)**,

Kontogeorgeos *et al*. (2014) and **Wang and Hue (2013)**. These authors indicate negative and significant association between members' perception on the cooperative's weaknesses and their willingness to contribute equity capital.

However, in this study, we did not find statistically significant association between households' taking credit (CREDIT) and present role as a committee member (SRVCMM), and their willingness to contribute equity capital. The implication is that members' taking credit and present role as a committee member had no role on their willingness to contribute equity capital.

CONCLUSION AND RECOMMENDATION

The result showed that, agricultural cooperatives were weak with respect to market linkage, informing members about directors' actions, and inputs supply on the right time. The result also showed that more than half (51.4%) of households were not-willing to contribute equity capital for their agricultural cooperatives' investment in growth activities. This could be because of these members' negative attitude towards making equity capital contribution due to their perception on the above weaknesses of their agricultural cooperatives. The implication is that cooperatives should attend to the service needs and interests of their members and assess their performance depending on, among others, the values that their members perceive to obtain from the membership.

The result also showed that members' trust on other members' commitment and directors' leadership had a positive influence on their willingness to contribute equity capital. The implication is that cooperatives should develop and foster trust among members and between members and directors. To develop trust among members, it is recommended to implement activities that facilitate social interactions and mutual-supports among members. To develop members' trust on directors' leadership, it is recommended to enhance directors' leadership abilities through training, workshops and seminars. These in turn enhances members' willingness to contribute equity capital.

Moreover, the result showed that past role as a committee member significantly and positively influenced households' willingness to make equity capital contribution. This could be because of through serving as a committee member or involving in roles related to committee households are developing a sense of ownership, and that in turn enhance their willingness to contribute. Thus, it is recommended to increase the number of committee members in the board of directors so that more members could get opportunity to assume a role in board committee member.

Furthermore, in the result as education is positively influencing members' willingness to make equity capital contribution, it necessitates educating members through training, workshops and seminars. Such education should focus on the advantages that members could obtain with their cooperative's investment on growth activities. In doing so, members' awareness about the advantages of cooperative's investment for the betterment of their incomes is enhanced. This in turn will enhance members' willingness to make equity capital contribution.

Based on the above, the study concludes that social capital theory and the two behavioural theories (planned behaviour and norm activation model) provides important framework to explain members' willingness to contribute equity capital in agricultural cooperatives.

Finally, this cross-sectional study is subjected to limitations inherent in this type of research. The study's focuses on one geographic location with specific institutional culture may limit the generalizability of its results to all agricultural cooperatives. Further research is needed to help determine if the results in this study are valid to all agricultural cooperatives.

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CHALLENGES OF AGRICULTURAL COOPERATIVES AND THEIR IMPACT ON PROFITABILITY OF POTATO GROWERS IN EASTERN ETHIOPIA

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ABSTRACT

Background of the research: Agricultural cooperatives are established for the sake of improving the livelihood of smallholder farm households through improving their profitability. However, due to several challenges facing the cooperatives, their establishment may not guarantee such an achievement. Hence, it is essential to empirically verify their impact on profitability of the smallholder farm households.
Purpose of the article: The purpose of this study is to measure the impact of agricultural cooperatives on profitability of small holder potato farmers in Eastern Ethiopia.
Methods: The study was conducted making use of survey data on members and non-members of agricultural cooperatives in Eastern Hararghe based on multi-stage sampling method. Simple inferential and econometric methods of data analyses were carried out. The simple inferential analysis involves mean comparison tests whereas the econometric analysis is related to PSM method along with simulation-based sensitivity analysis.
Findings and value added: The inferential analysis indicates that there is no significant difference in per unit profit between members and non-members. This result also holds true with disintegration of components of the profitability into per unit price, per unit cost of production and per unit cost of marketing. The PSM result also shows that, except the slightly significance for per unit cost of production in favour of non-members, there is no significant difference in terms of per unit profit, per unit price, and per unit cost of marketing. The result implies that membership to cooperatives does not guarantee positive impact on profitability of its members.
Recommendation: Therefore, it is recommended that strict follow-up is crucial on the cooperatives' performance; agricultural cooperatives better be functional in all aspects attached to profitability of farmers; active participation of member farmers is inevitable; frequent and regular trainings are also necessitated in order to build the managerial capacity of the leaders; and there should be clear framework of coordination in production and marketing activities. The other mentioned challenges should also be considered.

Key words: agricultural cooperatives; profitability; impact; PSM; potato
JEL Codes: D43; L13; Q13; Q18

INTRODUCTION

Ethiopia is one of the developing countries for which agriculture is considered as the mainstay of the economy. Different studies show that in Ethiopia agriculture is the dominant sector of economic activity; in which majority of the people are engaged; contributing slightly less than half of GDP; and known to be the main source of foreign currency (**Matousa *et al.*, 2013**). However, majority of the people engaged in this sector are smallholder farmers who lead their livelihood with subsistence agriculture. This sector also accompanied with a number of challenges like low level of productivity; lower land size; lack of adequate knowledge and information transfer; slow return of benefit and lack of financial support; lack of improved seed and others (**Habtewold & Challa, 2019; Zerssa *et al*, 2021**). The prevalence of this subsistence agriculture has the tendency to prolong impoverishment of majority of the people.

The development in the agricultural sector is believed to have spillover effects for the development of the economy as a whole, in terms of enhancing food security resulting from the rise in productivity of the agricultural sector. In regard to the importance of agriculture in a broader socio-economic sense, all the basic objectives of economic development of the country, namely, output

growth, price stability and poverty alleviation are best served by growth of the agriculture sector. This is expected to be realized if public investment and market infrastructure in agriculture are adequate (**MSPII, 2010**). In cognizant of this, the government has been formulating different policies related to commercialization of agricultural sector. Government's emphasis on a strong agricultural development led industrialization policy for sustained economic growth implies transforming traditional agriculture into a commercial agriculture. Toward that objective, a number of policies have been implemented in order to remove bottlenecks that had contributed to stagnation in yield and production in agriculture in the past (**Getnet *et al.*, 2005**).

African countries' experience like Ethiopia indicates that the agricultural research and development organizations have made significant progress on increasing agricultural productivity. But, sustainability of productivity and growth of the agricultural sector depends on expansion of market opportunities (**Gabre-Madhin & Haggblade, 2004**). Hence, it is now increasingly evident that smallholder farmers' key concern is not only agricultural productivity and household food consumption, but also increasing better market access. Agricultural research and development organizations are now under pressure to shift from enhancing productivity of food crops to improving profitability and competitiveness of small-scale farming, and linking smallholder farmers to more profitable markets (**Njuki *et al.*, 2015**).

However, the profitability and competitiveness of the smallholder farmers is determined by the efficiency of the market. In more competitive markets, there are lower marketing costs, better prices for farmers and consumers, and more efficient market services thereby the virtues of agricultural marketing are realized (**Njuki *et al.*, 2015**). Despite the fact that market for agricultural sector is believed to be an engine for economic growth and development, its effectiveness relies on the functioning of the market system. In a well-functioning market system, all economic agents have equal market participation and thereby generate fair and mutual benefit (**Barrett & Li, 2002**). However, market functioning system of agricultural sector is adversely affected by a number of factors which may limit the market participation of some agents (especially smallholder farmers) and their benefits.

It is argued that the agricultural marketing system in Ethiopia has several difficulties that specifically limit the market participation of smallholder farmers. These difficulties consist smallholders' lack of access to markets, high transaction costs resulted from low volume of transactions, supply rigidity due to perishability of agricultural products, instability of prices, inequity of prices due to producers' lack of information, frequent frauds on input quality and units of measurement, poor productivity potential due to lack of investment and farmers' aversion of risks (**Bienabe and Sautier, 2006)** The agricultural marketing system in Ethiopia also tends to be informal, unregulated and constrained by weak market linkages and lack of rural infrastructure. In the remote rural markets, producers suffer from high transaction costs in terms of searching, negotiation and transportation. Furthermore, transactions are thin that weaken the market power of smallholder producers. The absence of institutions in supplying information and facilitating exchange exacerbate the smallholders' market problem and expose producers to sell their products to traders who have high opportunistic buying behaviour. This constrained the participation of agricultural producers and gain relatively lower benefits from the market mechanisms (**Gabre-Madhin, 2001**).

In order to coup-up with these challenges, among policy enactments, agricultural cooperatives were established in the sense of empowering the smallholder farmers. Historically, agricultural cooperatives are said to have played an important role all over the world in providing market access, credit and information to producers/farmers. In particular, agricultural cooperatives have played an important economic role in providing competitive returns for independent farmers (**Chaddad *et al.*, 2005**). Cooperatives, as economic enterprises and as self-help organizations, play a meaningful role in uplifting the socio-economic conditions of their members and their local communities. The social role of cooperatives is promoted through voicing of common goals, enhanced participation in value chains, and protection of producers from unfair pricing. Cooperatives also create opportunity for networking and working in partnership with other agencies (**Argaw, 2019**).

Generally, **Barker (1989)**, states that the theoretical basis for such cooperation is related to three major factors. These are bargaining power **(**increasing farmers' bargaining strength), marketing economies (reducing the cost of marketing by improving the efficiency of existing services, or achieving scale economies in certain operations), and market investment (providing an additional investment opportunity in marketing of commodities covered by the cooperative).

In Ethiopia, the government has strongly promoted agricultural cooperatives to encourage smallholders' participation in the market (**Bernard *et al.*, 2008**). Currently agricultural cooperatives in the country are assumed to play significant role that are mainly able to insure the benefits of the member farming rural community through effective value chain development and market linkage. In terms of market linkage, for instance, in SNNPR, WFP-P4P program buys agricultural products from the market cooperatives which creates greater opportunity in terms of improving the bargaining power position of members and thus guarantee their benefit from what they have produced. This is due to cutting the very long and inefficient chain, the significance of the business volume made with the program, and motivation of the market by realizing domestic purchase of grain that would have been imported as a relief or emergency support (**Argaw, 2019**).

However, agricultural cooperatives are also said to have a number of drawbacks which may hamper the benefit of farmers from the market. In addition, agricultural cooperatives may face problems such as conflict of interest among members, inadequate level of education and training of members, exploitation of members by dishonest members, lack of effective leadership, excessive government control, poor

capitalization, lack of total commitment by members, inadequate and ill–timed supply of inputs by some members, and poor capitalization (**Llebani, 2010**).

Farmers under agricultural cooperatives are also expected to bear additional costs of transaction to manage transactions as membership. Perhaps, their net gain from the market can be relatively higher or lower depending on the extent of benefit derived from the cooperation. In this regard, **Hendrikse & Veerman (2000)** state, based on theory of transaction cost economics, that cooperatives are not advocated when the degree of asset specificity by the farmers is low because it increases the bureaucratic costs of exchange within a firm. In this case, farmers should opt for the best alternative market based on their product differentiation, individually.

Moreover, within the conception of theory of transaction cost economics, **Ortmann & King (2007)** identify five problems of cooperatives. These include: free rider problem (a type of common property problem that emerges when property rights are not tradable or are not sufficiently well defined and enforced to ensure that individuals bear the full cost of their actions or receive the full benefits they create), horizon problem (when a member's residual claim on the net income generated by an asset is shorter than the productive life of that asset), portfolio problem (members are unable to diversify their individual investment portfolios according to their personal wealth and preferences for risk taking), control problem (principal-agent problems due to divergence of interests), and influence cost problem (costs associated with activities in which members or groups within an organization engage in an attempt to influence the decisions that affect the distribution of wealth or other benefits within an organization).

Given these possible pros and cons of agricultural cooperatives, it is crucial to empirically investigate the real impact of their existence on profitability of farmers. Perhaps, in Ethiopia, there are few previous empirical studies, in this regard. These studies focus on analyses of productivity performance of cooperatives and measurement of their impact on technical efficiency of farmers (**Abate *et al.*, 2014**), on wellbeing of smallholder farmers (**Ahmed and Mesfin, 2017**) and on economy (**Debela *et al*, 2018**). All these past works disregard the importance of the interplay of the market. Specifically, they have overlooked analysis of the impact of existence of the cooperatives on profitability of the smallholder farmers. Therefore, this study attempts to fill this gap by conducting an empirical study on the impact of participation in agricultural cooperatives on the net gain of farmers, as well as to identify and rank the major challenges facing them. The study was conducted making use of potato growers in Eastern Ethiopia (Eastern Hararghe Zone).

LITERATURE REVIEW

Theories of market-oriented agricultural cooperatives and their empowering role for smallholder farmers

Historically, agricultural cooperatives are said to have played an important role all over the world in providing market access, credit and information to producers/farmers. In particular, agricultural cooperatives have played an important economic role in providing competitive returns for independent farmers (**Chaddad *et al.*, 2005**). The rationale behind establishing market-oriented cooperatives is that farmers generally market their crops to large, highly organized, commodity merchant firms or to large processing firms. Since these firms combine expertise and capital, farmers should be allowed to develop their own marketing firms in order to compete with them on equal footing (**Branson & Douglass, 1983**). According to **Staatz (1989**), they were established as service providers and were primarily aimed at countervailing the market power of producers' trading partners, preservation of market options and reduction of risk through pooling.

Cooperatives are known to be member-owned businesses. They aggregate the market power of people who on their own could achieve little or nothing, and in so doing they provide ways out of poverty and powerlessness. Cooperatives, as economic enterprises and as self-help organizations, play a meaningful role in uplifting the socio-economic conditions of their members and their local communities. The social role of cooperatives is promoted through voicing of common goals, enhanced participation in value chains, and protection of producers from unfair pricing. Cooperatives also create opportunity for networking and working in partnership with other agencies (**Argaw, 2019**).

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However, market cooperatives are also said to have a number of drawbacks which may hamper the benefit of farmers from the market. Marketing cooperatives may face problems such as conflict of interest among members, inadequate level of education and training of members, exploitation of members by dishonest members, lack of effective leadership, excessive government control, poor

capitalization, lack of total commitment by members, inadequate and ill–timed supply of inputs by some members, and poor capitalization (**Llebani, 2010**).

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Moreover, within the conception of theory of transaction cost economics, **Ortmann & King (2007)** identify five problems of cooperatives. These include: free rider problem (a type of common property problem that emerges when property rights are not tradable or are not sufficiently well defined and enforced to ensure that individuals bear the full cost of their actions or receive the full benefits they create), horizon problem (when a member's residual claim on the net income generated by an asset is shorter than the productive life of that asset), portfolio problem (members are unable to diversify their individual investment portfolios according to their personal wealth and preferences for risk taking), control problem (principal-agent problems due to divergence of interests), and influence cost problem (costs associated with activities in which members or groups within an organization engage in an attempt to influence the decisions that affect the distribution of wealth or other benefits within an organization).

Empirical studies on impact of marketing cooperatives for smallholder farmers

Theoretically, agricultural market cooperatives are said to play an immense role in reducing poverty among smallholder farmers by correcting market failure. They are established to make smallholder farmers capable while confronting with the prevailing higher marketing transaction costs, limited access of finance and input markets, and risk of price fluctuations (**Blokland & Gouet, 2007**). However, some believe that cooperatives may bring about contradictive outcomes on the welfare of the farmers for a number of reasons (**Ruben & Heras, 2012**). Hence, the positive or adverse role of the cooperatives can only be confirmed using empirical studies. To this end, in Ethiopia, various empirical works were undertaken to show the practical role of agricultural cooperatives in different places, which came up with different results.

Kodama (2009) has shown that agricultural cooperatives can have a wider effect to the extent that their spillover effects provide benefit for non-members as well. He has empirically indicated that, by increasing competition, the activities of coffee cooperatives in Ethiopia have generally increased the prices paid to both member and nonmember farmers. Besides, with the existence of the cooperatives, the export volume of fair-trade coffee has also increased and has helped buffer fair trade coffee farmers from international price fluctuations.

However, there are studies revealing that some cooperatives are not performing well. In this regard, there are studies showing that better off farmers prefer to sale their produce through traders than cooperatives due to the inefficiency of cooperatives. **Kuma *et al* (2013)** have empirically shown that the likelihood of accessing cooperative milk market outlet, in Wolaita zone of Ethiopia, was lower among households who owned large number of cows.

In fact, in a given place, different types of cooperatives can have different levels of performance due to different reasons. **Ruben & Heras (2012)** have compared the activities of coffee cooperatives in Sidama zone based on their level of social capital and governance structure. Their findings indicate that the cooperatives of Kege and Magerra present significantly lower levels of social capital shared by their members compared to the better performing cooperative societies of Waycho, Shoye and Goyda. This is because the former are situated close to the main road and near to the Woreda township whereas the latter are located at the considerable geographic distance. Having better social capital means better access to markets and information, and proximity to road reduces the external transaction costs.

With regard to the differences in governance structure, they have shown that in Kege and Magerra cooperatives, the participation in assembly meetings and the coffee deliveries by members are indeed significantly lower. Consequently, cooperative profits and traded volumes are highly dependent on members' commitment for devoting time and resources to coffee production and delivering coffee to the cooperative society. Moreover, Kege and Magerra cooperatives present a very low and distant feelings of ownership regarding their organization, whereas in the other three cooperatives members instead share strong feelings of opposition against the committee that are reflected in active participation in the assemblies and stronger involvement in cooperative affairs. This is further reinforced by the fact that Waycho, Shoye and Goyda cooperatives are eligible for bank loans and can thus provide early payments for coffee deliveries (**Ruben & Heras, 2012**).

So far, we have presented more about the performance of the cooperatives in terms of their own efficiency or strength. However, it is also crucial to see the impact of these organizations on the farmers' livelihood. As far as our knowledge, in Ethiopia, it is only **Abate *et al.* (2013)** who have undertaken a study related to this specific aspect (impact assessment). **Abate *et al.* (2013),** in their investigation of the impact of agricultural cooperatives on small holders' technical efficiency in Ethiopia, have shown that agricultural cooperatives are effective in providing support services that significantly contribute to members' technical efficiency.

However, this result does not necessarily imply that cooperatives improve profitability of member farmers since their study focuses on efficiency of the use of inputs,

which does not consider the feature of pricing of final outputs in particular and the interplay of the market in general. In other words, there may be a situation where farmers are technically efficient but they face unfair price for their final output due to market failure. In consideration of this gap, this inquiry will give much focus towards the impact of the cooperatives on profitability of farmers, giving due attention to the interplay of the market. In addition, in this study, an attempt will be made to identify the major marketing challenges facing the market oriented agricultural cooperatives in general and the farmers in particular.

DATA AND METHODS

Description of the Study Area

East Hararghe is one of the Zones of the Region of Oromia found in Eastern part of Ethiopia. East Hararghe takes its name from the former province of Hararghe. East Hararghe is bordered on the southwest by the Shebelle River which separates it from Bale, on the west by Western Hararghe, on the north by Dire Dawa and on the north and east by the Somali Region. The Harari Region is an enclave inside this zone. The Administrative center of this zone is Harar.

In eastern Hararghe (Oromia region), all types of agro-ecological zones (Kola, Dega and Weyna Dega) exist having both highland and lowland societies. The mean annual rainfall varies from lowland to highland. It has two rainy seasons for agricultural production which are known to be "Belg"/Autumn (covers months of September, October and November which is known to be more of a harvest season) and "Kiremt"/Summer (which is the rainiest season that covers months of June, July and August) seasons. Output is expected to be higher during "Kiremt" and "Belg" season than that of the dry seasons including "Bega"/Winter (covers December, January and February which is the dry season with frost in morning specially in January).and "Tseday"/Spring (covers March, April and May are the autumn season with occasional showers). May is the hottest month in Ethiopia seasons. Hence, prices of the produce are expected to show ups and downs across these seasons and places (**UNDP-EUE, 1994**).

Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), this Zone has a total population of 2,723,850, an increase of 48.79% over the 1994 census, of whom 1,383,198 are men and 1,340,652 women; with an area of 17,935.40 square kilometers. East Hararghe has a population density of 151.87. While 216,943 or 8.27% are urban inhabitants, a further 30,215 or 1.11% are pastoralists. A total of 580,735 households were counted in this Zone, which results in an average of 4.69 persons to a household, and 560,223 housing units.

Production in Eastern Hararghe zone is based on roughly 70% crops and 30% on livestock. Major cash crops grown in Eastern Hararghe include khat, coffee, onion, haricot beans, groundnuts, mangos, sweet potato, potatoes and other types of fruits and vegetables. Generally, the dominant cash crops in the area were found to be khat, coffee and vegetables (**UNDP-EUE, 1994**). Of vegetables, potato production takes the largest share in some areas such as Kombolcha and Haramaya (**Piguet, 2003**). Hararghe, in eastern Ethiopia is one of the major potato producing regions of the country and potato is grown in both the rainy and dry season. The presence of regional and domestic markets around nearby cities as well as exports to neighbouring countries such as Djibouti and Somalia have contributed to the development of potato production in Hararghe highlands (**Adane *et al*., 2010**).

The Woredas found in East Hararghe zone include Fedis, Babile, Jarso, Kombolcha, Kersa, Haramaya, Meta, Deder, Gursum, Kurfachele, Gorogutu, Bedeno, and Garamuleta. From these Woredas, Haramaya and Kombolcha were selected as the study areas since these areas are the major producers and suppliers to local and export markets.

Data Type, Sources and Methods of Data Collection

The type of data required to undertake this study is cross-sectional. Sources of data for this inquiry are both primary and secondary. The primary data was collected using survey on farm households whereas the secondary data were extracted from books, articles, and published and unpublished documents of offices of agriculture and cooperatives. The primary method of data collection in this study was questionnaires/schedule method. To this end, 12 Development Agent (DA) workers were recruited as enumerators for the data collection. Besides, Focus Group Discussions (FGDs) were held with concerned officials from offices of Agriculture and Cooperatives.

Sampling Procedure

In this study, multi-stage sampling method was applied. In the first stage the two Woredas (Haramaya and Kombolcha) were selected as specific study areas purposively as these are the major suppliers of the crop. In the second stage, four Kebeles (which are much closer to irrigation for production of vegetables including potato) from which the farm households to be drawn were selected purposively based on consultation with expertise from Offices of Agriculture of the two Woredas. These include: Tinike, Tuji Gabisa, Kerensa, and Bilisuma. In third stage, potato grower households, in each Kebele, were clustered into cooperative members and non-members. Finally, the farm households which are using irrigation were selected (from both members and non-members of agricultural cooperatives) randomly using probability proportional to size (PPS). Accordingly, the total sample size taken for the study is 300 (102 from members and 198 from non-members).

Data Analysis Methods

To undertake this study, descriptive, inferential statistics and econometrics methods of analyses were carried out. The descriptive and inferential analysis involves comparison of per unit profit, per unit price, per unit cost of marketing and per unit production cost for members (treated group) and non-members (control group) making use of mean comparison test. Apart from this, Likert scale was used to assess the severity of challenges facing the cooperatives.

The econometric analysis is used to measure the impact of participation in agricultural cooperatives on net gain of farmers through application of Propensity Score Matching Method (PSM). This method involves the following five major steps.

A. Estimation of the propensity score for each household
B. Choice of matching algorithm
C. Test of overlap assumption
D. Estimating the average treatment effect on the treated
E. Sensitivity analysis

Estimation of propensity scores

In technical terms, suppose there are two types of farmers: those that are members of cooperatives $D_i = 1$ and those that do not $D_i = 0$. Members (treated group) are matched to those non-members (comparison group) on the basis of the propensity score. The propensity score (p-score) for individual *i is* defined as Eq. 1.

$$P(X_i) = P(D_i = 1|X_i) \quad (1)$$

Where:
$0 < P(X_i) < 1$ and X_i is a vector of pre-treated explanatory variables such as farmers characteristics.

A probit or logit model can be used to estimate the propensity score using composite pre-intervention characteristics of the sample households (**Caliendo & Kopeining, 2005**). In this study, we primarily employed the logit model to estimate the p-score. In the specification of the logit model, the dependent variable is the probability to be member of cooperatives by the farmers. The logit model is specified as Eq. 2.

$$P(D = 1|X) = \frac{e^{W_i}}{1+ e^{W_i}} \quad (2)$$
$$W_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \cdots \beta_m X_{mi} + v_i$$

Where:
$P(D = 1|X)$ is the probability that an individual is a member of cooperative given X ; X_s represent the explanatory variables; β_S denote the parameters to be estimated; and v is the residual term. Descriptions of the variables considered for estimation of the logit model are stated with their hypothetical relationship, in Table 1.

$$Y_{i,t+s}(1) - Y_{i,t+s}(0) \quad (3)$$

Finally, existing studies on impact evaluation often estimate the average effect of the treatment on the treated (ATT), defined as Eq. 4.

$$ATT = E\left(Y_{i,t+s}(1) - Y_{i,t+s}(0)\middle|D_{it} = 1, P(X_i)_{i,t-1}\right) = E\left(Y_{i,t+s}(1)\middle|D_{it} = 1, P(X_i)_{i,t-1}\right) - E\left(Y_{i,t+s}(0)\middle|D_{it} = 1, P(X_i)_{i,t-1}\right) \quad (4)$$

Where:
X_i denotes pre- program characteristics of individual i in year t-1;
$P(X_i)$ is the *p*-score;
Y_i^1 and Y_i^0 are the potential outcomes in the two counterfactual situations of receiving treatment and no treatment.

Sensitivity analysis

The legitimacy of p-score analysis is based on the assumption of strongly ignorable treatment assignment which assumes all relevant covariates are employed in the treatment assignment and the bias due to the unmeasured covariates is ignorable (**Thoemmes & Kim, 2011**). If the estimated treatment effect is sensitive to the presence of unmeasured covariates, or in other words, the estimated treatment effect is possibly washed away with the unmeasured covariates, the treatment effect may be due to the bias of unobserved covariates rather than a true effect. On the other hand, if a considerable magnitude of unobserved covariate effect is not likely to mitigate the treatment effect, researchers gain confidence on the treatment effect as an unbiased estimate (**Lanehart *et al.*, 2012**).

Lanehart *et al.* (2012) specifies the re-estimation of the treatment effect given the unmeasured covariates (U) as Eq. 5.

$$\delta^* = \delta - \gamma(E[U_1] - E[U_0] \quad (5)$$

Where:
δ is the treatment effect after controlling for the observed covariates, $E[U_1 - E[U_0\}$ is the effect of unobserved covariates, and δ^* is the adjusted treatment effect. That is, the adjusted treatment effect can be obtained by removing the hidden bias due to unmeasured covariates from the estimated treatment effect.

Sensitivity analysis is a type of what-if analysis because the effects of unmeasured covariates with two sensitivity parameters (γ and $E[U_1] - E[U_0]$ are not empirically estimable. The proxy of sensitivity parameters can be obtained either from the observed data or from theory and literature (**Li *et al.*, 2011**). **Ichino *et al.* (2006)** propose simulation-based sensitivity analysis to assure the robustness of the result (see also **Nannicini, 2007** and **Arpino & Assve, 2013**). The analysis builds on **Rosenbaum & Rubin (1983)** and **Rosenbaum (1987)**, and simulates a potential binary confounder in order to assess the robustness of the estimated treatment effects with respect to specific deviations from the Conditional Independence Assumption (CIA). The procedure is explained as follows:

As a first step, the Average Treatment effect on the Treated (ATT) is estimated by using one of the following propensity score matching estimators: Nearest Neighbor (***attnd***, ***attnw***); Radius (***attr***); Kernel (***attk***). The options that are common to these commands specify how the baseline ATT is estimated. As a second step, a potential binary confounder(U) is simulated in the data, on the basis of four parameters: P_{ij}(with $i, j = 0, 1$). Defining Y as the outcome (or as a binary transformation of the outcome in the case of continuous outcomes) and D as the binary treatment, each simulation parameter P_{ij} represents the probability that $U = 1$ if $D = i$ and $Y = j$. Finally, U is considered as any other covariate and is included in the set

of matching variables used to estimate the propensity score and the ATT.

The imputation of U and the ATT estimation are replicated many times, and a simulated ATT is retrieved as an average of the ATTs over the distribution of U. This estimate is robust to the specific failure of the CIA implied by the parameters p_{ij}. A comparison of the simulated ATT and the baseline ATT tells us to what extent the latter is robust, with respect to the specific deviation from the CIA that we are assuming. In order to further emphasize the characteristics of the failure of the CIA implied by the simulated confounder (i.e., by the chosen P_{ij}), the estimated effect of U on the selection into treatment - *selection effect* (Λ) - and the estimated effect of U on the outcome of untreated subjects - *outcome effect* (Γ) - are also reported as odds ratios.

As indicated in **Arpino & Aassve (2013)**, the distribution of U is specified by four key parameters (Eq. 6).

$$P_{ij} = P(U = 1 \backslash D = i, Y = j) = P(U = 1 \backslash D = i, Y = j, X) \qquad i, j = 0, 1 \tag{6}$$

Hence, the possibilities of the effect of U on outcome (Y) and treatment (D) is determined by the values of $d = P_{01} - P_{00}$ and $s = P_1 - P_0$, where $P_i = P(U = 1|D = i)$. If $d > 0$, U has a positive effect on Y_0 (conditioning on X) whereas if $s > 0$, then U has a positive effect on D. Note that $P_{01}$is the probability that $U = 1$ given $D = 0$ and $Y = 1$; P_{00} is the probability that $U = 1$ given $D = 0$ and $Y = 0$; P_{10} is the probability that $U = 1$ given $D = 1$ and $Y = 0$; and $P_{11}$is the probability that $U = 1$ given $D = 1$ and $Y = 1$.

RESULTS AND DISCUSSION

Descriptive Comparative Analysis

In this part, comparison of per unit profit between treated and control groups carried out making use of mean comparison test. In order to disintegrate the main source of the difference in profitability of the farmers, comparisons were also made in terms of per unit production cost, per unit marketing cost and per unit price between the two groups. It is obvious that profitability of the farmers is related to production (reduction in cost of farming) or/and marketing (reduction in cost of marketing or getting higher price for the produce).

As indicated in Table 2, per unit cost of production between the two groups looks similar which is revealed by the significance test of difference. As shown in the Table 2, the t-value is very lower confirming that there is no significant difference in cost of production between the two groups at even 10% level of significance. The implication of this is that, if there is significant difference in per unit profit between the two groups, it must emanate from the interplay of the market (i.e. it is due to either the difference in costs of marketing or the difference in price of the product or both). However, this preliminary result also shows that there is no difference in per unit marketing cost and per unit price. The t-values for both of these variables are very smaller for significance.

Table 1: Description of the variables considered for the logit model

Name of the variable	Type of the variable	Description (unit of measurement)	Hypothetical relationship with the dependent variable
Dependent Variable: Membership of agricultural cooperatives	Dummy	Not member = 0; Member = 1	
Age of the household head	Continuous	Years	+/-
Education level	Dummy	Illiterate = 0; Literate = 1	+
Experience (in years) of the household head in potato production	Continuous	Years	+
Family size	Continuous	Number	+
Farm size	Continuous	Ha	+
Proportion of farm income	Continuous	Farm income/Total income	+
Quantity of potato production sold	Continuous	Kgs	+
Access to market information	Ordered variable	No access = 1; Little access = 2; Satisfactory = 3; Good = 4; Very good = 5	_
Access to extension services	Dummy	Not provided = 0; Provided = 1	+
Distance to the nearest urban center (market)	Continuous	Kms	+
Distance to the nearest asphalt road	Continuous	Kms	+
Location/Woredea	Dummy	Kombolcha = 0; Haramaya = 1;	indeterminate
Access to credit	Dummy	Doesn't have = 0; Have = 1;	-
Political participation	Dummy	Doesn't participate = 0; Participates = 1	+
Yield of potato production	Continuous	kg/ha	+

Table 2: Comparison of per unit profit, per unit cost of production, per unit marketing cost and per unit price between the members and non-members

Variable	Group	Mean	Std. Error	t-value
Per unit cost of production	Non-member	1.441348	0.0498988	-1.3805
	Member	1.565893	0.0801442	
	Difference	-0.1245454	0.0902197	
Per unit profit	Non-member	4.162862	0.0883085	0.8935
	Member	4.030784	0.1141284	
	Difference	0.1320781	0.1478224	
Per unit marketing cost	Non-member	0.5400571	0.0212221	-1.1859
	Member	0.954714	0.4861789	
	Difference	-0.4146569	0.3496533	
Per unit price	Non-member	6.137374	0.0810767	0.9246
	Member	6.018627	0.0850244	
	Difference	0.1187463	0.1284262	

Source: Own computation, 2019

Therefore, per unit profits of the two groups are too closer. Test of significance of the difference in per unit profit as indicated by the t-value depicts the similarity in per unit profit between the two groups. Therefore, lucrativeness of the market seems to be not brought about whether farmers are members of agricultural cooperatives or not.

Whatever the case may be, this preliminary result alone does not weigh enough to confirm the non-significance impact of cooperatives for profitability of farmers due to the fact that there is no randomization in membership to cooperatives. Therefore, the result should be verified by different methodology which can take into account the non-randomization of treatment. To this end, in the next section, econometric analysis making use of Propensity Score Matching (PSM) method was presented.

Propensity Score Matching Method

As indicated in the methodology part, we should follow several procedures in the application of PSM. These include, estimation of the propensity scores for all the observations, decision on choice of matching algorithm, making test of overlap assumption, estimation of the Average Treatment Effect on Treated (ATT), and making sensitivity analysis to verify the robustness of the result. Hence, the presentation follows accordingly.

Estimation of the propensity scores

Logistic regression was used to estimate the propensity score for each observation. Before estimation of the logistic regression, test of multicollinearity was carried out using variance inflation factor which shows there is no strong multicollinearity among the variables used for the logistic regression. The result of the logistic regression is presented using Table 3. As indicated in the Table 3, 14 variables were considered as the major determinants of membership to agricultural cooperatives.

Choice of matching algorithm

After estimation of the propensity score for each observation, we need to choose among the matching algorithms. As indicated in the methodology part, there are mainly three algorithms to consider with their different features/widths. These include Kernel Matching, Caliper Matching, and Nearest Neighbour Matching. Four selection criteria were considered to choose among the matching algorithms. An algorithm with lower Ps R^2, larger matched sample size, more number of balanced covariates, and lower mean bias is selected. Accordingly, as indicated in Table 4, Kernel Matching with bandwidth 0.1 was found to be the best matching algorithm based on the mentioned criteria.

Along with the choice of the matching algorithm, result of the balancing tests of covariates using the chosen algorithm was also reported using Table 5. As indicated in Table 5, 9 of the covariates and P-score were not balanced (show bias towards one of the groups) before matching. But, after matching, all the covariates were balanced as indicated by the t-test showing that there is no significant difference in the covariates between the two groups.

Test of the overlap assumption

Among the assumptions of Propensity Score Matching method, the overlap assumption is the one which states that the observations are properly matched in the common support region. This can be tested using graph of the propensity scores for the counterparts of the two groups.

For the sake of overlapping, we need to consider propensity scores in common support region only. In order to identify the common support region, we need to look at the minimum and maximum propensity scores for both groups. The minimum and maximum propensity scores for the treated group are 0.134984 and 0.9957619, respectively whereas the minimum and maximum propensity scores for the control group are 0.0038383 and 0.8152288, respectively. Hence, the common support region is between 0.134984 and 0.8152288. This implies observation with propensity scores lower than 0.134984 and greater than 0.8152288 should be dropped. Accordingly, 49 observations were dropped (40 from control and 9 from treated groups). Graphical test of the overlap assumption, as shown by Figure 1, indicates that there should be observations to be dropped which are in off support region. But, as shown by Figure 2, after finding the common support region, all the observations look overlapped with their counterparts in other group, based on their propensity scores.

Table 3: Result of the Logistic Regression (Dependent Variable: Membership to Agricultural Cooperatives)

Variable	Coefficients	Std. Err	Z	P-value
Sex of household head	-0.137294	0.9204022	-0.15	0.881
Age of household head	-0.1258002	0.0489251	-2.57	0.010
Education level of household head	0.3282416	0.2923579	1.12	0.262
Work experience	0.11996	0.0436034	2.75	0.006
Family size	0.0818664	0.0787382	1.04	0.298
Dependency ratio	-1.262241	0.8619453	-1.46	0.143
Access to credit	-2.997326	1.138137	-2.63	0.008
Farm size	0.4988442	0.6078762	0.82	0.412
Yield	-9.70e-06	9.44e-06	-1.03	0.304
Distance to the nearest market	-0.0627342	0.0552213	-1.14	0.256
Proportion of farm income	-3.761311	1.402942	-2.68	0.007
Quantity of potato provided to the market	0.0002553	0.0000896	2.85	0.004
Level of access for market information	0.2586787	0.1832803	1.41	0.158
Political participation of the household	0.2588929	0.3909519	0.66	0.508
_Cons	4.048278	2.42918	1.67	0.096
Number of observations	300			
LR chi2(14)	59.00			
Prob > chi2	0.0000			
Pseudo R2	0.1534			
Log likelihood	-162.81212			

Source: Own computation, 2019

Table 4: The Matching Algorithms with their Different Features and the Selection Criteria

S/N	Matching algorithm	Ps R^2	Matched sample size (on support)	No. of balanced covariates	Mean bias
1	Kernel normal band width	0.008	total = 251 untreated = 158 treated = 93	14 + the pscore	4.7
2	Kernel bandwidth 0.1	0.006	total = 251 untreated = 158 treated = 93	14 + the pscore	4.1
3	Kernel bandwidth 0.25	0.016	total = 251 untreated = 158 treated = 93	14 + the pscore	6.1
4	Kernel bandwidth 0.5	0.047	total = 251 untreated = 158 treated = 93	14	11.8
5	Caliper Matching Band width 0.01	0.012	total = 235 untreated = 148 treated = 87	14 + the pscore	4.6
6	Caliper Matching Band width 0.25	0.025	total = 251 untreated = 158 treated = 93	14	8.1
7	Caliper Matching Band width 0.5	0.061	total = 251 untreated = 158 treated = 93	13	13.5
8	Nearest Neighbor 1	0.035	total = 251 untreated = 158 treated = 93	14 + the pscore	8.9
9	Nearest Neighbor 2	0.017	total = 251 untreated = 158 treated = 93	13 + the pscore	6.8
10	Nearest Neighbor3	0.012	total = 251 untreated = 158 treated = 93	13 + the pscore	6.2
11	Nearest Neighbor4	0.014	total = 251 untreated = 158 treated = 93	14 + the pscore	7.0

Note: Ps stands for Pseudo
Source: Own computation, 2019

Table 5: Result of the balancing tests of covariates using the kernel matching estimation with bandwidth 0.1

Variables	Unmatched Mean		t-value	Matched Mean		t-value
	Treated	Control		Treated	Control	
Sex of household head	0.98039	0.96465	0.76	0.97849	0.98362	-0.25
Age of household head	38.461	37.919	0.73	38.054	38.563	-0.58
Education level of household head	0.53922	0.40909	2.15	0.52688	0.4983	0.39
Work experience	20.598	18.717	2.41	20.204	20.521	-0.35
Family size	7.598	7.1566	1.84	7.5806	7.6042	-0.08
Dependency ratio	0.49294	0.50463	-0.50	0.4939	0.48737	0.27
Access to credit	0.0098	0.08081	-2.54	0.01075	0.00508	0.43
Farm size	0.4451	0.3599	2.95	0.41694	0.42913	-0.31
Yield	27356	25545	0.74	26661	26244	0.15
Distance to the nearest market	5.2206	5.3425	-0.38	5.0699	5.2023	-0.35
Proportion of farm income	0.93419	0.97878	-3.24	0.96275	0.96776	-0.34
Quantity of potato provided to the market	4294.5	3247	3.96	3872.5	3844.8	0.09
Level of access for market information	3.4804	3.197	2.91	3.4194	3.4483	-0.25
Political participation of the household	0.23529	0.11111	2.86	0.2043	0.17783	0.46
P-score	0.45664	0.27991	7.80	0.41512	0.40824	0.30
Observations	102	198		93	158	

Source: Own computation, 2019

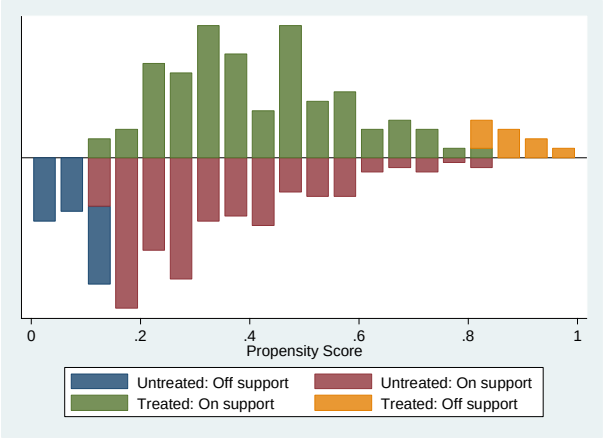

Figure 1: Histogram of propensity score distribution and common support

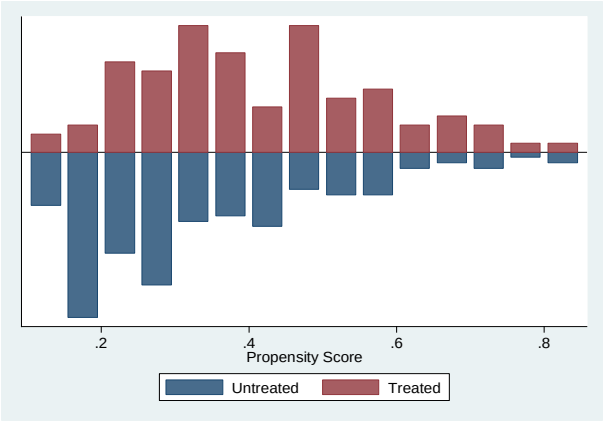

Figure 2: Common support

Average treatment effect on treated (ATT)

The main aim of this study is to measure the impact of membership in agricultural cooperatives on profitability of farmers. Following the above procedures, after we identify the common support region of the propensity scores, average treatment effect on treated is estimated. The major indicator for the estimation of the average treatment indicator is per unit profit. However, so as to disintegrate the main sources of the difference in profitability, per unit cost of production, per unit cost of marketing and per unit price were taken into account. The result of the estimation of the ATT was reported using Table 6.

Table 6 shows that, for all the outcome variables, there is no significant difference between the two groups, at 5% level of significance. However, in terms of per unit cost of production, the impact is marginally significant at 10% level of significance, in favour of non-members. Generally, the implication of this result is that membership to agricultural cooperatives does not bring about any better benefits (in terms of profitability), even it may be worse for members in terms of cost of production.

This result supports the findings of **Hun *et al* (20018)** and **Ofori *et al* (2019)** who have found that membership to agricultural cooperatives may not guarantee relatively better agricultural income. The former study reveals that agricultural cooperatives have no impact on paddy yields and paddy revenue in Takeo Province of Cambodia due to the fact that agricultural cooperatives do not provide sufficient training to their members, and members did not actively attend those trainings provided. Result of the later study also indicate that membership of commercial vegetable cooperatives has no effect on agricultural incomes or the value or amounts of agricultural inputs in Cambodia.

In contrast to the result of this study, **Abate *et al* (2014)** have found that membership to agricultural cooperatives can increase their technical efficiency as compared to non-members; whereas **Ahmed and Mesfin (2017)** have indicated that membership to cooperatives has the tendency to improve the wellbeing of smallholder farmers. However, these studies' perspectives are not related to the market. Even if cooperatives are efficient in

technical aspects, the outcome may be changed by the interplay of the market. The market outcome may be related to the quality of the product. **Francesconi & Ruben (2012)**, comparing production of milk between cooperative and non-cooperative enterprises in Ethiopia, they found cooperatives to be more productive, but that quality was lower. Cooperatives may encourage inputs and intensive practices which are not beneficial to production quality. In turn, quality really matter in determining the price and revenue. Moreover, the efficiency of cooperatives can be determined by their social capital and governance structure. **Ruben and Heras (2012)** have found that, in Sidama Zone of Ethiopia, some cooperatives are efficient in many aspects whereas others fail to achieve their targeted goal due to weak social capital and governance structure. From this, we can understand that not all cooperatives are successful. The justification behind this may be, membership to agricultural cooperatives, in the study areas, distracts the members from looking for better options of input supply, given that the cooperatives are functioning inefficiently. During the Focus Group Discussion, development agents complain that the cooperative union is inefficient in provision of input supply. In addition, it was found that the cooperatives are not functional in some observable aspects. For instance, the cooperatives are little operational in marketing activities, specially, in Kombolcha. In this regard, the Haramaya Cooperatives Union is relatively better.

Amazingly, it was found that choosing Cooperative Union as one of choice of market outlets has significant positive effect for profitability of the farmers (through reduction of marketing costs and getting better price). As indicated in Table 7, per unit profit of those who choose Cooperative Union as one of their market outlet is significantly higher than those who don't choose it.
However, only 44 (43%) of the total 102 sample members of cooperatives are enjoying this benefit (we should also note that non-members of agricultural cooperatives have the chance to use the Cooperative Union as market outlet). From our survey, 14 (7%) of the 198 sample non-members used Cooperative Union as one of their market outlet. Besides, several challenges were raised by the member respondents against the agricultural cooperatives. These were mentioned with their rank of severity in the next section of this paper.

Sensitivity analysis

The sensitivity analysis was carried out making use of the slightly significant outcome variable (per unit cost of production) as the centre of analysis (note that all the other outcome variables are components of per unit profit). As indicated in the methodology part, simulation-based sensitivity analysis was undertaken. The detail procedure of the method was explained in the methodology part. In this method, a simulation confounder (U)is created as a covariate factor for deviation from Conditional Independence Assumption (CIA) so that comparison is made between the ATTs without the simulated confounder and with simulated confounder. The extent of deviation of the ATT with simulated confounder away from the baseline ATT portrays the robustness of the result.

The ATT with simulated confounder is estimated in consideration of different possibilities of $d\ (= P_{01} - P_{00})$ and $s\ (= P_1 - P_0)$ which were defined in the methodology part. Accordingly, we present, in correspondence to different values of the parameters d and s, the estimated ATT, and the values of the parameters Γ and Λ, which measure the effect of the simulated confounder U on the outcome and on the treatment, respectively, controlling for the observed confounders.

As indicated in Table 8, based on Kernel Matching Algorithm, the result shows that, except in some few extreme cases, the percentage of deviation of the value of the ATT with simulated confounder away from the baseline ATT is fairly lower. As supplementary tool of analysis, we have used another algorithm (Nearest Neighbour Matching), for which appropriate standard errors with multiple imputation can be produced using STATA software, so as to see the robustness of the significance of the ATT with and without simulated confounder. The result shows that, almost in all cases, the ratios of the ATTs to their respective standard errors are slightly higher which confirm the slightly significance of per unit cost of production (see appendix). Therefore, in both cases, it can be concluded that our estimation is robust with consideration of unobserved covariates.

Table 6: Average Treatment Effect on Treated (ATT)

Outcome variable	Treated	Control	Difference	t-value
Per unit profit	3.95107532	4.20618533	-0.255110017	-1.63
Per unit cost of production	1.58025993	1.37630394	0.203955989	1.93
Per unit marketing cost	1.00039349	0.543047056	0.457346439	0.86
Per unit price	5.94623656	6.12394112	-0.177704558	-1.34

Source: Own computation, 2019

Table 7: Comparison of Per Unit Profit between Choosing and Not Choosing Cooperative Union as Market Outlet

Variable	Group	Mean	Std. Err	t-value
Per unit profit	Do not choose	3.995048	0.0774443	-3.7015
	Choose	4.64193	0.1454494	
	Difference	-0.6468814	0.1747643	

Source: Own Computation, 2019

Table 8: Sensitivity Analysis using Kernel Matching Algorithm

	Values of ATT with simulated confounder						Baseline ATT without simulated confounder using Kernel Matching
	S = -0.3	S = - 0.2	S = - 0.1	S = 0.1	S = 0.2	S = 0.3	
d = - 0.3	0.198 (18%) Γ = 0.266 Λ = 0.244	0.210 (13%) Γ = 0.266 Λ = 0.419	0.227 (6%) Γ= 0.266 Λ= 0.664	0.269 (12%) Γ= 0.265 Λ = 1.642	0.295 (22%) Γ= 0.255 Λ = 2.632	0.326 (35%) Γ= 0.259 Λ = 5.886	0.241
d = - 0.2	0.219 (9%) Γ = 0.449 Λ = 0.220	0.224 (7%) Γ = 0.411 Λ = 0.394	0.235 (2%) Γ = 0.436 Λ = 0.626	0.259 (7%) Γ = 0.450 Λ = 1.605	0.284 (18%) Γ = 0.402 Λ = 2.516	0.298 (24%) Γ = 0.455 Λ = 4.549	0.241
d = - 0.1	0.240 (0.4%) Γ = 0.693 Λ = 0.219	0.240 (0.4%) Γ = 0.697 Λ = 0.410	0.243 (0.8%) Γ = 0.703 Λ = 0.685	0.257 (7%) Γ = 0.648 Λ = 1.628	0.271 (12%) Γ = 0.683 Λ = 2.478	0.286 (19%) Γ = 0.653 Λ = 4.398	0.241
d = 0.1	0.276 (15%) Γ = 1.714 Λ = 0.221	0.241 (0%) Γ = 0.705 Λ = 0.419	0.242 (0.4%) Γ = 0.713 Λ = 0.700	0.256 (6%) Γ = 0.672 Λ = 1.625	0.270 (12%) Γ = 0.676 Λ = 2.617	0.282 (17%) Γ = 0.705 Λ = 4.460	0.241
d = 0.2	0.299 (24%) Γ = 2.630 Λ = 0.242	0.279 (16%) Γ = 2.423 Λ = 0.451	0.257 (7%) Γ = 2.457 Λ = 0.666	0.235 (2%) Γ = 2.673 Λ = 1.816	0.228 (5%) Γ = 2.698 Λ = 2.624	0.220 (9%) Γ = 2.555 Λ = 4.715	0.241
d = 0.3	0.311 (29%) Γ = 4.249 Λ = 0.303	0.290 (20%) Γ = 4.279 Λ = 0.471	0.262 (9%) Γ = 4.131 Λ = 0.735	0.224 (7%) Γ = 4.373 Λ = 1.818	0.214 (11%) Γ = 4.144 Λ = 3.292	0.188 (22%) Γ = 4.315 Λ = 7.276	0.241

Note: Values in parentheses are percentages of deviations of the ATT with simulated confounder from the baseline ATT
Source: Own computation, 2019

Table 9: Challenges Facing the Agricultural Cooperatives with their Rank of Severity

Challenges	Mean Scale	Rank	Min	Max
Lack of good management system	4.10101	1	1	5
Lack of Coordination	4.040404	2	1	5
Problem of participation and commitment of members	4	3	1	5
Lack of education or skilled human resource	3.949495	4	1	5
Lack of technology based system	3.919192	5	1	5
Competition and absence of well-developed competitive strategy	3.858586	6	1	5
Lack of well-developed market infrastructures such as communication and transportation	3.848485	7	1	5
Shortage of capital	3.787879	8	1	5
Lack of external assistance	3.666667	9	1	5
Absence of good governance structure	3.646465	10	1	5
Lower business volume (scale)	3.646465	11	1	5
High transaction cost	3.636364	12	1	5
Operational problems	3.616162	13	1	5
Market risk	3.585859	14	1	5
Limited access to credit	3.565657	15	1	5
Absence of homogeneity of products	3.464646	16	1	5
Customers inability to pay	3.414141	17	1	5
Accounts (credit) and cash flow problems.				
Obstacle of government policies and regulatory framework	3.353535	18	1	5
Low quality of the products	3.343434	19	1	5

Source: Own computation, 2019

Challenges Facing Agricultural Cooperatives

Performance efficiency of the agricultural cooperatives in the study areas are believed to be compromised by a number of factors. Among which, the major ones were listed down based on their rank of severity in Table 9. During the survey, the sample respondents under

membership of the agricultural cooperatives were asked to mention the major challenges facing the agricultural cooperatives and rate the extent of their severity using Likert type scaling (with five categories of order).

Based on their rating, the most severe ones with highest rate of severity include lack of good management system, lack of coordination, and problem of participation and commitment of members. In addition, lack of educated/skilled man power, lack of technical based system, competition and absence of well-developed competitive strategy, lack of well-developed market infrastructures such as communication and transportation, shortage of capital, lack of external assistance, absence of good governance structure, lower business volume (scale), high transaction cost, operational problems, market risk, and limited access to credit were also found to be considerable problems, respectively, in descending order of severity. Absence of homogeneity of products, customers' inability to pay accounts (credit) and cash flow problems, obstacle of government policies and regulatory framework, and low quality of the products are the least severe challenges.

CONCLUSION AND RECOMMENDATION

Agricultural cooperatives emerged in pursuit of empowering smallholder farmers through improvement in productivity and enhancing market gain (by reducing marketing cost and chasing better price) against opportunistic traders. Theoretically, several benefits are believed to be generated from agricultural cooperatives. This has been revealed by some empirical studies. In contrast, some other studies deny such positive impact referring to the possibilities of inefficient performance of these organizations in developing countries.

In cognizant of different drawbacks observed against agricultural cooperatives in Ethiopia, this study also intended to figure out the impact of the cooperatives on profitability of member farmers taking the experience of potato growers in Eastern Ethiopia.

The study was conducted using survey data collected from members and non-members of cooperatives from two woredas (Haramaya and Kombolcha) of Eastern Hararghe zone. Focus group discussions were also carried out for supplementary information. The study involved both descriptive and quantitative analyses. The quantitative analysis focused on Propensity Score Matching (PSM) method to measure the impact of the cooperatives on net gain of its members. The robustness of the result of the PSM was verified using simulated based sensitivity analysis.

Result of the descriptive analysis indicated, there is insignificant difference of per unit profit between members and non-members of agricultural cooperatives. This was also confirmed through disintegration of components of profitability. That is, there is no significant difference in per unit price, per unit cost of production, and per unit cost of marketing between members and non-members.

After following the standard procedures of PSM method (estimation of the propensity scores for each observation, selection of matching algorithm and test of balancing, test of the overlap assumption, and the sensitivity analysis), Average Treatment effect on Treated (ATT) for per unit profit was estimated which shows that there is no significant difference between members and non-members in this regard. The same holds true for per unit price, per unit cost of production, and per unit cost of marketing, except the marginal significance (at 10% level) for per unit cost of production in favour of non-members. The implication of this result is that membership to agricultural cooperatives does not have any positive impact in terms of profitability of the farmers.

The justification behind this result is that the existing agricultural cooperatives are little operational on activities attached to profitability of member farmers. This has the tendency to distract farmers not to look for better options of production and marketing. For instance, some cooperatives are hardly involved in marketing activities. The result shows that only few proportion of member farmers are enjoying sale of their outputs via agricultural Cooperative Union even if it is profitable to use the Cooperative Union as market outlet. Inactive participation of some members of the cooperatives can also be the reason for this.

In addition, several challenges are raised against the agricultural cooperatives. The most severe ones with highest scale of severity include lack of good management system, lack of coordination, and problem of participation and commitment of members. In addition, lack of educated/skilled man power, lack of technical based system, competition and absence of well-developed competitive strategy, lack of well-developed market infrastructures such as communication and transportation, shortage of capital, lack of external assistance, absence of good governance structure, lower business volume (scale), high transaction cost, operational problems, market risk, and limited access to credit were also found to be considerable problems, respectively, in descending order of severity.

Based on these results, it is recommended that there should be strict follow-up on cooperatives and their performance by the concerned entity; all agricultural cooperatives should be well functional in all aspects attached to profitability of farmers such as marketing activities and provision of productive input supply; there should be frequent and regular awareness creation to enhance active participation of member farmers; frequent and regular trainings are also necessitated in order to build the managerial capacity of the leaders; and there should be clear framework of coordination in production and marketing activities.

Moreover, we should take into account for provision of skilled man power, creation of technical based system (may be as in the case Ethiopian Commodity Exchange), developing well framed competitive strategy, improving market infrastructures such as communication and transportation, provision of capital, creating link for external assistance, improving good governance structure, increasing the business volume (scale), reduction of transaction cost, reducing operational problems, reducing market risks, and provision of better access to credit.

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DETERMINANTS OF VERTICAL COORDINATION OPTION CHOICES AMONG SMALLHOLDER FRENCH BEANS PRODUCERS IN KENYA

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ABSTRACT

Research background: With market liberalization and the introduction of the new Global GAP measures, several vertical coordination options have emerged, presenting smallholder farmers with multiple market outlets. The choice of any vertical coordination option (VCO) is likely to be entwined by farm, farmer and vertical coordination attributes, yet the selection of an appropriate market outlet for delivering farm produce is not clear-cut.
Purpose of the article: This study determines factors influencing the choice of vertical coordination options among smallholder French beans producers in Murang'a South Sub-County
Methods: Using data from a sample of 215 smallholder producers, the study employed a multivariate probit model (MVP) to explain the determinants of vertical coordination option choices among French beans farmers in four wards located in Murang'a South Sub-County.
Findings & Value added: The results indicate that the choice of vertical coordination option was significantly influenced by gender, household size, education stock, group membership, extension service, training access, farming experience, off-farm income, credit access, distance and market reliability. This implies that the promotion of collective action as an institutional tool for linking farmers to high-value markets, matters. These networks will aid in sharing knowledge, increasing borrowing power and thus, producers can improve French bean quality as required by the market. Additionally, financial institutions stakeholders should develop policies that favour the acquisition of credit at affordable rates. Further, the government with other relevant stakeholders should conduct more training on global gap standards.

Key words: vertical coordination; smallholder producers; multivariate probit model; french beans
JEL Codes: C01; D81; Q13

INTRODUCTION

In recent times, the significance of cereals and other staple food crops is declining in developing countries, with high-value commodities receiving an increasing demand. High-value products are commodities with high economic returns, such as cut flowers, fruits, vegetables, meat, milk and fish. Vegetable production being labour-intensive is considered to be an income-generating activity that fits well with the concept of smallholder agricultural development (**Dilamini *et al.*, 2019**). French beans is one of the most crucial export vegetable produced by smallholder farmers in Kenya. Besides, it has a short life cycle, thus ensures income flow throughout the year. Recently, the French beans market has expanded, as seen in Kenya's supermarket shelves and wholesale markets.

Structural changes in the agri-food supply chain, development of institutions for vertical coordination, and growth of high-value commodities present opportunities for smallholder farmers (**Nandi *et al.*, 2017**). In developed countries, vertical coordination options are well developed: thus, farmers make rational decisions on the choice of market outlet. However, in Sub-Saharan countries, in particular Kenya, vertical coordination options are weak, and as such, enforcement and choices are also spurious for smallholder producers. In addition, smallholder producers' farm produce is small in quantities that require aggregation. The aggregators are limited to buying companies or producer marketing organizations (PMO) that are most organized around a specific buyer or an NGO market-linked PMO. The supply chain has become an essential strategy for guaranteeing quality and reliable sourcing of fresh fruits and vegetables globally. Procurement between the producer and the buyer is usually based on observable features like size, volume and colour (**Nandi *et al.*, 2017**). The choice to sell is not mutually exclusive. Producers would prefer to sell a large proportion of their output to the primary buyer while the rest to other buyers (**Muthini *et al.*, 2017; Mojo *et al.*, 2017**).

Besides, market liberalization has given smallholder farmers chances to diversify their production to target high-value markets, for instance, export and processing oriented markets. However, in liberalized markets,

individual farmers lose negotiation power and are usually exploited by buyers due to imperfect information (**Muthini *et al.*, 2017**). Farmers also face behavioural uncertainty due to the perishable nature of some agri-food products (**Ciliberti *et al.*, 2020**). Therefore, Smallholder producers' participation in high-value markets remains a significant constraint. Empirical studies have shown that farmers need support from private and government sectors to access appropriate market channels (**Nandi *et al.*, 2017; Tarekegn *et al.*, 2017**).

The selection of appropriate market channels is an integral part of market participation decisions. Households' decisions to sell in different marketing outlets have a significant effect on income. Several factors are likely to influence farmers' decision to participate in any market outlets, including market access, prices, resource endowment and transaction cost (**Tarekegn *et al.*, 2017; Mmbando *et al.*, 2016**). Understanding these factors is fundamental in pinpointing possible interventions necessary to assist farmers in maximizing benefits derived from production and marketing activities. Further, the information could help develop strategies required to mitigate the effect of some challenges, thereby facilitating smallholder producers' market entry and increasing their probability of running a lucrative crop investment (**Abate *et al.*, 2019**). Besides, it increases income and alleviates poverty among rural households (**Hung and Bokelmann, 2019**). Every single market outlet is characterized by different risks, cost structure, profitability and other necessities. These features are essential to smallholder farmers who aim to access profitable channels (**Abate *et al.*, 2019**). **Muricho *et al.* (2015)** suggested that understanding the association between market outlets is essential in profiling the channels and creating policy interventions cautiously designed to benefit the farmer.

Research on determinants of smallholder market choice has attracted the attention of many empirical studies in recent times (**Kiprop *et al.*, 2020; Mulbah *et al.*, 2020; Abate *et al.*, 2019; Dessie *et al.*, 2018; Slamet *et al.*, 2017**). Given the potential of Murang'a County in French beans production, these study results are essential in providing vital information concerning appropriate vertical coordination options. Therefore, this study contributes to the literature by determining the factors influencing French beans channel choices among smallholder farmers. The study is predicated on time inconsistency in the choice of channels i.e., depending on the market situations on any given day or week, a smallholder could choose a channel or combination of channels to maximize returns. This inconsistency in the choices made is exacerbated by weak contract enforcement mechanisms when procuring from numerous smallholders producing a homogeneous commodity like French beans. Further, the market imperfections for instance, missing, incomplete and thin markets that dominate developing countries' commodity markets might generate less formal and complex arrangements compared to well-developed market systems in developed countries. Of more importance too is the poverty situation in rural farming set ups like Murang'a that might influence choice of more certain channels for pushing sales into the market and consequently quick cash, than relying on more stable relationships created over time, since the latter breed dependency syndrome.

LITERATURE REVIEW

Overview of vertical coordination options

Many studies have argued that vertical coordination strategies lie along a continuum running from spot market to full vertical integration. There are five major vertical coordination options: Spot markets are the simplest, and the intensity of coordination is low. The unseen hand of the market determines the price and broadly accepted standards. The parties involved only engage in price discovery and decide whether or not to enter into the transaction. In this sense, the opportunity to exercise control occurs entirely *ex-ante* to the transaction. The *ex-post* control decision is whether to repeat the transaction with the same party in the future (**Peterson *et al.*, 2001**). The second strategy is specification contracting. This consists of advanced agreements committing farmers and buyers to specific transactions. They include market contracts where buyers stipulate market specifications such as quality, quantity, pricing and timing while leaving production choice to farmers. In resource-providing contracts, farmers are provided with essential inputs and sometimes production advice (**Vroegindewey *et al.*, 2018**). The intensity of control is more than that related to the spot market. The parties involved exercise control through the *ex-ante* negotiation of contract specifications and mutually agreed on incentives for meeting the terms (**Peterson *et al.*, 2001**).

The third portion of the continuum is the relation-based alliance, which is defined as an exchange relationship in which the firms involved share risks and benefits emanating from mutually identified objectives. The parties agree to work closely together and thus find means to resolve internal differences and concerns as they remain independent entities. The intensity of coordination is higher than that of the spot market and specifications contracting. When benefits fail to materialize, the alliance is likely to dissolve because of the ease with which both parties could walk away (**Vroegindewey *et al.*, 2018**). A strategic alliance is an example of this vertical coordination option.

The equity-based alliance is the fourth position along the continuum. It involves some level of shared equity assets among the parties in an exchange relationship. The existence of the new formal organization intended to conduct transactions is one of the distinguishing features of this form of alliance. The defining of decision rights and responsibilities is more precise than in a relation-based alliance. Although the ability to walk away has been reduced, the control is decentralized among the ownership parties. The parties still maintain their separate entity, which allows them to walk away if they so desire. In this strategy, the *ex-ante* activities focus on the legal formation of the new entity, while the *ex-post* control is through the board of directors that sets policies and procedures for executing all transactions (**Bitsch *et al.*, 2020**). Agricultural cooperatives and joint ventures fall under this alliance.

Full vertical integration is the final portion of the continuum, which involves a combination of two or more separable stages of production and marketing under common ownership and management. These stages include production, distribution, sales and other economic practices (**Ayinde *et al.*, 2017**). It is characterized by centralized decision-making, high asset specificity and extensive information sharing. The advantage is that farmers can reduce transaction costs related to search for buyers. For *ex-ante* in this case, the control process involves negotiating the formal centralized *ex-post* governance structure. The *ex-post* control aims to achieve effective governance policies and procedures for the centralized entity (**Peterson *et al*., 2001**).

Determinants of vertical coordination option choices among farmers

Using a binary logistic regression model in Indonesian vegetable market participation, **Maspaitella *et al*. (2018)** found that education level, age, land size, family size and farmer group association were statistically significant in determining supermarket contract participation. These findings were similar to that of **Schipmann & Qaim (2011)** where the logit regression showed that age and household size statistically influenced women membership in a farmer cooperative. However, irrigation method, farm experience, distance to the market, average price, access to credit, extension service and access to market information were not statistically significant. The income obtained from vegetable farming was found to correlate positively with market participation. The authors suggested that prioritizing agricultural development strategies would increase farmer's involvement in the high-value market. These options included improving the technical innovations and empowering collective actions through farmer groups or cooperatives. In their study, the authors assumed that contract farming was homogenous, where farmers decided whether to participate or not. This approach is restrictive where multiple vertical coordination options are available; hence this study employed a multivariate probit to overcome this weakness.

Wollni *et al.* (2012) used a bivariate probit model to identify the determinants of farmer's participation in written and verbal contracts in the Costa Rican pineapple sector. The model results indicated that older, more educated farmers in group organizations were more likely to participate in a formal contract scheme. On the other hand, farmers with off-farm activities and access to credit from other sources were less likely to participate in formal contracts. Furthermore, more experienced farmers and the lesser the period a farmer had interacted with the buyer, the less likely they engaged in a formal agreement. The study also observed that participants in the verbal contract were more likely to be less educated and younger households with a larger number of male adults. Finally, the findings revealed that land size was not significant in either of the equations and hence there was no evidence for the exclusion of the smallholder farmers from verbal and written contracts. Thus, the model in this study is appropriate where there are two mutually inclusive outcomes.

Using the double hurdle model in the study of farmer's participation in the Zambian dairy interlocked contractual arrangement, **Kiwanuka *et al.* (2016)** found that smallholder's decision to participate in this arrangement was influenced by milk price, proximity to a water source, land size, ownership of non-land asset, net income, access to market information, number of lactating animals and ownership of improved breeds. The marginal effect indicated that any extra improved breed to the herd was associated with a 58.4% increase in the household probability of engaging in the program. Likewise, the increase in the processors' prices led to a rise in the households' probability to participate by 50.4 %. Similarly, access to market information and an increase in the value of non-land assets was associated with an increase in households' prospect to participate in the program. However, the limitation was that it only focused on one vertical aspect, the contract option. Therefore, this study included other vertical coordination options in the analysis to inform policymakers appropriately.

Carillo *et al*. (2017), in their survey on the choice of vertical coordination options, used a probit model which included; economic characteristics of the household, farm structure, and social-demographic features. The results indicated that various factors influenced a farm to be vertically coordinated as follows; large land size, high education level of the producer, household income, and product certification presence. The findings further showed that households headed by a male were more likely to be vertically coordinated than female headed households. A key factor that may explain this difference is the existence of gender gap in Sub-Sahara Africa with respect to extension services. The extension services tend to favour men over women. Consequently, men end up having better access to training, superior technology and are equipped with skills that assist them to participate in high value markets such as contract farming (**Agholor, 2019**). This was consistent with findings found by **Nyaupane & Gillespie (2011)**, where the probit results showed that age, education level and income affected the producer's choice of a market outlet. The limitation to this study is that the authors assumed that farmers had only one market choice to decide whether to participate. Therefore, this study included more market options to improve on the mentioned drawback.

In a similar study on factors that influence marketing decisions, **Carillo (2016)** used a linear regression model in the Italian Pasta supply chain. The findings indicated that gender and age did not affect the type of market option selected, and hence both coefficients were statistically insignificant. However, the education level or the number of training attended increased vertical coordination levels of the producers. The results showed low participation of smallholders into contractual arrangements as processors were discouraged from including them due to their inability to meet quality and quantity requirements. Consequently, other scholars argued that food companies prefer to work with medium and large producers (**Singh, 2002**). This model assumes linearity in parameters, while in reality, parameters are not always constant across time units.

Trifkovic (2016) used a multinomial logit model to analyse the predictions of different vertical coordination mechanisms in Vietnam. From the findings, the choice of vertical coordination options was determined by transaction cost, weak contract enforcement, social norms, trustworthiness, perceptions, reliability, age and education level of the household. The study found that young and more educated farmers had greater opportunities to benefit from contracts, as observed by **(Barrete *et al.* 2012)**. In a similar survey, **Abasimel (2020)** recommended interventions towards rural education, training and improving financial institutions to facilitate market access. This model is appropriate when individuals only choose a single option from the established set of mutually exclusive choices. However, the model also assumes independence of each choice hence does not allow correlation between them. This study overpowered this weakness by using a multivariate model.

In examining the implication of contract farming for welfare and food security in China, **Islam *et al.* (2019)** used a probit model to determine factors that influence farmer's participation in contractual arrangements. The results from the study indicated that land size did not seem to be a barrier against smallholder participation. The factors that influenced farmer's participation included distance to the input and output market, farming experience, herd size, family member marital status, the price received before the contract, access to credit and extension service. Using a similar model in the analysis of factors that influence farmer participation in a cooperative in Germany, **Pascucci & Gardebroek (2010)** found that, number of cooperatives within the vicinity of the farmer, wealth and better networking had positive impacts on horizontal integration decision. These studies focused on one vertical coordination option, whereas this study included other vertical coordination options as a basis of analysis.

A Multivariate probit model was used to determine factors that influence farmers' preference for pepper market outlets. In their study, **Wosene *et al.* (2018)** found that the sampled household made their choices depending on the following factors; farmer's experience, frequency of the extension contacts, education level, value addition, total livestock owned, quantity of pepper and distance to the market. The author further found that market contracts and consumer market outlets had a complementary relationship. The findings in this study were in line with that of **Burkitbayeva & Swinnen (2020)**, which also found that extension service contributed to developing skills and knowledge of the farmer hence adopting a closely coordinated supply chain. This model stands to be appropriate for the proposed study because it allows smallholder farmers to choose more than one option simultaneously.

In a study on determinants of market participation among smallholder pineapple farmers, **Sigei *et al.* (2014)** used Heckman two-stage selection model to determine the decision to participate and the extent of participation in a high-value supply chain. The model involved two stages, firstly the selected equation was estimated using a probit model and secondly, the ordinary least squares regression method was used to estimate the outcome equation. The findings indicated that age, gender, marketing experience, price information, group marketing, yield and education level influenced farmers' participation in high-value markets. The results showed that 53% of the producers were under contracts while 43% did spot market transactions. The two-tailed results revealed that age was statistically significant at 1%, indicating that market participants' mean age was less than non-participants. This result is consistent with that of **Barrett (2010)**, which also concluded that the young people participated more in the market because they were more receptive to new ideas less risk-averse than older people. One weakness with this model is that it performs poorly when the normality assumption is violated.

DATA AND METHODS

Study area

The study was carried out in Murang'a South Sub County. The total area of Murang'a South Sub-County is 456.9 sq. Kilometers with a population of 184, 824 people (**KNBS, 2019**). The Sub County is located between Longitudes 37 º 08' 60" East and Latitude 0 º 43' 0" North. Murang'a South Sub-County comprises 6 wards, namely Kimorori, Makuyu, Kamahuha and Ichagaki. The area receives an annual average rainfall of 1164 mm and an annual temperature of 19.8 ºC. It experiences long rains in March, April and May, with short rains being recorded between October-November. Agriculture is the main economic activity in the region, and it contributes to about 57% of the county's population income. The major cash crops in the county include tea, coffee, avocados, mangoes and macadamia. Horticultural crops include French beans, tomatoes, cabbages, kales and spinach, while food crops include bananas, maize, sweet potatoes and cassava (**County Government of Murang'a, 2018**).

Sampling and sampling procedure

Using a multistage sampling technique, a total of 215 farmers was obtained. At the first stage, Murang'a County was selected purposively since French beans are one of the three priority value chains that the county is promoting. It is also one of the few counties where the export of horticultural produce is a significant economic activity. At the second stage of sampling, Murang'a South Sub-County was purposely selected because it leads in French beans production and has the highest number of smallholder farmers. At the third stage, four wards namely, Kamahuha, Makuyu, Kimorori and Ichagaki were purposively selected based on the production level. At the fourth stage, two management systems (contract and non-contract farming) were purposively selected from each production ecologies. As suggested by Yamane (1967), when the study area's population size is known with certainty, the following formula is appropriate to determine the sample size Eq. (1).

$$n = \frac{N}{1 + N(e^2)}$$

$$n = \frac{937}{1+937(0.06^2)} = 214.3 \approx 215 \qquad (1)$$

Where:
n is the sample size, N is the total population of interest and e is the allowable margin of error. This gives a sample size of 215 respondents. French beans farmers were proportionately selected since the population in each ward was not equal in size. Finally, simple random sampling was used to select the 215 respondents.

Empirical model specification

Based on empirical studies reviewed, and considering time inconsistency, market imperfections and poverty condition as a possible motivation for the choice of vertical condition options in a rural set up like Murang'a, a multivariate probit model was adopted for this study. This model is preferred since it has the ability to simultaneously set out the influence of a set of explanatory variables on the choice of vertical coordination options while allowing the unobserved disturbances as well as different coordination options to be correlated (**Belderbos *et al.*, 2004**). Smallholder farmers in this study are faced with different vertical coordination options like contracts, middlemen and spot market transactions. The producer's decision for any vertical coordination option is based on utility maximization. This implies that the alternative choice requires different costs and benefits and hence different utilities. Considering the possibility of simultaneous choices of vertical coordination options and the potential correlations among these coordination option decisions, a multivariate probit model stands to be appropriate. The model also helps to capture household variation in the choice of vertical coordination and to estimate several correlated binary outcomes jointly.

Other studies used a multinomial logit model in determining factors influencing producer's vertical coordination choice. The use of this model is misleading because it assumes individuals choose only one option from mutually exclusive alternatives. The choice of vertical coordination j is dependent on the selection of the other. This is because smallholder farmer's choice decisions are interdependent.

Empirically this model can be presented as Eq. (2).

$$Y_{ij}^{*} = \beta_{ij} X_{ij} + \varepsilon_i \qquad (j = Y_1, Y_2, Y_3) \qquad (2)$$

Where: Y_{ij}^{*} is the latent variable, Y_{ij} is the observed dummy variable for all the options Eq. (3).

$$Y_{ij} = {}_{0}^{1}\int if \; {}^{Y^{*}>0}_{otherwise} \; j = Y_1, Y_2, Y_3 \qquad (3)$$

$X_{ij}$is a set of explanatory variables, $B_{ij}$are the coefficients to be estimated, Y_{i1} =1if a farmer chooses contract, 0 otherwise $Y_{i2} = 2$ if a producer selects middlemen, 0 otherwise, $Y_{i3} = 3$ if spot market is taken, 0 otherwise while ε_i is the error term.

In a multivariate approach, the use of various vertical coordination options simultaneously is possible and the disturbance terms jointly follow a multivariate normal distribution with a mean of zero and a variance normalized to unity Eq. (4).

$$\begin{pmatrix} \varepsilon_{i1} \\ \varepsilon_{i2} \\ \varepsilon_{i3} \end{pmatrix} \ldots N \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix} \begin{bmatrix} 1 & P_{i12} & P_{i23} \\ P_{i21} & 1 & P_{i23} \\ P_{i31} & P_{i32} & 1 \end{bmatrix} \qquad (4)$$

Where:
P_i represents the correlation between different vertical coordination options, ε_{i1} to ε_{i3} are the error terms. The off-diagonal elements in the covariance matrix represent the unobserved correlation between the stochastic components of different vertical coordination options.

Table 1 provides variables hypothesized to influence the choice of vertical coordination option.

Post estimation test methods

Variance inflation factor (VIF) was used to test the presence of multicollinearity while the Breusch-Pagan test was used to test the presence of heteroscedasticity. The presence of multicollinearity causes the estimated regression coefficients to have incorrect signs that could lead to wrong conclusions. Correlation among categorical variables was determined using a pairwise correlation test.

RESULTS AND DISCUSSION

Table 2 provides descriptive statistics of continuous household characteristics while Table 3 gives descriptive statistics of farm and farmer characteristics for categorical variables. The age of the sampled households ranged from 21 to 75 years. The mean age of the households surveyed was 46 years. This implies that most farmers are still in their productive age. According to Table 3, the majority of the respondents were males (61%) which could be attributed to the fact that most males have land ownership rights relative to females. Education level was defined by the number of formal schooling. The overall mean education stock for the households surveyed was 38 years. A higher number of formal schooling among the households means that they are more receptive to new management practices and technologies. Household size was used as a proxy variable for the labour force and household dependency ratio. The results indicated that the mean family size of the sampled households was 4.4 with an adult equivalent ratio of 3.9. Farm size was assumed to be a good proxy gauge of wealth. The mean land size among the respondents was 1.26 acres implying that landholdings are very small. The small farm sizes generally suggest that majority of farmers are poor. Credit access was also inadequate (KES 2604) suggesting that farmers received low amounts of credit due to lack of collateral. Agricultural extension service is essential in informing and influencing farmers' decisions, especially in the adoption of new technologies. Sixty-one (61) percent of the farmers received extension services while the number of training received on average was 3.3 times for the last production year. Out of the sampled households, (62%) of the key production decision-makers were members of agricultural groups. Horizontal coordination assists smallholder farmers in pooling resources to achieve economies of scale, thereby increasing their access to input and output markets. Group membership also aids farmers to attain bargaining power thus they can negotiate for better prices for their produce.

The mean of farming experience was 10.33 years among the farmers. Producers who possess many years of farming experience have a better understanding of market opportunities and are less likely to be cheated since they know the market outlet dynamics. The association between farming experience and usage of vertical coordination options was statistically significant at 1%. In terms of distance, farmers reported a mean of 3.8 Kilometres to the output market. A longer distance to the output market is associated with high transport cost thereby farmers were likely to choose market outlets that would reduce transaction cost. Concerning vertical coordination attributes, the availability of the channel had a mean score of 3.6 while that of reliability was 3.3. This implies that farmers who participated in vertical coordination options they perceived to have the highest attribute score.

Farmers participated in either a single choice or a combination of outlets. The six identified options include contract (38%) middlemen (13%), spot (8%), contract and middlemen (8%), middlemen and spot (17%) while contract, middlemen and spot market at 16%. Contracting was the dominant marketing outlet among farmers as shown in Figure 1.

Post estimation test results

The VIF mean value was 1.75 ranging from 1.06 to 3.75. Based on the threshold of 10 the study found the absence of multicollinearity.

The probability chi-square was 0.2828 which is greater than 0.05 suggesting that heteroscedasticity was not a problem. We fail to reject the null hypothesis that the variance is homoscedastic.

Results on the correlation among categorical variables are given in Table 4. The pairwise correlation values for categorical variables ranged from 0.0225 to 0.2593 which is below the acceptable cut-off point of 0.5. This implies that there was no strong association among the categorical variables used in the model.

Table 1: Description of variables used in the study

Variable	Description	Measurement	Expected sign
Dependent			
Y_i	Choice of vertical coordination, 1=contract, 2=spot, 3=middlemen	Categorical	
Independent			
Age	Age of HH head(years)	Continuous	+
Hhsize	Household size(adult equivalent)	Continuous	+/-
Gender	Sex of the household head, 1=male, 0=female	Dummy	+
Edu	Education stock (years of formal schooling)	Continuous	+
AccCrdt	Amount of credit (KES)	Continuous	+
Fsize	Farm size (in acres)	Continuous	+
Offincome	Off-farm income	Continuous	+
ExtAcc	Extension access	Dummy 1=yes, 0=no	+
Notra	Number of training	Continuous	+
Grpm	Group membership	Dummy 1=yes, 0=no	+
Dist	Distant to market (kilometers)	Continuous	+/-
Fexp	Farming experience(years)	Continuous	+
Infoacc	Information access	Dummy 1=yes, 0=no	+
Rel	Reliability of the outlet	5 Likert=(SD to SA)	+

Note: SD=Strongly Disagree, D= Disagree, N= Neutral, A=Agree, SA=Strongly Agree

Table 2: Descriptive statistics of farm, farmer and vertical coordination attributes for continuous variables

Variables	All (215) Mean	Contract Mean	Non-Contract Mean	t-value
Age	46.4(12.53)	46.9(12.66)	45.7(12.36)	-0.679
Education of the respondent	9.71(3.45)	10.17(3.74)	8.97(3.18)	-2.514**
Education stock	38.3(19.93)	37.4(19.87)	39.6(20.05)	0.774
Household size (number)	4.4(2.02)	4.2(1.94)	4.7(2.11)	-2.514**
Household size (adult equivalent)	3.9(1.78)	3.72(1.71)	4.2(1.85)	1.924**
Farm size (acres)	1.26(0.94)	1.33(0.95)	1.14(0.91)	-1.475
Land under French beans	0.4(0.29)	0.44(0.29)	0.35(0.29)	-2.311**
Farming experience	10.33(6.86)	13.75(6.28)	4.9(3.34)	-11.832***
Number of training	3.3(3.05)	4.8(2.86)	0.95(1.50)	-11.205***
Credit in KES	2604(9548)	3007(10857)	1964(70001)	-0.780
Distance to market center	3.8(1.86)	3.8(1.94)	4.0(1.72)	1.006
Availability of the channel	3.6(0.78)	3.8(0.66)	3.2(0.80)	-6.253***
Reliability of the channel	3.3(0.77)	3.6(0.68)	2.8(0.65)	-8.744***

Note: ***, ** denotes statistical significance at 1% and 5% level respectively.
Figures in parenthesis are standard deviations associated with means of the variables indicated.
Source: survey data 2020

Table 3: Descriptive statistics of farm and farmer characteristics for categorical variables

Variables		All %	Contract %	Non-Contract %	Chi2
Farmer characteristics					
Gender	Male	60.47	57.58	65.06	1.194
	Female	39.53	42.42	34.94	
Marital status	Married	75.81	71.21	83.13	5.515*
	Single	15.35	16.67	13.25	
	Widowed	8.84	12.12	3.61	
Occupation	Business	2.33	2.27	2.41	12.864***
	Casual	1.86	0.00	4.82	
	Farmer	86.98	84.85	90.36	
	Civil servant	8.84	12.88	2.41	
Off-farm income	Yes	27.44	32.58	19.28	4.526**
	No	72.56	67.42	80.72	
Land ownership	Yes	79.53	81.06	77.11	0.4890
	No	20.47	18.94	22.89	
Rented-in land	Yes	68.37	68.18	68.67	0.005
	No	31.63	31.82	31.33	
Institutional factors					
Information access	Yes	76.74	83.33	66.27	8.318***
	No	23.26	16.67	33.73	
Extension access	Yes	61.40	76.52	37.35	32.980***
	No	38.60	23.48	62.65	
Training access	Yes	69.30	86.36	42.17	46.785***
	No	30.70	13.64	57.83	
Group membership	Yes	62.33	74.24	43.37	20.680****
	No	37.67	25.76	56.63	
Credit access	Yes	10.7	10.61	10.84	0.956***
	No	89.30	89.39	89.16	

Note: ***, **,* denotes statistical significance at 1%, 5% and 10% level. Source: Survey data (2020).

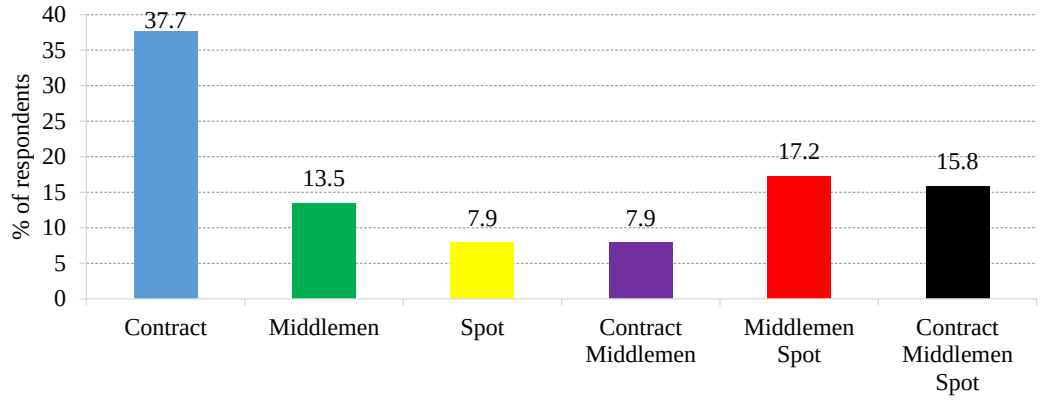

Figure 1: Vertical coordination options used by smallholder farmers
Source: survey data (2020)

Empirical results

Table 5 gives the empirical results for factors influencing the choice of vertical coordination options among smallholder farmers.

The Wald chi-square test that all the regression beta coefficients are jointly equal to zero is rejected. (Wald chi-square (42) = 131.69; Prob > chi-square = 0.0000). These imply that all the explanatory variables are significant. The likelihood ratio test (LR test: Chi-square (3) = 33.359; Prob > chi-square=0) is highly significant at 1% suggesting that multivariate probit model fits well the data.

Gender of the household head had a highly significant influence on the probability of choosing contract and middlemen options at 1% significance level each. Male-headed households had a higher likelihood of selling through middlemen by 4% and a lower probability of selling through contract by 9%. This implies that households headed by males were more likely to participate in middlemen options while less likely to select contract outlet. A possible explanation for the shift of males from contract to middlemen is that access to middlemen could reduce transport cost and market risks associated with the produces' perishability. Further, quick payment plays a crucial role while farmers make decisions

on which marketing channel to use as reported by the respondents during the interviews. This finding is in line with that of **Adugna *et al*. (2019)**, where farmers chose farm gate outlets to reduce transaction cost and cash constraints. However, **Shammah *et al*. (2017**) pointed out that male-headed households had a higher probability of selling pineapple in the export market than farm gate. According to **Shammah *et al.* (2017)**, men have the ability to engage in negotiations, possess more marketing networks and interact with more buyers, unlike women who are restricted by family roles.

Household size had a negative and significant effect on the choice of contract option at 5% level. Any additional adult to a household reduced the chances of participation in the contract by 47.7%. An additional member could imply more responsibilities to care for the aged thus increasing the family expenditure on food and other basic needs. An increased dependency ratio in a household would mean that less money is left to pay for contract requirements such as registration fees. This result conforms to that of **Muricho *et al*. (2015)** which indicated that a higher dependency ratio puts more pressure on market participants to meet home consumption needs. However, **Abu *et al*. (2016)** found that household size had positive and negative effects on market participation. The authors argued that an increase in the number of family members could enhance market participation through the provision of labour and also reduce the probability of participating in multiple market outlets due to the limited surplus available for sale.

Education stock was positive and statistically significant at 10% for the choice of contract option. Households with higher education stock were more likely to participate in the contract as opposed to non-contract options. A one-year increase in the number of formal schooling among household members resulted in a 3% likelihood that a household will choose a contract. This implies that better-educated household members are more likely to have improved access to market information thereby affecting their decision-making. Access to this information places farmers in a better position to negotiate for better output prices, seek better market opportunities, and meet the required market quality standards. This result corroborates with studies showing that education has a positive impact on the producers' choice of market channel (**Mariyono *et al*., 2019; Slamet *et al*., 2017**).

Off-farm income had a positive effect on the choice of middlemen and spot market options at 1% significance level each. Involvement in off-farm activities increased the probability of participating in middlemen and spot market options by 62.8% and 62.5% respectively. A probable explanation for this is that farmers prefer to sell to channels that reduce the transaction cost involved in searching for the buyer. This result tallies with that of **Emana *et al*. (2015)** who noted that farmers with off-farm income would prefer to sell their produce to the nearby market channel with lower prices than searching for other channels. However, **Muthini *et al*. (2017)** reported that farmers with off-farm income were less likely to sell to brokers. The contradicting authors argued that these farmers probably were not cash-constrained and therefore could delay their sales as they seek better prices from other channels.

Access to extension service was found to be significant for the selection of contract and middlemen options at 5% and 1% significance levels respectively. Producers who received extension services were more likely to select contract by 67.4% while less likely to choose the middlemen option by 69.4%. Extension agents provide advisory services to farmers which in turn, increases their ability to choose the best market channels such as contracts. Similarly, **Muthini *et al*. (2017)** reported that lack of extension services positively influenced the quantity of output sold to brokers. Moreover, **Hirpesa *et al*. (2020)** argued that access to extension services significantly increased the likelihood that a smallholder dairy farmer would participate in the contract market relative to the non-contract supply chain.

Number of training was positive and statistically significant at 5% level for the contract option. A unit increase in the number of training increased the probability of choosing a contract option by 18.1%. This result suggests that training exposes farmers to a wide range of ideas and gives farmers opportunities to have better access to appropriate market information. Similarly, **Taregken *et al*. 2017** noted that frequent training on improved production methods enabled farmers to access high-value channels.

Group membership was positive and statistically significant at 10% for the contract channel. Farmers belonging to an agricultural group had a higher probability of selling through a contract outlet by 55.4%. This can be attributed to the fact that producers who collectively market their produce to distant areas tended to incur reduced transaction cost. It may further be explained by the role of collective action in attaining bargaining power and reducing transaction cost which corroborates with findings by **Mulbah *et al*. (2020**). This finding is also consistent with those of **Kiprop *et al*. (2020)** which stated that the probability of accessing processor market outlets increased with group membership as compared to accessing the market as an individual producer. However, group membership can negatively impact market participation in case disagreement emerges among members, distorting marketing decisions (**Olwande & Mathenge, 2012**).

Access to credit was positive and statically significant at 10% for the contract channel. A unit increase in credit received increased the chances of participating in the contract option. A possible explanation for this is that obtaining a contract market for French beans is both labour and capital-intensive and therefore credit access eases the liquidity constraint of households. Similarly, **Melese *et al*. (2018)** found that the availability of credit services had a positive significant effect on the choice of assemblers as a viable marketing channel for selling onions as opposed to direct consumers.

Farming experience was highly significant at 1% significance level for contract and spot market. An additional year of farming experience increased the probability of selling through contract option by 22.3% while less experience was associated with selling a larger proportion of output to the spot market by 9%. Farmers

who had more farming experience were assumed to have better bargaining power and marketing linkage, and therefore, were able to understand opportunities and threats in the market. These producers, thereby, tended to sell their produce to the contract option because it offered farm inputs. **Hung & Bokelmann, (2019)** found a similar result.

Perception on the reliability of the outlet was statistically significant at 5%, 1% and 1% significance level for contract, middlemen and spot market respectively. High perception of reliability of the channel increased the probability of choosing a contract option by 62.1% while reducing the likelihood of selling through middlemen and spot market by 54.9% and 36.6% respectively. With the perishable nature of French beans, producers tend to choose market channels that have a ready market to supply their produce. This implies that contract attributes such as stable market prices, availability of market information, timely payments and guaranteed market motivated farmers to sell their produce through this channel. This result is in line with **Dlamini *et al.* (2019)** who reported that market incentives such as bulk purchasing, quick process and lump sum payments encouraged farmers to sell through supermarkets compared to traditional markets.

Distance to the market center was positive and statistically significant at 10% for the contract option. A unit increase in distance to market increased the likelihood of choosing a contract by 3%. This implies that the probability of choosing a contract option increases with an additional distance to the market center. A plausible explanation for this behaviour could be, farmers incurred extra transaction cost while moving their produce to the market and thus they preferred to sell through contract since it provides transport for their produce. Similarly, **Shammah *et al.* (2017)** noted that additional distance to the market increased the probability of choosing an export market for pineapple fruits as opposed to the farm gate. According to the authors, gross margin from a high-value channel outweighs the opportunity cost of selling the produce at the farm gate due to transaction cost incurred. Additionally, farmers who are farther from the market are more likely to have large farms which exporters prefer because of economies of scale (**Muthini *et al.*, 2017**). However, **Van den Berg *et al.* (2004)** argued that small farms owned by resource-rich farmers, not relying on family labour, perform better than large farmers owned by resource-poor farmers.

Table 4: Pairwise correlation test for categorical variables

	Gender	Extension access	Training access	Off-farm income	Group membership	Information access
Gender	1					
Extension access	-0.1136	1				
Training access	-0.0225	0.2593	1			
Off-farm income	0.0496	0.1023	0.2059	1		
Group membership	-0.0594	0.1327	0.2317	0.0694	1	
Information access	-0.1524	0.1741	0.2542	0.1412	0.1855	1

Table 5: MVP estimates for factors influencing VCO selection decisions

Variable	Contract		Middlemen		Spot	
	Coeff.	Std.Err	Coeff.	Std.Err	Coeff.	Std.Err
Age	-0.014	0.015	0.010	0.010	0.014	0.010
Gender	-0.948***	0.352	0.407***	0.207	0.105	0.206
Household size	-0.457**	0.184	0.044	0.093	-0.112	0.095
Education stock	0.031*	0.017	0.002	0.009	0.013	0.009
Farm size	-0.104	0.173	0.001	0.124	-0.017	0.116
Off-farm income	0.308	0.363	0.628***	0.237	0.625***	0.237
Group membership	0.554*	0.322	-0.326	0.225	0.009	0.215
Extension access	0.674**	0.330	-0.694***	0.222	-0.156	0.221
Number of training	0.181**	0.089	-0.021	0.045	0.038	0.051
Reliability	0.621**	0.190	-0.549***	0.148	-0.366***	0.141
Distance	0.039*	0.023	-0.020	0.015	-0.015	0.014
Farming experience	0.223***	0.052	-0.005	0.021	-0.092***	0.028
Information access	-0.151	0.378	0.061	0.248	0.311	0.238
Credit access	0.000*	0.000	0.000	0.000	0.000	0.000
_cons	-3.113	1.065	1.724	0.692	0.809	0.670

Number of observations =215
L.R test of rho30=rho31=rho32=0 Chi2(3)=33.359 Prob > chi2=0.0000
Wald chi2 (42) = 131.69 Prob > chi2 = 0.0000

Note: ***, **,* denotes statistical significance at 1%, 5% and 10% level respectively.
Source: survey data 2020

CONCLUSION AND POLICY RECOMMENDATION

Kenya operates under imperfect input and output market resulting in high transaction cost, price risks and thin markets. The study focuses on determinants of vertical coordination option choices based on data collected from smallholder French beans producers in Murang'a South Sub-County. The findings show that gender, household size, education, group membership, extension access, number of training, market reliability, farming experience, credit access, off-farm income and distance to market have a significant effect in explaining farmers' vertical coordination option selection strategy. The study also revealed that French beans were marketed through a single or combination of channels. Further, the findings established that the Contract option was the dominant channel among smallholder French beans producers.

The following are policy recommendations drawn from the study. First, there is a need to strengthen rural farmer organizations to increase their bargaining power and borrowing ability. Distance from the farm to the market significantly influenced vertical coordination choice decisions. This study recommends investing in infrastructure, especially roads, to reduce transaction cost and improve supply reliability. Household size was negative and statistically significant for the choice of contract option. This result brings forward the importance of demographic policy, which takes into account the households' composition. Therefore, this study recommends the need for policy geared towards helping farmers with a high dependency ratio to improve their household income. Farming experience was highly significant for the choice of contract market option. Therefore, the government needs to organize more training on the new Global GAPs, especially for older farmers. This move would enable farmers to meet high-value market requirements. Access to credit was found critical in driving uptake of formal French beans marketing channel. Financial institutions stakeholders should develop policies that favour the acquisition of credit at affordable rates.

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DETERMINANTS OF CUSTOMER'S CHOICE OF RETAIL OUTLET FOR THE PURCHASE OF FRUITS AND VEGETABLES

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ABSTRACT

Research background: Adequate and sufficient intake of fruits and vegetables has been listed as one of the important avenues for actualizing a healthy living. More so, access to fruits and vegetables through a preference for retail outlets is indispensable to the debate on fruits and vegetable consumption among households.
Purpose of the article: The study examines factors influencing the choice of retail outlets and frequency of visits to retail outlets for the purchase of fruits and vegetables.
Methods: The study employed multistage sampling to select the respondent for the study. Primary data were collected from 290 respondents through semi-structured questionnaires and were analysed using Descriptive statistics and Multinomial Logistic Regression.
Findings & Value added: The results indicate that majority (52.76%) of consumers preferred to purchase fruits and vegetables daily, weekly, and monthly, while 27.59% preferred to purchase fruits and vegetables weekly only. Regarding the choice of retail outlet, most (46.21%) preferred both open market, neighbourhood stores, and supermarkets, while 33.10% preferred open market only for the choice of fruits and vegetables. The results also indicate important and significant factors like household size ($p<0.1$), number of people working within the household ($p<0.05$), total household income ($p<0.05$) that influenced the consumer's choice of retail outlet for fruits and vegetable. Likewise, important and significant factors such as customer service ($p<0.05$), sex of consumer ($p<0.05$), shopping habit ($p<0.01$) influenced the frequency of visits to fruit and vegetable retail outlets by consumers. The study recommended that retail outlet owners should strive to create a conducive and friendly atmosphere with their customers to engender an enduring customer service experience to encourage customers' repeat purchases.

Key words: retail outlets; fruits and vegetable; consumer's choice; socioeconomics; urban
JEL Codes: D1; D5; C8; D12; Q11; Q12

INTRODUCTION

Adequate and sufficient intake of fruits and vegetables has been listed as one of the important avenues for actualizing a wish for healthy living. **WHO (2003)** reported that fruits and vegetables are indispensable food groups for human development and growth. In Nigeria, the consumption of fruits such as banana, apple, orange, grape, pear, and lemon and vegetables such as tomato, pepper, eggplant, lettuce, cucumber, garlic, carrot, and cabbage are undoubtedly common in the household food basket (**Ogundari and Arifalo, 2013**). Therefore, the importance of fruits and vegetable consumption among household members in Nigeria cannot be overemphasized. Additionally, **WHO (2003)** report revealed that low consumption of fruits and vegetables make people to be vulnerable to gastrointestinal cancer, ischemic heart disease, and stroke globally. Fruits and vegetables as part of the daily diet that could help prevent major non-communicable diseases (NCD). Moreover, eating a variety of vegetables and fruits ensures an adequate intake of most micronutrients, dietary fibres, and a host of essential non-nutrient substances.

Nigeria provides a large and attractive retail food industry including fruits and vegetable because of the major traditional foodstuffs consumed by the majority of the population. The examples of such food stuff include fruits, vegetables, corn, sorghum, tubers, and seafood (fish) which are predominantly unprocessed and/or semi-processed. There has also been an increase in the establishment of large international and local supermarkets with several conveniences or neighbourhood retail stores springing up daily in all nooks and crannies within the cities. Government urban renewal activities have favoured and encouraged the establishment of these supermarkets and convenience stores because of the government's city development and investment objectives to the detriment of the development of

traditional open-air markets. As a matter of fact, in some instances, government agencies purposely or clandestinely demolish the existing traditional open-air markets in urban centers and convert them into semi-modern retail outlets to give the city a "befitting" appearance deserving of a developed metropolis. Some of these open-air markets display several raw food products ranging from cereals, roots, and tubers to fresh fruits and vegetables

Despite the urban renewal project of governments and their bias for the promotion of modern retail outlets, traditional open-air retail outlets are still the most frequented outlets in Nigeria. The evidence is based on the transactions percentage distribution among the 3 established trading platforms in Nigeria as outlined by a United States Department of Agriculture **(Nzeka, 2011)** report. This assertion is corroborated by **Meng *et al.*, (2014)** in their study in Ghana where open-air markets were found to continue to dominate the food retail system, with 70% of households reporting to patronize them at least once a week. Open-air markets are traditional food outlets particularly attractive to large households. More so, most households who are low-income earners prefer to engage open markets for their raw foods, particularly fruits and vegetables.

It is important to note that available literature by **Ohen *et al* (2014), Layade and Adeoye (2014), and Ogundari and Arifalo (2013)** on fruits and vegetables in Nigeria are focused primarily on the consumption, nutritional, health, and disease prevention. However, the previous studies did not expressly examine the factors influencing the choice of retail outlets where fruits and vegetables are purchased by consumers. Thus, it neglects or underestimates the important factors that may be responsible for the choice of retail outlets for fruits and vegetables. More so, we lack the understand of important factor and how they influence the choice of retail outlets for fruits and vegetable. Moreover, other studies that touched on consumer preferences for location of purchase either dwelt on the blanket grocery transactions **(Nzeka, 2011)** or under the general foodstuffs category with fruits and vegetables being just an item in the study as it relates to consumer's diet and nutrition **(Meng *et al* 2014; Kapoor & Kumar, 2015)**. This study, therefore, develops a better understanding of factors that influence customers' preference for a particular retail outlet(s) for the purchase of fruits and vegetables in urban Ibadan. The objective of our study was to:

1. determine the factors that are responsible for the most preferred retail outlet where customers purchase fruits and vegetables;
2. determine factors influencing the frequency of visits of a customer to a preferred retail outlet.

LITERATURE REVIEW

Importance of fruits and vegetable

The importance of fruits and vegetables in daily diet is indispensable as recommended by World Health Organization. Vegetable constitutes the most important and inexpensive component of a balanced diet, which people now realize due to their high nutritive values indispensable for the body adequate functioning **(Bvenura & Sivakumar, 2017)**. A robust body of evidence supports the recommendations for people to consume a diet rich in fruits and vegetables to reduce their risk of noncommunicable chronic diseases (NCDs), including cardiovascular disease, stroke, and cancer **(Raaijmakers *et al.*, 2018; Englund *et al.*, 2020)**. Recognizing these benefits, governmental agencies and non-government organizations (NGOs) have undertaken a range of farm-to institution initiatives to improve access of institutional clients to fresh produce from small scale fruit and vegetable farmers **(Boys *et al.*, 2017)**. Apart from their economic importance, they are forest and environmentally friendly to fight against drought, use as shade, firewood, food security, agro industry, export, etc. Fruits account for a substantial fraction of world's agricultural output and some of such as apple have acquired extensive cultural and symbolic meanings. Despite its importance the daily consumption of vegetables is insufficient in Nigeria **(Olatona *et al.*, 2018)**. Reliable data on food intake in populations in developing countries (including Nigeria) are scarce and limited, meaning that the mentioned numbers may deviate from actual consumption **(Raaijmakers *et al.*, 2018)**. In the latest national survey 12.4% of the households reported to consume leafy vegetables, and 16.3% consumed non-leafy vegetables, at least once or twice per week. In urban areas, 11.1% of the households indicated to consume at least once or twice a week leafy vegetables and 16.6% indicated to consume non-leafy vegetables at the same frequency **(Maziya-Dixon, 2004)**.

Fruits and Vegetables Retail Outlets

Traditional market is a market with little central control or organization, lacks refrigeration, and does not process fresh foods into branded goods for sale (**Trappey & Lai, 1997)**. According to **Pricewaterhouse Coopers (2006)** and **Pandit *et al.* (2020)** convenience stores are located in major urban centers and along highways to capture those consumers who prefer convenience where they offer a greater variety of products, longer hours of operation and lower prices compared to the traditional grocery stores. Locally grown foods can offer health benefits as well. As produce harvested closer to its peak maturity can offer more health-promoting benefits and as fresh produce can quickly lose its nutrient value after harvest **(Bvenura & Sivakumar, 2017)**, locally grown produce can be more nutritionally dense. These retail outlets specialise in selling a broad variety and range of fresh fruits and vegetables purchased directly from growers/producers or wholesalers for locally produced ones while they get imported/exotic fruits and vegetables mainly from wholesalers and middlemen **(Tedesco et al., 2021)**. These retailers are largely located in open air markets in dedicated fruits and vegetables section among other stalls, but they are also commonly found in small neighbourhood or street markets, roadside kiosks, cart pushers/street hawkers and in large supermarkets or shopping malls. Nigeria retail food sector consists of supermarkets, convenience stores/small groceries, and traditional, open-air markets sharing 1.0%, 34% and 65% of total retail food sales, respectively **Nzeka (2011)**. Additionally, in spite of

the urban renewal project of governments and their bias for the promotion of modern retail outlets, traditional open-air retail outlets are still the most frequented outlets in Africa and some other countries in the world. This assertion is corroborated **by Meng *et al.* (2014)** in their study in Ghana where open-air markets were found to continue to dominate the food retail system in Ghana, with 70% of households reporting to patronize them "once a week" or "more than once a week" and that open-air markets are traditional food outlets particularly attractive to large households in Accra. Similar situations also occur outside the African continent as **Meng *et al.* (2014)** quoted the research works of **Faiguenbaum *et al.* (2002)** where it was stated that, in Chile, the traditional markets still compete strongly in the fruit and vegetable sub-sector, and that the ability of traditional markets to compete is a result of consumer perceptions that traditional markets offer both good prices and freshness **(Goldman *et al.* 2002)** and also that in several large Chinese cities, about 49% of consumers reported buying the bulk of their fresh vegetables from supermarkets **(Hu *et al.* 2004)**. **Gido *et al.* (2016)** revealed in their work that local open air markets and green groceries were the most preferred retail outlets in rural and urban households, respectively in Kenya for African indigenous vegetables (AIV). More so, gender, age and educational level of the key decision-maker, household size, varietal diversity, vegetable bunch size, market distance and perceptions regarding AIV retail prices significantly influenced the choice for AIV retail outlets **(Salanieta *et al*., 2021)**.

Marketing fruits and vegetables

The dramatic increase in consumption of fruit and vegetable products in the world makes it even more relevant to develop effective export marketing strategies aimed at ensuring competitiveness **(Ahmadjanovna, 2020)**. The middlemen and poor supply chain facilities have increased agricultural prices up to 60% without actually adding any value **(Behera *et al*., 2015)**. The internationalization of markets (particularly supply competition) and the increased emphasis on value-added characteristics are two important features that changed the marketing and distribution system in the fruit and vegetable sector **(Pandit *et al*., 2020).** Thus, in about two decades, marketing of fruit and vegetables has undergone profound changes, moving from a traditional model based on a large number of operators and on simple transactions (daily, price, class, and volume specifications) between shippers and buyers in wholesale markets. As a result of the current trends, the fruit and vegetable supply chain presents a complex and diversified organizational structure from country to country. This depends on multiple factors: the nature of the produce, the characteristics of production structures, the level of innovation technology and the role of actors along the supply chain. The actors play different roles according to structural and operational features such as the volume of the agricultural production marketed, the fragmentation of farms, and the development of modern distribution and retail systems, which require performing organizational systems, adequate size and logistic platforms **(Camanzi *et al*., 2011)**.

DATA AND METHODS

The Study rea

The study was carried out in Ibadan, Oyo State in the southwest geopolitical zone of Nigeria. Ibadan is the capital of Oyo State, located in the south-eastern part of Oyo State. It has a population of about 4 million **(Adelekan, 2016)**. It is the most urban and metropolitan area in the State with the presence of shopping malls having notable international and local supermarkets, banks, recreation centers, hotels, etc. The city has numerous convenience/neighbourhood stores and a sizeable number of open-air traditional markets where they retail fruits and vegetables. The city also contains a good mixture of both the high, middle, and low-income earners with the location of the supermarkets, convenience stores, and the open-air markets fairly distributed within the city. There are eleven (11) Local Governments Areas in Ibadan consisting of five (5) urban local governments in the city and six (6) in peri-urban.

Sources of Data

Primary data were used for the study derived from structured questionnaires designed for fruits and vegetable customers within the chosen study areas. Data were obtained on the socio-economic characteristics of the consumers, frequency of purchase (daily, weekly or monthly) and where (open markets, convenience stores, or supermarkets) they purchase fruits and vegetables, amount spent (daily/weekly) on fruits and vegetables, the characteristic features of retail outlets and reasons for customers' decision to visit the retail outlets.

Sampling Procedure

A multi-stage random sampling technique was used for this study. The first stage was the purposive selection of the five (5) urban LGAs out of the eleven (11) LGAs in Ibadan. The selected LGAs are Ibadan North (Agodi Gate), Ibadan North-East (Iwo road), Ibadan North-West (Onireke/Jericho), Ibadan South-West (Ring road) and Ibadan South-East (Mapo/oje). The second stage involved the randomly sampling of the open-air market (see Table 1) within the selected LGAs The third stage included the selection of individual shoppers at different open-air markets. The selection was done by positioning enumerators at major roads/intersections, retail stores, and markets within the chosen areas where there was significant human traffic; the enumerators randomly selected, approached, and questionnaires were administered to the customers. Informed consent was obtained from respondents before questionnaires were administered to the respondents. A total of 290 responses were eventually retrieved, while 10 questionnaires were returned incomplete. Table 1 showing the distribution of how the sampling technique was undertaken.

Econometric model specification

The study employed multinomial logistic regression to analyse the influence socioeconomic and demographic factors on the choice of preferred retail outlets and frequency of visit to retail outlets by the consumers.

The Multinomial regression model for categorical dependent variable with K levels in series of K – 1 equation, one for each independent odds, with each equation consisting of an intercept and B predictors.
Assuming that the last or K_{th}, category of the dependent variable is the proxy or reference category, the equations are expressed in Equation 1 - Equation 5.

$$\text{Log}O_1 = \alpha^1 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_b X_b \quad (1)$$

$$\text{Log}O_2 = \alpha^2 + \beta_1^2 X_1 + \beta_2^2 X_2 + \cdots + \beta_b^2 X_b \quad (2)$$

$$\text{Log}O_1 = \alpha^3 + \beta_1^3 X_1 + \beta_2^3 X_2 + \cdots + \beta_b^3 X_b \quad (3)$$

$$\text{Log}O_{k-1} = \alpha^{k-1} + \beta_1^{k-1} X_1 + \beta_2^{k-1} X_2 + \cdots + \beta_b^{k-1} X_b \quad (4)$$

$$\text{Log}RETAIL\ OUTLETS_{k-1} = \alpha^{k-1} + \beta_1^{k-1} X_1 + \beta_2^{k-1} X_2 + \ldots + \beta_b^{k-1} X_b \quad (5)$$

Where:
$Log_{retail\ outlets}$ Log of choice of retail outlets/frequency of visit;
k – 1 number of equation;
k representing logits;
β coefficient;
X_b socioeconomic and demographic characteristics of respondents.

The X_s in the equation above are independent variables. As in logistic regression with binary response, parameters are estimated by maximizing the likelihood function for the sample responses on the dependent variable **(Chukwuone, 2009).**

Thus, Multinomial logit regression analysis was used to examine the determinants of the most preferred retail outlets where customers purchase fruits and vegetables.
Likewise, Multinomial logit regression analysis was also used to determine the factors that influence frequency of visit of a customer to a preferred retail outlet following **Bond *et al*., (2009)** (Equation 6).

$$P_j = P\left(Y_j = {}^{K}/_{X_j}\right) = \frac{\exp(\beta_{oj} + \sum_k \beta_{1k} xjk + \varepsilon_j)}{\sum_{i=1}^{j} exp(\beta_{oi} + \sum_k \beta_{1k} xik + \varepsilon_i)} \quad (6)$$

Where:
Y_i categories of frequency of visit of a customer to a preferred retail outlet: Y_0 =Daily, Y_1 =Weekly, Y_2 =Monthly.
Likewise,
Y_i categories of choice of retail outlets for purchase of fruits and vegetable: Y_0 = Open air market, Y_1 = Neighbourhood stores, Y_2 = Supermarket, Y_3 = Combination of open market, neighbourhood, and supermarket.

Table 2 present the measurement of the explanatory variable.

Table 1: Overview of randomly selected respondents from the surveyed locations

SN	LGAs	Surveyed Locations	Number of Respondents
1.	Ibadan north	Bodija market	10
		Bodija estate	10
		Ashi road	10
		Sango	10
		Agbowo/ui	10
		Poly road	10
2	Ibadan south east	Oje market	20
		Oja oba	10
		Beere	10
		Bode/molete	10
		Oke ado	10
3	Ibadan north east	Iwo road	20
		Bashorun	20
		Akobo	20
4	Ibadan south west	Challenge	15
		Ring road/shoprite	15
		Oluyole estate	15
		Felele/pinnacle area	15
5	Ibadan north west	Sabo/mokola	15
		Dugbe	15
		Eleyele	15
		Jericho/aleshinloye	15
		Total	300

Table 2: Explanatory variables used in the study

Choice of most preferred retail outlets	Apriori expectation	Frequency of visit of a customer to a preferred retail outlet	Apriori expectation
X_1 Affordable price of fruits and vegetables (Yes=1, 0= otherwise).	+	X_1 shopping habit of customers (1="planned", 0="otherwise")	+
X_2 Proximity/Nearness to the retail outlet (Yes=1, 0= otherwise).	+	X_2 Amount spent on fruits and vegetables by customers (Naira)	+
X_3 Freshness of the fruits and vegetables (Yes=1, 0= otherwise).	+	X_3 Availability of fruits and vegetables at the retail outlets (Yes=1, 0= otherwise)	+
X_4 Hygiene consideration of the retail outlet (Yes=1, 0= otherwise).	+/-	X_4 Customer service offered by the retail outlets (Yes=1, 0= otherwise)	+
X_5 Household size of the customers (number)	+/-	X_5 Freshness of the fruits and vegetables (Yes=1, 0= otherwise)	+
X_6 Age of customers (years)	+/-	X_6 Storage facility by the customers (Yes=1, 0= otherwise)	+
X_7 Formal education of customers (years)	+/-	X_7 Household size of the customer (number)	+/-
X_8 Occupation of customers (1="public salaried", 0= "otherwise")	+/-	X_8 Competitive pricing of fruits and vegetables at the outlet (Yes=1, 0= otherwise)	+/-
X_9 Total household income of the customers (Naira)	+	X_9 Occupation of customers (1="public salaried", 0= "otherwise")	+/-

RESULTS AND DISCUSSION

Frequency distribution of consumers' purchases of fruit and vegetable (Table 3) shows that 27.59% of the respondents purchase fruits and vegetables on a weekly basis, while 18.97% purchase fruits and vegetables on daily basis. Regarding frequency of purchase, about 52.76% of respondents purchase fruits and vegetables on both daily, weekly and monthly basis.

Table 3: Frequency Distribution of Purchase by Consumers

Frequency of Purchase	Frequency	Percentage
Daily	55	18.97
Weekly	80	27.59
Monthly	2	0.69
Combination of Daily, Weekly and Monthly	153	52.76
Total	290	100.00

Source: Field Survey 2017

Retail Outlet for the Purchase of Fruits and Vegetables by Customers

The results of the most preferred retail outlet for the purchase of fruits and vegetables by consumers is presented in Table 4. The findings from the study shows that customers who purchased fruits and vegetables from different retail outlets. Regarding open market retail, about 33.10% of consumers buy their fruits and vegetables from open air market. Likewise, about 15.17% engage supermarket, while neighbourhood stores only have the lowest patronage with 5.52%. The majority (46.21%.) of the consumers patronize more than one retail outlets. The percentage of respondents who engage open market retail outlet only for the purchase of fruits and vegetables is a confirmation of the widely documented fact that the traditional retail channel still the most and commonly accessible food outlet by households in developing countries, Nigeria inclusive. This finding agree with the findings of **Chamhuri & Batt (2013), Gido *et al.*, (2016), Meng *et al.*, (2014) Mącik *et al.*, (2013)** that open market is commonly used by households.

Determinants of the Most Preferred Retail Outlets for the Purchase Fruits and Vegetables by Customers

Table 5 shows a multinomial logit regression result on the determinants of the most preferred retail outlet for the purchase of fruits and vegetables in urban Ibadan. The Chi-Square statistics is significant (at 1% probability level) which shows the goodness of fit of the model. The three categories of the dependent variables used here are Open-markets, Neighbourhood/Convenience Stores, and Supermarkets. The base category adopted is the combination of these three categories.

Firstly, household size is positively and statistically significant (at 10% probability level) for selecting an open market retail channel for the purchase of fruits. This implies that a unit increase in a household size will increase the probability of a household's purchase in the open market by 4.3% relative to more than one retail outlet. In other words, the larger the household size, the more likely it is that the household will purchase fruits and vegetables from an open market compare to a combination of the three retail outlets. This may be due to the fact that fruits and vegetables in open markets are perceived to be cheap which makes the channel more desirable for families with large family sizes as it affords them the opportunity to purchase a large number of fruits and vegetables at a cheaper price. According to **Meng *et al.* (2014)**, larger households shop for foods in open-air markets more frequently. This also confirm the findings of **Adams *et al.*, (2020)** that household size is important factor that influence the choice of retail outlets. Likewise, proximity is positively and statistically significant (at 10% probability level) in determining respondents' choice of open market as a retail outlet they engage with. This means that close distance to an open market retail channel is to a respondent increases the probability of purchasing from there by 30%. **Panda (2013)** opined that the major benefits of the traditional markets (open markets) over the modern markets are related to the convenience of location, customized services, and ease of

goods return or exchange policy. Product freshness was however found to be negatively and statistically significant (5% probability level) in determining the household choice of open market as a retail outlet for the purchase of fruits and vegetables. Respondents show that they have a 30% less probability of purchasing fruits and vegetables in the open market when freshness is under consideration. This implies that respondents would prefer the choice of the three retail outlets when considering freshness as a factor for determining the purchase of fruits and vegetables. This may be due to the perception among respondents whose majority are highly educated (57.93%) that open market retail outlets are unsuitable for purchasing fruits and vegetables because of the unhygienic nature of the open-market environment which impacts the product quality. **Meng *et al.* (2014)** found that college-educated households have a lower probability of shopping for food in open-air markets, because an open-air market may not meet their high expectations for food quality.

Secondly, regarding engaging neighbourhood stores, sex and number of persons working in a household are statistically significant. The sex of respondents is found to be positively and statistically significant (10% probability level). This implies that being a male customer increases the probability of purchasing from neighbourhood stores by 5%, it indicates that male respondents would rather prefer to visit neighbourhood convenience stores as compared to the combination of the three retail outlets. According to **Panda (2013)**, *Kiranas* (a type of neighbourhood/convenience store in India) are perceived to be better than the organized retailers in terms of extending credit and phone order services and this is possible due to the familiarity of the customers with the local shop owners and goodwill. The product quality is perceived to be better at neighbourhood outlets especially for food and grocery items because of the choice of freshness in the case of food products in India. Likewise, the number of people working in a household is positively and statistically significant (5% probability level). This depicts that an additional working adult in a household increases the probability of purchasing fruits and vegetables in a neighbourhood store by 5%, this implies that the higher the number of persons working in a household, the higher the likelihood they will purchase their fruits and vegetables from neighbourhood/convenience store as against the combination of the three retail outlets. As **Meng *et al.*, (2014)** confirmed that income significantly influences where consumers shop, it is expected that the more money available for the purchase of food in a household, the higher the level of convenience that will be sought by the household as the total household income would have increased. Likewise, **Iton (2017)** predicts income as important element in the choice of retail outlet. As the number of persons working in a household increases, there will be less time dedicated for long hour shopping and thus will prefer to purchase within the neighbourhood due to closeness and convenience as **PriceWaterhouseCoopers (2006)** found that convenience stores are located in major urban centers and along highways to capture those consumers who prefer convenience where they offer a greater variety of products, longer hours of operation and lower prices compared to the traditional grocery stores. This also support the finding of **Tanwar (2015)**.

Thirdly, regarding supermarket as retail outlet choice, the number of persons working in a household, total household income, affordability, and public salaried are statistically significant. Total household income is positively and statistically significant (5% probability level) for the choice of the supermarket as a retail outlet for fruits and vegetable purchase. This result is consistent with the findings of **Meng *et al.* (2014)** that posits income has a significant positive influence on food shopping frequency in supermarkets. However, the marginal effect of the total household income as a result of the total number of working persons in the household was found to be negligible. This also confirms the result from **Meng *et al.* (2014)** who posited that although income is an essential factor for buying food in a supermarket, the magnitude of its effect is still quite small. The negligible marginal effect of total household income notwithstanding, the wide diversity of products including both food and non-food items makes a supermarket the most convenient one-stop store for large households especially those consisting of two or three generations **(Meng *et al*., 2014)**. The result also shows that public salaried (work type) is positively and statistically significant (10% probability level) in determining the household choice of Supermarket as a retail outlet for fruits and vegetable purchase. It is, however, instructive to note from the result that the salary earned by public servants have a very negligible effect on the probability of public salaried respondents purchasing fruits and vegetables from supermarket retail outlet. This negligible purchasing probability by public salaried respondents may be attributable to the epileptic and inconsistent monthly salary payment of these workers as the government is owing to a backlog of unpaid salaries.

The result from this study is similar to the report by **Ohen *et al.*, (2014)** where the result from their ordered probit regression indicated that the frequency of monthly purchase of fruits and vegetables among civil servants in Essien Udim LGA, Akwa Ibom State, Nigeria was significantly determined by the monthly income of the workers while other variables such as age, sex, marital status, and educational level had no significant effect on the frequency of monthly purchase. Additionally, affordability was found to be positively and statistically significant (1% probability level) for the purchase of fruits and vegetables at the supermarket retail outlet as compared against the combination of the three retail outlets. Affordability as a factor however has a very low or nearly negligible probability of 0.002% to be an important factor to entice a customer to purchase from a supermarket. Supermarket purchase is seen among the customers as a status symbol often frequented by the high and middle-income households who can afford the non-negotiable shelf prices of the various products in the outlet. To these high and middle-income earners, supermarket prices are not enough hindrance to purchasing from there as **Chaiyasoonthorn & Suksa-ngiam (2011)** found that factors correlated with the purchase of goods and services from modern retail stores (supermarket inclusive) were a distance from home, distance from the workplace, purchase intention, customer satisfaction, perceived service quality, personal income, and household income.

Table 4: Distribution by the Most Preferred Retail Outlet for the Purchase of Fruits and Vegetables by Consumers

Retail outlet	Frequency	Percentage
Open market	96	33.10
Neighbourhood/Convenience Stores	16	5.52
Super market	44	15.17
Combination Open market, Neighbourhood Stores and Supermarkets	134	46.21
Total	290	100

Source: Field Survey 2017

Table 5: Determinants of the Most Preferred Retail Outlets for the Purchase of Fruits and Vegetables by Customers

Where purchases made	Coef.	Std. Err.	dydx	Z	P>z
Open market					
Sex	0.014	.305	-.016	0.05	0.962
Years of Education	-0.053	.039	-.012	-1.36	0.174
Household size	0.174	.101	.042	1.72	0.086*
Number of persons working	-0.228	.250	-.072	-0.91	0.362
Public salaried	-0.186	.382	-.031	-0.49	0.626
Proximity	1.273	.743	.295	1.71	0.087*
Affordability	0.439	.570	-.096	-0.77	0.441
Hygiene	0.217	.339	.045	0.64	0.521
Freshness	-1.379	.692	-.300	-1.99	0.046**
Total amount fruits and vegetable	8.080	.000	6.910	0.23	0.821
Total household income	-1.820	1.760	-3.750	-1.04	0.300
cons	0.603	1.159		0.52	0.602
Neighborhood Stores					
Sex	1.022	.598	.049	1.71	0.088*
Years of Education	0.0186	.086	.001	0.21	0.831
Household size	-0.091	.202	-.007	-0.45	0.651
Number of persons working	1.004	.419	.053	2.39	0.017**
Public salaried	-.628	.843	-.027	-0.75	0.456
Proximity	0.178	1.205	-.015	0.15	0.883
Affordability	-0.325	1.094	-.007	-0.30	0.766
Hygiene	0.265	.695	.008	0.38	0.703
Freshness	-1.186	1.304	-.031	-0.91	0.363
Total amount of fruits and vegetable	0.000	.000	2.880	1.28	0.202
Total household income	-2.680	3.780	-0.960	-0.71	0.478
cons	-3.285	2.206		-1.49	0.137
Supermarket					
Sex	0.149	.904	0.005	0.17	0.868
Years of Education	-0.166	.126	-0.801	-1.31	0.191
Household size	-0.137	.263	-0.108	-0.52	0.602
Number of persons working	1.171	.530	0.657	2.21	0.027**
Public salaried	1.511	.849	0.880	1.78	0.075*
Proximity	-0.860	.904	-0.735	-0.95	0.341
Affordability	-5.483	1.070	-.000	-5.12	0.000***
Hygiene	26.48078	1251.725	.0001439	0.02	0.983
Freshness	18.40245	3009.234	.0001035	0.01	0.995
Total amount fruits and vegetable	0.0000439	.0000709	2.06e-10	0.62	0.535
Total household income	9.24e-06	4.22e-06	5.49e-11	2.19	0.029**
cons	-43.11971	3259.17		-0.01	0.989
Combination of more than one outlet	(base outcome)				

Number of observations = 290 LR chi2 (33) = 218.66 Prob > chi2 = 0.0000 Log likelihood = -229.58097
Pseudo R2 = 0.3226, *, **, ***, indicates 0.1, 0.05, 0.01 probability level respectively.
Source: Field Survey 2017

Drawing from this conclusion, it is, therefore, safe to say that affordability is given whenever a resident decided to purchase fruits and vegetables at the supermarket retail outlet as **Meng *et al.* (2014)** puts it that high-income and well-educated households, who buy regularly in supermarkets, are more likely to consume healthy food items including imported vegetables and fruits, as well as new highly nutritious food products because a typical supermarket has a wide selection of food products, and offerings that may include but are not limited to out-of-season vegetables and fruits or international products with high nutritional density.

Factors Influencing Frequency of Visit of a Consumer to the Preferred Retail Outlet

Table 6 shows a multinomial logit regression result on the factors influencing the frequency of visits of a consumer to a preferred retail outlet for the purchase of fruits and vegetables in urban Ibadan. The Chi-Square statistics are significant at a 1% probability level which shows the goodness of fit of the model. The three categories of the dependent variables examined in this study are: daily, weekly, and a combination of both daily and weekly purchases. The monthly purchase frequency wasn't

considered because the observations were insignificant, thus negligible.

Firstly, the variables that are statistically significant under the daily frequency of purchase are the total amount spent on fruits and vegetables, shopping habits, and customer service. The total amount allocated to the purchase of fruits and vegetables was found to be negatively and statistically significant (10% probability level) in determining the consumer daily purchase of fruits and vegetables. It can be inferred that because of the price of fruits and vegetables, respondents are less likely to be willing to do daily purchase rather they will want more of the combination of the purchasing frequencies. This might be true of households with large sizes who may want to take advantage of weekly bulk. The result also indicated that shopping habit was found to be negatively and statistically significant (10% probability level) in determining if a consumer will daily purchase fruits and vegetable. Consumers have a 15% less probability of daily shopping for fruits and vegetables. Customer service is positively and statistically significant (5% probability level) in determining if consumers will daily purchase fruits and vegetables as against the combination of both. Excellent customer service makes customer feels wanted and that the retailer cares about developing a long-term relationship that means more than just making a one-off sale. The result means that the better services a customer gets from the retailer of fruits and vegetables the higher the likelihood that such customer will daily purchase fruits and vegetables from such outlet. Consumers desire not just satisfaction of a product bought but also the satisfaction of service rendered and thus will frequently visit retail outlets where both are adequately available and given. This agrees with the findings of **Mącik *et al.* (2013)** that consumers have different preferences for the choice of their retail food outlets. Good customer service also inspires loyalty among customers which leads to a good reputation for the retail outlet and eventually long-term business growth. This is a win-win situation for both customers and retailers.

Secondly, regarding the weekly frequency of purchase fruits and vegetables, the significant factors include the sex of the customer, household size, total household income, and shopping habits of the customers. The sex of customers was found to be positively and statistically significant (5% probability level) in determining if a customer will purchase fruits and vegetables weekly. The result indicated that male customers have a 12% probability of weekly fruits and vegetable purchases as against the combination of the three purchase frequencies. This is similar to the findings of **Ogundari &Arifalo (2013)** and **Yen *et al*., (2011)**.

Table 6: Factors Influencing Frequency of Visit of a Customer to a Preferred Retail Outlet

Frequency of Purchase of Fruits and Vegetables	Coef.	Std. Err.	dy/dx	Z	P>z
Daily Purchase					
Age of customer	-.012	.016	-.001	-0.74	0.458
Sex of customer	.0187	.390	-.021	0.05	0.962
Years of formal education	.042	.052	.003	0.81	0.419
Household size	.033	.117	-.002	0.28	0.778
Total amount spent on fruits and vegetable	-.000	.000	-.000	-1.78	0.075*
Total household income(Primary)	0.271	0.178	0.473	1.52	0.128
Public salaried	-.147	.436	-.036	-0.34	0.736
Storage facility	-.013	.380	.002	-0.03	0.973
Shopping habit	-.929	.475	-.153	-1.96	0.051*
Customer service	.756	.385	.082	1.96	0.050**
Availability of fruit and vegetable	.876	.524	.114	1.67	0.095
cons	-0.207	1.118		-1.86	0.063
Weekly Purchase					
Age	.011	.016	.002	0.69	0.488
Sex	.655	.322	.124	2.03	0.042**
Years of Education	.036	.045	.005	0.80	0.422
Household size	.169	.102	.031	1.66	0.097*
Total Amount spent on fruit and vegetable	.000	.000	0.000	0.96	0.338
Total household income(Primary)	-0.385	0.002	-0.000	-1.93	0.054*
Public salaried	.494	.385	.099	1.28	0.200
Storage facility	-.107	.352	-.019	-0.30	0.761
Shopping habit	1.089	.326	.241	3.33	0.001**
Customer service	.272	.365	.024	0.75	0.456
Availability of fruits and vegetables	-.183	.381	-.067	-0.48	0.629
cons	-2.847	.919		-3.10	0.002**
Combination of Daily, Weekly and both Daily and Weekly	(base outcome)				

Notes: Number of observations = 288; LR chi2(22) = 77.89; Prob > chi2 = 0.0000; Pseudo R2 = 0.1341; Log likelihood = -251.36598.
*, **, ***, indicates 0.1, 0.05, 0.01 probability level respectively.
Source: Field Survey 2017

According to **Ogundari & Arifalo (2013)**, the probability of consumption and the demand for vegetables decrease significantly with household size, educational level of the head, and among households headed male. In the same vein, **Yen *et al.*, (2011)** stated that the effects of gender as a determinant of fruits and vegetable consumption suggests that men consume fewer fruits while the effects on vegetables are insignificant. Likewise, household size is positively and statistically significant (10% probability level) in determining if a customer will purchase fruits and vegetables weekly. The probability of a household purchasing fruits and vegetables weekly rather than daily or monthly is 3% showing therefore that the larger the family size, the more likely the household will prefer weekly purchases as against the combination of the three frequencies. In contrast to this finding, however, the result from the work of **Meng *et al.* (2014)** states that one additional adult to a household increases the probability of buying food in supermarkets "more than once a week" by 4.8 %. Total household income is negatively and statistically significant (10% probability level) in determining if a customer will purchase fruits and vegetables weekly. This means it is less likely higher total household income will make consumers purchase fruits and vegetables weekly. This finding is against the apriori expectation from this study because of the high level of formal education and the health benefit awareness level of the customers but it is a confirmation of the result of **Ogundari & Arifalo (2013)** that the demand for fruit responds slowly to rise in income among low-income households in Nigeria. shopping habit is positively and statistically significant (1% probability level) for weekly purchase of fruits and vegetables as earlier discussed. The respondents' shopping habits have a 2% probability of influencing the weekly purchase of fruits and vegetables as against the combination of the three frequencies. Customers believe that adhering to a weekly frequency of shopping will encourage them to practice planned shopping by drawing up a list of needed home essentials rather than unplanned or impulse shopping. Planned shopping affords customers to save money while impulse shopping makes them spend more than expected.

CONCLUSION AND POLICY RECOMMENDATION

Most households in urban Ibadan purchased their fruits and vegetables more on a weekly than on daily basis. Education and awareness of nutritional benefits had a positive effect on the daily and weekly consumption patterns of fruits and vegetables. Despite the increasing development and recorded growth of modern retail stores within urban Ibadan, the traditional open market retail channel still commands the highest percentage patronage among urban households for the purchase of fruits and vegetables; followed by supermarkets and neighbourhood/convenience stores. The freshness and quality of fruits and vegetables and customer convenience are the two most important determinants of customers' choice of different retail outlets as against competitive and affordable prices.

As a result of the findings from this study, it is recommended that:

i. Urban renewal activities should not be an avenue to dislodge or demolish traditional open market outlets, rather, the priority for these existing open-market retail outlets should be to restructure/reorganize them into making the market environment more friendly, convenient, accessible, and hygienic for both the retailers and customers. The restructuring can be in form of efficient waste management (timely evacuation), maintenance of market roads (free flow of human and vehicular traffic), thorough drainages (free flow of waste water and floods), construction of adequate car parks (reduce market roads congestion and eliminates customers' fears of their cars being towed while parked in an unauthorized area), provision of functional public toilets (promote hygiene and prevent communicable diseases), water supply (for drinking and daily essentials) and assurance of security of lives and properties of customers, consumers, and shoppers.
ii. Fruits and vegetables producers and retailers should be quality conscious during the processes of production and handling of fruits and vegetables to preserve the freshness of the products. The preservation of the products' freshness will encourage customers and consumers to frequently visit their preferred outlets for fruits and vegetable purchases thereby enhancing the livelihood of the customers and improving the sales revenue and profitability of the retailers and producers.
iii. Retail outlet owners should strive to create a conducive and friendly atmosphere with their customers to engender an enduring customer service experience to encourage customers' repeat purchases.

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DETERMINANTS OF INTENSITY OF SOYBEAN COMMERCIALIZATION AMONG SMALLHOLDER FARMERS IN BUTERE, KENYA

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ABSTRACT

Research background: Soybean commercialization plays a vital role in enhancing the livelihoods, and income of small-scale farmers. Despite the government efforts to boost agricultural commercialization in Kenya, the intensity of soybean commercialization in the Butere Sub-County has remained low for unknown reasons.
Purpose of the article: This study investigates factors influencing the intensity of soybean commercialization in Butere Sub-county with an aim of recommending policies for improving the effectiveness and efficiency of the soybean commercialization process to improve rural livelihoods as well as realize major economic goals.
Methods: A sample of 201 smallholder soybean farmers was selected using a multistage sampling procedure. Face to face interviews using a pretested semi-structured questionnaire was used to collect the data. Data analysis was done using descriptive statistics and a double hurdle regression model.
Findings & Value added: The results revealed a relatively low soybean commercialization level (56.72 %) among soybean-producing households in the study area with schooling years, the number of extension contacts, and total land size under soybean production positively and significantly influencing soybean commercialization decisions. Similarly, schooling years, the number of extension contacts, and total land size under soybean production positively and significantly determined the intensity of soybean commercialization. The study, therefore, recommends equitable access to agricultural resources by all gender, the creation of exclusive land ownership rights, and the structuring and strengthening of the extension system.

Key words: soybean; intensity; commercialization; double hurdle model
JEL Codes: C01; C13; C31; Q12

INTRODUCTION

Globally, agricultural commercialization plays a passive and supportive role in economic growth and development **(Leavy and Poulton, 2007; Kirsten *et al.*, 2012; Todaro and Smith, 2015)**. Agricultural commercialization represents a major transformation in the sector of agriculture that aims at improving the livelihoods of many small-scale farmers through employment creation, increased incomes, and food and nutritional security **(Todaro and Smith, 2015).** As efforts proceed to further transform the agricultural sector to help boosts the livelihoods of rural farmers in developing countries, much of the discourse focuses on agricultural commercialization **(World Bank, 2008).**

Lapar *et al.* (2003) defined agricultural commercialization as any market-oriented activity conducted to promote the sale of produce. They added that it represents produce sales as a fraction of total output. According to **Jagwe *et al.* (2001),** commercialization refers to market participation that involves a transition from subsistence farming to market engagement networks as well as frequent use of market institutions and market infrastructures to trade agricultural products and services. The process usually involves a gradual change from subsistence to fully commercialized agriculture with the main aim of realizing various welfare effects **(Pingali and Rosegrant, 1995).** It involves farm households' decision to fully commercialize production when targeting output markets than being connected only to the volume of produce they would probably send to the market due to surplus production (**Pingali and Rosegrant, 1995**). It also relates to the agricultural production to meet specific output market needs as well as the supply of inputs for production to farmers **(Jagwe *et al.*, 2001; Brian and Barret, 2014).**

Like in many developing countries, commercialization is not new in Kenya for it dates backs to more than five decades ago, but gained prominence during structural adjustment period when Kenya, with support from international development agencies, started implementing liberalization policies. **(GoK, 1965; GoK, 1981; GoK, 1986, Rono, 2002; GoK, 2004; GoK, 2005; GoK, 2007; GoK, 2010; GoK, 2017).** Focusing on the

Strategy for Revitalization of Agriculture (SRA), Agricultural Sector Transformation and Growth Strategy (ASTGS), and Agricultural Sector Development Strategy (ASDS), commercialization was identified among transformational strategies for realizing food security and eradicating poverty in Kenya. The sole purpose of these major economic policies was to change Kenya's agricultural sector from subsistence farming to a market oriented and profitable economic activity **(GoK, 2005; GoK, 2010).** Additionally, the implementation of these market liberalization policies shifted agricultural development from subsistence farming to agribusiness by promoting transparent agricultural input and output markets, agribusiness-oriented culture, access to agricultural credit, and efficient use of farming inputs **(GoK, 2007; GoK, 2010).**

Importantly, agricultural stakeholders have overtime emphasized legume commercialization. This is because legumes are important sources of nutrients (protein and oils) in human diet and positively contribute to soil fertility through biological nitrogen fixation, income, and livelihoods of many households **(Chianu *et al.*, 2006; Varia, 2011).** However, it is crucial to acknowledge that given the human and industrial demand for other legumes such as soybean, *Glycine max (*L.) *Merrill*, research organizations are increasingly developing and disseminating soybean technology with the view of encouraging soybean production, as well as commercialization. Soybean commercialization enables farmers to increase farm margins or income from higher yields for improved living standards **(Osmani *et al.*, 2015).** In this regard, various development partners have been promoting soybean production as well as its commercialization activities especially in many developing countries **(Varia, 2011).**

Soybean production and commercialization are largely practiced by small-scale producers with limited capability to deal with agricultural production and commercialization challenges such as market inaccessibility, pests, and diseases, effects of climate change, and many more **(Idrisa *et al.*, 2010)**. Soybean production is largely done in western part of Kenya such as Vihiga, Busia, Kakamega, and Bungoma. In these areas, soybean is majorly intercropped with stable crops, however, this is far below the current production potential and market demand **(Rachier, 2001, Nyongesa *et al.*, 2017).** According to **Mahasi *et al.* (2011)** over 2,500 hectares of total arable land in Kenya is under soybean production**.** Importantly, the production per hectare in Kenya averages at 0.8 tonnes, and which is far below the average potential of 3.0 tonnes per hectare. Currently, demographic shifts as resulted in an increase in the industrial demand for soybean and products as nutritious and safer food and raw material for the making livestock feed as well as human food **(Chianu *et al.*, 2009; AGRA, 2017).** This presents an opportunity to promote soybean commercialization especially among small-scale producers in Kenya. Commercialization, therefore, remains a major step towards realizing increased soybean productivity, increasing farm incomes **(Nyongesa *et al.*, 2017).**

Increasing soybean production and commercialization activities is, therefore, vital in improving the livelihoods of small-scale farmers. In this regard, the government of Kenya among other stakeholders through a number of programs have come up with strategies to boost soybean commercialization in Kenya, especially in Butere Sub-County. Despite these efforts as well as an increased marketing opportunity, commercialization of soybean in Butere Sub-County has remained low for unknown reasons. Little exists on factors that determine the intensity of soybean commercialization among small-scale farmers. Therefore, understanding determinants of intensity of soybean commercialization among smallholder farmers through this study remains valuable in meeting the current and future demand for soybean and soybean products, while contributing to improved rural livelihoods.

In light of the foregoing, and based on quantitative study design, this identified the factors influencing the intensity of soybean commercialization using a more comprehensive farm-level index and more robust and recent econometric models. This study adds to the existing empirical literature on the determinants of soybean commercialization intensity. From the results, a number of policy recommendations are discussed to improve the effectiveness and efficiency of the soybean commercialization process to realize major economic goals i.e. the big four Agenda of realizing food security and Sustainable Development Goals (SDGs) of meeting zero hunger.

This paper proceeds as follows; section two presents the literature review and section three presents the research methodology of the study. Section four presents the study results and discussions. Finally, section five presents the conclusion and policy recommendations derived from the findings.

LITERATURE REVIEW

Commercialization refers to market participation that involves a transition from subsistence farming to market engagement networks as well as frequent use of market institutions and market infrastructures to trade agricultural products and services (**Jagwe *et al.*, 2001).** Soybean commercialization literature, which includes the factors influencing soybean commercialization decision, intensity, and impacts on welfare, presents diverse results based on the place of the study, welfare indicators, and other factors. **Zamasiya *et al.* (2014)** studied factors influencing the decision to participate in soybean markets and extent of a farmer's participation in the market using Heckman's Probit model with sample selection, and found inoculants, improved soybean seed varieties, ownership of radios, quantity produced, marital status, and education to be significant determinants. **Mbembe *et al.* (2019)** also found that the quantity of seed planted, fertilizer, access to credit, and use of inoculants positively affected the probability of soybean commercialization. They added that the intensity of soybean market participation was influenced by the quantity of seed planted, the quantity of soybean harvested, output price, use of fertilizer, and access to the extension positively. In a related study on beans, **Mbitsemunda and Karangwa (2017)** identified

factors such as farm size allocated to beans, access to market information, market experience, bean quantity produced, access to credit, and access to irrigation as determinants of the degree of commercialization measured using Household Commercialization Index (HCI) in Nyanza District, Rwanda. Nonetheless, **Zamasiya *et al.* (2014)** added that the extent of market participation among small-scale soybean farmers in the market remains low due to many constraints.

Importantly, according to **Nyein *et al.* (2018),** most of the smallholder farmers resides in rural areas with the underdeveloped market and transport infrastructures, leading to high transportation and transaction cost. **Key (2000)** added that these smallholder farmers lack reliable information on potential markets as well as information on potential customers. Due to their poor production techniques, smallholder farmers tend to produce small surpluses thus generally exposed to a higher degree of transaction costs and risk **(Omiti *et al.*, 2009).** This normally forces smallholder farmers to sell their soybean produce at low-value market outlets such as farm gate and village markets. Generally, the decision to sell as well as the quantity of soybean to take to the market are mainly determined by market prices, distance to the market, and amount of marketing information available **(Omiti *et al.*, 2009; Zamasiya *et al.*, 2014)**. Consequently, the reviewed empirical literature shows the determinants of agricultural commercialization analysed using different approaches for different crops in Kenya and beyond. Previous studies have made a significant contribution to understanding factors influencing smallholder commercialization. However, no study has explicitly and empirically studied the determinants of intensity of soybean commercialization among smallholder producers in Butere Sub-county, Kenya.

DATA AND METHODS

Study Area

This study was carried out in Kakamega County, Butere sub-county located in the western part of Kenya. The Sub-County occupies approximately 210.6 Km^2, with a human density of 186 persons per square kilometre, totalling a population of 154,100 people **(KNBS, 2019).** The sub-county is located between the longitude 34˚ 45' 0.00" East and latitude 0˚ 16' 60.00" North. Butere Sub-County experiences a bimodal rainfall pattern; where the long rains occur between March and July while short rains occur between August and October, with annual rainfall amount ranging between 1280.1- 2214.1 mm per annum. The Sub-County is located at an altitude ranging from 1240 meters to 2000 meters above sea level with temperatures ranging from 18 to 29 degrees Celsius. Higher temperatures are recorded in January, February, and March, with other months experiencing similar temperatures except for July and August with cold spells. Agriculture especially crop production remains the main economic activity in the area. Butere is characterized by fertile and well-drained soils which support the production of major crops like soybean, sugar, maize, beans, horticulture etc. Smallholder maize production dominates the area. The choice of the study area was motivated due to the fact that most of the small-scale farmers are engaging in soybean production, as the area is suitable for soybean production. Again, the sub-county remains one of the areas in western Kenya where the government of Kenya among other development partners have widely promoted soybean production and commercialization **(Mbembe *et al.*, 2021).**

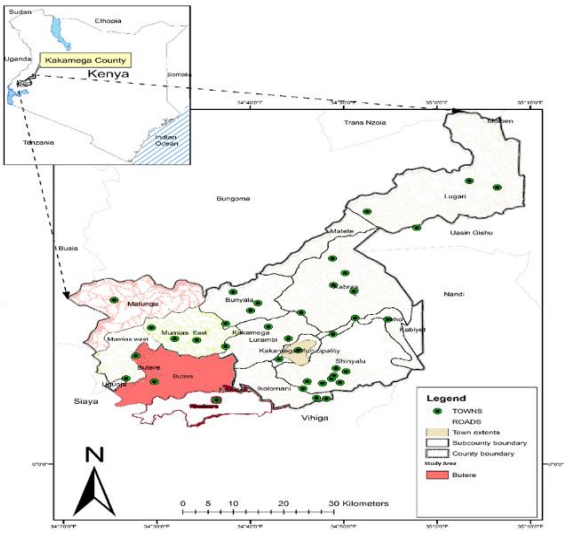

Figure 1. Map of Kakamega County showing the study area

Sampling and Data Collection

This study adopted exploratory research design. Small-scale farmers in Butere were the study target population, whereas the smallholder soybean farmers formed the sampling unit. Since the population of the smallholder soybean farmers was unknown, the study adopted Cochran's sample size determination formula to arrive at a sample size of 201 respondents **(Cochran, 1997).** Here, z as the critical value of the normal curve that cut off the area was estimated at 1.96, e as the desired level of precision set at 6.9%, p as the estimated proportion of attributes present in the population and $Q = 1 - P$. According to Cochran (1997), an error of less than 10% is usually acceptable. Therefore, assuming that , therefore, $Q = 1 - 0.5$; $e = 0.069$; and $z = 1.96$, the sample was determined to be 201: A random sampling of 201 small-scale soybean farmers in the study area was done using a multistage random sampling technique.

The first stage involved a purposive selection of Kakamega County as one of the counties in the western region where soybean production is largely done. The second stage involved a purposive selection of Butere Sub-county as one of the leading soybean producing counties with low commercialization. Finally, a random selection of 201 soybean farmers was done from two purposively selected wards namely; Masaba and West Marama. In other words, a proportionate to size distribution sampling was used based on the targeted number of the producers and total number of smallholder farmers in selected wards, and this resulted in 114 randomly selected soybean households from West Marama, since majority of farmers there are engaging in the commercialization of soybean. 87 randomly selected

soybean households from Masaba ward was done, since soybean commercialization remains low.

This study used face-to-face interviews with semi-structured questionnaires to collect primary data from the selected respondents. The questionnaire was first pretested before the actual data collection using 15 farmers in sample households. This was done to enable the correction of mistakes, thus improving the quality, accuracy and reliability of the data collected. The information collected consisted of soybean production and commercialization activities in the year 2018. Most respondents were household heads who were participating in soybean marketing in the last season of the year. A group of trained enumerators through personal interviews administered the questionnaires. Data were then entered and analysed using the STATA computer software.

Analytical Framework

Previous empirical studies on commercialization have characterized farmer decision to commercialize as a two-step decision-making process. The first step is conceived as involving farmers' decision to participate in the market or not. In the second step, farmers' who choose to participate in the market must decide on the volume of the commodity to sell. The empirical estimation of the two-step decisions usually involves fitting a double hurdle model. Most of the empirical studies **(Mathenge *et al*., 2010; Woldeyohanes *et al*., 2016; Camara, 2017)** have applied a double hurdle model to separate farmers who participate in the market from those do not, in the first step. The first hurdle involves the estimation of a probit model. The second step involves the estimation of a truncated or censored tobit regression for the quantities of produce sold in the market. This implies that double hurdle regression model is the appropriate model for estimating two-step models when the targeted group of farmers who are all producers **(Burke *et al*., 2015)**. Therefore, following **Burke *et al*. (2015)** approach, this study adopted a double hurdle model in estimating factors influencing intensity of soybean commercialization among smallholder farmers in the Butere. This is because the study targets only a group of farmers who are soybean producers. Therefore, the decision to commercialize soybean was regarded as the initial condition for commercialization. **Burke *et al*. (2015)** noted that although production is an initial decision, it may result from a completely different structural decision making process compared to the decision to commercialize production and the intensity of commercialization. Thus, this allows the decision to participate in the market and the intensity of participation to be modelled using a two-step approach. Here, the first step examined the factors associated with whether or not to sell soybean in the market. The last step estimates the intensity of market participation or commercialization measured using the Household Commercialization Index (HCI) as follows (Eq.1);

$$HCI = \left(\frac{Total\ Value/Quanity\ of\ Soybean\ Sold}{Total\ Soybean\ production\ Value}\right) \quad (1)$$

The first step of Double Hurdle Model involved estimating a probit model. Following **Wooldridge (2013)** the decision whether or not to commercialize was estimated as shown in Eq. (2).

$$p_i^* = \delta + x_i + \epsilon_i \quad (2)$$

$$p_i = \begin{cases} 1\ if\ p_i^* > 0 \\ 0\ otherwise \end{cases}$$

Where:

p_i^* was the underlying latent variable representing changes in utility or net benefit for commercializing soybean production. $p_i = 1$ was if a household participated in soybean output market (commercialized), and 0 otherwise (non-commercialization). φ was the vector of parameters to be estimated. $X_i$was the vector of explanatory variables and ε_i was independent identically distributed error terms.

In the last step, a truncated Tobit regression was estimated for the determinants of intensity of soybean commercialization as shown in Eq. (3).

$$c = \beta_0 + \beta x_i + \mu_i \quad (3)$$

Equation (2) represented the probability of smallholder farmer's commercializing soybean production which is a binary choice of whether to commercialize or not. The probability of commercializing soybean picks the value of 1 if the farmer participates in the soybean output market or zero otherwise. c in Equation (3) represented the intensity of commercialization (the quantity of soybean sold in the market) measured in terms of the Household commercialization index, which is the ratio of quantity of produce taken to the market to the total quantity produced by households. Turning to other terms in the Double Hurdle Model in Equation 3, X represents a vector of explanatory variables, β represents parameters to be estimated and associated with the explanatory variables. δ, β_0 are intercepts for Equation 2, and Equation 3, respectively. Lastly, ε_i , μ_i are stochastic disturbance terms.

The study expected that the intensity of soybean commercialization was enhanced or constrained by a number of factors. Farm characteristics were also expected to have either a positive or a negative effect on the intensity of soybean commercialization Infrastructural factors also were expected to constrain smallholder farmer participation in soybean marketing as well as the intensity of commercialization. Similarly, socio-economic characteristics (age, education, household size, farming experience, gender, and income) were also expected to either constrain or encourage the intensity of soybean commercialization.

RESULTS AND DISCUSSION

Descriptive statistics

Descriptive statistics of the soybean households in Butere Sub-County are presented in Table 1. The study revealed that the majority of the sampled households (approximately 57%) were participating in soybean commercialization, even though the intensity varies.

Results also showed that the commercialization level for West Marama ward was 63% and that of Masaba ward was 33%. This justifies our assumption on the level of soybean commercialization in the two wards. Further, a higher percentage of sampled soybean households were male-headed regardless of whether they commercialized soybean production (61.60%) or not (70.11%). Similarly, a higher percentage were married regardless of whether they commercialized (71.93%) or not (81.39%). Descriptive results further revealed that a larger proportion of soybean farmers who commercialized soybean production (80.70%) as well as those who did not commercialize (73.56%) were engaging in crop and livestock farming as their primary occupation. The results further revealed that, on average, non-commercialized soybean farmers were significantly older (59.05 years) than commercialized soybean farmers (50.25 years). This could be attributed to the unattractiveness of soybean production and marketing among the older farmers due to high labour requirement for the production and marketing of soybean.

Results also revealed that commercialized soybean farmers had on average, significantly higher levels of education (10 years) compared to non-commercialized soybean farmers (7 years). Educated farmers are much informed and can effectively search and interpret agricultural information on modern technologies to produce a surplus for the market **(Awotide *et al.*, 2016)**. Non-commercialized soybean households had on average, significantly large household sizes (7 members) compared to commercialized soybean households (5 members), and this is attributed to the fact that large households have more mouths to feed thus require more food which lowers the amount of surplus available for the market. On average, commercialized soybean households had significantly more years of experience (7 years) in soybean production than non-commercialized household (5 years). Further, t-test results revealed that on average, there was no statistically significant difference in the annual incomes of commercialized and non-commercialized soybean households. Type of soil fertility plays a vital role in enhancing the quantity of soybean produced. Descriptive statistics showed that commercialized soybean households had significantly more fertile plots (74.56%) than non-commercialized soybean households (68.51%). The majority of those who engaged in soybean commercialization (95.61%) and those who don't (93.10%) owned their plots with titles. On overage, commercialized soybean farmers significantly allocated bigger farms size for soybean production (0.37 acres) compared to non-commercialized farmers (0.23 acres). Greater allocation of land for soybean production increases production levels, as well as surplus level, hence increasing the likelihood of agricultural commercialization.

A higher proportion of commercialized soybean households did not have access to credit (57.02%) compared to the non-commercialized soybean farmers (50.57%). On average, the results further showed that commercialized soybean households significantly had a higher extension visits (5) compared to non-commercialized soybean households (2). The majority of the surveyed respondents had membership in active farmer groups (61.69%). On average, commercialized soybean farmers were significantly living near market centres (16 walking minutes) compared to non-commercialized soybean farmers (35 walking minutes). Soybean Household Commercialization Index was measured as; the total amount of soybean sold in the market from own production over the total amount of soybean produced on the farm. The average Household Commercialization Index of soybean in Butere Sub-County was 0.38. Overall, this implies that soybean households in the Butere Sub-County were marketing on average about 38% of the total value of soybean produced. Therefore, they were consuming more than 62% of the total value of all soybean harvested. The low level of soybean commercialization was, therefore, evident in Butere Sub-County. For the non-commercialized soybean households, the average commercialization index as a measure of the intensity of commercialization was 0. For commercialized soybean households, the average commercialization index as a measure of the intensity of commercialization was 0.68. This implies that commercialized households sold on average about 68% of the total value of soybean they produced. Therefore, commercialized soybean households were only consuming less than 32% of the total amount of soybean they harvested. This is a clear indication of a high soybean commercialization level among commercialized soybean households.

Factors influencing intensity of soybean commercialization among smallholder farmers in Butere Sub-county, Kenya

Even though the decision to sell soybean as well as the intensity of commercialization can be modelled independently, either by using a probit/ logit and Tobit models, respectively, such econometric modelling may result in biased and inefficient parameters estimates. This is because such estimation ignores the potential correlation between the unobserved error terms of the two decisions; that is the decision on the volume of soybean to sell is dependent on the initial decision to commercialize soybean. In this regard, a double hurdle model with sample selection problems was run to solve the problem.

The double hurdle regression model was then used to determine factors affecting the decision to commercialize soybean (binary) and intensity commercialization (HCI) among smallholder farmers in Butere. The results of the maximum likelihood estimation for a double hurdle regression model, using the craggit command, for the decision to commercialize soybean and intensity of soybean commercialization, are presented in Table 2. However, it was vital to first test whether the double hurdle regression model was preferred over the Tobit regression model or Heckman model using the log-likelihood ratio (LR) statistic. In this regard, the suitability of the double hurdle regression model against a Tobit model was checked using a likelihood ratio test. In this study, the LR test statistic was 146.45, and it was significant at a 1% level. Therefore, this test statistic showed that the double hurdle model was strongly preferred to other specification. This indicates that two

separate decision-making stages exist where soybean farmers make independent decisions regarding whether to commercialize or not and the intensity of commercialization. Also, the Tobit model is restrictive therefore unable to make any distinction between the two stages of commercialization decision-making the process. Besides, since dependent variable in second tier is a ratio, double hurdle seems to be the best as it use maximum likelihood estimation than Heckman that uses least square regression in the second tier.

Post-estimation tests were also conducted to check the correctness, fitness, and robustness of the double hurdle regression model. The test for multicollinearity among the independent variables was conducted using variance inflation factors (VIF), and the results in Table 2. The result show that all VIF values were below the recommended value of 3.3, with an average of VIF of 1.15. This implied that multi-collinearity existed between the predictors **(Greene, 2018; Hair *et al.*, 2011; Knock and Lynn, 2012).** Pairwise correlation test results confirmed that there was no multicollinearity among the categorical independent variables because the pairwise correlation coefficients were all less than the recommended value of 0.75 in all cases (Greene, 2018). The results of the Breusch- Pagan test revealed that we could not reject the null hypothesis of homoscedasticity (p= 0.1077). This showed that the double hurdle model was free from heteroscedasticity. However, to counter further heteroscedasticity problem, robust standard errors were used in all the analyses.

Table 1: Soybean Commercialization. Descriptive statistics

Variables	Description	Overall (n=201)	Commercialized (n=114)	Non-commercialized (n=87)	Chi^2 value / t-value
		Mean/ Percent	Mean/ Percent	Mean/ Percent	
Socio-economic					
Gender of the house head	Male	65.17	61.60	70.11	1.65
	Female	34.83	38.60	29.89	
Marital status of household head	Married	76.12	71.93	81.39	2.54
	Not married	23.88	28.07	18.39	
Primary occupation of the head	Crop/livestock farming	77.61	80.70	73.56	3.74
	Non-farm employment	22.39	19.30	26.44	
Age of household head	Years	54.04 (0.85)	50.25 (1.11)	59.05 (1.12)	5.47***
Years of schooling of head	Years	8.89 (0.27)	10.39 (0.28)	6.92 (0.40)	-7.22***
Household size	Number	5.81 (0.19)	4.72 (0.17)	7.22 (0.33)	7.19***
Household head experience in soybean production	Years	6.30 (0.43)	7.12 (0.62)	5.23 (0.52)	-2.22**
Annual income	US$	463.83 (40.46)	506.23 (52.66)	408.27 (629.1)	-1.20
Farm					
Soil fertility	Fertile	91.54	74.56	68.51	5.16*
	Not fertile	8.46	24.44	31.49	
Land tenure	Owned with title	94.53	95.61	95.4	2.66
	Owned without title	5.47	4.39	4.60	
Land under soybean	Acres	0.31 (0.02)	0.37 (0.03)	0.23 (0.02)	-3.00***
Institutional					
Credit Access	Yes	45.77	42.98	49.43	0.83
	No	54.23	57.02	50.57	
Group membership	Yes	61.69	66.30	57.80	1.53
	No	38.31	33.70	42.20	
Extension Visit	Number	4 (0.35)	5 (0.54)	2 (0.30)	-4.82***
Market					
Distance to the nearest market	Walking minutes	24.30 (2.24)	16.35 (1.11)	34.71 (2.11)	8.20***
Soybean commercialization decision	Yes	56.72	56.72	43.28	
	No	43.28	0	0	

Note: *, ** and *** is significant at 10%, 5% and 1% level, respectively. Standard deviations are in parenthesis. T- test was used since we assumed that the variables in question are normally distributed in the two groups

Also, the sigma constant was relatively high (0.179) and statistically significant at 1% level (Table 2). Sigma constant measures the correlation coefficient between the first tier model (Decision to commercialize soybean) and the second tier model (soybean commercialization intensity model). The significant value of sigma constant statistic is a clear image of strong dependence between the two double hurdle tiers, thus supporting the appropriateness of the model approach over the Tobit specification (Wooldridge, 2010). Again, the log pseudo-likelihood for the fitted model was -22.164 and Wald chi^2 (15) of 74.12, (Prob > χ^2= 0.000), indicating that all parameters are jointly significant and all independent variables included in the double hurdle models explained the decision to commercialize soybean and intensity of soybean commercialization at 1% significance level.

The model revealed a vector of variables significantly influencing soybean commercialization decision and intensity of commercialization. Regarding household characteristics, the results in Table 2 showed that the primary occupation of the household head was negatively and significantly related to the soybean commercialization decision and intensity of soybean commercialization at 10% and 5% levels, respectively. Farmers engaging in crop and livestock farming as their primary occupation were more likely to commercialize soybean production compared to those engaging in non-farm employment as a primary occupation. Household participation in off-farm duty as their primary occupation often limit the time available for soybean production and thus discouraging uptake of the labour-intensive technologies that would result in higher soybean yield and surplus for markets. The intensity of soybean commercialization for household primarily engaging in off-farm jobs was significantly lower than that of farmers primarily engaging in crop and livestock farming by 17.4%, at a 5% significance level, ceteris paribus. This finding is similar with those from a study by **Wollni *et al.* (2010)** who found that participation in off-farm work negatively affects the adoption of labour-intensive conservational technologies thus lowering yield and surplus for sale.

The age of the household head had a negative and significant influence on the decision to commercialize soybean as well as soybean commercialization intensity both at a 1% significance level. This shows that the elder farmer is, the lesser the likelihood of participating in the soybean market. This implies that if the age of the household head increases by one year it reduces the intensity of soybean commercialization by 0.010, *ceteris paribus.* This could be attributed to the unattractiveness of soybean production and marketing among the older farmers due to high labour requirement for the production and marketing of soybean. Besides, younger farmers are less risk-averse and more adaptable innovative, and hence able to continuously adopt new technologies like improved soybean seeds which makes them produce surpluses for the markets compared to older farmers **(Onyeneke, 2017).**

Education of the household head also had a positive and significant effect on the decision to commercialize soybean and intensity of soybean commercialization both at a 1% significance level. This implies that the more educated a household head is, the higher the likelihood of participating in soybean commercialization. A one-year increase in years of schooling was likely to increase soybean commercialization intensity by 0.029, *ceteris paribus.* This could be attributed to the fact that education equips farmers with more agricultural information and skills that enable them to make commercialization decision accurately, hence increasing their participation in the soybean market and in a more profitable way. Again, educated farmers are able to adopt new production technologies thereby increasing their production and surplus level. These results were consistent with findings from other studies by **Omiti *et al.* (2009)** and **Mottaleb *et al.* (2015)**.

Further, household size was negatively and significantly related to the soybean commercialization decision and intensity of soybean commercialization both at a 1% significance level. This shows that if the household size increases by one member it decreases the probability of participating in soybean commercialization. Also, a unit increase in household size decreases the intensity of soybean commercialization by 0.277, *ceteris paribus.* Households with more members often have more mouths to feed thus associated with higher demand for food compared to households with fewer members. Larger household size thus requires more food from available produce which lowers the amount of surplus available for the market. This finding is consistent with that from **Turaa *et al.* (2016).**

The total amount of annual household income from other sources other than soybean production had a negative and significant influence on soybean commercialization decision at 10% level. The results indicated that an increase in the total amount of annual household income from other sources reduces the probability of household soybean commercialization. A negative effect of the amount of income from other sources on commercialization decision could be attributed to the fact farmers invest less of such funds on activities to increase soybean yields and surplus. Also, they spend much income to expand other activities instead of soybean production. Again, an increased amount of total annual income reduces the farmers' incentive to commercialize its soybean production probably because they have alternative income sources. A similar finding was found by **Kpadonou *et al.* (2017).** However, the amount of income received from other sources had an insignificant effect on the intensity of soybean commercialization.

The total land under soybean production was found to affect positively and significantly the decision to commercialize soybean and commercialization intensity both at 1% level. By implications, farmers who allocated a large piece of land for soybean production are more likely to participate in commercialization, compared to those allocating small land sizes. Again, when all other factors are held constant, a unit increase in the total land under soybean production was found to increase the intensity of soybean commercialization by about 0.340 (Table 2). Greater allocation of land for soybean implies a greater access to land, higher production levels, as well as higher surplus level, hence increasing the probability as well as the intensity of soybean commercialization.

Table 2: Double hurdle with selection estimation results for soybean commercialization decision and intensity of soybean commercialization

	Probit Commercialization decision model (Selection equation) 1=Commercialized, 0= Non-commercialized		Truncated Tobit Regression Intensity of Commercialization model (HCI) (Outcome equation)	
Variable Description	Coefficient	Standard Error	Coefficient	Standard Error
Socio-economic characteristics				
Gender of household head (1= Male, 0 = Female)	-0.164	0.417	0.054	0.085
Marital status of household head (1=Married, 0= Not married)	0.053	0.495	-0.094	0.010
Primary occupation of the head (1= Crop and livestock farming, 2= non-farm employment)	-0.638	0.355*	-0.174	0.075**
Age of household head (Years)	-0.055	0.014***	-0.010	0.003***
Years of schooling of household head (Years)	0.122	0.036***	0.029	0.009***
Household head experience in soybean (Years)	-0.017	0.024	-0.006	0.004
Household size (Number)	-0.277	0.062***	-0.081	0.014***
Natural logarithm of other income	-0.183	0.101*	-0.040	0.026
Farm Characteristics				
Total land under soybean production (Acres)	2.058	0.758***	0.340	0.121***
Soil fertility (1= Fertile, 0= Not fertile)	0.551	0.435	0.142	0.111
Land tenure (1=Owned with title, 2= Owned without title)	-1.289	0.468***	-0.141	0.142
Institutional Characteristics				
Credit Access (1 = Yes, 0 = No)	0.049	0.276	0.030	0.066
Group membership (1 = Yes, 0 = No)	-0.230	0.284	-0.003	0.068
Extension visit (Number)	0.154	0.043***	0.023	.006***
Market Characteristic				
Distance to nearest market (Walking minutes)	-0.040	0.009***	-0.011	0.002***
Constant	7.365	1.638***	1.85	0.394***
Sigma constant	0.178	0.012***		

Note: Log pseudo likelihood = -22.16402; Wald chi^2 (15): χ^2 = 74.12, Prob > χ^2= 0.000; Number of observation = 201; Likelihood-ratio test (LR) (16) = 146.45, Prob > chi^2 = 0.0000; *, ** and *** denote significant at 10%, 5% and 1% levels, respectively; Dependent variable for Selection model (first) is commercialization decision, 1=Soybean commercialization decision, 0=Non-commercialization decision; Dependent variable for outcome model (second) is Household commercialization index for soybean.
Mean VIF=1.15, chi2(1)=2.59; Prob > chi2 =0.1077

CONCLUSIONS AND IMPLICATIONS

Understanding the determinants of intensity of soybean commercialization among small-scale farmers in the Butere sub-county is vital when designing sustainable l production and marketing policies. This study aimed to determine factors influencing the intensity of soybean commercialization in Butere Sub-County, Kakamega County. This study revealed significant variations in the farm, market, socio-economic, and institutional characteristics of sampled farmers. It was established that the average Household Commercialization Index of soybean in the Butere Sub-County was 0.38. In other words, the study showed that soybean households in Butere Sub-County were selling and consuming on average 38% and 62% of the total value of soybean produced, respectively. This showed that the soybean commercialization level in Butere Sub-County is relatively low.

Double hurdle model estimation revealed that important factors influencing the soybean commercialization decision in Butere Sub-County also influence its commercialization intensity. Therefore, this study concludes that a higher level of education, larger land area under soybean production and frequent extension visits increase households' participation in soybean commercialization. Further, ageing, participation in off-farm activities, larger household sizes, higher off-farm income, possession of land without title deed, as well as long-distance to the nearest market center discourage households to participate in soybean commercialization. Similarly, a higher level of education, larger land area under soybean production and frequent extension visits increase the intensity of soybean commercialization. Lastly, ageing, participation in the off-farm activity as a primary occupation, larger household size, and long distance to the nearest market center negatively affect the intensity of commercialization.

This study recommends policies such as fertilizer and seed subsidy policies that will ensure equitable access to production resources such as high yielding and fast-maturing soybean varieties and fertilizer by all gender to increase acreage and yields for soybean. Policies that ensure exclusive land ownership rights through the issuance of title deeds that thus leading to the expansion of actual land under soybean cropping are also encouraged. Polices are also needed to restructure and strengthen the extension system to facilitate frequent and timely provision of extension services as well as market information. There is a need for governments to consider policies that will ensure literacy development and training across all age brackets. Due to problems associated with cross-sectional data, future research should be more comprehensive in modelling the determinants of soybean commercialization intensity, using panel data to control for unobserved endogeneity and heterogeneity.

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TECHNICAL EFFICIENCY OF IRISH POTATO PRODUCTION: A CASE STUDY FROM NIGERIA

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ABSTRACT

Research background: Irish-potato (*Solanum tuberosum L.)* is one of the main root crops in Nigeria with the potential to improve food security, income and human nutrition. However, farmers are losing outputs due to inefficiency in resource use, whereas, past studies on Irish potato in Nigeria have not focussed on efficiency of the enterprise.
Purpose of the article: This study is aimed at measuring technical efficiency to provide a way of quantifying and comparing the performance of each farmer, and identification of factors responsible for variation in technical efficiency. Hence, technical efficiency, and its determinants and returns to scale of Irish-potato farmers were analysed
Methods: Primary data was collected from 260 Irish potato farmers using a structured questionnaire through a multi-stage sampling method. Descriptive statistics (frequency, mean, standard deviation and percentages) and a two-stage estimation procedure to fit the stochastic frontier production function for Irish potato farmers were used.
Findings & value added: Results indicated that the farmers have a mean age of 48 years which indicates an agile workforce. Over 80% of the farmers possessed some form of formal education, predominantly at the secondary level. The efficiency estimates indicated a disparity in technical efficiency among farmers with a mean technical efficiency of 89±4%. The farmers were producing at decreasing returns to scale. At the same time, socio-economic factors of gender, extension contact, membership in cooperative society and farming experience were positive determinants of farmers' technical efficiency, while household size was negative. Thus, being a male farmer, farming experience, encouraging contact between farmers and extension workers as well as membership in cooperative societies, while reducing household size can improve technical efficiency in Irish potato production.

Key words: Irish potato; farmers; technical efficiency; returns to scale, SFA
JEL Codes: C21; D22; D61; Q12

INTRODUCTION

Irish potato (*Solanum tuberosum* L.) is the greatest contributor of food energy in the developing regions of the world, providing 75 percent in food energy per unit area of the countries while both wheat and rice are capturing 58 percent of the total share in food energy (**FAO, 2017; Sher *et al.*, 2016**). Global output is estimated at 388 million metric tonnes and the yield per hectare stands at 20,110.8kg/ha (**FAOSTAT, 2019a**). Developing countries produce over half of the world's output with China having the highest production in the world (99,205,600 metric tonnes in 2017), and almost one-third of the world's output is harvested in China and India (**FAOSTAT, 2019a**). Global domestic consumption rate of fresh and processed Irish potato stands at 34.64 kg/capita (**FAOSTAT, 2016**). In Africa, Irish potato production is estimated at 25 million metric tonnes with a yield of 13,215.4kg/ha (**FAOSTAT, 2019a**), and a consumption rate (fresh and processed) of 18.76 kg/capita/year in 2011 (**FAOSTAT, 2016**). In sub-Saharan Africa, Irish potato has had an average growth in demand of 3.1% and rank as the number one staple, particularly in East Africa (**Wassihun *et al*, 2019**). Nigeria is the seventh-largest producer in Africa, with an output of 1,284,370 metric tonnes and a yield of 37,201 hg/ha (3,720.1 kg/ha) in 2017 (**FAOSTAT, 2019a**). Domestic consumption of both fresh and processed Irish potato stands at 4.63kg/capita (**FAOSTAT, 2016**). Potato is critical to food security and sustenance of livelihoods of subsistent farmers, especially in the highlands areas where its growth can be economically sustained (**Amadi, *et al*; 2021**). The crop is mainly cultivated in commercial quantities in Plateau, Kaduna and Taraba states (**Dimlong, 2012**).

Irish potato is an underexploited food crop in Nigeria, despite its wide cultivation in commercial quantities (**Muhammad *et al.*, 2016**) and potential to improve food security, income and human nutrition (**Schulte-Geldermann 2013**). Several efforts have been devoted to the development and transfer of new technologies to improve Irish potato production in Nigeria; including Irish potato seed multiplication, training of farmers, Irish potato research, breeding and selection of new improved

varieties (**Zemba *et al.*, 2013**). However, annual Irish potato production in Nigeria has not improved appreciably (**Jwanya *et al.*, 2014; FAOSTAT, 2019b**). This indicates that technological advances generated through research and investments have not widely translated into improved efficiency.

Previous research on Irish potato focused on agronomic practices, marketing efficiency, growth and crop productivity (**Okonkwo *et al*., 2009; Wuyep et al**., **2013; Zemba *et al*., 2013; Sanusi *et al*., 2017**). Growth in output is not determined by introducing new technology alone, but by the efficiency with which technologies and inputs are used (**Jwanya *et al.*, 2014**). Most resources used in agricultural production are not used at optimal levels and are constantly degraded (**Panwall, 2018**). These differences in technical efficiency level among farmers arise due to inefficiencies linked to farmers' and farms' specific characteristics (**Wubshet, 2018**). Irish potato farmers are losing yield due to inefficiency in resource use, and attaining high technical efficiency remains a problem among Irish potato farmers (**Kiptoo *et al.*, 2016**). Hence, there is a knowledge gap on technical efficiency in Irish potato production and factors determining technical efficiency in Nigeria (**Sanusi & Babatunde, 2017**). This study was undertaken to investigate the technical efficiency of Irish potato farmers, the response of output to inputs used and determinants of technical efficiency of Irish potato farmers in Plateau state, Nigeria.

THEORETICAL AND CONCEPTUAL UNDERPINNING

The study draws on the theory of production in which a farm is viewed as a cost minimising and profit maximising entity. The farm is a producing unit having the ultimate objective of profit maximization, output maximization, cost minimization, utility maximization or a combination of the four (**Oluwatayo *et al.*, 2008**). Hence, employing a production function, which is a model used to specify the relationship between independent and dependent variables, the specification of the economic production function model can be represented as:

$Y = f(X_1, X_2, \dots, X_n)$

Where: Y represents a firm's output and a number of inputs represented by the X_1 to X_n purchased at given prices, $N = N_1, N_2, \dots, N_n$.

Measuring production efficiency requires an understanding of farm and farmer production characteristics that influence input usage and the consequent output. Hence, the production function; $Y = f(L, K)$ is used to express the relationship.

Where *f* shows the maximum output that can be produced using combinations of inputs. *Y* is output, *L* and *K* are inputs used.

The farmer maximizes profit by either increasing the quantity of *Y* or by reducing the cost of producing *Y*. Hence, efficiency can be measured using either one of two approaches: input-oriented or output-oriented approaches (**Farrell, 1957**). The input-oriented approach addresses the question of how much can a production unit be proportionally reduced such that the quantities of input used to produce a given amount of output is reduced without any change in the output (**Coelli *et al.*, 1998**). According to **Farrell (1957)**, input-oriented measure of farm efficiency can be illustrated using two firms which employ two inputs of production, capital (*K*) and labour (*L*), to produce a single output (*Y*), and face a production function, $Y = f(L, K)$, under the assumption of constant returns to scale. The firm seeks the level of technology that attains the least combination of inputs required to produce a unit of output. This is usually shown on an isoquant. Thus, all input combinations along the isoquant are considered technically efficient. There are technically efficient and inefficient point along the isoquant. Hence, a firm operating at a technically inefficient point will be technically inefficient since it uses inputs that could have been saved without decreasing the amount of output. Thus, all inputs need to be reduced by a percentage to achieve technically efficient production. This describes the technical efficiency (TE) of the producer. Output oriented approach of efficiency measurement, on the other hand, addresses the question of by how much can the output be increased such that the given level of input used remains unchanged, that is, without increasing the number of inputs used (**Coelli *et al.*, 1998**). This approach uses production possibility curves which show the possible combination of two outputs that can be produced from a given input and level of technology. The production possibility curve represents the upper bound of production possibilities, hence, producers cannot be located above but can be located either on the curve, indicating efficient firms, or even below it, indicating inefficient firms. Hence, technical efficiency under the output-oriented approach measures the proportion by which outputs could be increased without requiring extra input. For both input and output-oriented approaches, technical efficiency lies between 0 and 1.

In sum, technical efficiency measures how well the individual transforms inputs into a set of outputs **(Wubshet, 2018; Tolno, 2016**) and can be influenced by both external and internal factors (farm inputs) associated with the production environment (**Bokusheva *et al.*, 2006; Hasanthika *et al.*, 2013)**. In this study, the dependent variable is the value of agricultural output harvested on the given farm. The independent variables considered to assess the technical efficiency of Irish potato farmers include various inputs such as area planted with Irish Potato, labour, fertilizers and other agrochemicals used in Irish Potato farming. The technical inputs and the management practices jointly determine the quantity and quality of output produced. Hence, the technical efficiency level of farmers is influenced by socio-economic, institutional and managerial factors which interact to affect the technical efficiency of Irish potato farming in line with **Wubshet (2018)**, **Kuwornu, *et al.* (2012)** and**, Abdulquadri & Mohammed (2012)**.

DATA AND METHODS

Study area

This study was carried out in Plateau State, North-Central Nigeria. Primary data was collected using a structured questionnaire through a multi-stage sampling method. In the first stage, two local government areas (LGAs),

Bokkos and Mangu, were randomly selected out of the five major Irish potato-producing LGAs. The second stage involved a simple random sampling of three districts each from the list of eight districts in each of the two LGAs. From the six districts, three villages each were randomly selected to make a total of 18 villages. The last stage involved a random selection of Irish potato farmers from the 18 villages in proportion to their size since an updated list of Irish potato farmers in the study area was not available. A total of 260 Irish potato farmers were randomly selected, but only 252 gave complete information which was used for data analyses. Analytical tools employed include Descriptive statistics and Stochastic frontier production function using the STATA package.

Theoretical Framework and Estimation Procedure

The stochastic frontier production function (SFPF) utilises the maximum likelihood technique due to its composite error term. Also, the technical efficiency of an individual farm is defined in terms of the ratio of observed output (Y_i) to the corresponding frontier output (Y_i^*) conditional on the level of inputs used by the firm and given the available technology (Eq. 1).

$$TE_i = \frac{y_i}{y_i^*} \quad \text{i.e.} \quad TE_i = \frac{f(x_i\beta_i)\, exp(v_i - u_i)}{f(x_i\beta_i) exp v_i}\ ;$$
$$TE_i = \exp(-u_i) \qquad (1)$$

Where:

TE_i technical efficiency of farmer i; Y_i observed output from farm i; Y_i^* and frontier output for farm i.

The technical efficiency values are assumed to range between zero and one; that is as fixed given values ($0 \leq TE_i \leq 1$). Thus, the technical inefficiency is equal to $1 - TE$

Model Specification

A two-stage estimation procedure was used to run the stochastic frontier production function.

Stage one: The model used for this study followed that of **Maina *et al.* (2018)** and **Dube *et al*. (2018)** with a slight modification in explanatory variables. The production function is as shown Eq. 2.

$$Y = f(x) \qquad (2)$$

The farmers' technical efficiency is given by the equation of the Stochastic frontier production function as in Equation 3.

$$lnY = \beta_0 + \beta_1 l_n X_1 + \beta_2 l_n X_2 + \beta_3 l_n X_3 + \beta_4 l_n X_4 + v_i - u_i \qquad (3)$$

Where:

Y Output of Irish potato (kilogram),
X_1 Farm size (hectare),
X_2 Quantity of Irish potato seed planted (kilogram),
X_3 Agrochemicals (litre),
X_4 Total labour used (man-days)
v_i Stochastic error term
u_i The inefficiency component of the error term
ln Natural Logarithms
β Coefficients to be estimated

Variance parameters: sigma-square ($\sigma 2$) gamma (γ) and lambda (λ)

Also, the following relationships $\sigma^2 = \sigma_v^2 + \sigma_u^2$;

$\gamma = \frac{\sigma_v^2}{\sigma^2}$; $\lambda = \frac{\sigma_v^2}{\sigma_u^2}$

Where: σ^2, σ_u^2 , σ_v^2 are the overall variance of the model, the variance of the random error, and variance of the technical inefficiencies respectively. The variances of the random errors, σ_v^2 and that of the technical inefficiency effects σ_u^2, and the overall variance of the model sigma-squared (σ^2) are related thus: $\sigma^2 = \sigma_v^2 + \sigma_u^2$ and the ratio $\gamma = \sigma_u^2 / \sigma_v^2$ measures the frontier which can be attributed to technical efficiency (**Battese & Corra, 1977**) and used by **Balogun & Akinyemi (2017); Maina *et al.* (2018)**.

The Gamma (γ) shows the explained proportion of the variation between the actual and frontier outputs, which can be attributed to underlying technical inefficiency (**Battese & Corra, 1977**). Technical inefficiency of farms is measured by one minus gamma. Lambda (λ) is expected to be >1. This condition indicates a good fit for the model and the correctness of the specified distribution assumptions (**Tadesse & Krishnamoorthy, 1997**).

Stage Two: Determinants of Technical Efficiency (TE)

Determinants of the farmers' technical efficiency were also examined. To identify the determinants of technical efficiency**,** the second stage of the estimation procedure was used (**Rahji, 2005**). Technical efficiencies were empirically identified and regressed against the farm and farmer characteristics. Based on empirical evidence, these determinants include farmer age, farm experience, marital status, level of education, gender, household size and contact with extension agents (**Rahji, 2005; Balogun & Akinyemi, 2017**).

Technical efficiency values are assumed to range between 0 and 1 as fixed given values. However, these values cannot be assumed to be normally distributed (**Ekanayake, 1987; Squires & Tobor, 1991)**. At this stage, it violates the assumption of ordinary least square which states that the dependent variable should be normally distributed with a mean of 0 and a constant variance suggested that the technical efficiency index estimated must be transformed into the natural logarithm of the ratio of the technical efficiency to technical inefficiency as transformed technical efficiency (TTE) (**Ekanayake, 1987**). This transformation makes it possible for the technical efficiency ratio to assume any value. The dependent variable for the estimating equation is as reported by **Rahji (2005)**. The dependent variable for the estimating equation thus becomes (Eq. 4).

$$TTE = ln(TE/1 - TE) \qquad (4)$$

Where;

TTE= Transformed Technical Efficiency
TE= Technical Efficiency

The independent variables hypothesised to determine technical efficiency is explicitly stated as Equation 5.

$$U_i = \alpha_0 + \alpha_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \alpha_4 Z_4 + \alpha_5 Z_5 + \alpha_6 Z_6 + e_i \quad (5)$$

Where:
U_i Transformed technical efficiency variable;
Z_1 Sex (Male=1, Female= 0);
Z_2 Access to credit (Yes=1, No= 0);
Z_3 Contact with extension agent (Yes=1, No= 0);
Z_4 Membership of cooperative society (member=1, Non-member=0);
Z_5 Farming Experience (years);
Z_6 Household size of farmers (number of persons in the household);
e_i Error term.
While α_0 , α_1, . . ., α_6 are parameters to be estimated.
The β's and α's are scalar parameters that were estimated, which reflect the elasticity of the agricultural inputs on output.

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Irish Potato Farmers

The description of the socioeconomic characteristics of Irish potato farmers in the study area is presented in Table 1. Males dominate Irish potato farming, and over 70% of the farmers were married with a large household size of 11 persons (Table 1). The mean age of 48 years indicates an agile workforce. This follows closely with **Wassihun *et al.*, (2019)** who also found that Irish potato farmers were mostly male and aged 47 years on the average. Over 80% of the farmers possessed some form of formal education, predominantly at the secondary level. Almost two-thirds of the farmers belonged to cooperative societies, while about 70% of farmers had no access to credit. Nearly three-quarters of farmers had contacts with extension agents, indicating they have access to information about innovations which could improve the efficiency of production. This aligns with **Danso-Abeam *et al.* (2020)** who also found majority of farmers to be members of cooperatives and having contact with extension agents. The mean farm size of about 2 hectares also shows that most farmers were small-holders.

Input-Output Relationship of Irish Potato Farmers

The results of the estimated stochastic frontier production function of Irish potato farmers are shown in Table 2. The results indicated that the variance parameter sigma-squared was significant, with a lambda (λ) value >1 indicating the goodness of fit of the model. The variance ratio, $\gamma = \frac{\sigma_v^2}{\sigma^2}$, where γ indicated slightly more than 50% of the variation in output was due to disparities in technical efficiency (Table 2).

The estimated coefficient of farm size was statistically significant 1% level of probability and had a positive relationship with the quantity of Irish potato produced. This indicates that an increase in the farm size by one hectare will lead to about a 38.3% increase in the kilogram of Irish potato produced. This suggests that as Irish potato farmers increase the farmland allocated to Irish potato cultivation, the output is increased. This is in accordance with **Obare *et al.*, 2010; Dube *et al.*, 2018** who also found that increase in area planted influences output. The estimated coefficient for fertiliser was positive and significant at 5% probability level. This indicates that a 1% increase in the quantity of fertiliser applied is expected to increase the output of Irish potato production by 15.7%. The coefficient for agrochemicals was positive and significant at 1% probability level, for Irish potato production, which implied that a 1% increase in the amount of agrochemicals applied would result in a 16.02% increase in Irish potato output. This suggests that to control risks posed by weeds, pests and diseases and increase output, farmers will have to efficiently and appropriately apply agrochemicals which agrees with **Nyagaka *et al.* (2010); Akpaeti & Frank (2021)**. Labour had a negative influence, significant at 10% probability level; and a coefficient indicating a 1% increase in the quantity of labour used decreases Irish potato output by 5%. This may be because the sources of labour (family and "communal" labour) are readily available but usually poorly motivated, thus, leading to production inefficiencies and consequently affecting Irish potato output.

Table 1: Socioeconomic characteristics of Irish Potato farmers.

Characteristic	Frequency	Per cent
Sex		
Female	72	28.57
Male	180	71.43
Age (years)		
Mean	48	
S.D.	11.02	
Marital status		
Single	66	26.19
Married	186	73.81
Household size		
Mean	11	
S.D.	5.2	
Educational status (years)		
No formal education	30	11.90
1-6	76	30.16
7-12	103	40.87
Above 12	43	17.06
Mean	9	
S.D.	4.8	
Farming experience (years)		
Mean	18	
S.D.	8	
Membership in cooperative		
No	99	39.29
Yes	153	60.71
Access to credit		
No	176	69.84
Yes	76	30.16
Contact with extension agent		
No	62	24.60
Yes	190	75.40
Farm size (ha)		
Mean	2.32	
S.D.	0.86	

Source: Author's computation, 2019. Sample Size = 252.

Table 2: Maximum likelihood Estimates Stochastic Frontier Production function.

Variable	Parameter	Coefficient	Std. Err.	z-value	P>|z|
Constant	β_0	3.9052***	0.3414	11.44	0.000
Farm size (X_1)	β_1	0.3833***	0.0645	5.94	0.000
Seed (X_2)	β_2	0.0385 ns	0.0402	0.96	0.338
Fertilizer (X_3)	β_3	0.1569**	0.0747	2.10	0.036
Agrochemicals (X_4)	β_4	0.1602***	0.0187	8.54	0.000
Labour (X_5)	β_5	-0.0501*	0.0275	-1.83	0.068
Variance Parameter					
σ^2		0.0431			
Lambda (λ)		1.0024			
Gamma (γ)		0.5012			
Sample size		252			

Source: Author's computation, 2019.
Note: ns, *, **, *** not significant or significant at 10, 5 or 1% level.

Table 3. Elasticity of production and returns to scale estimates.

Input	Parameter	Elasticity of production
Farm size (X_1)	β_1	0.3833
Seed (X_2)	β_2	0.0385
Fertilizer (X_3)	β_3	0.1569
Agrochemicals (X_4)	β_4	0.1602
Labour (X_5)	β_5	-0.0501
Returns to scale		0.6888

Source: Author's computation, 2019

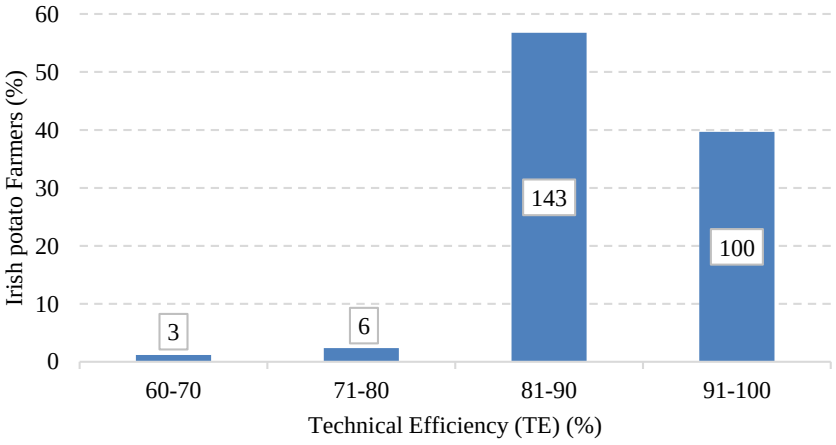

Figure 1. Distribution of Irish Potato Farmers based on their Technical Efficiency

The estimates for elasticity of production and returns to scale of Irish potato farmers are presented in Table 3. Production elasticities for inputs and returns to scale of Irish potato farmers varied. The Returns to Scale was <1 indicating Irish potato farmers were experiencing a decreasing return to scale in production, an indication that inputs used were inelastic: 1% increase in all inputs included on the production function results in <1% increase in output of Irish potato. This indicates farmers are operating in stage II of the production region which is an economic relevance stage of production (the rational Stage) where inputs and output are efficient. At this stage, every farmer attempts to maximise output as well as minimise cost. Farmers should maintain the level of input utilisation at this stage and attempt to maximise output from a given level of inputs. The decreasing returns to scale was consistent with **Nyagaka *et al.* (2010)** and **Watchmann & Watchmann (2020).**

Technical Efficiency of Irish Potato Farmers in the Study Area

The distribution of Irish potato farmers according to technical efficiency levels is depicted in Figure 1. This was derived from the analysis of the stochastic frontier production function. The technical efficiency levels indicate the majority of farmers were operating at technical efficiencies between 81-90%, with fewer at 91-100%; 71-80% and ≤70% technical efficiencies. The least

efficient farmer and the most efficient farmer had estimated technical efficiencies values of 65% and 97% respectively, indicating farmers were fairly efficient in production. The distribution is comparable with the results of **Dube *et al*. (2018)** though farther from **Wassihun *et al.*, (2019)** who found least efficient farmers to have estimated technical efficiency values of 46% on Irish potato production. The mean technical efficiency score implies that the average farmer was able to obtain 89% of the potential output at the given input level and technology. On average, farmers were relatively efficient, but some output was lost due to technical inefficiency which could be due to farming systems or to inefficiency among the farmers, or both. Although not a single farmer appears as fully technically efficient, the result indicates that on average, the output level can be increased without necessarily employing additional resources. An average farmer in the study area could reduce cost and attain the technical efficiency level of its most efficient counterpart. The least efficient farmer could also reduce cost and attain the technical efficiency level of the most efficient farmer through adopting practices and technology used by the most efficient farmer. The results of this study agree with **Nyagaka *et al.* (2010)** and **Akpaeti & Frank (2021)** on the technical efficiency of smallholder farmers.

Determinants of Technical Efficiency of Irish Potato Farmers

Table 4 reveals the regression estimates for the determinants of technical efficiency of Irish potato farming in the study area. Most of the estimated regression coefficients were positive, and significant, indicating their relative effect in increasing technical efficiency. The coefficient of multiple determinations (R^2) indicated independent variables explained variation in technical efficiency; the remaining amount was attributed to uncaptured variables in the model. The F-Statistics was significant, indicating the joint effect of variables included in the model was able to determine technical efficiency. The coefficient of Sex was positive, and significant at 1%, indicating that being a male farmer improves technical efficiency. The majority of the farmers were male. This suggests that male farmers were more likely to be technically efficient than female farmers. Being male farmer increased technical efficiency by 3.3816 magnitudes compared to being a female farmer. This could be explained by the fact that the male farmers are decision-makers, had access to land, labour supply and other production resources due to cultural prejudice. This result is consistent with **Danso-Abeam *et al*. (2020)** Similarly, the coefficient of extension contact was positive and significantly influenced technical efficiency at 1% level. Farmers who have contacts with extension officers would increase technical efficiency as such farmers gain better knowledge on input use, access modern agricultural technology, obtain information on proper agronomic practices relating to land preparation, planting, weeding, fertiliser application, pests and diseases control, improving farmer technical efficiency (**Dube *et al., 2018***). Membership in cooperatives had a positive and significant influence on technical efficiency at 1% level. This indicates that farmers who are members of cooperatives are more likely to improve their technical efficiency because they tend to enjoy benefits such as access to relevant information on-farm management practices, introduction of new technologies, and financial assistance (**Nyagaka *et al*., 2009; Akpaeti & Frank, 2021**). The farming experience was positive and significant at 5% level, indicating that a year increase in farming experience would increase technical efficiency indicating by 5.79% (Table 1). Hence, the more years farming, the better the technical efficiency of the farmer. Farmers who have more years of experience would be more likely to have good managerial abilities, improved technical skills, and broader networking with other farmers on best agronomic practices and efficient use of inputs (**Otitolaiye *et al*., (2014**). Household size was negatively and significantly influenced technical efficiency at 1% level. This implies that increased household size would reduce technical efficiency. This may be due to a greater cash constraint leaving the household with little cash to purchase production inputs and new technologies (**Dube *et al*.,** 2018; **Danso-Abeam *et al*., 2020**). Finally, it was noted that none of the Irish potato farmers operated on the production frontier (efficient level), indicating there is room for improvement. Irish potato farmers operate at a rational state of production.

Table 4. Estimated factors influencing technical efficiency of Irish potato farmers.

Variable	Parameter	Coefficient	Std. Err.	t- value	P>|t|
Constant	α_0	4.7353***	0.5828	8.13	0.000
Sex (Male = 1, Female = 0)	α_1	3.3816***	0.5276	6.41	0.000
Access to credit (Yes = 1, No = 0)	α_2	0.5346 ns	0.3888	1.37	0.170
Extension contact (Yes = 1, No = 0)	α_3	0.8941***	0.1121	7.98	0.000
Membership in cooperative (Yes = 1, No = 0)	α_4	1.6831***	0.4434	3.80	0.000
Farming experience (Years)	α_5	0.0579**	0.0273	2.12	0.035
Household size (number)	α_6	-0.1449***	0.0391	-3.70	0.000
$R^2 = 0.51$					
Adj $R^2 = 0.50$					
F-Stat = 42.37***					
Sample size = 252					

Source: Author's computation, 2019, ns, **, *** not significant or significant at 5 or 1% levels, respectively.

CONCLUSIONS AND RECOMMENDATIONS

This study set out to measure the technical efficiency of Irish potato farmers in Nigeria's Plateau state and identify the factors that cause variation in the technical efficiency of farmers in the study area. None of the sampled Irish potato farmers operated on the production frontier (efficient level), indicating a gap in efficiency and room for its improvement. The farmers were operating below the production frontier due to technical inefficiency, which is attributed to farming systems or due to the inefficiency among the sampled farmers, or both. The study established that Irish potato farmers operate at the rational state of production. In contrast, socioeconomic factors of gender, extension contact, membership in cooperative society and farming experience were positive determinants of farmers' technical efficiency, while household size was a negative determinant/was negative. Thus, encouraging contact between farmers and extension workers will enhance their level of efficiency in the production of Irish potatoes. Since farming experience also improves the level of efficiency, new entrants into Irish potato farming should consider either hiring experienced Irish potato farmers or understudying them for efficient production. Membership of cooperative societies should also be encouraged among Irish potato farmers to attain an optimal level of efficiency. It is also recommended that birth control measures are recommended for Irish potato farming households to bring about the desired efficiency level in production. Finally, since it was established that being a male farmer increases efficiency of Irish potato production compared to being a female farmer, it is recommended that further research should be done to identify factors that can increase the efficiency of Irish potato production among female farmers.

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