
Determinants of Crop Enterprise Diversification among Small Holder Farmers in Delta State, Nigeria.

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ABSTRACT

The study analysed the determinants of crop enterprise diversification among smallholder crop farmers in Delta State. Specifically, it sought to ascertain the socioeconomic characteristics of respondent, the determinants of crop enterprise diversification among the smallholder crop farmers, the intensity of crop enterprise diversification, the different crop combinations, the reasons for participating in crop enterprise diversification, the likely benefits of participating in crop enterprise diversification and the constraints to crop diversification. Primary data for the study were obtained by the use of structured questionnaire administered to a cross section of 192 farming household that were randomly selected through a multi-stage sampling procedure. A three stage was used to draw samples for the study, using lottery method. The result obtained indicate that 61.3% of the farmers were females; most of the farmers have small farm size of 0.2-0.4 hectares. Test of Differences between means of Socioeconomic variables among farmers who participants in crop enterprise diversification and those who do not showed that the following were significant $p < 0.01$ age, farm size, farm income, farm experience. The result obtained from Heckman selection model reveals that age,

attitude to risk, size of farm and access to credit had positive and significant effect on crop enterprise diversification while farm experience, level of education were significant at $p < 0.05$. Results from the outcome equation, which indicates the intensity of crop diversification also revealed that farm size and farming experience were significant at $p < 0.05$ while credit access was significant at $p < 0.01$. It was observed that 87 respondents participated in crop enterprise diversification. More income or rather additional income is adjudged as the major benefit derived by farmers who participate in crop enterprise diversification. The constraints that have major effect on crop diversification are inadequate farm size and lack of access to credit. It is the recommendations of this study that government should implement policies that will mitigate the challenges confronting crop enterprise diversification among smallholder crop farmers in the state.

Key expression

Determinants of crop enterprise diversification among small holder farmers

Background to the Study

Agriculture plays a significant role in the economic development of Nigeria. It provides food for the growing populace, it creates employment for more than 65 percent of the population and it generates foreign exchange earnings for the growth of the industrial sector (Ojo, 1990). As a result of this, the Nigeria smallholder farmers are taken into consideration during policy formulation, since the country gained independence in 1960. The reason for this is not far-fetched as the nation's agriculture has always been dominated by small-scale farmers who produce a substantial portion of Nigeria's food requirements (Okuneye, 1989).

Crop diversification is usually viewed as shift from traditionally grown less remunerative crops to more remunerative crops. Crop diversification can also take place as a result of governmental policies and thrust on some crops over a given time.

Development in market infrastructure and certain other price related supports also induce crop diversification. Crop diversification is intended to give a wider choice in the production of a variety of crops in a given area so as to expand production related activities on various crops and also to lessen risk (Imbs and Wacziarg, 2003).

The intensification and specialization of agricultural production neglect traditional crops on which livelihoods have been built for centuries. Increased reliance on major crops led to a shrinking of the food basket which mankind has been relying upon for generations (Prescott- Allen and Prescott Allen 1990). Similarly, the livelihood of a number of smallholder crop farmers in the rural areas, should include traditional crops since this will help to lift farmers out of poverty.

Crop diversification can also be referred to as the cultivation of large number

of crops in rain-fed lands to reduce the risk of crop failures as a result of drought.

Statement of Problem

Decisions on the crops to plant are complex and are highly contextual. The amount of land allocated to a crop can rarely be explained by a single factor. A range of different socio-economic, political and environmental factors inform such decisions. The individual circumstances of households, their resources, aspirations, traditions and values - all inform the decisions they make. Moreover, the decision as to which crops are cultivated and how much land they should occupy has consequences for the other activities that make up the household's livelihood (Mansfield, 2008). For many farmers in Delta State these decisions are constrained by the social and economic structures that govern access to assets such as land, credit and labour.

It is contended that viability of small farms can be improved through crop diversification and also that diversification can lead to sustenance of the farming household. Against this background, a modest attempt has been made to understand the determinants of crop enterprise diversification and the constraints confronting it, so that it would help to frame appropriate agricultural strategy to boost the agricultural economy of the State. Therefore, the study is designed to determine the factors influencing farmer's decision to participate in crop enterprise diversification in Delta State. As a result the following research question will be addressed:

1. What factors influence farmer's decision to diversify into selected crops?

2. What is the intensity of diversification into selected crops?
 3. What are the predominantly crop combination enterprises?
 4. What are the benefits of crop enterprise diversification?
 5. What constraint do farmers face in diversifying into selected crop?
- ii. Examine factors that influence crop enterprise diversification
 - iii. Determine the intensity of crop enterprise diversification in the study area
 - iv. Identify the major crop enterprise combinations.
 - v. Identify the benefits derived by the farmer from crop enterprise diversification.
 - vi. Identify constraints farmers face in diversifying their crop enterprises.

Objective of the Study

General Objectives

The general objective of this study is to examine factors that influence crop diversification among small holder crop farmers in Delta state, Nigeria.

The specific Objectives

The specific objectives are to;

- i. Describe the socio-economic characteristics of the farmers in the study area.

Hypothesis

The hypothesis tested in the study;

H₀₁: Socio-economic characteristics of farmers have no significant effect on crop enterprise diversification

MATERIALS AND METHODS

The aforementioned objectives were achieved using descriptive and inferential statistics. Quantitative data used for this study was obtained through close – ended

questionnaires administered to the respondent using interview method. The data were analysed quantitatively.

Sampling Procedure and Sampling Size

A three stage multi sampling procedure was used to draw samples for the study. Two (2) local Government Areas were randomly selected from each of the three (3) Agricultural Zones in the State. Delta North Agricultural Zones – Ika North East Local Government Areas and Oshimili South Local Government Areas, Delta South Agricultural Zones – Bomadi and Burutu Local Government Areas, Delta Central Agricultural Zones- Ethiope East Local Government Areas and Isoko North Local Government Areas. This gave a total of six (6) Local Government Areas, selected as shown in (Figure 3.1). In stage two, four (4) farming communities were randomly selected from each of the six (6) Local Government Areas earlier selected to give a

total of twenty four (24) farming communities. Finally in stage three, eight (8) crop farmers were randomly selected using lottery method (drawing lots).

In this case (lottery method), the farmers in each of the farming communities chosen are assigned with a number and these numbers are recorded on identical piece of paper, folded identically and then put into a box. The box is then shaken to ensure proper randomization. Then eight (8) papers are taken out of the box in each farming communities earlier selected one following the other and the numbers taken are recorded. The farmers bearing these numbers all constitute the sample frame.

Instruments of Data Collection

Questionnaires

Primary data were used for this study. The primary data was obtained from cross section of smallholder crop farmers using structured questionnaire. Copies of

questionnaire were administered to 192 smallholder crop farmers randomly and 173 questionnaires were retrieved, hence 173 responses were used for the analysis. Trained enumerators fluent in both English and local languages of the areas also help in administering the questionnaire where the researcher cannot speak the local dialect.

Data Organization and Analysis

The analytical tool that was used in the study includes descriptive and inferential statistics. Inferential statistics such as the Heckman two stage model was used to examine factors that influence crop diversification and the intensity of diversification. Data collected from the farmers with the aid of questionnaires were fed to the software, “Stata” via the computer. Descriptive statistics was employed to analysed and present data for as simple percentage and frequency. Then, the results were discussed and implications were

drawn according to the views of the majority of the respondents.

DATA PRESENTATION AND DISCUSSION AND PRESENTATION OF RESULTS

Socio- Economic Characteristics of Respondents

Distribution of Respondents by Sex

The result in Table 4.1 reveals that 106 respondents representing 61.3 % of the farmers surveyed were women, while 67 respondents representing 38.7% were men. This indicates that women dominate farming in the study area. Though, most women in the study area do not own land on their own especially when their husband are alive. They join hands with their husbands to do the farm work as family business.

4.1.2 Distribution of Respondents by Age

The age distribution of the respondents indicates that 25.4% of the farmers interviewed were within the ages of 42 and

51 years. This also conforms to the findings of FAO (2012) which reported that elderly farmers look at farming as a way of life and it is expected that elderly farmers will not participate in crop diversification, whereas

young farmers may be more inclined to look at farming as a business opportunity for family sustenance and are more likely to participate in crop diversification.

Table 4.1: Socio – Economic Characteristics of respondents

Variable	Frequency	Percentages (%)	Mean (mode)
Sex			
Male	67	38.7	(Female)
Female	106	61.3	
Age			
22-31	28	16.2	48.3
32-41	39	22.5	
42-51	44	25.4	
52-61	33	19.1	
62-71	25	14.5	
72-81	4	2.3	
Household size			
1-3	67	38.7	5.3
4-6	74	42.8	
7-9	29	16.8	
10-12	3	1.7	
Farm Experience			
2-12	81	46.8	12.4
13-23	34	19.7	
24-34	38	22.0	
35-45	17	9.8	
46-56	3	1.7	
Farm Size			
0.2-0.4	56	32.4	1.4
0.5-0.7	42	24.3	
0.8-1.0	50	28.9	
1.1-1.0	19	11.0	
1.4-1.6	6	3.5	
Marital Status			
Single	16	9.2	(Married)
Married	111	64.2	
Others	46	26.2	
Educational Level (Years)			
No formal education	26	15.0	
Primary school certificate	44	25.4	

SSCE/GCE	41	23.7	(SSCE/GCE)
OND/NCE	34	19.7	
First Degree	28	16.2	
Occupation of household			
Non-farming activities	56	32.4	(Farming)
Farming	117	67.6	
INCOME (₦)			
70,000 - 150,000	49	28.3	
151,000 - 230,000	31	17.9	₦154,289
231,000 - 310,000	37	21.4	
311,000 - 470,000	52	30.1	
471,000 - 630,000	4	2.3	

(Source: Field Data, 2015)

4.1.3 Marital Status

Findings as shown in Table 4.1 indicate that most of the respondents (64.2%) in the study area were married. The study presents a true reflection of most Africa farming communities where early marriages are the norm in order to raise large families to support the family farming activities.

4.1.4 Educational Level of Respondents

Information on educational qualification showed that about 25.4% of the smallholder farmers who were interviewed had primary school certificate. This implies that farmers in the study area were relatively

literate; this agrees with the findings of Benor *et al.*, (1997) that; education is thought to create a favourable mental attitude toward adoption of farming innovations.

4.1.5 Household Size

A high proportion of the respondents had household size of 4 – 6 persons. The larger the household size, the higher the tendency to participate in crop diversification. Previous studies also support this hypothesis (Weiss and Briglauer (2000), Ehui. *et al* 2004).

4.1.6 Farming Experience

About 46.8% of the respondents had low farming experience of 2-12 years. This implies that majority of the farmers interviewed have farming experience of less than 12 years. This is because most of the respondents in the study area are young farmers.

4.1.7 Farm Size

The result indicate that majority of the farmers in the study area were small scale farmers with less than 0.4ha. This finding corroborate with the findings of Olayide et al., (1980) which states that the Nigerian agricultural scene is largely dominated by small farms of less than 2.0 hectares, which collectively account for over 90% of the total agricultural production in the country.

4.1.8 Occupation of Household

About 67.6% of the respondents were involved in full time crop production. 32.4% were involved in part time crop

production. This implies that most of the farmers in the study area are actively involved in farming as a means of livelihood.

4.1.9 Income of Farmers

Diversification aids income stability. Table 4.1 shows that majority of the crop farmer has an income, which ranges from ₦ 311,000 to ₦ 470,000. This is about 30.1% of the total respondents surveyed.

4.2 Socioeconomic Variables among Participants and Non-Participants in Crop Enterprise Diversification

The result of socioeconomic characteristics of farmers who participate in crop enterprise diversification and those who do not participate in crop enterprise diversification which were compared using test of differences of mean. The result of only significant variable was used in the discussion.

From the result obtained, it can be observed that there is a significant difference ($P < 0.01$) between the Age of those who participate in crop enterprise diversification and those who do not participate. This finding implies that Age is a major determinant influencing farmer's decision, whether to participate in crop enterprise diversification or not to participate in crop enterprise diversification. This conforms to

the findings of FAO (2012) which reported that elderly farmers look at farming as a way of life and it is expected that elderly farmers will most likely participate in crop enterprise diversification, whereas young farmers may be more inclined to look at farming as a business opportunity for family sustenance and are less likely to diversify their crop enterprise.

Table .4.2: comparison of Means of Socioeconomic Variables among Participants and Non-participants in Crop Diversification

Variables	Diversifiers	Non- diversifiers	Mean diff.	T-test	Sig. (2-tailed)
Age	54.667	41.826	12.841	10.947	0.000***
Farm experience	14.483	10.337	4.146	4.519	0.000***
Farm income	306336.3	200522.5	1.05814E5	0.241	0.000***
Farm size	1.653	1.275	0.3780	0.065	0.000***

*** sig. at 1% **sig. at 5%

Based on farming experience, it can be deduced that there is significant difference ($P < 0.01$) between the farming experience of farmers who participate in crop diversification and those who do not. This connotes that farmers whose farming

experience has span over a decade or more, would have amass great knowledge in the production of different varieties of crops. Therefore, are more likely to participate in crop diversification. This agrees to the findings of Ashfaq, et al. (2008), who posits

that farming experience is among the major factors which influence farmer's decision to participate in crop enterprise diversification.

Farm income shows a significant difference ($p < 0.01$) between the farmers who participate in crop enterprise diversification and those who do not participate. This indicates that farm income has a great effect on farmer's decision making whether to participate in crop enterprise diversification or not, since farmers with higher income will have the financial capacity to meet the necessary requirement involved in crop enterprise diversification.

Finally, the result also indicate that there is a significant difference ($P < 0.01$) between the farm size of farmers who diversified and those who do not diversify. This result indicates that farmers with large farm size will most likely participate in crop enterprise diversification unlike farmers

with small farm. Previous studies also indicated that farm size positively affect crop enterprise diversification. (Benin et al., 2004; Ashfaq *et al.*, 2008; Fetien et al., 2009).

Determinants of Crop Enterprise

Diversification

The results obtained from probit estimate of determinants of crop enterprise diversification among smallholder crop farmers are presented in Table 4.3. The result of factors which determines participation in crop enterprise diversification by smallholder crop farmers in the study area, are presented and discussed below.

In this study, the log likelihood ratio chi square value of 125.8881 is statistically significant ($p < 0.01$), so we conclude that there is a significant effect between the dependent variable and the set of

independent variables. Moreover, the goodness-of-fit of the Heckman model was also examined in Table 4.3. McFadden's R^2 value was 0.52, this value indicate that 52.0% of the variation in the crop enterprise diversification variable was jointly explained by all the independent variables included in the model. In addition, significant of the Heckman model adopted for the study was also tested based on percentage of correct prediction and it was also found to be relevant to the study, this value indicate that independent variables are able to explain the relevant changes on the dependent variable with a percentage of 87.

The significance of the likelihood ratio statistic test rejected the null hypothesis of this study which state that socio-economic characteristics of farmers have no significant effect on crop enterprise diversification and the alternate hypothesis, which state that socioeconomic

characteristics of farmers have significant effect on crop enterprise diversification.

Finally, the marginal effect included in the Table 4.3, explains the rate of change in one quantity relative to another, or the change in the dependent variable per unit change in the independent variable. More specifically, a unit change in Age increases the probability of participating in crop diversification by 0.03. Secondly, a unit change in farming experience increases the probability of participating in crop diversification by 0.03. Similarly, educational level had the least effect on the probability of participating in crop enterprise diversification, where a change in the independent variable increases the chances of participating in crop enterprise diversification by 0.01.

In addition, farm size had the most impact on the probability of participating in crop enterprise diversification, where a unit

change in the independent variable increases the probability of participating in crop enterprise diversification by 0.42. Finally, a unit increase on attitude to risk and credit access will increase the corresponding probability with 0.35 and 0.39, respectively.

Age: Age has a positive and significant influence ($p < 0.01$), on crop enterprise diversification. The positive coefficient of age indicates that the probability of engaging in crop diversification increases with an increase in the age of the farmer. It is observed that a unit increase in age of the farmer will lead to a 0.03% probability of

participation in crop enterprise diversification. This implies that age has a direct relationship with diversification as young farmers lack the basic requisite knowledge needed for effective participation in crop diversification while the aged farmers lack the strength to engage in meaningful farming activities, hence, diversification is practiced mainly by middle aged farmers. This corroborate the findings of Pope and Prescott (1980), which state that young farmers usually have less farming experience and are more likely to use crop diversification to avoid production risks.

Table 4.3: Determinants of Crop Enterprise Diversification

Variable	Coefficient	z-stat	p-value	Marginal effect
Constant	-8.148	-6.955	0.000***	
Age	0.073	4.546	0.000***	0.03
Sex	-0.401	-1.394	0.163	
Marital status	0.141	0.502	0.615	
Membership of cooperative	0.980	0.349	0.727	
House hold size	0.041	0.552	0.581	
Farm experience	0.068	2.407	0.016**	0.03
Farm income	0.068	0.680	0.046**	0.04
Educational level	0.240	2.049	0.040**	0.01
Farm size	1.045	2.570	0.010***	0.42

Attitude to risk	0.890	3.122	0.002***	0.35
Credit access	0.977	3.020	0.003***	0.39
Market distance	-0.040	-0.516	0.606	
Ext access	0.328	1.206	0.228	
Hired labour	0.156	1.951	0.051**	

No. Of Obs 173
 Chi square 125.88
 Prob >chi 0.0000
 Log likelihood -56.967
 Log likelihood Ratio: chi square (14)
 = 125.89
 % of correct prediction = 150
 (87%)
 Mcfadden R² = 0.52

*** Significant at 1% ** Significant at 5%

Farming experience: Farming experience has a positive and significant effect ($p < 0.05$) and the positive coefficient 0.068 of farming experience indicates that the probability of engaging in crop diversification increases with an increase in experience acquired by the farmer as he progresses in farming activities. A 10% increase in farm experience will result to 0.3% probability of participation in crop diversification.

Education Level: As expected, education is statistically significant ($p < 0.05$) and had a positive influence 0.240 with the decision to

participate in crop enterprise diversification. A 10% increase in Education level of the farmer will result in 0.1% of probability of participating in crop enterprise diversification. The result reveals that the probability of participating in crop enterprise diversification increases with the level of education attain by the farmer. This finding agrees with other studies that the importance of knowledge and ability to absorb new information through formal education increases crop diversification (Rahman, 2008; Guachan et al., 2005).

Farm income: Farm income has a positive and significant effect ($p < 0.05$) and the positive coefficient of 0.068 of farm income indicates that the probability of engaging in crop enterprise diversification increases with an increase in income derived by the farmer in participating in crop enterprise diversification. The result indicates that a unit increase in farm income will lead to 0.04% probability of participating in crop enterprise diversification. This corroborate the findings of another study on crop diversification carried out by Ibrahim et al (2009), which state that income obtained from crop enterprise diversification is among the significant determinants of crop diversification in Nigeria.

Farm size: Farm size is a key determining factor in farmers decision, whether to diversify or not. Farm size is statistically significant ($p < 0.01$) and has a positive relationship 1.045 with the decision to

participate in crop diversification. A 10% increase in farm size will result to 4.2% probability of participating in crop enterprise diversification. The positive coefficient indicates that the probability of participating in crop diversification increases with an increase in farm size. This means that the bigger the farm size, the more crops will be cultivated in the farm. The result is consistent with the findings of Bradshaw et al. (2004) that large farms grow more crops than small farms.

Attitude to risk: Attitude to risk influences the decision of farmers whether to participate in crop enterprise diversification or not. Attitude to risk has a positively and significant influence ($p < 0.01$) on crop diversification. A 10% increase in attitude to risk will lead to 3.5% probability of participating in crop diversification. This implies that those farmers who are risk averse will most likely participate in crop

diversification while those who are not risk averse will not participate in crop diversification. Therefore, crop diversification is an effective strategy for farmers to mitigate risk. This is also consistent with the previous findings (Sonka and Patrick 1984; Knutson et al. 1998; Bradshaw et al. 2004; Di Falco and Perrings 2005).

Credit access: Access to credit has a positive and significant influence ($p < 0.01$) on crop enterprise diversification. The result further shows that a 10% increase in the access to credit increases the probability of participating in crop enterprise diversification by 3.9%. This indicates that farmers who have access to credit would likely participate in crop enterprise diversification unlike farmers who lack access to credit. This results support earlier study of Ajibefun and fatuse (2011), reported a positive relationship between

access to farm credit and the adoption behavior of farmers.

OLS Estimates of the Intensity of Crop Diversification

The OLS model was used to analyze the intensity of crop diversification among smallholder crop farmers in the study area. The F- statistic is statistically significant at the 1% level, implying that the variables included in the OLS model are jointly significant in determining the intensity of crop diversification among smallholder crop farmers in the study area. The R^2 value is 0.43. This means that 43% of the variation in decision to participate in crop diversification is explained by the variables included in the model, while 57% are explained by other factors not included in the model. The coefficient on lambda (inverse mill ratio) is statistically significant at 5%, indicating the presence of sample selection bias and therefore the use of

Heckman model was justified. An OLS log likelihood of 106.0974 was statistically significant ($P < 0.01$), showing that the model was relevant for the study. Percentage of correct prediction is 87%, this high percentage indicate that the model is highly suitable for the estimate.

Finally, among the diversified farmers, there are varying degrees of diversification as measured by the crop Diversification Index (CDI). The CDI was adopted since it has a direct relationship with diversification. When the value tends to zero, it signifies specialization, with an increase in the degree of diversification the value tends to one. The mean CDI of the diversified farmers in the study area was 0.818. This indicates high level of crop diversification among the farmers in the study area who practice crop diversification.

Farming Experience: The result of the study shows that farming experience has positive and significant influence ($p < 0.05$) with crop enterprise diversification and also has a great influence in determining the intensity of crop diversification. A 10% increase in farming experience will result to 0.1% probability of the intensity of participating in crop enterprise diversification. This implies that farmers who have acquired more farming experience through formal or informal system are more likely to participate in crop diversification unlike those who have little or no experience. This complies with the findings of Ashfaq, et al. (2008), who posited that farm experience is among the major factors which influence farmer's decision to diversify in crop diversification.

Table 4.4: OLS Estimates of the Intensity of Crop Enterprise Diversification

Variable	Coefficient	z-stat	p-value	Marginal effect
Constant	0.662	3.665	0.000	
Age	-0.001	-0.887	0.375	
Sex	-0.014	-0.765	0.444	
Marital status	0.013	-0.689	0.491	
Membership of cooperative	0.026	1.376	0.170	
House hold size	-0.003	-0.637	0.524	
Farming experience	0.005	2.409	0.0160**	0.01
Farm income	0.000	0.313	0.045**	0.02
Educational level	-0.013	-1.573	0.116	
Farm size	0.060	2.311	0.021**	0.06
Attitude to risk	0.002	0.109	0.913	
Credit access	0.106	3.662	0.000***	0.11
Market distance	-0.000	-0.182	0.855	
Extension access	0.013	0.655	0.513	
Hired labour	0.005	0.930	0.352	
IMR (lambda)	0.395	0.918	0.035**	
No. Of Obs	173			
R – squared	0.4306			
Adjusted R – squared	0.3103			
F (15,17)	3.58			
Prob > F	0.0014			
Log likelihood	106.0974			
% of correct prediction = 150 (87%)				

***significant at 1%

**significant at 5%

Farm income: The result of the study shows that farm income has positive and significant effect ($p < 0.05$) with crop enterprise diversification and also a great influence in determining the intensity of crop diversification. A 10 % increase in farm income will result to 0.2% probability of the intensity of participating in crop enterprise

diversification. This implies that the more income derived by farmers in participating in crop diversification, the higher the tendency to diversify his crop enterprise.

Farm Size: The size of farmland owned by the farmer has positive and significant effect ($p < 0.05$) on the degree of crop diversification with an increase in farm size

leading to an increase in the crop diversification index. This implies that there is a direct relationship between the intensity of crop diversification and farm size. A 10% increase in the unit of farm size will lead to an increase in the degree of crop diversification by 0.6%. Likewise, Benin *et al.* (2004) found that farm size positively affects crop diversification.

Credit Access: Access to credit has a great effect in determining the intensity of crop diversification. It is statistically significant and it is positively related ($p < 0.01$) to crop diversification. A 10% increase in the access to credit increases the intensity of crop diversification by 1.1%. This implies that having access to credit whether through formal or informal institution influences the intensity at which the farmers diversify. The finding agree with Pingali (1992) who reported that changing from rice monoculture to diversified farming requires

substantial investments and operating expenses that need long-term and seasonal credit arrangement.

Crops Combination Pattern in the Study Area

The result of crop combination pattern in the study area as shown in Table 4.5 indicate that the farmer in the study area adopt different crop diversification strategies to fully utilize highly fragmented agricultural land and thus attempt to reduce the risks and uncertainties in their operations. The strategies include cultivation of one, two crops up to six crop combinations on a piece of land. The result shows that most of the farming household heads planted more than three crops in their farm land. This clearly shows the intensity of farmland scarcity in the study area. The result obtained showed that farming household heads that participate in crop diversification derive more farm income

than those that specialized on mono-cropping.

Table 4.5: Distribution of Farming Household Heads According To Major Crop Combinations

Types of crop combination	Frequency	Percentage
RICE	8	4.62
CASSAVA	42	24.28
LEAFY VEGETABLE	9	5.20
BANANA	8	4.62
PLATAIN	19	10.98
BANANA +PLATAIN	7	4.05
CASSAVA + MAIZE	5	2.90
CASSAVA +OKRA + MAIZE	13	7.51
CASSAVA + OKRA + MAIZE + COCOYAM	6	3.47
CASSAVA + OKRA + POTATO + MAIZE	9	5.20
CASSAVA + OKRA + PEPPER + MAIZE + MELON + LEAFY VEGETABLE	11	6.36
CASSAVA + OKRA + TOMATO + MAIZE	7	4.05
CASSAVA +YAM + MAIZE	8	4.62
CASSAVA + YAM +OKRA +MAIZE	5	2.90
CASSAVA + YAM + OKRA + MAIZE + LEAFY VEGETABLE	8	4.62
CASSAVA + YAM + OKRA + POTATO + COCOYAM	5	2.89
CASSAVA + YAM + OKRA +TOMATO + POTATO + MAIZE	3	1.73
Total	173	100

SOURCE: Field Survey Data, 2015.

Distribution of Income and Area Cultivated To Various Crop Combination

Enterprise	No. of farming household head	Mean area of farm land	Mean Monthly farm income (₦)	Min. Monthly farm income	Max. monthly farm income (₦)
Monocropping	86	0.672	10,108	7,050	11,976
Two crop-combination	12	0.084	21,805	8,000	29,166
Three crop-combination	21	0.112	16,428	9,500	34,166
Four crop-combination	27	0.154	25,616	10,250	36,833
Five crop-combination	5	0.182	21,569	10,500	41,416
Five crop-combination	14	0.147	13,207	10,310	49,166
Six crop combination	8	0.049	14,113	10,113	50,420

SOURCE: Computed from analysis data 2015.

4.7: Reason for Participating In Crop Diversification

From the table, the three most important reasons advanced by the farmers for

participating in crop diversification were; the need to avoid crop failure, minimize risk and to enhance the production of other

crops, others were; to guard against the unpredictability of weather, price instability, the supply of varieties of crops in the family menu and finally cultural factors such as traditional crops grown in the locality. This finding is in line with the study conducted by Rechar and Mahen (2005), their study revealed that, the type of uncertainty most

feared are climate factors, pests and diseases, price uncertainty and policies related to agricultural production, marketing and trade; in this respect, farm diversification may be considered as a spontaneous response to avoid many of these uncertainties.

Table 4.7 Reasons for Participating in Crop Diversification

Reasons	Frequency	Percentages
Price not stable	50*	57.5*
Unpredictability of weather	47	54
To enhance production of other crops	53	60
Household size	21	24.1
Cultural factor	15	17.2
To minimize risk	61	70
To avoid failure	78	89.7

*Multiple responses

Source: Field survey, 2015.

4.8: Benefits of Crop Diversification

On income derivation, (100%) of the farmers agrees that they derive more income by diversifying their crop production while none disagree. This study agrees with other studies that farmers earn more income by practicing crop diversification Joshi et al., (2007). On erosion control and risk

reduction, (54.0%) and (89.7%) of the farmers agrees that diversification helps to control erosion and reduce farmers exposure to risk respectively. On pest and disease control, (58.6%) of the farmers agrees that crop diversification helps to control pest and disease attack on the crop. On improvement

of knowledge on other crops, (51.7%) agree that diversification helps farmers to acquire additional knowledge about other crops and

finally, increase in soil nutrient, (91.5%) of the farmers agree that crop diversification helps to increase farm diversification.

Distribution of Benefits of Crop Diversification

Statement	Frequency (Yes)	Frequency (No)	Total
Do you derive more income by participating in crop diversification?	87(100%)	(0%)	87(100%)
Does crop diversification help to control erosion?	47(54%)	40(46%)	87(100%)
Does diversification help to reduce farmer’s exposure to risk?	78(89.7%)	9(10.3%)	87(100%)
Does diversification help to control pest and disease attack?	51(58.6%)	36(41.4%)	87(100%)
Does diversification help to improve the farmer’s knowledge on other crops?	45(51.7%)	42(48.3%)	87(100%)
Does crop diversification improve the soil nutrient?	80(92%)	7(8%)	87(100%)

Source: Field Survey Data, 2015.

Constraint to Crop Diversification

The constraints identified in the study include the following; lack of access to farm credit, lack of extension services, inadequate farm size, lack of storage facilities and in adequate provision of improved seeds, long distance to markets,

low level of education, lack of irrigation facilities and lack of storage facilities.

The major constraints identified are; lack of access to credit, inadequate supply of improved seeds, inadequate farm size, lack of storage facilities. This result agrees with the following findings; (Ogungbile et. al., 1998). Who posit that lack of access to seeds

of new varieties is a major factor limiting farmer's adoption of crop diversification and Kasryno (1992) who posit that access to credit is a key constraint to the movement of farmers and rural firms towards diversification because of inadequate capital.

Table 4.9: Constraint to Crop Diversification

CONSTRAINTS	RANKS					MEAN	REMARK
	SD	D	U	A	SA	\bar{X}	
	(1)	(2)	(3)	(4)	(5)		
Inadequate supply of improved seed	4	4	0	38	127	4.62*	Important constraint
Lack of access to credit	3	5	5	34	126	4.59*	Important constraint
lack of storage facilities	3	8	8	57	97	4.37*	Important constraint
Inadequate farm size	2	13	25	48	85	4.16*	Important constraint
Long distance to market	7	19	44	87	16	3.5*	Important constraint
Lack of irrigation facilities	7	19	44	87	16	3.5*	Important constraint
Lack of extension services	3	28	50	75	17	3.4*	Important constraint
Inadequate farming experience	19	35	12	87	20	3.3*	Important constraint
Low level of education	18	45	24	51	35	3.2*	Important constraint
Non-membership of cooperative group	27	63	54	21	8	2.5	Non- important constraint
Low returns/ capital	74	37	20	23	19	2.28	Non-important constraint

***important constraint**

CHAPTER FIVE

SUMMARY, CONCLUSION

AND RECOMMENDATION

Summary of the Major Findings

The study sought to determine the factors influencing smallholder crop farmer's decision to participate in crop enterprise diversification in Delta State, Nigeria. Specifically, the study was aimed at describing the socioeconomic characteristics of the respondents, identifying the constraints, benefit of engaging in crop enterprise diversification and the intensity of crop enterprise diversification.

Data used in this study were collected, using questionnaire that was administered to smallholder crop farmers drawn from thirty (30) farming communities, in six (6) Local Government Area of Delta State. On the whole, 173 properly filled copies of the questionnaire were used for the analysis.

The result showed that (25.4%) were within the age range of 42-51 years with a mean age of 48.5 years. Average household was about 7 persons, while 147 persons had formal education. Farm size ranged between 0.2-0.4 hectares, while 117 persons were solely engaged in crop production as the only source of livelihood.

Factors such as lack of access to credit, inadequate supply of improved seeds, inadequate farm size, and lack of storage facilities were the major constraints to crop diversification. Others include; long distance to market, lack of extension service, and low level of education.

Some endogenous variables were examined using Heckman selection model to ascertain their effect on crop diversification. Results showed that age, farming experience, farm size and access to credit

were significant at $p < 0.05$ while access to credit size was significant at $p < 0.01$.

5.0 Conclusion

This study has analysed the determinants of crop enterprise diversification among smallholder crop farmers in Delta State, Nigeria by ascertaining the socioeconomic characteristics of the respondents in the study area and also, the various constraints to crop diversification in the area were also established.

Gender, age, education, farming experience, farm size, credit, all played in concert to determine the decision of the farmer whether to participate in crop diversification or not. The degree of intensity of diversification is also determined by farm experience, farm size, and credit size.

5.1 Recommendations

From the findings of this study, the recommendations made are as follows:

- i. Government should implement policies that will enable smallholder crop farmers to access credit facilities, so as to increase their participation in crop enterprise diversification.
- ii. Secondly; government should consider undertaking policies that will improve access to land by smallholder farmers'. Since bulk of the food are produced by this categories of farmers
- iii. Programmes that help farmers to raise their farm income through crop enterprise diversification should be promoted by the government.
- iv. This can be achieved by improving agricultural extension delivery service, especially in the rural areas.

Hence, there is need for the government to pay more attention to agricultural extension programmes through the recruitment and training of adequate extension workers in order to boost food production through information dissemination.

- v. The government should promote and support policies oriented towards bringing trading markets closer to the farmers, since distance to the market is an indicator of market access, organized trade and proximity to economic resources.

This can be done by investing in reliable and adequate market infrastructure thus fostering agricultural trade for farmers. Thus market infrastructure will improve the accessibility of market by farmers, thereby increasing their

earnings and improving their livelihoods

5.4 Contribution to knowledge

This study has contributed to the body of knowledge in the following ways;

1. The study established the benefits of crop enterprise diversification among smallholder farmers.
2. The study also established positive relationship between income and intensity of diversification.

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