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ECONOMIC IMPACT OF THE VALUE CHAIN DEVELOPMENT PROGRAM ON THE FOOD SECURITY OF RICE FARMERS IN NIGERIA

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Abstract

This study evaluated the economic impact of the value chain development program (VCDP) on the food security of rice farmers in Nigeria. Data from primary sources were used. A multi-stage sampling technique was applied to select a total sample size of 292 rice farmers which comprises of 155 value chain development program beneficiaries and 137 non-beneficiaries. Data were analyzed using the following tools: descriptive statistics, food security index, Logit dichotomous regression model, F-Chow test, and t-test. About 61% and 27% of the beneficiaries and non-beneficiaries of the value chain development program were food secured based on head count ratio. The 2/3 MCFE for beneficiaries and non-beneficiaries were 13203.954 Naira and 4759.605 Naira respectively. The significant factors influencing food security among the rice VCDP beneficiaries were the following: gender ($P < 0.10$), household size ($P < 0.01$), farm experience ($P < 0.10$), access to credit ($P < 0.05$), and labour input ($P < 0.10$). The F-Chow test conducted reveals that the VCDP impacted positively on the food security of rice farmers. The study recommends that interest rate free loans or low-interest loans should be made available to rice farmers to increase production and food security.

Keywords: economic impact, food security, Value Chain Development Program, rice farmers, Niger State Nigeria

INTRODUCTION

The sub-Saharan Africa has enormous natural, physical, and human potential, compared to the developed countries, where the cost of producing food is becoming high and land is scarce. In sub-Saharan Africa for instance, maximizing the potentials of agriculture would yield faster growth in reducing poverty than investing in other sectors, knowing the world population and the increasing demand, as population rises. The International Fund for Agriculture Development (IFAD) in partnership with the Federal Government of Nigeria focused on the Value Chain Development Program (VCDP) for the potential economic value of the staple crops if every challenge is removed from planting through harvesting to consumption. Also, to achieve Nigeria's Agricultural Transformation

Agenda which aims to increase production, reduce food imports and provide millions of new jobs for young people, the potential of agriculture needs to be adequately harnessed since the sector is seen as an alternative to the oil dependent economy that has not been able to deliver the country from the economic, social and other challenges be-devilling the nation (Agbaeze et al. 2015). The value chain can be explained as the set of actors (private, public, and including service providers) and the sequence of value-adding farming activities involved in bringing a product from production to the final or end consumer (Miller & Da Silva 2014). A value chain can also be describe as the entire range of operations (activities) undertaken by farmers to bring agricultural product from the initial input-supply stage, through various phases of agricultural processing, to its final market destination, and it

also includes disposing agricultural products after use (United Nations Industrial Development Organization (UNIDO 2016)). It can also be described as a chain of activities where agricultural products pass through all activities of the chain in sequence, and at each activity, the product gains some value (Russell & Hanoomanjee 2012). For instance, rice value chains comprise of all activities that take place at the rural or farm level, which include input supply, and continue through processing, handling, packaging, storage, and distribution. As agricultural products move successively through the different stages, transactions take place between multiple chain agricultural stakeholders, information is exchanged, money changes hands, and value is progressively added. Macroeconomic conditions, standards, policies, regulations, laws, and institutional support services (finance, communications, innovation, research, etc.) all of which form the value chain environment – are also critical elements affecting the performance of value chains.

Rice is a rich and cheap source of carbohydrate to human and animals. The demand for rice has risen over the last four decades, and 80 % of Nigerians consume rice. It has become not only a diet, but also a major source of calories for the urban poor (Ojogho & Alufohai 2010). Rice serves as a major staple crop that cushions the impact of under-nutrition and severe hunger in Nigeria and many other developing or sub-Saharan African (SSA) countries of the world (Nwalieji et al. 2014). Rice generates more revenue (income) for Nigerian farmers than any other cash crop in the country. A report by the Federal Ministry of Agriculture and Rural Development indicated that domestic rice consumption is below per capita need. The national estimates of the demand for rice in Nigeria is about 5.2 million tons per annum, where production is estimated at only 3.3 million tons and a deficit of 1.9 million for importation with the attendant drain on the nation's foreign reserve (Onyeneke 2017).

Objectives of the Study

The broad objective is to analyze the economic impact of the value chain development program (VCDP) on the food security of rice farmers in Nigeria. The specific objectives are to:

- (i) estimate the food security status of rice farmers beneficiaries and non-beneficiaries of the VCDP,
- (ii) evaluate the factors influencing the food security of rice farmers beneficiaries and non-beneficiaries of the VCDP, and
- (iii) evaluate the impacts of the VCDP on the food security of rice farmers beneficiaries.

Hypothesis of the Study

This study was guided by the following study hypothesis:

Ho₁: There is no significant impact of the VCDP on the food security of rice farmers.

Ha₁: There is a significant impact of the VCDP on the food security of rice farmers in the study area.

METHODOLOGY

This study was carried out in Niger State, Nigeria. It lies between Latitudes 80⁰ to 11⁰30' North and Longitudes 03⁰ to 07⁰40' East. It has a total population of 5,556,200 (NPC 2016).

The predominant occupation of the people is farming; the crops grown in the state are rice, maize, yam, sorghum, and millet. The target population for this study was all rice farmers that are participants and non-participants in the value chain development program in Niger State, Nigeria. The purposive sampling method was used to select Niger State because it is one of the states participating in the Value Chain Development Program (VCDP) initiative of the FGN and the IFAD program on the improvement of rice and cassava value chain. Multistage sampling procedure was adopted in the selection of representative samples. In the first stage, five (5) Local Government Areas were selected. The second

stage involved the use of simple random sampling technique employing the use of raffle-draw ballot-box, raffle-draw method. This technique was adopted to select the two (2) wards from each of the five (5) Local Governments Areas. In the third stage, systematic sampling techniques were used. Firstly, simple random sampling was used to selects the first respondents; subsequently, systematic sampling was used to select every n^{th} (3^{rd}) rice farmers participating in the value chain development program from the list of registered rice farmers obtained from the baseline survey. A total sample size of 292 rice farmers was selected comprising of 155 beneficiaries and 137 non-beneficiaries of the Value Chain Development Program (VCDP). Primary sources were employed to gather necessary data from the sample respondents.

$$F_i(X) = \frac{\text{Per Capita Food Expenditure for the } i^{\text{th}} \text{ Rice Farmer}}{\frac{2}{3} \text{ Mean Per Capita Food Expenditure of all Rice Farmers}} \quad (1)$$

Where;

F_i = Food Security Index (Units),

If $F_i \geq 1$ = Food Secured i^{th} Rice Farmer, and

If $F_i < 1$ = Food Insecured i^{th} Rice Farmer.

Additionally, the number of rice farmers who are food secured (insecured) was estimated by taking the frequency of the rice farmers who are food secured (insecured). The headcount ratio (H) of the food security was estimated to measure the % of the population of the rice farmers that are food secured (insecured). The headcount index (H) formula is stated as;

$$\text{Headcount Index}(H) = \frac{M}{N} \quad (2)$$

Where;

M = Number of Food Secured/Insecured Rice Farmer (Unit) and

N = The Number of Rice Farmer in the Sample (Unit).

This was used to achieve part of the specific objective one (i)

The following tools of analysis were used to achieve the stated objectives:

Descriptive Statistics

Descriptive statistics involves the use of mean, mode, range, frequency distribution tables and percentages, minimum and maximum values and standard deviations.

Food Security Index

Omonona et al. (2007) stated that a household is defined to be food secured if it obtains at least $\frac{2}{3}$ of the average per capita food expenditure per month of the sampled households and may be considered food insecured if the households falls below $\frac{2}{3}$ of the average per capita food expenditure.

Logit Dichotomous Regression Model

The probability that the farmers participating in the VCDP will be food secured dependents on some factors expressed using a Logit regression model. It is therefore expressed as;

$$F_i \begin{cases} F_i \text{ if } F_i > 0 \\ F_i \text{ if } F_i \leq 0 \end{cases} \quad (3)$$

F_i is therefore expressed as a latent variable that is observed for a value greater than zero and censored otherwise. The relationship is expressed thus;

$$F_i = X_i\beta + \varepsilon_i$$

Where, $\varepsilon \sim N(0, \delta^2)$. The observed F_i is defined by the following measurement equations.

$$F_i = 0 \text{ if } F_i^* \leq 0 \\ = F_i^* \text{ if } F_i^* > 0$$

$$F_i^* = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \mu_i \quad (4)$$

Where,

F_i^* = Food Security Index of the i^{th} Farmer (1, Food Secured; 0, Otherwise),
 i = Number of Independent Variables,
 α_0 = Intercept,
 $\beta_1 - \beta_{10}$ = Regression Coefficients,
 X_1 = Gender (1, Male; 0, Otherwise),
 X_2 = Marital Status (1, Married; 0, Otherwise),
 X_3 = Size of Households (Total Number of Persons),
 X_4 = Extension Agent Service Dummy (1, Contact; 0, Otherwise),
 X_5 = Farm Experience (Naira),
 X_6 = Access to Credit (1, Access; 0, Otherwise),
 X_7 = Labour Input (Mandays),
 X_8 = Age of Rice Farmers (Years),

X_9 = Farm Size (Ha),
 X_{10} = Level of Education (0, Non-Formal; 1, Primary; 2, Secondary; 3, Tertiary),
 and

U_i = Error Term.

This was used to achieve part of the specific objective two (ii)

F-Chow Test

F-chow Test statistics is often used in program evaluation to determine whether the program has impacts on different subgroup population. Chow Test is an application of the F-distribution test, if F-chow is greater than the F-Table, then there is a projects impact on the beneficiaries otherwise, there is no impact. The F-Chow test is stated as follows:

$$F^* - \text{Chow Test} = \frac{RSS - (RSS_1 + RSS_2) / K}{RSS_1 + RSS_2 / [N_1 + N_2 - 2K]} \quad (5)$$

Where,

RSS = Sum of Square Residual from Pooled Data,
 RSS_1 = Sum of Square from the First Group (participants),
 RSS_2 = Sum of Square from the Second Group (Non-Participants),
 K = Total Number of Parameter,
 N_1, N_2 = Number of Observation in Each Group.

This was used to achieve part of the specific objective three (iii)

RESULTS AND DISCUSSION

Determinants of the Household Food Security Index of Beneficiaries and Non-Beneficiaries of the VCDP in the Study Area

Beneficiaries and non-beneficiaries were classified into food secured and food insecure groups making use of their per capita food expenditure (MCFE) as shown in Table 1. Following Omonona et al. (2007) on household

food security, we observed that a household is classified as food secured if it obtains at least $\frac{2}{3}$ of the MCFE per month of the sampled households. Therefore, the beneficiaries who spent minimum of ₦13203.954 on food per month were classified as food secured, and those who spent below this estimated value were classified as food insecure. Also, the non-beneficiaries who spent a minimum of ₦4759.605 on food per month were classified as food secured, and those who spent below this calculated value were classified as food insecure. This means that for a beneficiary to be considered food secured, he or she should be able to spend four hundred and forty-naira thirteen kobo (₦ 440.13k) or above on food per day.

Table 1. Food Security Status of Rice Farmers in the Study Area

Food Security Status	Non-Beneficiaries			Beneficiaries			Combined			
	Food Secured	Food Insecured	Total	Food Secured	Food Insecured	Total	Food Secured	Food Insecured	Total	
Percentage	27.01	72.99	100	61.29	38.71	100	33.22	66.78	100	
Frequency	37	100	137	95	60	155	97	195	292	
Monthly Expenditure on Food										
Sum (Naira)	353068.5	625030.2	978098.77	2763499	306420	3 069919	3011575	1036443	4048017	
Mean (Naira)	3530.685	16892.71	7139.41	17829.02	1976.903	19805.93	31047.16	5315.092	13863.07	
Head Count Ratio (H)	0.27	0.73		0.61	0.39		0.33	0.67		
2/3 Mean Per Capita Food Expenditure			4759.605				13203.954			
									13863.07	

Source: Field Survey (2020)

650 Naira = 1 USD

Table 1 further showed that 61.29% of the beneficiaries were food secured, while only 27.01% of the non-beneficiaries were food secured. This further implies that the program had an impact on the food security of rice farmers. Based on the headcount ratio, 61% of the beneficiaries had their MCFE equal or above ₦13203.954, while 39% of the beneficiaries had their MCFE below ₦13203.954. The MCFE monthly of the beneficiaries who were food secured was ₦17829.02. This result is higher than ₦2694.95 (₦86.93/day) reported in the Kano State of Nigeria by Irohibe & Agwu (2014), and also higher than ₦3513 (₦117.10/day) observed by Olabisi & Olawamiwa (2014) in Oyo State, Nigeria; but lower than ₦14498.67 reported by Iorlamen et al. (2014) in Benue State, Nigeria.

Determinants of the Food Security Status among the Beneficiaries of the VCDP

The results presented in Table 2 show that out of the eleven (11) predictor variables included in the Logistic regression model, the coefficients of household size ($P < 0.01$), farm experience ($P < 0.10$), access to credit ($P < 0.05$), and labor input ($P < 0.10$) were the statistically significant factors influencing the food security status among the rice value chain program beneficiaries. The positive sign on a parameter indicates an increase in the likelihood or probability of the food security status, while the negative sign of a coefficient implies decreases in the likelihood or probability of food security (food insecurity).

Table 2. Maximum Likelihood Estimates (MLE) of the Logit Model

Variables	Coefficient	Standard Error	t-value	Marginal Effect
Gender (X ₁)	0.71	0.68	1.84*	0.082
Marital Status (X ₂)	0.11	0.43	0.25	0.012
Household Size (X ₃)	-0.63	0.12	-5.41***	-0.073
Extension Services (X ₄)	0.45	0.58	0.79	0.052
Farm Experience (X ₅)	0.04	0.03	1.83*	0.004
Access to Credit (X ₆)	0.24	0.62	2.39**	0.028
Labour Input (X ₇)	-0.02	0.01	-1.82*	-0.003
Age (X ₈)	0.03	0.04	0.77	0.003
Farm Size (X ₉)	-0.10	0.31	-0.34	-0.012
Education Level (X ₁₀)	0.32	0.28	1.15	0.037
Constant	4.33	1.69	2.57	
Chi Square = 93.69***				
Log Likelihood = -56.61				
Pseudo R ² = 0.45				

*** - Significant at ($P \leq 0.01$), ** - Significant at ($P \leq 0.05$), * - Significant at ($P \leq 0.10$)

Source: Author (2020)

Maximum Likelihood Estimate shows that the Log-Likelihood was -56.61, while the Chi-Square value was 93.69 and was significant at 1% levels of probability. This implies that the overall effects of the predictor variables were statistically significant. The coefficient of determinations (Pseudo R-Square) was 0.45 (45%). This signifies that 45% of the variations

in the food security index (i.e. dependent variable) were explained by the predictor variables included in the regression model. Household size (X₃) and Labour input (X₈) were negative and significant at 1% and 10% probability levels respectively. Farm experience (X₅) and access to credit facilities (X₆) had

positive coefficients and were significant at 10% and 5% probability levels respectively.

Household size (X_3) had a negative coefficient and was significant at ($P < 0.01$). This shows that a unit increase in household size will lead to a 0.073 marginal increase in food insecurity. This means that as the household size increases, food security decreases (increase in food insecurity). An increase in the family size signifies an increase in household food expenditure, especially, in a situation where many of the other household members do not generate any income but only depend on the household head, the likelihood (probability) that food security would reduce as the household size increased is high. This agrees with the findings of Place et al. (2003). Access to credit facilities (X_6) had a positive coefficient and was significant at a 5% probability level. A unit increase in access to credit will lead to a 0.028 marginal increase in food security of the beneficiaries. Credit is an important means of investment and households that have access to credit facilities can invest in preferred businesses and earn more income resulting in an

increased financial capacity and purchasing power of the beneficiaries, thus reducing the risk of food insecurity. Farm experience (X_5) had a positive coefficient and was significant at a 10% probability level. A unit increase in farm experience will lead to a 0.004 marginal increase in food security of the beneficiaries.

F-Chow Test

Analysis of the Significant Impact of the Value Chain Development Program on the Food Security of Rice Farmers

Table 3 reveals the F-chow-test analysis between the impact of the value chain development program on the food security of rice farmers. Based on the findings of this study, the hypothesis which states that there is no significant impact of the VCDP on the food security of rice farmers was rejected, while the alternative hypothesis which states that there is a significant impact of the VCDP on the food security of rice farmers was accepted. This implies that the VCDP had an impact on the food security of rice farmers.

Table 3. F-Chow – Test Analysis of Impact of Value Chain Development Program on Food Security of Rice Farmers.

Group Sample	R ²	Residual Sum of Square	N	K	F-Cal	F-Tab	Prob
Pooled	0.0572	772.4954	292	3	5.82***	1.96	0.0007
Participants	0.0651	131.8941	155	3	3.50***	1.96	0.0170
Non-Participants	0.0573	603.7946	137	3	2.79***	1.96	0.0485

***, Significant at 1% level of Probability

Source: Field Survey (2020)

CONCLUSION AND RECOMMENDATIONS

This research study has established that the F-Chow test conducted shows that the value chain development program impacted positively on the food security status of rice farmers. About 61% and 27% of the VCDP beneficiaries and non-beneficiaries were food secured. Two-third per capital food expenditure for the VCDP

beneficiaries and non-beneficiaries were 13203.954 Naira and 4759.605 Naira respectively. Household size, farm experience, access to credit, and labor input were found to be the statistically significant factors influencing the food security among the rice value chain program beneficiaries. The policy implications and recommendations from this study include the following:

(i) The policy implications of these findings emphasized the integration of rice farmers into the value chain development program to achieve food security and increase their net farm incomes.

(ii) Provision of extension officers to train rice farmers on new technologies, innovation, and new research findings.

(iii) Rice farmers should be provided with credit facilities at low interest rate with no collateral securities. This will enable them to improve productivity and hence the net farm income.

(iv) Rice farmers should be provided with farm inputs and improved varieties of rice. This will increase rice production and hence net farm income.

(v) The clashes between herdsmen and farmers were a major constraint faced in rice production, hence the Governments are hereby glad to provide adequate security for farmers.

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