






Research Article

Economic Impact Analysis of Value Chain Development Programme (VCDP) on Net Farm Income of Rice Farmers in Niger State, Nigeria

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ABSTRACT**ARTICLE
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This study evaluated economic impact analysis of VCDP on net farm income (NFI) of rice farmers in Niger State, Nigeria. Primary data were used. A multi-stage sampling technique was used to select a total sample size of 292 rice farmers which comprised of 155 value chain development program beneficiaries and 137 non-beneficiaries. Data were analyzed using descriptive statistics, gross margin analysis, multiple regression analysis, difference-in-difference method (DD), propensity score matching (PSM), principal component analysis, F-Chow test, and t-test. The gross margin ratio for VCDP beneficiaries and non-beneficiaries was 88% and 71%. Rice production was profitable. The result of the difference-in-difference regression analysis showed that treatment ($P < 0.10$), period ($P < 0.01$), interaction ($P < 0.10$), level of educational ($P < 0.10$), and farm experience ($P < 0.10$), were statistically significant variables influencing the net farm income of rice farmers in the study area. The results of PSM show that the coefficient of Average Treatment Effect for all matching algorithms for net farm income of rice farmers such as nearest neighbor, radius, kernel, and stratification were significant at ($P < 0.01$). The F-Chow test conducted for difference between NFI of participant and non-participant of VCDP was statistical significant. This shows that VCDP impacted positively on NFI of rice farmers. The study recommends that low-interest loans should be made available to rice farmers to increase income.

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INTRODUCTION

Rice is a rich and cheap source of carbohydrate to both human and animals, the demand for rice has increased over the last 4 decades and 80 percent of Nigerians consume rice and has become not only a diet but major source of calories for the urban poor (Ojogho and Alufohai, 2010). Rice serves as a major staple crop that cushions the effect of under-nutrition and severe hunger in Nigeria and many other developing countries of the world (Nwalieji, Madukwe, Agwu and Umerah, 2014). The demand for local rice is increasing by day as people are becoming more enlightened and informed about the nourishment. As a result of the population growth and the Federal Government Policy ban on rice importation, the Nigerian rice sector has witnessed a remarkable improvement both in terms of production, processing, and consumption. Nigerian not only being one of the largest producers is also the leading consumer of the rice in Africa and simultaneously one of the largest rice importers in the world mostly from Thailand (Emodi, and Madukwe, 2012). Rice consumption in Nigeria has been increasing over time and high percentage of the increase is supplied by imports. Between 2012 and 2015, the country imported 2.41 billion USD worth of rice in order to meet expanding consumption. The VCDP programme is a developmental initiative of FGN and IFAD with the aim to utilize private investment in the agricultural sector in order to increase efficiency and alleviate poverty (IFAD, 2017). The International Fund for Agricultural Development (IFAD) was established to finance agricultural development projects primarily for food production in the developing countries with focus on alleviating poverty of the rural dwellers through investment in agricultural activities, as agriculture is seen in the developing countries as a sector with viable potentials to move the rural poor out of poverty and with the capacity to feed the world (World Bank, 2011a). The IFAD intervention in Nigeria is focused on VCDP because of the challenges faced by smallholder farmers such as low productivity, poor access to market, poor processing technology, lack of adequate information, high costs of farm inputs, inadequate credit system, the vicious cycle of poverty and the recent challenge which has seemed formidable; climate change (World Bank, 2011b). The partnership between the IFAD and the Federal Government of Nigeria is focused on cassava and rice smallholder farmers. The six-year programme is aimed at improving cassava and rice value chains in six states in Nigeria. The IFAD/FGN adopted the value chain approach to enhance productivity, promote agro-processing, access to markets and opportunities to facilitate improved engagement of the private sector and farmers' organizations. Over 80% of the total farming population in Nigeria are smallholder farmers cultivating less than 5 hectares in the rural areas producing about 95% of the total output, yet poverty still remains a rural phenomenon with two-third of the total population considered poor (Bamidele, Olayide and Onigbide, 2019). The value chain describes the full range of activities that firms and workers do to bring a product from its conception to its end use and beyond (WBCSD, 2011). The Nigerian Government has sought ways to improve productive capacity in rice production in order to become a net exporter in the future. With this in mind, the Federal Government of Nigeria and IFAD established the VCDP in 2015. The goal of the 6-year program is to improve cassava and rice value chains for small farmers in the states of Anambra, Benue, Niger, Niger, Ogun and Taraba in Nigeria. In doing this, the programme hopes to reduce rural poverty, increase food security and accelerate economic growth on a sustainable basis (VCDP, 2015). The programme utilizes a market-led approach that hinges on private sector participation to leverage investment and knowledge to drive improved productivity in rice and cassava cultivation, while continuing to promote commercially oriented smallholder farming practices.

Objectives of the Study

The broad objective analyzed economic impact of VCDP on NFI of rice farmers' in Niger State, Nigeria. The specific objectives were to: (i) determine the socio-economic profiles of rice farmers' participants and non-participants of VCDP, (ii) analyze the NFI of rice farmers' participants and non-participants of VCDP, (iii) evaluate the impacts of VCDP on NFI of rice farmers' participants and non-participants, (iv) evaluate the factors influencing NFI of rice farmers' participants and non-participants of VCDP, and (v) determine the constraints faced by rice farmers' participants and non-participants of VCDP

MATERIALS AND METHODS

This study was carried out in Niger State, Nigeria. It lies between Latitudes 8° to $11^{\circ}30'$ North and Longitudes 03° to $07^{\circ}40'$ 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 areas include rice farmers of about 465 participants and 411 non-participants in the VCDP in

Niger State, Nigeria. Purposive sampling method was used to select Niger State because it is one of the State participating in the VCDP initiative of the Federal Government of Nigeria and The IFAD programme on the improvement of rice and cassava value chain. Multistage sampling procedure was adopted in selection of representative samples. First stage, five (5) Local Government Areas were selected. The second stage, simple random sampling technique using raffle-draw ballot-box raffle-draw method was adopted to select the two (2) wards from each of the five (5) Local Governments Areas. In the third stage, systematic sampling techniques was 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 VCDP 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 VCDP. The total target population of rice farmers' beneficiaries and non-beneficiaries was 876. Primary and secondary data were used to gather necessary data from the sample respondents. The following analytical tools were used to achieve 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.

Gross Margin Analysis

Gross Margin Analysis is by definition the difference between total revenue and total variable cost (Olukosi and Erhabor, 2005). Gross margin model is expressed as follows:

$$GM = \sum_{i=1}^n TR_i - \sum_{i=1}^n TVC_i \dots \dots \dots (1)$$

Where,

GM = Gross Margin (Naira),

TR = Total Revenue or Total Value of Output from the Rice Enterprise (Naira),

TVC = Total Variable Cost (Naira), and

TR = P.Q (Naira).

Where: -P = Price of Rice Produced in Naira per Kilogram, Q = Output of Rice Produced in Kilogram.

Financial Analysis

Gross Margin Ratio (GMR) following Ben-Chendo *et al.* (2015) was used to determine the profitability of rice production.

$$\text{Gross Margin Ratio} = \frac{\text{Net Farm Income}}{\text{Total Revenue}} \dots \dots \dots (2)$$

Net Farm Income Analysis

$$NFI = TR - TC \dots \dots \dots (3)$$

$$\% \text{ Change in Net Farm Income (NFI)} = \frac{NFI_{\text{After}} - NFI_{\text{Before}}}{NFI_{\text{After}}} \times 10 \dots \dots \dots (4)$$

Where,

NFI = Net Farm Income (Naira),

TR = Total Revenue (Naira), and

TC = Total Cost (Naira).

Double Difference Method / Difference-in –Difference Method (DD)

The impact assessment method involved the selection of respondents that participated in rice VCDP (beneficiaries) and non-participants (non-beneficiaries). The model can be explicitly specified as follows:

$$DD = \left[\frac{1}{P} \sum_{t=1}^P (Y_{ta}^1 - Y_{tb}^1) \right] - \left[\frac{1}{C} \sum_{i=1}^C (Y_{ta}^0 - Y_{tb}^0) \right] \dots \dots \dots (5)$$

Where,

DD = NFI Difference between Respondents (Units),

P = Number of Participants (Units),

C = Number of Non-Participants (units),

Y_{ta}^1 = NFI of Participants after the Programme (Naira),

Y_{tb}^1 = NFI of Participants before the Programme (Naira),

Y_{ta}^0 = NFI of Non-Participants after the Programme (Naira), and

Y_{tb}^0 = NFI of Non-Participants before the Programme (Naira).

Multiple Regression Analysis

The double difference analysis of the multiple regression model for participants and non-participants of rice farmers VCDP is stated below: -

$$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \mu_i \dots \dots \dots (6)$$

Y = Net Farm Income (Naira),

α_1 = Intercept,

$\beta_1 - \beta_{11}$ = Regression Coefficients,

X_1 = Treatment (T) (1, Beneficiaries; 0, Otherwise),

X_2 = Period (P) (Months),

X_3 = Interactions (T x P) (Units),

X_4 = Age of Rice Farmers (Years)

X_5 = Level of Education (0, Non-Formal; 1, Primary; 2, Secondary; 3, Tertiary),

X_6 = Extension Agent Service Dummy (1, Contact; 0, Otherwise),

X_7 = Household Size (Units),

X_8 = Farm Experience (Years),

X_9 = Access to Credit Facilities (1, Access; 0, Otherwise),

X_{10} = Member of Cooperative Societies (1, Member; 0, Otherwise), and

X_{11} = Gender (1, Male; 0, Otherwise), and

U_i = Error Term.

Propensity Scoring Matching (PSM)

PSM was employed to determine the impact of VCDP on the NFI of the participants of the programme; usually the propensity score matching is used in programme evaluation to access whether the programme has impact on the participants. The most common evaluation parameter of interest is the Average Treatment Effect on the treated (ATT) which is defined as: -

$$ATT = E \left(\frac{Y_1 - Y_0}{P = 1} \right) - \left(\frac{Y_1}{P = 1} \right) \dots \dots \dots (7)$$

The propensity score is the probability of the participation for farm households, if given a set $X = X_i$ of characteristics.

$$P(X) = P_r \left(\frac{P = 1}{X = X_i} \right) \text{ (Pufahl and Weiss, 2009) } \dots \dots \dots (8)$$

The propensity scores were derived from the regression model in which these characteristics were compared. The impacts of treatment on the treated (causal effect of project participants) were estimated by computing the differences across both groups:

$$ATT = \frac{1}{N_1} [Y_1 - Y_0] \dots \dots \dots (9)$$

Where,

ATT = Average Impact of Treatment on the Treated,

N_1 = Number of Matches (From Regression Model),

Y_1 = Productivity Index by Participants, and

Y_0 = Productivity Index by Non-Participants.

A positive (Negative) value of ATT will usually suggest that beneficiaries in a programme have higher (lower) outcome variable than non-beneficiaries. This was used to achieve specific objective four (iv)

Principal Component Analysis (PCA)

The constraints faced by rice farmers participating in the VCDP was achieved using principal component tools (PCA).

F-chow Test

F-chow Test statistics is often used in programme evaluation to determine whether the programme 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 model is specified as follows:

$$F * -\text{Chow Test} = \frac{RSS - (RSS_1 + RSS_2) / K}{RSS_1 + RSS_2 / [N_1 + N_2 - 2K]} \dots \dots \dots (10)$$

Where, O

RSS = Sum of Square Residual from Pooled Data,

RSS_1 = Sum of Square from the First Group (Beneficiaries),

RSS_2 = Sum of Square from the Second Group (Non-Beneficiaries),

K = Total Number of Parameter,

N_1, N_2 = Number of Observation in Each Group

RESULTS AND DISCUSSION

Socio-Economic Profiles of Rice Farmers VCDP Beneficiaries and Non-Beneficiaries

Table 1 shows that the mean age of rice farmers' beneficiaries was 46 years. The non-beneficiaries had a mean age of 51 years, when combined the mean age was 49 years. This implies that most of the rice farmers were middle-aged, resourceful, and energetic in their economically active age. Farmers' age is said to influence farmers' maturity and decision-making ability (Sani *et al.*, 2014). The results show that younger farmers are agile, and able to adopt modern production technologies with potential high productivity. This finding is similar to that of Sani *et al.* (2014). About 55.48% of the beneficiaries had less than 10 people as members of households. The mean household sizes were 13, 11, and 12 people for beneficiaries, non-beneficiaries, and when combined respectively. This has a direct implication on labor supply to the farm because of the potential contributions to labor available for rice production. The results agree with the findings of Sani *et al.* (2010) and Fakayode *et al.* (2014). The mean years of experience were 22 years, and 18 years for beneficiaries, and non-beneficiaries respectively. According to Olaoye *et al.* (2013) number of years of experience could improve skills and better approaches to rice farming practices. Experience can help to correct past errors and expand or contract the scale of the applications of tested skills. This result is in line with findings of Bashir *et al.* (2018). Also, the rice farmers had formal education, the expectations are rice farmers had formal education given that the respondents had attained at least 6 years in school. This agrees with the findings of Olagunju *et al.* (2010).

Table 1. Socio-Economic Profiles of Rice Farmers VCDP Participants and Non-Participants

Variables	Beneficiaries	Non-Beneficiaries	Pooled
Age (Years)	51	46	49
Household Size (Number)	13	11	12
Farm Experience (Years)	22	18	20
Level of Education (Years)	12	8	10

Source: Field Survey (2020)

Net Farm Income Analysis of Rice Production among VCDP Beneficiaries and Non-Beneficiaries per farming season

The various costs incurred on various resources used and the benefits (profit) received from the sales of the products were estimated based on the market price at the period under consideration (2019/2020 farming season) is presented in Table 2. The total revenue for program beneficiaries and non-beneficiaries was estimated to be ₦698, 400.00 and ₦381, 600.00 respectively. The total variable cost for program beneficiaries and non-beneficiaries was estimated to be ₦180, 528.41 and ₦151, 821.70 respectively. The fixed cost for program beneficiaries and non-beneficiaries was estimated to ₦39, 625.26 and ₦19, 000.00 respectively. The variable cost for program beneficiaries and non-beneficiaries accounted for 85% and 80% of the total cost of production. The gross margin for program beneficiaries and non-beneficiaries was estimated to be ₦517, 871.59 and ₦229,778.30 respectively. On average both program beneficiaries and non-beneficiaries made a NFI of ₦ 478, 246.33 and ₦210,778.30 respectively per hectare of rice production. The gross margin ratio for program beneficiaries and non-beneficiaries was 74% and 60% respectively. This indicates that rice production was profitable. This implies that for every one Naira generated from sales by smallholder rice farmers that benefitted and non-beneficiaries of the program, 74.00 kobo and 60.00 kobo covered the operating costs and profit respectively. This suggests that rice production by the program beneficiaries were more profitable than non-beneficiaries

Table 2. Net Farm Income Analysis of Rice Production for Beneficiaries, Non-Beneficiaries per Farming Season

Variables	Beneficiaries	Non-Beneficiaries	Pooled
Total Variable Costs (Naira)	180,528.41	151,821.70	332,350.11
Total Fixed Cost(Naira)	39,625.26	19,000.00	58,625.26
Total Cost (Naira)	220,153.67	170,821.70	390,975.37
Quantity (Kg)	3,492.00	1,908.00	5,400.00
Unit Price (Naira/Kg)	200	200	200
Total Revenue (Naira)	698,400.00	381,600.00	1,080,000.00
Gross Margin (Naira)	517,871.59	229,778.30	747,649.89
Net Farm Income (NFI) (Naira)	478,246.33	210,778.30	689,024.63
Gross Margin Ratio (Unit)	0.74	0.60	0.69

Source: Field Survey (2020) 1 USD = 820 NAIRA

Difference-in-Difference Estimation of Impacts of VCDP on NFI of Rice Farmers Beneficiaries and Non-Beneficiaries

From Table 3 the NFI difference between rice farmers' beneficiaries and non-beneficiaries' groups were ₦5, 481.4477 before the program and this increased by 97.95% to 267,468.03 after the program. This suggests that the program had a positive impact on the income of the beneficiaries of the program. Also, the between group effect shows that the NFI of beneficiaries and non-beneficiaries increased by 76.69% and 49.73%. This further suggests that the program had a positive impact on the income of the beneficiaries of the program hence the beneficiaries may be more food secured given their participation in the value chain program. The NFI difference in difference was calculated to be ₦261, 986.58. The F-value (321.01) confirmed that there was a significant difference between net farm income of rice farmers' beneficiaries and non-beneficiaries of VCDP at 1% probability level. This result is in line with the findings of Olaoye *et al.*, (2013) and Zalkuwi (2015) who both found out that rice production was profitable.

Table 3. Double Difference Result of Impacts of VCDP on Net Farm Income of Rice Farmers Beneficiaries and Non-Beneficiaries

Group	Net Farm Income (Naira)		
	Before	After	Difference Between Period
Beneficiaries	111, 436.5253	478, 246.33	366.809.80
Non-Beneficiaries	105, 955.0776	210,778.30	104,823.22
Difference Between Groups	5, 481.4477	267,468.03	261,986.58
F-Value = 321.01***			

Source: Field Survey (2020) ***-Significant at 1 percent probability level

Difference-in-Difference Method of Regression Analysis of the Impacts of VCDP on Net Farm Income of Rice Farmers Beneficiaries and Non-Beneficiaries

Table 4 shows the estimated difference-in-difference method of regression analysis of the impacts of VCDP on NFI of rice farmers beneficiaries and non-beneficiaries. From the result, variables with positive coefficient leads to increase in NFI while variables with negative coefficient leads to decrease in net farm income. Coefficient of determination (R^2) was approximately 0.7912 which means that 79.12% of the variations in the NFI of the rice farmers was as a result of the variations in the explanatory variables included. The F-Statistics value of 96.47 was significant at 1% probability level. This implies that the joint effect of the variables included in the model were significant in determining net farm income. The results showed that treatment (X_1), period (X_2), interaction (X_3), level of educational (X_5), and farm experience (X_8) were statistically significant variables influencing the net farm income of rice farmers in the study area. Level of educational (X_5) and farm experience (X_8) had positive coefficients and were statistically significant at 10% probability levels ($P < 0.10$). Treatment (X_1), period (X_2), and interaction (X_3) had positive coefficients and were statistically significant 10%, 1%, and 10% probability levels respectively. From the regression result, the treatment (X_1) was positively related to NFI of rice farmers. This suggest that the program had a positive impact on the income of farmers in the study area. Period (X_2) was positively related to net farm income. Interaction (X_3) was positively related to net farm income. The statistical significant of interaction (X_3) implies that the VCDP impacted positively on the rice farmers' participant.

Table 4. Double Difference Estimate from Regression Analysis of the Impacts of VCDP on NFI of Rice Farmers Participants and Non-Participants

Variables	Coefficients	Standard Error	t-Value
Treatment (X_1)	0.1312	0.1903	1.69*
Period (X_2)	0.5559	0.1708	3.25***
Interaction (X_3)	0.2113	0.1193	1.77*
Age (X_4)	0.1062	0.1322	0.8
Educational Level (X_5)	0.0911	0.0501	1.82*
Extension Contact (X_6)	0.0240	0.0535	0.45
Household Size (X_7)	-0.0199	0.0455	-0.44
Farm Experience (X_8)	0.0585	0.0504	1.67*
Access to Credit (X_9)	0.0040	0.0475	0.08
Member of Cooperative Society (X_{10})	0.0198	0.0472	0.42
Gender (X_{11})	0.0313	0.0463	0.68
Constant	12.3284	0.5264	23.42
R-squared	0.7912	Adj R²	0.7830
F Statistic	96.47		

Source: Field Survey (2020)

Table 5. Average Treatment Effect of Before and After Bootstrap on NFI of Rice Farmers

Matching Algorithm	ATT	Standard Error Before Bootstrap	Standard Error After Bootstrap	Bias	t-Value
Nearest Neighbour	446, 000	115, 000	145, 068.4	-36, 961.45	3.076 ***
Radius	331, 000	132, 000	88, 269.622	-16, 173.44	3.752 ***
Kernel	347, 000	-	95940.82	4, 784.654	3.612***
Stratification	378, 000	108, 000	109, 034.6	6, 914.596	3.464 ***

Source: Field Survey (2020)

Propensity Score Matching of the Impacts of VCDP on Income of Rice Farmers

Table 5 shows the PSM of the impacts of VCDP on NFI of rice farmers. The coefficient of ATT for nearest neighbour, radius, kernel, and stratification were positive. All the matching algorithms were significant at 1%

probability levels. This implies that the VCDP had significant impact on income of rice farmers' beneficiaries. The value of ATT for nearest neighbour, radius, kernel, and stratification were 446, 000, 331, 000, 347, 000, and 378, 000 respectively. They were all statistically significant at ($P < 0.01$) respectively.

Constraints Faced by Rice Farmers' Beneficiaries of VCDP

Principal Component Analysis is a statistical technique that transfers a data set with many interrelated variables into one with a smaller number of uncorrelated variables. From the result presented in Table 6, the number of principal components retained using the Kaiser criterion was four (4) which had an Eigen-value above 1. At this component, for beneficiaries of VCDP, 58% of the variations have been explained by the component captured in the model. The Kaiser-Meyer-Olkin which measures of sampling adequacy (KMO) was 0.515 and Bartlett test of sphericity was 80.579 and significant at a 1% level of probability which further demonstrated the feasibility of employing the data set for factor analysis. The result in Table 6 further shows the constraints faced by rice farmers' beneficiaries of the VCDP as identified by the farmers include: herdsman and farmers-clashes which was rank 1st in the order of importance based on the perceptions of the rice farmers with 19% proportion. Inadequate funds were ranked 2nd in the order of importance based on the perceptions of the rice farmers with 14%. Bureaucracy in accessing credit was ranked 3rd in the order of importance based on the perceptions of the rice farmers with 13%. Inadequate fertilizers were ranked 4th in the order of importance based on the perception of the rice farmers with 11%. The results agreed with that of Bashir *et al.* (2018).

Constraints Faced by Rice Farmers' Non-Beneficiaries of VCDP

The constraints facing rice farmers' non-beneficiaries of VCDP was presented in Table 6. The number of principal components retained using the Kaiser criterion was four (4) which had an Eigen-value greater than 1. At this component, for non-beneficiaries of VCDP, 59% of the variations have been explained by the component retained in the model. The Kaiser-Meyer-Olkin which measures of sampling adequacy (KMO) was 0.529 and Bartlett test of sphericity of 67.484 and was significant at a 1% level of probability which further demonstrated the feasibility of employing the data set for factor analysis. The result in Table 6 further shows the constraints faced by rice farmers' non-beneficiaries of the VCDP as identified by the farmers include: herdsman and farmers-clashes which was rank 1st in the order of importance based on the perceptions of the rice farmers with 18% proportion. Inadequate funds were ranked 2nd in the order of importance based on the perceptions of the rice farmers with 16%. Bureaucracy in accessing credit was ranked 3rd in the order of importance based on the perceptions of the rice farmers with 14%. Inadequate fertilizers were ranked 4th in the order of importance based on the perception of the rice farmers with 12%. The results also agreed with that of Bashir *et al.* (2018).

Analysis of the Significant Impact of VCDP on Net Farm Income of Rice Farmers

Table 7 revealed the F-chow-test analysis between impact of VCDP on NFI of rice production. Based on the findings of this study, the hypothesis which states that there is no significant impact of VCDP on NFI of rice production was rejected, while the alternative hypothesis which states that there is significant impact of VCDP on NFI of rice production was accepted. This implies that the VCDP had impact on the NFI of rice farmers.

Table 6. Principal Component Analysis of Constraints Faced by Rice Farmers in Niger State, Nigeria

Component	Beneficiaries			Non-Beneficiaries			Combined		
	Eigen-Value	Propor-tion	Cumul-ative	Eigen-Value	Propor-tion	Cumul-ative	Eigen-Value	Propor-tion	Cumul-ative
Herdsmen's and Farmer Clashes	1.74	0.19	0.19	1.63	0.18	0.18	1.63	0.18	0.18
Inadequate Funds	1.28	0.14	0.33	1.41	0.16	0.34	1.28	0.14	0.32
Bureaucracy in Accessing Credits	1.18	0.13	0.46	1.21	0.14	0.47	1.17	0.13	0.45
Inadequate Fertilizer	1.02	0.11	0.58	1.05	0.12	0.59	1.09	0.12	0.57
Pest and diseases	0.97	0.10	0.68	0.89	0.10	0.69	0.94	0.11	0.68
Poor Access to Extension Agent	0.87	0.09	0.78	0.82	0.09	0.78	0.84	0.09	0.77
Distance to the Market	0.72	0.08	0.86	0.74	0.08	0.86	0.76	0.08	0.85
High Cost of Labour	0.69	0.08	0.94	0.65	0.07	0.94	0.69	0.07	0.93
High Cost of Maintenance	0.49	0.05	1.00	0.55	0.06	1.00	0.57	0.06	1.00
Bartlett Test of Sphericity	Chi-Square = 80.579***			Chi-square = 67.484***			Chi-square = 122.849***		
	KMO = 0.515			KMO = 0.529			KMO = 0.520		

Source: Field Survey (2020)

Table 7. F-Chow – Test Analysis of Impact of VCDP on Net Farm Income of Rice Farmers

Group Sample	R ²	Residual Sum of Square	N	K	F-Cal	F-Tab	Prob
Pooled	0.0968	21.029	292	3	10.29	1.96	0.0000
Participants	0.1770	12.003	155	3	10.82	1.96	0.0000
Non-Participants	0.0599	8.1473	137	3	2.82	1.96	0.0413

***, Significant at 5% level of Probability

Source: Field Survey (2020)

CONCLUSION AND RECOMMENDATIONS

This study has established that rice farmers' beneficiaries of VCDP were young, energetic, and resourceful. The VCDP had impacted positively on the net farm income of rice farmers. The policy implications and recommendations from this study include:

- (i) Provision of extension officers to train rice farmers on new technologies, innovation, and new research findings.
- (ii) Rice farmers should be provided with credit facilities at low interest rate with no collateral securities. This will enable the farmers improve productivity and hence net farm income.
- (iii) Rice farmers should be provided with farm inputs and improved varieties of rice. This will increase rice production and hence net farm income.
- (iv) Governments are hereby enjoined to put policy in place that will help remove administrative bottle necks in accessing agricultural loans.

CONFLICT OF INTEREST

The authors declared that there is no conflict of interest.

AUTHOR CONTRIBUTION

All authors contributed equally towards this publication.

ETHICAL APPROVAL

There is full compliance with ethical standards. No ethical issues raised.

REFERENCES

- Bamidele, T; Olayide, O; and Ohigbinde, D (2019). Assessing IFAD Value Chain Development Programme on Productivity and Income of Smallholder Farmers' in Obafemi-Owode and Yewa Local Government Areas of Ogun State, Nigeria. *African Journal of Sustainable Development*, 9 (1), 1 – 22.
- Bashir, M.K., Schilizzi, S., & Pandit, R. (2018). *The Determinants of Rural Household Food Security for Landless Households of the Punjab, Pakistan*. AgEcon Search.
- Ben-Chendo, G, N., Lawal, N., Osuji, M.N., Osugiri, I.I., and Ibeagwa, B.O (2015). Cost and Returns of Paddy Rice Production in Kaduna State, Nigeria. *International Journal of Agricultural-Marketing*, 2 (5), 084 – 089
- Emodi, I. A. and Madukwe, M.C. (2012). A review of policies, acts and initiatives in rice innovation system in Nigeria. *Journal of Agricultural Extension*, 12(2). doi:10.4314/jae.v12i2.47052.
- Fakayode, S.B., Babatunde R.D and Ajao R.(2014). “Productivity Analysis of Cassava-Based Production Systems in the Guinea Savannah: Case Study of Kwara State, Nigeria”. *American-Eurasian Journal of Scientific Research*, 3, 33-39
- IFAD (2017). Value Chain Development Programme (VCDP) Supervision report. Main Report and appendices. West and Central Africa Division Programme Management Department, 28-08-2017. Obtained on 18-04-2018 from <https://operations.ifad.org/documents/654016/e186f287-8f12-4738-9499-9b89093e5f0a>
- Nwalieji, H. U., Madukwe, M.C, Agwu, A.E and Umerah, M. I (2014). Adoption of Rice Technologies Introduced by the United States Agency for International Development in Anambra and Ebonyi States, Nigeria. *Journal of Agricultural Extension*, 18(1), 158-169.
- Ojogho, O and Alufohai, G.O. (2010). Rice Consumption Pattern in Nigeria: A Road to Sustainable food Consumption. *Int'l. J. Agriculture*, 3(3), 56-63
- Olaoye, O. J., Ashley-Dejo, S. S., Fakoya, E. O., Ikeweinwe, N. B., Alegbeleye, W. O., Ashaolu, F. O and Adelaja, O. A., (2013). Assessment of Socio-Economic Analysis of Fish Farming in Oyo State, Nigeria. *Journal of Agricultural Research*, 3 (2), 22-30.
- Olagunju, F.I, Adesiyani, I.O. and Ezekiel, A.A. (2010) Economic Viability of Cat Fish Production in Oyo State, Nigeria. *Journal of Human Ecology*, 21(2), 121-124.
- Olukosi, J.O. and Erhabor, P.O (2005) *Introduction to Farm Management Economics: Principles and Applications*. Zaria: AGITAB Publishers.
- Pufahl, A and Weiss, C.R (2009). Evaluating the Effects of Farm Programmes: Result from Propensity Score Matching. *European Review of Agricultural Economics*, 36(1), 79 - 101
- Sani A, Yakubu, A.A., and Bello, H.M. (2014). Resource-Use Efficiency in Rice Production Under Small Scale Irrigation in Bunkure Local Government Area of Kano State. *Nigerian Journal of Basic and Applied Science*. 18(2): 292-296
- Value Chain Development Program (2015). Who we are. Obtained on 18-04-2018 from http://vcdpnigeria.org/?page_id=94IFAD(n.d.)Performance of VCDP/Olam Partnership in Nigeria in 2017 Cropping Season.
- WBSCD (2011). World Business Council for Sustainable Development. A Vision for Sustainable Consumption, Innovation, Collaboration, and the Management of Choice. WBSCD Consumption and Value Chain. <https://docs.wbcsd.org/2011/10/AVisionforSustainableConsumption>. 24/7/23
- World Bank (2011a). *Missing food: The case of postharvest grain losses in sub-Saharan Africa*. The World Bank.
- World Bank (2011b). *Gender Equality and Development*. World development report 2012.
- Zalkuwi, J (2015). Production Cost and Return; Comparative Analysis of Sorghum in India and Nigeria. *Economics*, 4,18. Doi:10.11648/j.eo.20150402.11.