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Economic Impact Analysis of Value Chain Development Programme (Vcdp) on Productivity of Rice Farmers in Niger State, Nigeria

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Abstract

This study evaluated economic impact analysis of value chain development programme on productivity 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 two hundred and ninety-two (292) rice farmers which comprised of one hundred and fifty-five (155) value chain development program beneficiaries and one hundred and thirty-seven (137) non-beneficiaries. Data were analyzed using descriptive statistics, farm budgeting technique, total factor productivity index, Tobit dichotomous regression model, propensity score matching (PSM), principal component analysis, F-Chow test, and t-test. The results revealed that the 65.81% of the rice farmers who benefited from the value chain program were male. Also, 48.91% of the non-beneficiaries of VCDP were at sub-optimal productivity level, while 36.13% of the beneficiaries were at super-optimal productivity level. The result of the Tobit regression estimates shows that the significant factors influencing total factor productivity were: that household size ($P< 0.10$), farm experience ($P< 0.10$), access to credit ($P< 0.05$), labour input ($P< 0.10$), and farm size ($P< 0.10$). Rice production in the study area was profitable. The coefficient of Average Treatment Effect for all matching algorithms for yields of rice farmers such as nearest neighbor, radius, kernel, and stratification were significant at ($P< 0.01$). This shows that value chain development program impacted positively on productivity of rice farmers. Extension officers should be employed to train rice farmers. Governments should put policies in place that will help remove bottlenecks in accessing agricultural loans.

Keywords: Economic Impact, Value Chain Development Programme, Productivity, Niger State, Nigeria.

INTRODUCTION

Agriculture plays a key role in rural transformation and improvement in the overall well-being of Nigerians. Agriculture is an important source of employment and a catalyst in the GDP and wealth creation process in many African countries (Ayevbuowan, Popoola and Adeoti, 2016). Rice (*Oryza sativa L.*) is the world's most important food products, as research has shown that about three billion people world-wide consume rice every day, the increasing rate of consumption makes most countries import dependent on rice (Agbogo, Udouso, and Tiku, 2013). In the Nigerian agriculture environment, rice has become an increasingly important commodity for majority of Nigerians, and it constitutes about 20% of total food expenditure (Braun, 2006). Rice generates more 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. Estimated national 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

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foreign reserve (Onyeneke, 2017). The Nigerian rice production sector reflects the combined effects of both the traditional and non-traditional rice production techniques which is primarily sold in its paddy form. It is view of this that the International Fund for Agriculture Development (IFAD) adopted the innovative rice production technique in Nigeria to enhance the quality and purity of locally produced rice in six States (Abia, Anambra, Benue, Ebonyi, Niger, Ogun and Taraba) under the rice and cassava Value Chain Development Programme (VCDP) in order to complement the growing rice demand particularly at the rural poor and also to serve as a means of empowerment. With the magnitude of untapped resources in sub-Saharan Africa, the focus of the international community (Agricultural finance donors) has shifted from food aid to developing the capacity of the numerous smallholder farmers to increase their productivity (Mgbenka and Mbah, 2016). Africa has large expanse of land and with enough resources, agriculture would set a new pace for Africa's growth and development. The IFAD intervention maximizes the potentials of smallholder farmers by exposing them to opportunities through inputs support, market access and services that would increase their farming yields, build their human capacity, and consequently increase their income. The programme, through commodity-specific Value Chain Action Plans (VCAP) at different local governments in the participating states engages with actors along the chain – producers, processors, marketers and their farmer organisations as well as public and private institutions, service providers, policy and regulatory environment to deliver relevant and sustainable activities that would lead to gradual transformation of the sector and contribute to achieving food security, expand income-generating activities and employment opportunities. The concept of 'agricultural value chain' includes the full range of activities and participants involved in moving agricultural products from input suppliers to farmers' fields, and ultimately, to consumers' tables (Miller and Jones, 2010). Value is added by some additional transformation or enhancement made to the product. This may be simply moving the product from one point of manufacture to the market or to complex processing and packaging. At each stage of the chain, the value of the product goes up because the product becomes more available or attractive to the consumer. Efficient value chains normally reduce the use of intermediaries in the chain, and strengthen value-added activities because of better technology and inputs, farm gate procurement, upgraded infrastructure, improved price opportunities through demand-driven production. Value chain participants sometimes cooperate to improve the overall competitiveness of the final product, but may also be completely unaware of the linkages between their operation and other upstream or downstream participants (Keyser, 2015). Value chains therefore encompass all of the factors of production including land, labour, capital, technology, and inputs as well as all economic activities including input supply, production, transformation, handling, transport, marketing, and distribution necessary to create, sell, and deliver a product to a certain destination.

Objectives of the Study

The broad objective is to analyze economic impact of value chain development programme (VCDP) on productivity of rice farmers' in Niger State, Nigeria. The specific objectives were to:

(i) determine the socio-economic characteristics of rice farmers' beneficiaries and non-beneficiaries of VCDP,
(ii) analyze the costs, returns, and profitability of rice production for beneficiaries and non-beneficiaries of VCDP,
(iii) evaluate factors influencing total factor productivity of rice farmers' beneficiaries of VCDP,
(iv) evaluate the impact of VCDP on productivity of the rice farmers' beneficiaries, and
(v) identify the constraints faced by rice farmers' beneficiaries of VCDP in the study area.

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Methodology

This study was carried out in Niger State, Nigeria. It lies between Latitudes 8^0 to $11^0 30'$ North and Longitudes 03^0 to $07^0 40'$ East. It has a total population of 5,556,200 (NPC, 2016).

The predominant occupation of the people is farming, 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 programme in Niger State, Nigeria. Purposive sampling method was used to select Niger State because it is one of the State participating in the Value Chain Development Programme (VCDP) initiative of the Federal Government of Nigeria and The International Fund for Agricultural Development (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 will be used to select every n^{th} (3^{rd}) rice farmers participating in the value chain development programme 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 Value Chain Development Programme (VCDP). Primary sources 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.

Farm Budgeting Technique

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:

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

$$NFI = TR - TC \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

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.

NFI = Net farm Income (Naira),

TC = Total Cost (Naira).

Financial Analysis

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

$$\textbf{Gross Margin Ratio} = \frac{Net\ Farm\ Income}{Total\ Revenue} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

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Total Factor Productivity Index (TFP)

TFP model Following Singh *et al.* (2019) and Sadiq *et al.* (2015), was used. The TFP approach adopted is given as: -

$$TFP = \frac{Y}{TVC} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.(4)$$

$$TFP = \frac{Y}{\sum P_i X_i} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(5)$$

Where,
Y = Output (Kg),
TVC = Total Variable Cost (₦),
P_i = Unit Price of i^th^ Variable Input (₦), and
X_i = Quantity of i^{th} Variable Input (Kg).
This methodology ignores the role of total fixed cost (TFC) as it does not affect both the profit maximization and the resource use efficiency conditions as the study focused on smallholder farmers. Total fixed cost is constant as it is fixed.
From Cost Theory:

$$AVC = \frac{TVC}{Y} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots.(6)$$

Where, AVC = Average Variable Cost in naira (₦)
Therefore, the transpose of AVC will be TFP

$$TFP = \frac{Y}{TVC} = \frac{1}{AVC} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(7)$$

As such, TFP is the inverse of the AVC. The partial productivity estimate is the marginal products (MP) given as

$$MP = \frac{\Delta TFP}{\Delta X} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..(8)$$

Tobit Dichotomous Regression Model

Tobit model following Tobin, (1958) as stated in Sadiq *et al.* (2015) was adopted for this study and used to achieve part of stated specific objective one (i). The model is given below: -

$$Y_i^* = \propto_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots..(9)$$

Y_i^*= is a censored variable. Now,
Y_i= 0 if $Y_i^* \leq 0$
= Y_i^* if Y_i^*> 0
Where,
Y_i^*= TFP Index of the i^{th} Farmer (Units) (1, TFP > 0; 0, Otherwise),
i = Number of Independent Variables,
$\propto_0$ = Intercept,
$\beta_1 - \beta_6$ = Regression Coefficients,
X_1 = Size of Households (Total Number of Persons),
X_2 = Farm Experience (Years),
X_3 = Access to Credit (1, Access; 0, Otherwise),
X_4 = Labour Input (Mandays),
X_5 = Age of Rice Farmers (Years),
X_6 = Farm Size (Ha), and

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U_i= Error Term.

Propensity Scoring Matching

Propensity score matching was employed to determine the impact of value chain development programme on the net farm income 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: -

$$ATT = E\left(\frac{Y_1 - Y_0}{P = 1}\right) - \left(\frac{Y_1}{P = 1}\right) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

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

$$P(X) = P_r\left(\frac{P = 1}{X = X_i}\right) (Pufahl\ and\ Weiss, 2009) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

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:

$$ATT = \frac{1}{N_1}[Y_1 - Y_0] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

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 participants in a programme have higher (lower) outcome variable than non-participants. This was used to achieve specific objective four (iv)

Principal Component Analysis (PCA)

The constraints faced by rice farmers participating in the value chain development program 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:

$$F{-}Chow\ Test = \frac{\frac{RSS-(RSS_1+RSS_2)}{K}}{\frac{RSS_1+RSS_2}{(N_1+N_2-2K)}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

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

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RESULTS and DISCUSSION

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

Table 1 shows the result of the socio-economic profiles or characteristics of rice farmers. Majority (65.81%) of the rice farmers who benefited from the value chain program were male, while 34.19% were female, in the same vein majority (78.10%) rice farmers who do not benefit from the value chain program were male, while 21.90% were female. When combined the majority (71.58 %) of the rice farmers were male, while 28.42% were male. This is in agreement with the findings of Yusuf (2022).

From the result, majority (65.81%) of the rice farmers that benefited from the value chain program were less than 50 years of age. The mean age of rice farmers' beneficiaries was 46.91 years. The non-beneficiaries had a mean age of 51.67 years with 41.61% of them less than 70 years of age. When combined the mean age was 49.15 years. This implies that most of the rice farmers were predominantly young, 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 likely to be agile, more likely 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 12, 10, and 11 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). Furthermore, 50.32% of the rice farmers in the study area who benefited from the program had between 11 and 20 years of experience in rice production. Also, 50.36% of the rice farmers in the study area who do not benefit from the program had between 21 and 30 years of experience. The mean years of experience were 21.53 years, and 17.94 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 Yusuf (2022).

Most (74.19%) of the rice farmers who benefitted from the program were married, also majority (81.02%) of the rice farmers who do not benefited were married. In all, most (77.40%) were married. The high proportion of the farmers who were married was an indication that family labor could be available for rice farmers in the study area. This result agrees with the findings of Abah and Tor (2012). Also, 83.87% of the rice farmers that benefitted from the value chain program had formal education. About 96.35% of the rice farmers that do not benefit from the program had formal education, in all, 89.73% of 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 Alabi *et al.* (2022). About 71.61% of beneficiaries had access to credit, while 68.61% of non-beneficiaries of the program had no access to credit. This result indicates that agricultural loans were easily accessible to rice farmers who participated in the value chain program in the study area. Also 78.77% of rice farmers in the study area had access to the extension agent. Adoption of rice production technologies is highly facilitated by the efforts of extension workers in introducing and demonstrating new research findings, innovation to the farmer how to use the technologies. This result agrees with findings of Tijani *et al.* (2015).

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Table 1: *Socio-Economic Profiles or Characteristics of the Rice Farmers in the Study Area*

	Non- Beneficiaries			Beneficiaries			Combined		
Variables	**Freq.**	**Per**	**Mean**	**Freq**	**Per**	**Mean**	**Freq**	**Per**	**Mean**
Sex									
Female	30	21.90		53	34.19		83	28.42	
Male	107	78.10		102	65.81		209	71.58	
Age (Years)			**51.67**			**46.91**			**49.15**
21 – 30	-	-		13	8.39		13	4.45	
31 – 40	19	13.87		29	18.71		48	16.44	
41 – 50	38	27.74		60	38.71		98	33.56	
51 – 70	80	58.39		53	34.19		133	45.55	
Household Size (Units)			**12.64**			**10.79**			**11.66**
1 – 10	41	29.93		86	55.48		127	43.49	
11 – 20	90	65.69		60	38.71		150	51.37	
20 – 30	6	4.38		9	5.80		15	5.14	
Farm Experience (Years)			**21.53**			**17.94**			**19.65**
1 – 10	19	13.87		26	16.77		45	15.41	
11 – 20	29	21.17		78	50.32		107	36.64	
21 – 30	69	50.36		31	20.00		100	34.25	
31 – 40	20	14.6		20	12.90		40	13.69	
Marital Status									
Single	26	18.98		16	10.32		42	14.38	
Married	111	81.02		115	74.19		226	77.40	
Widow/widower	-	-		18	11.61		18	6.16	
Divorced	-	-		6	3.87		6	2.05	
Level of Education									
Non-Formal Education	5	3.65		25	16.13		30	10.27	
Primary	55	40.15		29	18.71		84	28.77	
Secondary	77	56.20		61	39.35		138	47.26	
Tertiary	-			40	25.81		40	13.70	
Member of Cooperative									
No	58	42.34		44	28.39		102	34.93	
Yes	79	57.66		111	71.61		190	65.07	
Access to Credit									
No	94	68.61		40	25.81		134	45.89	
Yes	43	31.39		115	74.19		158	54.10	
Extension Visit									
No	24	17.52		38	24.52		62	21.23	
Yes	113	82.48		117	75.48		230	78.77	
Total	**137**	**100**		**155**	**100**		**292**	**100**	

Freq = Frequency; Per = Percentage
Source: Field Survey (2020)

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Total Factor Productivity Index of Smallholder Rice Farmers

The summary statistics of the total factor productivity indices showed that 48.91% of the non-beneficiaries were at sub-optimal productivity, while, 36.13% of the beneficiaries were at super-optimal productivity and 34.84% were at optimal productivity. This suggests that the value chain development program had an impact on the productivity of rice farmers in the study area. (Table 2). The mean total factor productivity for non-beneficiaries was 0.92, while that of the beneficiaries was 1.06 which is about 7% in total factor productivity. This result is in line with the findings of Sadiq *et al.* (2015). Figure 1 below gives a pictorial diagram of the total factor productivity of the smallholder rice farmers who benefitted from the value chain development program in the study area.

Table 2: *Total Factor Productivity Index of Smallholder Rice Farmers*

	Non-Beneficiaries		**Beneficiaries**		**Combined**	
TFP Index	**Frequency**	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
Sub-Optimal (< 1.00)	67	48.91	45	29.03	112	38.36
Optimal (1.01–1.09)	47	34.31	54	34.84	101	34.59
Super-Optimal (≥ 1.10)	23	16.79	56	36.13	79	27.05
Total	137	100	155	100	292	100
Mean	0.92		1.06		0.99	
Minimum	0.06		0.54		0.06	
Maximum	1.92		2.3		2.3	
Standard Deviation	0.29		0.27		0.28	

Source: Field Survey (2020)

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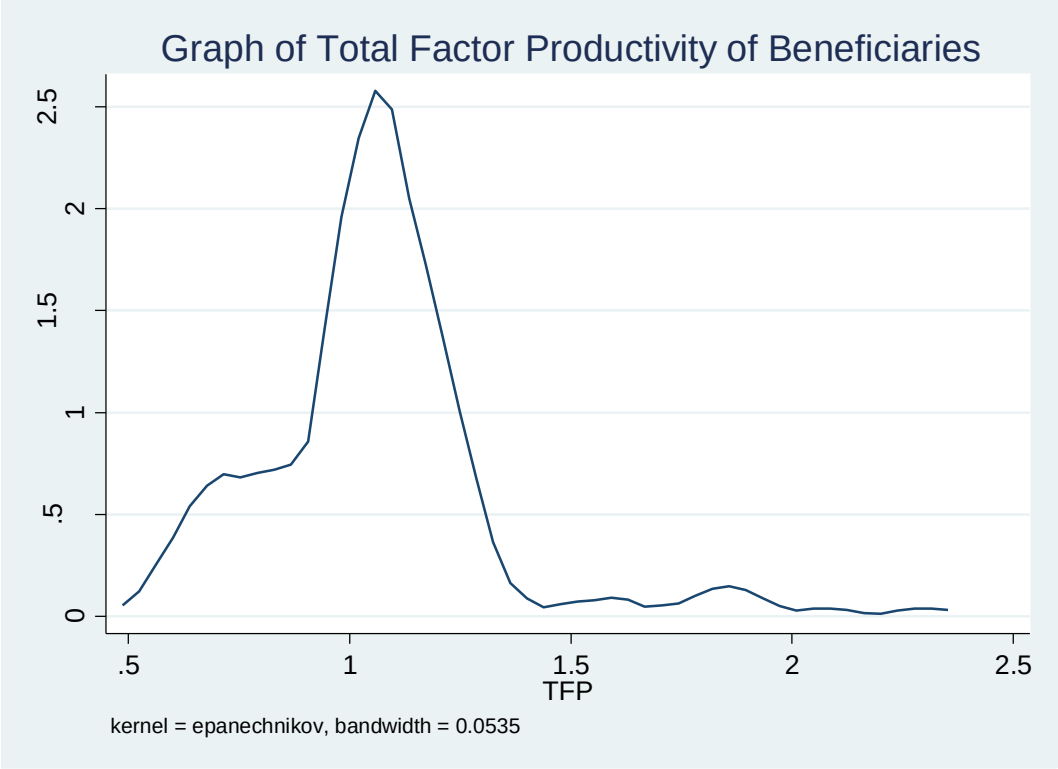

Figure 1: *Total Factor Productivity of Beneficiaries of VCDP*

Factors Influencing Total Factor Productivity of Smallholder Rice Farmers

The results of the Tobit regression estimates of the factors influencing total factor productivity of rice farmers who participated in value chain development program were presented in Table 3. The explanatory variables included in the Tobit regression model were: household size, farm experience, access to credit, labor input, age of farmers, and farm size. From Table 3, variables with positive coefficient leads to an increase in total factor productivity, while, variables with negative coefficient lead to a decrease in total factor productivity. The results showed that household size (X_1), farm experience (X_2), and farm size (X_6) were statistically significant at 10% probability levels respectively. Labor input (X_4) was statistically significant at 5% probability level. From the regression result, household size (X_1) was negatively related to total factor productivity. Marginal effect shows that a unit increase in household size will lead to a 0.006 marginal decrease in total factor productivity. This result disagrees with the findings of Sadiq *et al.* (2015). The farming experience was positively related to total factor productivity. Returns of marginal effect shows that a unit increase in farming experience will lead to a 0.004 marginal increase in total factor productivity of rice production. Labour input was negatively related to total factor productivity. A unit increase in labor input will lead to a 0.003 marginal decrease in total factor productivity of rice production. The Log-Likelihood and Chi-Square value were -56.61 and 12.37 respectively. The Chi-Square was significant at ($P<0.05$).

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Table 3: *Maximum Likelihood Estimate (MLE) of the Tobit Regression Model*

TFP	Coefficient	Standard Error	t-value	Marginal Effect
Household Size (X_1)	-0.006	0.006	1.70*	-0.006
Farm Experience (X_2)	0.004	0.003	1.85*	0.004
Access to Credit (X_3)	0.031	0.054	0.58	0.031
Labour Input (X_4)	-0.003	0.001	-2.26**	-0.003
Age of Farmer (X_5)	0.003	0.003	0.93	0.003
Farm Size (X_6)	-0.050	0.028	-1.82*	-0.050
Constant	1.256	0.121	10.41	-0.006
Chi Square = 12.37**				
Log-Likelihood = -56.61				
Pseudo R^2 = 0.1207				

** - Significant at (P≤0.05); * - Significant at (P≤0.10)
Source: Field Survey (2020)

Costs, Returns and Profitability Analysis of Rice Production among Beneficiaries and Non-Beneficiaries of Value Chain Development Programme

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 4. 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 ₦216, 177.00 and ₦251, 712.31 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 ₦482, 223.00 and ₦129, 887.69 respectively. On average both program beneficiaries and non-beneficiaries made a net farm income of ₦442, 597.74 and ₦110,887.69 respectively per hectare of rice production in the study area. The gross margin ratio for program beneficiaries and non-beneficiaries was 69% and 34% respectively. This indicates that rice production in the study area was profitable. This implies that for every one Naira generated from sales by smallholder rice farmers that benefitted and non-beneficiaries of the program, 69.00kobo and 34.00kobocovered the operating costs and profit respectively. This suggests that rice production by the program beneficiaries were more profitable than non-beneficiaries. The percentage change in the gross margin ratio was 50.72%.

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Table 4: *Costs, Returns and Profitability Analysis of Rice Production Per Hectare*

	Beneficiaries	Non- Beneficiaries	Combined
Variable Costs			
Seed Cost	23,143.55	24,545.12	47,688.67
Fertilizer Cost	70,835.00	84,682.97	155,517.97
Agrochemical cost	5,973.71	10,281.58	16,255.30
Land Preparation cost	27,248.91	29,531.68	56,780.59
Planting Cost	17,433.91	19,470.26	36,904.17
Fertilizer Application cost	12,481.96	17,141.34	29,623.30
weeding cost	20,634.07	23,358.38	43,992.45
Harvesting Cost	22,152.84	23,474.40	45,627.24
Jute bag Cost	5,037.31	11,048.61	16,085.92
Consume Cost	12,267.83	7,045.15	19,312.98
Gifts Cost	4,549.35	4,538.49	9,087.84
Transportation Cost	17,562.11	21,139.45	38,701.56
Total Variable Cost	**216,177.00**	**251,712.31**	**467,889.31**
Fixed Costs			
Rent on Land	36,625.26	15,500.00	52,125.26
Equipment	3,000.00	3,500.00	6,500.00
Total Fixed Cost	**39,625.26**	**19,000.00**	**58,625.26**
Total Cost	**255,802.26**	**270,712.31**	**526,514.56**
Quantity (Kg)	3,492.00	1,908.00	5,400.00
Unit Price	200.00	200.00	200.00
Total Revenue	**698,400.00**	**381,600.00**	**1,080,000.00**
Gross Margin	**482,223.00**	**129,887.69**	**612,110.69**
Net Farm Income	**442,597.74**	**110,887.69**	**553,485.44**
Gross Margin Ratio	**0.69**	**0.34**	**0.57**

Source: Author (2020)

Propensity Score Matching of the Impacts of Value Chain Development Programme on Productivity (Yield) of Rice Farmers

Table 5 shows the propensity score matching of the Impacts of Value Chain Development Programme on Productivity (Yield) of Rice Farmers. The coefficient of average treatment effect on Yield of Rice Farmers for nearest neighbour, radius, kernel, and stratification were positive. All the matching algorithms were significant at 1% probability levels. This means that considering the matching method selected the program had a positive impact on the yield of farmers for the beneficiaries. The value of average treatment effects for nearest neighbour, radius, kernel, and stratification were 0.609, 0.622, 0.626, and 0.614 respectively. They were all statistically significant at ($P < 0.01$) respectively.

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Table 5: *Average Treatment Effect of Before and After Bootstrap on Yield of Rice Farmers*

Matching Algorithm	ATT	Standard Error Before Bootstrap	Standard Error After Bootstrap	Bias	t-Value
Nearest Neighbour	0.609	0.052	0.0408	0.0073	13.314 ***
Radius	0.622	0.035	0.0311	0.0050	19.980 ***
Kernel	0.626	-	0.034	0.0083	18.610***
Stratification	0.614	0.036	0.035	0.0024	17.611 ***

Source: Field Survey (2020)

Constraints Faced by Rice Farmers Participants in Value Chain Development Programme in the Study Area

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, 58% of the variations have been explained by the component captured in the model for beneficiaries of VCDP. 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 value chain development program in the study area as identified by the farmers. From the results, herdsmen and farmers-clashes 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 Yusuf (2022).

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

Component	Eigen-Value	Proportion	Cumulative
Herdsmen's and Farmer Clashes	1.74	0.19	0.19
Inadequate Funds	1.28	0.14	0.33
Bureaucracy in Accessing Credits	1.18	0.13	0.46
Inadequate Fertilizer	1.02	0.11	0.58
Pest and diseases	0.97	0.10	0.68
Poor Access to Extension Agent	0.87	0.09	0.78
Distance to the Market	0.72	0.08	0.86
High Cost of Labour	0.69	0.08	0.94
High Cost of Maintenance	0.49	0.05	1.00
Bartlett Test of Sphericity			
Chi-Square=80.579***			
KMO= 0.515			

Source: Field Survey (2020)

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Analysis of the Significant Impact of Value Chain Development Programme, on Productivity of Rice Farmers in the Study Area

Table 7 reveals the F-chow-test analysis between impact of value chain development program on productivity of rice production in the study area. Based on the findings of this study, the hypothesis which states that there is no significant impact of value chain development program on productivity of rice production in the study area was rejected, while the alternative hypothesis which states that there is significant impact of value chain development program on productivity of rice production in the study area was accepted. This implies that the value chain development program had impact on the yield of rice production in the study area.

Table 7: *Chow – Test Analysis of Impact of Value Chain Development Program on Productivity of Rice Farmers in the Study Area*

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

The rice farmers' beneficiaries of value chain development programme were young, energetic, and resourceful with a mean age of 46.91 years. The mean values of total factor productivity for non-beneficiaries and beneficiaries were 0.92 and 1.06 respectively. Household size, years of experience, labour input were statistically significant factors influencing the total factor productivity of rice farmers in the area. The mean values of total factor productivity for non-beneficiaries and beneficiaries were 0.92 and 1.06 respectively. Household size, years of experience, labour input were statistically significant factors influencing the total factor productivity of rice farmers in the area. The matching algorithms such as nearest neighbour, radius, kernel, and stratification were significant at ($P < 0.01$) both for yield of rice farmers. This shows that the value chain development programme impacted positively on the yield and 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 farm inputs and improved varieties of rice. This will increase rice production and hence net farm income.

(iii) Governments are hereby enjoyed to put policy in place that will help remove administrative bottle necks in accessing agricultural loans.

(iv) 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.

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