INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY COMPREHENSIVE RESEARCH

Determinants of rice Farmers' Choice of marketing Outlet and Performance in FGN-IFAD Value Chain Development Programme in Anambra State, Nigeria

Anyanwu UG [1*], Mejeha RO [1], Njoku ME [1], Amusa TA [1], Ben-Chendo GN [2], Osuji MN [2], Uhuegbulam IJ [2], Maduike IA [2], Oshaji IO [2], Obi-Nwandikom CO [2], Azubuogu CC [2]

[1] Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike, Nigeria
[2] Department of Agricultural Economics, Federal University of Technology, Owerri, Nigeria

* Corresponding Author: **Anyanwu UG**

Article Info

ISSN (online): 2583-5289
Volume: 04
Issue: 04
July - August 2025
Received: 06-05-2025
Accepted: 10-06-2025
Published: 03-07-2025
Page No: 13-25

Abstract

The study on determinants of rice farmers' choice of marketing outlet and performance in FGN-IFAD Value Chain Development Programme in Anambra State, Nigeria, employed several analytical techniques to analyze the data collect from random sampling of 380 rice farmers. The analytical tools employed include multinomial logit, ordinary least square regression and principal component factor analysis. It was observed that age (2.35)** significantly influenced the choice of open market selection by participants, while farm size (1.97)** positively influenced it among the nonparticipants. For the selection of structured market; Sex (2.61)**, Age (2.98)***, Education (3.13)***, and Farming experience (2.15)** were significant for participants whereas; Education (3.91)***, Farming experience (2.81)**, Household size (2.56)**, and Farm size (2.57)** are the significant variables. The study further revealed that sex (11.92)***, level of education (14.06)***, and extension contacts (8.04)*** among others significantly influence ANSVCDP rice farmer's performance, whereas; access to credit (1.97)**, fertilizer use (5.58)***, and household size (2.04)** among others influenced performance among non-beneficiaries of ANSVCDP. We further found that the rice farmers in ANSVCDP still struggle with unhealthy competition, price volatility, and poor infrastructure among others, while the non-participants faced more severe challenges including limited access to extension services, inadequate capital, poor education, and lack of standardization in market transactions among others. The author(s) therefore recommend the need to deepen and scale up VCDP interventions; particularly in areas of market linkages, and infrastructural development to bridge the commercialization gap and improve the standard of living of the rural poor farmers.

DOI: https://doi.org/10.54660/IJMCR.2025.4.4.13-25

Keywords: Production, Marketing Outlet, Rice Production, Anambra State, Nigeria

1. Introduction

In line with the Federal Government interventions in the agricultural sector, efforts have been made at reducing rural poverty, enhancing food security, increasing incomes and profit, sharing wealth among farmers, minimizing post-harvest losses, attracting private sector investment, facilitating research-extension transfer, ensuring input supply, and developing rural infrastructure (Adi *et al*., 2020) [2]. The Federal Government of Nigeria (FGN), in collaboration with the International Fund for Agricultural Development (IFAD), is implementing the Value Chain Development Programme (VCDP) to enhance the rice value chain in Anambra State, Nigeria due to its potential to bring about positive changes in the production, commercialization, performance (net returns), welfare, and livelihoods of rice farmers in the VCDP. Osabuohien *et al*. (2018) [36] have argued that several issues and challenges hindering the ability of rice farmers to expand their production capacity need to be addressed. According to Obianefo *et al*. (2022) [27], the program has not completely addressed the issues of income inequality among different actors,

which can exacerbate existing socioeconomic disparities within the state. Another challenge of interest is productivity gaps. Despite the program's aim to improve rice productivity, variations in the degree of improvement among different farmers still exist (Obianefo *et al*., 2023) [28]; thereby affecting their levels of market participation or commercialization. While the FGN-IFAD VCDP intends to enhance the overall welfare and livelihoods of rice farmers (Enenchi and Ojiagu, 2021), there might be underlying issues affecting their well-being, such as access to essential services, working conditions, and vulnerability to external shocks, which may be beyond the purview of the program intervention.

In line with above assertion, the Federal Government of Nigeria (FGN) and International Fund for Agricultural Development (IFAD) Value Chain Development Programme (VCDP) aims to enhance the commercialization, welfare, and performance of rice farmers in Anambra State, Nigeria. Despite previous studies (Tenabe *et al*., 2018; Ityokumbul *et al*., 2020; Chukwujekwu *et al*., 2022) [43, 20, 9,] examining the effect of VCDP on the welfare status of farmers, there remains a gap in the literature regarding the impact of the program on the commercialization, particularly concerning the choice of marketing outlets by participating and non-participating rice farmers and its subsequent effect on sales volume. The closest to the study was done by Sadiq *et al*. (2020) [39] in Niger State when the scholars only investigated the impact of VCDP on commercialization alone. Unlike this very study that attempts to combine several economic indicators such as welfare, commercialization, and farmers' performance. However the programme effort to support the farmers is still being constrained by certain factors which Onugu *et al*. (2018) [35] described as low level of education among program participants, the age of farmers, weak cooperative structures, and the technical aspects associated with commercial agriculture, among others. Onugu *et al*. (2018); Adi *et al*. (2020) [35, 2] further emphasize that this delayed arrival of inputs poses a significant challenge to agricultural productivity, as it disrupts planting schedules and subsequently affects farmer performance, and delays in the payment of counterpart funds by both federal and state governments.

Furthermore, while existing research (Sadiq, 2020; Obianefo *et al*., 2021; Keghter *et al*., 2023) [39, 21, 23] has often focused on technical efficiency as a proxy for productivity, this study seeks to evaluate performance in terms of net returns, aligning with the primary objective of the VCDP to increase farmers' income. This distinction is crucial, as it acknowledges that farmers may be technically efficient but still unable to realize substantial profits due to limitations in their production performance influenced by their chosen marketing outlets.

The methodological approach chosen, including the use of econometric techniques such as multinomial logit model, and ordinary least square regression, enhances the rigor and credibility of the study. Additionally, the application of principal factor analysis to discern the underlying weight of challenges faced by rice farmers in participating in the enterprise provides insights for effective policy interventions (Schoneveld *et al*., 2019) [41].

Addressing challenges such as the high cost of inputs, labour, and the limited involvement of youth in agribusiness is crucial for Nigeria to achieve self-sufficiency in rice production and supply. By identifying and understanding these challenges within the context of the FGN-IFAD VCDP, this study aims to contribute to the development of targeted policies and interventions that can facilitate the program's effectiveness and ultimately improve the livelihoods of rice farmers in Anambra State.

1.2 Objectives of the Study

- The specific objectives are to:
- Examine the determinants of choice of marketing outlet by rice farmers;
- Estimate the determinants of performance of the participating and non-participating rice farmers;
- Identify the major constraints that are associated with market participation of rice farmers in the study area.

2 Analytical Literature

Cost and Returns

When analyzing a business or investment opportunity, it's essential to take into account both the costs and the returns. While costs are often perceived as a downside, having a comprehensive understanding of them can help you make an informed decision. Costs refer to the amount of money spent or used to purchase or obtain something, such as equipment for a business. When analyzing an investment, it's important to be aware of both the initial costs and any ongoing charges such as broker commissions or account management fees. These costs can accumulate quickly and cut into long-term returns. In smallholder farming, and small-scale processing, gross margin or profit is often the primary focus. Ibrahim *et al*. (2011) [18] suggest that this is particularly helpful in cases where fixed costs are minimal, as is common with small scale operators.

Budgetary method is the appropriate tools to employ to determine the cost and returns from rice VCAs. Net return is the difference between the total revenue (TR) and the total cost (TC). Meanwhile, total revenue is the product of rice quantity per unit/bag (Q) and the price of rice per unit/bag (Pr). This total cost is given by summation of the total fixed cost (TFC) and the total variable cost (TVC). Abdulaleem *et al*. (2017) [1] noted that that rice production is profitable and that the profit from rice is the difference between gross revenue and total variable cost. The mathematically technique adapted from Kaine (2016) [22] is defined as:

$$GM = TR - TVC$$

$$TC = TVC + TFC$$

$$NPM = GM - Depreciation$$

Where: GM =Gross Margin, TR =Total Revenue (N), TVC =Total Variable Cost (N), TFC =Total Fixed Cost (N), NPM =Net Profit Margin, and TC =Total Cost.

Multinomial Logit

According to Shah *et al*. (2022) [42], Multinomial logistic regression (MLR) is a statistical method used to model the relationship between a categorical dependent variable with more than two categories and one or more independent variables. In the context of studying the effect of the FGN-IFAD Value Chain Development Programme (VCDP) on the commercialization, welfare, and performance of rice farmers in Anambra State, Nigeria, multinomial logistic regression

can be a valuable analytical tool. El-Habil (2012) [11] believed that multinomial logistic regression (MLR) is a specialized case of generalized linear models (GLM) which has proven effective in analyzing response variables that are composed of more than two categories. Garson (2009) [13] noted that the MLR model can simultaneously compare more than one contrast; and estimate the log odds of three or more covariates simultaneously. This is to say that the impact of predictor variables is usually explained in terms of odds ratios (El-Habil, 2012) [11]. One important aspect is that MLR applies maximum likelihood estimation to transform the dependent variable into a logit variable, while changes are calculated in the log odds of the dependent and not in the dependent itself as well by the ordinary least square. The model uses pseudo-statistics to summarize the strength of the relationship between the dependent and independent variables.

MLR has less stringent requirements unlike linear regression that assumes linearity of the relationship between the independent and dependent variable, requires the variables to be normally distributed, and that homoscedasticity must exist. In the classification table of logistic regression to check for the correctness or incorrectness of the dichotomous, ordinal, or polytomous dependent, the goodness of fit tests (likelihood ratio test) is checked for the significance of individual independent variables that should be retained in the further analysis of the model.

The dependent variable in this case would be categorical, representing different choice of marketing outlet related to the FGN-IFAD VCDP. For example, it could include categories such as:

a. Farm gate
b. Open market, and
c. Off-taker arrangement

Again, the independent variables would consist of factors that may influence the likelihood or choice of a particular marketing outlet in the FGN-IFAD VCDP and its impact on the commercialization, welfare, and performance of rice farmers. Such variables may include:

a. Socioeconomic characteristics of farmers (e.g., age, education level, household size).
b. Farm-level characteristics (e.g., farm size, land tenure, access to credit).
c. Geographic factors (e.g., proximity to markets, agro-ecological conditions).
d. Programme-related factors (e.g., access to extension services, training, input support).

The MLR adopted from EL-Habil (2012) [11] is defined as:

$$\log\left(\frac{P(Y=K)}{P(Y=\text{reference})}\right) = \alpha_k + \beta_{1j}X_{1i} + \beta_{2j}X_{2i} + \cdots \beta_{pj}X_{pi}1$$

Where:

$P(Y = K)$ is the probability of belonging to category

$X_{1i} + X_{2i} + \cdots X_{pi}$ are the independent variables

$\beta_{1j} + \beta_{2j} + \cdots \beta_{pj}$ are the coefficients associated with the independent variables

Where all the Y's add to unity, then the reduced model is reduced to:

$$\text{Log}(P(Y = K) = \frac{\exp^{\alpha_{oi}+\beta_{1j}X_{1i}+\beta_{2j}X_{2i}+\cdots\beta_{pj}X_{pi}}}{\sum_{j=1}^{k-1}\exp^{\alpha_{oi}+\beta_{1j}X_{1i}+\beta_{2j}X_{2i}+\cdots\beta_{pj}X_{pi}}} \quad 2$$

Where Y is the response categories or Choice market (1 = farm-gate, 2 = open market, and 3 = off-taker arrangement), X_i is the vector(s) of explanatory variables (determinants of choice market), β_j is the parameter to be estimated which uses maximum likelihood estimate method (Chatterjee and Hadi, 2006; Shah *et al*., 2022) [8, 42].

MLR uses a reference or baseline category and the predicted probability of estimate is defined as:

$$P(Y = \text{refernce}) = \frac{e^{\alpha_j+\beta_j Y}}{\sum_h e^{\alpha_h+\beta_h Y}} \quad 3$$

$$P(Y_1 = \text{refernce}) = \frac{\exp(y_1)}{1+\exp(y_1)+\exp(y_2)+\exp(y_3)+\exp(y_4)} \quad 4$$

$$P(Y_2 = \text{refernce}) = \frac{\exp(y_2)}{1+\exp(y_1)+\exp(y_2)+\exp(y_3)+\exp(y_4)} \quad 5$$

Where Y_i is the predicted responses from the multinomial coefficient.

Principal Factor Analysis

Principal Factor Analysis (PFA) is a statistical method used for dimensionality reduction and identifying patterns in data (Obianefo *et al*., 2020) [26]. It aims to transform a set of possibly correlated variables into a smaller set of uncorrelated variables called principal components. While PFA is not specifically designed to analyse challenges in rice production, it can still provide valuable insights into the multifaceted nature of agricultural systems and help identify underlying factors affecting the commercialization, welfare, and performance of rice farmers in Anambra State, Nigeria, as influenced by the FGN-IFAD Value Chain Development Programme (VCDP).

Reiteratively, de Oliveira *et al*. (2019) [10] suggested that the PFA is a multivariate statistical method that analyzes several variables to reduce a large dimension of data to a relatively smaller number of dimensions, components, or latent factors. The key concept behind PFA is that it assumes all variables in the data set have a common underlying structure. It then uses linear algebra to identify a few factors that explain the structure of the data. Each factor represents a subsection of the data that provides meaningful information (de Oliveira *et al*., 2019; Johnson and Wichern, 1998) [10, 21]. The factors are determined by the factor analysis model and are calculated using mathematical algorithms. The calculation of the factors requires knowledge of the correlation between the variables in the data set (Johnson and Wichern, 1998) [21]. The resulting factors are then used to explain the underlying structure of the data set and help identify relationships among the variables.

PFA is a useful tool for data analysis and can help uncover patterns in data that other methods may not be able to detect (Guido, 2011) [14]. However, as with any statistical technique, there are certain considerations that need to be taken when using PFA. For example, if the data is too complex or has too many variables, the accuracy of the PFA model may suffer. Additionally, if the underlying structure of the data is not consistent across the entire data set, it could lead to inaccurate results.

In order to ensure adequate sample size for Partial Factor Analysis (PFA), assessing the multiple correlations between the variables is recommended. The variables should be correlated; if the correlations are low, it is beneficial to have

a larger sample size. A good indication of sample adequacy for PFA is when the set of variables have statistically significant correlations. However, it is still recommended to observe the magnitude of the correlations. In terms of sample adequacy for PFA, two tests can be applied: the Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test. The KMO statistic should be a proportion of variance among variables that might be common variance, which should be between zero and one, where values close to one are adequate (Meyers, *et al*., 2006) [25]. KMO values above 0.50 with a p-value < 0.05 for Bartlett's sphericity test are considered acceptable (Hair *et al*., 2006; de Oliveira *et al*., 2019) [15, 10]. Finally, it is necessary to select one of the several extraction methods available.

The PFA model is explicitly adapted from Obianefo *et al*. (2020) [26] and is defined as:

$$\text{Constraints}_{ij} = \delta_{i1}F_{i1} + \delta_{i2}F_{i2} + \delta_{jm}F_{jm} + \varepsilon_{ij} \quad (8)$$

Where: Constraints_{ij} is the observed challenges to rice production on ith sample number, F1- Fm is the number of common factors, ε_{ij} is the value on the residual variable or stochastic error term, δ_{i1} - δ_{im} is the factor loading (regression weight).

3. Research Methodology

3.1 Study Area

Anambra State, situated in the southeastern part of Nigeria, consists of 21 Local Government Areas (LGAs). The state is divided into four agricultural zones for the purpose of planning and rural development. It shares borders with Delta State to the West, Imo State and Rivers State to the South, Enugu State to the East, and Kogi State to the North. The administrative headquarters of the state is located in Awka. The majority of the state's population, approximately 98%, belongs to the Igbo ethnic community, while the remaining 2% comprises the Igala ethnic community, mainly residing in the northwestern part of the state. Anambra State is geographically positioned between Latitudes 5° 32' and 6° 45' N and Longitudes 6° 43' and 7° 22' E, encompassing an estimated land area of 4,865 square kilometers. In 2023, the Nigerian Bureau of Statistics estimated the population of Anambra State as 7,299,910 people (NBS, 2023). Most rural people in Anambra State are primarily engaged in crop (rice, yam, potato, and cassava) production, fishing due to the presence of river Niger. The people of Anambra State are good in the trade and commerce sector of the economy.

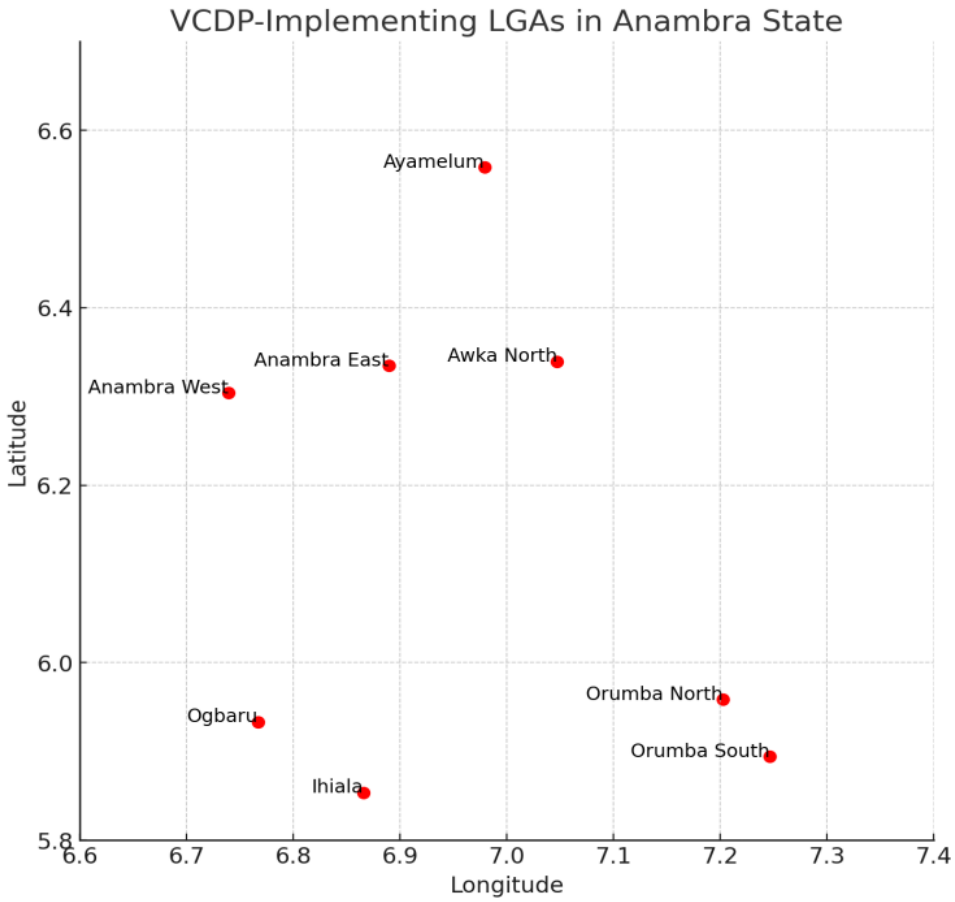

Fig 1: Coordinate placement of VCDP Implementation LGAs

3.2 Sampling Procedure

The study employed a multistage sampling technique to select respondents for both the treatment (VCDP beneficiaries) and control (non-beneficiaries) groups. The target population for this study consists of rice farmers in Anambra State which include 8,480 (male – 4452, and female – 4029) farmers who are beneficiaries of the FGN-IFAD Value Chain Development Programme (VCDP) and a comparable group of non-beneficiary farmers.

Selection of VCDP Beneficiaries

To ensure a representative sampling of the treatment

(beneficiaries), the Taro Yamane sample size determination technique was adopted from Otabor and Obahiagbon (2016) [37] as defined by:

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

Where:

N	=	Population of the Study
n	=	Sample Size
(e)	=	Level of significance
1	=	Unit (a constant)

Note: (e)= 0.05

$$n = \frac{8480}{1+8480(0.05)^2} = \frac{8480}{1+8480\ (0.0025)}$$

$$= \frac{8480}{1+(21.3)} = \frac{8480}{22.3}$$

$$= 380.27 \approx 380 \text{ rice farmers}$$

Later on, 50% (190 farmers) of the determined sample size was allotted to the treatment group so that the next 50% was allocated to the control group for a balanced impact assessment of the programme effect.

In the second stage, being that IFAD VCDP is currently being implemented in eight LGAs of Anambra State, two communities were purposively selected due to high dominance of rice farmers, and within each community, four villages were purposively selected, resulting in a total of sixty-four (64) villages.

In the last stage, approximately 3 rice farmers were randomly selected from sixty-three (63) villages and two from one village to make the sample exactly one-hundred and ninety (190) participating farmers.

Selection of Non-Beneficiaries (Control Group)

A matching approach was used to select 190 non-beneficiary rice farmers from the same LGAs where VCDP operates. The selection criteria ensured that non-beneficiaries had similar characteristics (e.g., farm size, production experience, and demographics) to the VCDP beneficiaries to allow for meaningful impact assessment.

A combination of purposive and random sampling was used, where non-beneficiaries were first identified through extension officers and local farmer associations, and then randomly selected to achieve the required sample size. This sampling design ensures that the study can effectively compare the impact of VCDP on rice farmers' commercialization, welfare, and performance while minimizing selection bias.

3.3 Methods of data collection

Data for the study were primarily sourced. Primary data were collected using a structured questionnaire and interview schedule with the rice farmers. These structured questionnaires were coded in the Kobo-Collect Android toolkit. The tool kit is a digital data collection approach where the coded information is restricted to reduce malpractices, and speed up data collection and data entry process for accurate analysis (Obianefo *et al*., 2024) [30]. Furthermore, four research assistants were recruited and trained to assist with the data collection, each assistant covered two Local Government Areas. The assistants spent at least two weeks on the field to collect the required data for the study. The data collected include information on the rice farmers' socioeconomic characteristics, marketing outlet, commercialization information, performance, welfare status, and the outcome of the Programme interventions.

3.4 Data Analysis

A combination of analytical techniques were used to operationalize the objectives of the study. The statistical technique include multinomial Logit, Ordinary least square regression and principal component factor analysis. The multinomial logit model to estimate the determinants of the choice of marketing outlet adopted by Shah *et al*. (2022) [42] is defined by:

$$P(y_i = j|X_i) = \frac{e^{X_i\beta_j}}{\sum_{k=1}^{3} e^{X_i\beta_k}},$$

Where:

$P(y_i = j|X_i)$ is the probability that individual i chooses market outlet j

β_j is a vector of coefficients associated with the independent variables for market outlet j, and

e is Euler's number (approximately equal to 2.718).

j =1, 2, 3 represent the three market outlet choices (farm-gate, open market, and off-taker arrangement, respectively).

i = 1, 2, ..., n represent the individuals or observations.

Again, the multiple regression analysis was used to achieve the determinants of performance which is defined as:

Linear function: $Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots \beta_{12} X_{12i} + e_i$

Exponential function: $\log Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots \beta_{12} X_{12i} + e_i$

Semi-log function: $Y_i = \beta_0 + \beta_1 \log X_{1i} + \beta_2 \log X_{2i} + \beta_3 \log X_{3i} + \cdots \beta_{12} \log X_{12i} + e_i$

Double-log function: $\log Y_i = \beta_0 + \beta_1 \log X_{1i} + \beta_2 \log X_{2i} + \beta_3 \log X_{3i} + \cdots \beta_{12} \log X_{12i} + e_i$

Where:

Y_i = performance (net returns) of farmers as defined by equation 7.

X_1 = age (year)

X_2 = gender (dummy: 1 = male, 0 = female)

X_3 = farming experience (years)

X_4 = farm size (ha)

X_5 = level of education (years spent in school)

X_6 = access to credit (amount received in Naira)

X_7 = household size (number of people)

X_8 = extension contacts (number of visits)

X_9 = seed (kg)

X_{10} = labour (man-day)

X_{11} = agrochemical (litre)

X_{12} = fertilizer (kg)

X13 = rice output (in kg)

X14 = primary occupation (1 if farming, 0 if otherwise)

The four functional forms were tried and the function with the highest R^2, and the highest number of variables with significant observation was chosen as the lead equation.

Lastly, the principal component factor analysis (PFA) model for the constraints as adapted from Obianefo *et al*. (2020) [26]

is explicitly defined as:

$$\text{Constraints}_{ij} = \delta_{i1}F_{i1} + \delta_{i2}F_{i2} + \delta_{jm}F_{jm} + \varepsilon_{ij}$$

Where:

Constraints_{ij} is the observed challenges to rice production on ith sample number,

F1- Fm is the number of common factors,

ε_{ij} is the value on the residual variable or stochastic error term,

δ_{i1} - δ_{im} is the factor loading (regression weight).

4. Results and Discussion

For better understanding of the program's impact, the analysis was conducted comparatively to clearly reveal the differences in economic opportunities between participants and non-participants.

Determinants of Choice of Marketing Outlet

Table 1 shows the result of the determinants of the choice of marketing outlet adopted by the ANSVCDP participating and non-participating rice farmers. The determinants of the choice of marketing outlets for rice farmers participating in the FGN-IFAD Value Chain Development Programme (VCDP) (ANSVCDP) and non-participating farmers were analyzed using a multinomial logistic regression. The farm-gate market was the baseline category. Below is a detailed interpretation and discussion of the significant findings from the regression analysis for both groups.

Open Market

Age: The coefficient for age is positive (β = 0.066) and significant at the 5% level, with an exponential value of 1.068. This indicates that as the age of ANSVCDP rice farmers increases, their likelihood of choosing the open market increases by 6.8%. This suggests that older farmers in the Programme might prefer the open market due to potentially higher bargaining power or better market knowledge. Again, age is not a significant factor for non-participating farmers, implying no noticeable impact of age on their choice of marketing outlet. The result for the participants is similar to the work of Peng *et al*. (2021) who argued that older farmers have better bargaining power.

Farm Size: The coefficient for farm size is positive (8.548) and significant at the 5% level, with an exponential value of 5.158. This indicates that larger farm sizes significantly increase the likelihood of non-participating farmers choosing the open market by 15.8%. This may reflect a need to access larger and possibly more lucrative markets to sell more significant quantities of produce. This result contradicts the opinion of Alabi *et al*. (2023) [4] who noted that contiguous farmland is more associated with Programme participants Notably, farm size was not significant for ANSVCDP rice farmers.

Structured Market

Sex: The coefficient for sex is negative (β = -3.02) and significant at the 5% level, with an exponential value of 0.049. This indicates that male ANSVCDP farmers are less likely to choose structured markets. This could be due to male farmers finding better opportunities or negotiating better deals in other types of markets. Sex is not a significant factor for non-participants. This result for ANSVCDP farmers reflects the opinion of Akanle *et al*. (2019) [3] who argued that women are more involved with structured market arrangements probably due to their ability to keep to MoU agreement better than their male counterparts.

Age is positively significant (β = 0.082) at the 1% level, with an exponential value of 1.085. Older ANSVCDP farmers are more likely to choose structured markets, suggesting they might value the stability and reduced risk these markets offer. Equally, age is not significant for non-participants. This was in agreement with the result of Alabi *et al*. (2023) [4] who found a positive effect of age on the marketing of rice in Niger State.

Education has a negative coefficient (β = -0.36) and is significant at the 1% level, with an exponential value of 0.698. This implies that higher educational levels decrease the likelihood of choosing structured markets among ANSVCDP farmers by 69.8%. This could be because more educated farmers might seek higher returns in less structured, but potentially more lucrative, markets (Fan, and Rue, 2020) [12]. Education is also negative (β = -0.692) and significant at the 1% level, for non-ANSVCDP farmers with an exponential value of 0.501, indicating similar behaviour among non-participating farmers.

The coefficient of farm farming experience is negative (β = -0.337) and significant at the 5% level, with an exponential value of 0.714, suggesting that more experienced ANSVCDP farmers are less likely to choose structured markets. They might prefer open or other types of markets where they can leverage their experience for better prices. On the other hand, experience is positive (β = 0.314) and significant at the 5% level, with an exponential value of 1.368. More experienced non-participating farmers are more likely to choose structured markets, possibly valuing the security and consistent demand these markets provide. This result was in agreement with Ben-Chendo and Joseph (2014) [6] who found positive relationship between productivity and marketing in their study.

The coefficient for household size is positive (β = 0.681) and significant at the 5% level, with an exponential value of 1.977 for non-ANSVCDP farmers. Suggesting that larger households may drive the need for stable income, making structured markets more attractive (Oluwatusin, and Sekumade, 2016) [33].

The coefficient for farm size is positive (β = 2.637) and significant at the 5% level, with an exponential value of 13.967. Larger farm sizes significantly increase the likelihood of choosing structured markets, indicating that ANSVCDP farmers with larger farms seek the stability and bulk purchasing power of structured markets. Similarly, the coefficient for farm size is positive (10.277) and significant at the 5% level for non-ANSVCDP farmers, with an exponential value of 2.905, indicating that larger farms are more likely to use structured markets.

Access to credit is highly significant (β = 3.076) at the 1% level, with an exponential value of 21.68, suggesting that those with access to credit are much more likely to choose structured markets. This access likely provides the financial stability and capacity to engage in these markets (Ogebe *et al*., 2022) [32] Furthermore, access to credit is not significant for non-ANSVCDP farmers and has a negative coefficient (β = -22.304), indicating no reliable pattern.

In the agricultural sector, the study found that older ANSVCDP farmers favour open and structured markets more, indicating a need for targeted marketing strategies and support services for this demographic to maximize their productivity and market access. Again, larger farm sizes being associated with both open and structured market

choices suggests that policies and support systems should cater to the scalability and bulk sales needs of larger farms. Equally, the significant impact of credit access on market choices for ANSVCDP farmers highlights the importance of improving financial services and credit facilities for farmers to enhance their market participation and overall welfare.

Table 1: Determinants of choice of marketing outlet

		Participants			Non-participants		
	Covariates	**Coeff.**	**t-stat.**	**Exp(B)**	**Coeff.**	**t-stat.**	**Exp(B)**
Open market	Intercept	-6.334	1.61		-0.819	0.02	
	Sex	0.403	0.12	1.496	1.146	0.38	3.146
	Age	0.066	2.35**	1.068	-0.027	0.29	0.974
	Education	-0.031	0.05	0.969	-0.021	0.03	0.98
	Farming experience	0.077	0.19	1.08	0.136	1.03	1.146
	Household size	0.15	0.59	1.161	0.419	1.25	1.52
	Extension contacts	-0.057	0.03	0.944	-0.326	0.35	0.722
	Farm size	0.851	0.58	2.342	8.548	1.97**	5.158
	Access to credit	0.052	0.00	1.053	-1.735	0.80	0.176
Structured market	Intercept	-3.091	0.35		-6.176	0.85	
	Sex	-3.02	2.61**	0.049	-0.325	0.02	0.722
	Age	0.082	2.98***	1.085	-0.03	0.24	0.97
	Education	-0.36	3.13***	0.698	-0.692	3.91***	0.501
	Farming experience	-0.337	2.15**	0.714	0.314	2.81**	1.368
	Household size	-0.004	0.00	0.996	0.681	2.56**	1.977
	Extension contacts	0.541	0.84	1.717	-0.726	1.11	0.484
	Farm size	2.637	2.49**	13.967	10.277	2.57**	2.905
	Access to credit	3.076	4.07***	21.68	-22.304	0.00	0.000
	Nagelkerke Pseudo R-Square	0.636			0.493		
	Goodness-of-Fit	0.015			0.042		

Source: Field Survey, 2024. Baseline: farm-gate market. Sig. at 5% (**), and 1% (***).

Furthermore, the varying effects of education and farming experience on market choices reveal the need for tailored training and extension services that consider these factors to optimize market engagement strategies. Lastly, the negative impact of being male on choosing structured markets among ANSVCDP farmers suggests that market interventions need to address gender-specific barriers and opportunities to ensure equitable access and benefits from structured markets. The FGN-IFAD VCDP has influenced the marketing behaviours of participating farmers, notably in their increased use of structured markets facilitated by access to credit and larger farm sizes. These findings highlight the Programme's positive impact on commercialization and suggest areas for further policy and support interventions to sustain and enhance the performance and welfare of rice farmers in Anambra State.

The null hypothesis one was rejected with respect to age, farm size, and access to credit because of their positive and significant relationship with the choice of market outlet.

Estimation of the Determinants of Performance of the Participating and Non-Participating Rice Farmers

The results of the regression analysis presented in Table 2 highlight the determinants of performance (net returns) for rice farmers participating in the FGN-IFAD value chain development Programme compared to non-participating farmers in Anambra State, Nigeria.

The four functional forms of Linear, Semi-log, Exponential, and Double were performed in R-software to select the lead equation based on the form that returned the highest F-statistics and the highest R-square and in conformity with the a priori expectation. Semi-log and linear forms were selected as the lead equation for participants and non-participants respectively.

For the ANSVCDP participants, the semi-log model, with an R-square value of 0.810, explains 81.0% of the variation in performance, indicating a robust model fit. The highly significant F-statistic underscores the model's reliability. Again, the linear model, with an R-square value of 0.605, explains 60.5% of the variation in performance, showing a moderately strong fit. The significant F-statistic confirms the model's effectiveness.

The coefficient of sex for the participants (0.143) is positive and significant at the 1% level, indicating that male farmers significantly increase net returns by 0.143 units. This highlights the impact of male involvement in improving farm performance for participants. Equally, the coefficient is negative but insignificant for non-participants, suggesting that sex does not markedly influence performance for non-participants. This result was in agreement with the study by Onubogu (2023) [34] who reported a positive effect of sex on profit performance.

The coefficient of age for participants (-0.001) is negative and significant at a 1% level of probability, suggesting that older participants might experience lower net returns, possibly due to reduced physical capacity or adaptability. Equally, the negative and significant coefficient for non-participants also indicates that younger non-participants tend to perform better, reinforcing the need for youth engagement in agriculture (Henning *et al*., 2022) [17].

The level of education was positive and significant (0.022) at a 1% level of probability, which indicates that higher education levels significantly enhance performance, likely through better management and adoption of improved practices for ANSVCDP participants (Obianefo *et al*., 2022) [27]. The coefficient is positive but insignificant, suggesting that education does not significantly impact performance among non-participants.

Farming experience was negative and significant (-2521.69) at a 1% level of probability, this suggests that more experienced non-participants may face challenges adapting to new methods or market conditions. The result points to the

fact that ANSVCDP is teaching the farmers not to rely on their age-long dogmatic experience, but should embrace modern agricultural production techniques through best practice adoption.

Household size for the participants is negative and significant (-0.022) at a 1% level of probability, which indicates that larger households negatively impact performance, likely due to higher consumption needs and dependency ratios. Moreso, the positive and significant coefficient (1474.98) for non-participants suggests that larger households contribute positively to performance, possibly through more labour availability (Bula *et al*., 2023) [7].

The coefficient of extension contacts was positive and highly significant (0.026) at a 1% level which shows that extension services significantly improve performance, reflecting the benefits of technical support and knowledge transfer among ANSVCDP rice farmers alone.

Farm size was positive and highly significant (0.153) at a 1% level of probability for the participants, which implied that larger farms lead to better performance by 0.153 units, highlighting the advantages of scale and productivity (Alabi *et al*., 2023) [4]. A negative and significant coefficient (-40107.6) at a 5% level for the non-participants suggests that larger farms might struggle without the Programme's support, facing challenges in managing resources efficiently.

The coefficient of access to credit was positive and significant (0.101) at a 1% level for participants, suggesting that access to credit improves performance by enabling investments in farming activities (Haryanto *et al*., 2023) [16]. The positive and significant coefficient (11729.2) for non-participants at a 5% level also indicates that credit access benefits non-participants, but the effect size is smaller compared to participants.

The coefficient of labour was positive and significant (0.004) at a 1% level of probability for participants at 1a 1% level, indicating that labour availability improves performance, reflecting efficient use of human resources (Ofor-Douglas, 2021) [31]. The practice of best practices in rice production is labour intensive in the absence of mechanicalized equipment.

The coefficient of seed was positive and significant (0.001) at a 1% level for the participants, which indicates that seed quality and availability improve performance. The Programme has always supported farmers with the right rice input for improved yield (Obianefo *et al*., 2022) [27].

The coefficient of fertilizer was positive and significant (188.66) at a 1% level of probability for non-Participants, which indicates that fertilizer use significantly improves performance by 188.66 units. Again, the coefficient of agrochemicals was positive and significant (0.009) at a 1% level for participants, which indicates that agrochemical use improves performance by 0.009 units. Equally, for the non-Participants, a negative and significant coefficient (-14136.5) at a 1% level suggests that agrochemical use might adversely affect performance, possibly due to improper use or cost issues. The significant effects of seeds and agrochemicals among participants suggest that proper input use enhances performance (Alabi *et al*., 2023) [4]. Non-participants may need guidance on effective input utilization to avoid negative impacts.

The coefficient of primary occupation was negative and significant (-3506.1) at a 5% level of probability, which indicates that non-participants whose primary occupation is farming might face performance challenges, possibly due to limited diversification opportunities.

Lastly, the FGN-IFAD value chain development Programme significantly enhances the performance of participating rice farmers through various determinants such as education, extension services, and credit access. Extending similar support to non-participants can bridge the performance gap and boost the overall productivity of the rice production sector in Anambra State. The null hypothesis six was rejected with respect to the following socioeconomic characteristics sex, age, level of education, household size, farm size, access to credit, and primary occupation with significant relationship with rice farmers' performance.

Table 2: Estimation of the determinants of performance of the participating and non-participating rice farmers

	Participants				**Non-participant**			
Covariates	Linear	**Semi-log**	Exponential	Double-log	**Linear**	Semi-log	Exponential	Double-log
(Intercept)	1467683 (9.40)	14.22 (243.49)	1841804 (4.08)	14.361 (81.94)	450141.6 (19.01)	13.22 (134.17)	503229.6 (7.54)	13.33306 (49.29)
Sex	-303248 (-9.48)	0.143 (11.92)***	-303869 (-8.68)	-0.143 (-10.52)	-2599.45 (-0.48)	-0.001 (-0.05)	-3016.17 (-0.52)	-0.006 (-0.25)
Age	-2410.9 (-2.02)	-0.001 (-2.74)**	-90884 (-1.90)	-0.047 (-2.54)	-834.32 (-5.79)***	-0.004 (-5.97)	-27181.3 (-4.00)	-0.11912 (-4.32)
Level of education	44282 (10.75)	0.022 (14.06)***	308149 (8.90)	0.155 (11.50)	16.09 (0.05)	0.000 (-0.02)	-35.66 (-0.09)	-0.00014 (-0.09)
Farming experience	1870.2 (0.48)	0.001 (0.72)	14381 (0.28)	0.006 (0.30)	-2521.69 (-6.92)***	-0.009 (-6.26)	-38236.9 (-6.14)	-0.14083 (-5.58)
Household size	-42360.5 (-7.74)	-0.022 (-10.54)***	-333588 (-6.59)	-0.169 (-8.60)	1474.98 (2.04)**	0.005 (1.51)	11083.11 (2.30)	0.033119 (1.69)
Extension contacts	52718 (6.18)	0.026 (8.04)***	48426 (5.20)	0.023 (6.48)	-2164.75 (-1.45)	-0.009 (-1.52)	-3121.21 (-1.97)	-0.01336 (-2.08)
Farm size	325926.6 (6.61)	0.153 (8.29)***	326152 (5.97)	0.157 (7.42)	-40107.6 (-1.97)**	-0.122 (-1.44)	35632.54 (2.62)	0.121651 (2.21)
Access to credit	-205207 (-6.19)	0.101 (8.12)***	-207191 (-5.81)	-0.101 (-7.33)	11729.2 (1.97)**	-0.033 (-1.33)	-13841.7 (-2.18)	-0.04184 (-1.63)
Labour	7062.3 (6.17)	0.004 (8.86)***	271978 (5.33)	0.147 (7.42)	-200.26 (-0.84)	0.000 (-0.48)	-10111.2 (-0.85)	-0.02321 (-0.48)
Output	-482.6 (-0.13)	0.000 (0.09)	-20220 (-0.58)	-0.006 (-0.41)	-1067.02 (-0.39)	-0.008 (-0.72)	-2358.96 (-0.81)	-0.01444 (-1.22)
Seed	-1821.4	0.001	-181654	-0.100	59.75	0.000	-9250.37	-0.03261

	(-4.92)	(7.01)***	(-4.23)	(-5.98)	(1.69)	(1.37)	(-1.69)	(-1.47)
Fertilizer	-204.6 (-1.06)	0.000 (-0.53)	-14041 (-0.30)	0.003 (0.18)	188.66 (5.58)***	0.001 (4.97)	28554.18 (3.99)	0.126725 (4.37)
Agrochemical	-20671.1 (-3.95)	-0.009 (-4.60)***	-23927 (-4.21)	-0.011 (-4.83)	-14136.5 (-9.25)***	-0.06 (-9.39)	-13546 (-8.32)	-0.05767 (-8.74)
Primary occupation	7430.1 (0.67)	0.003 (0.81)	5333 (0.45)	0.003 (0.55)	-3506.1 (-2.11)**	-0.012 (-1.77)	-3947.67 (-2.22)	-0.01442 (-2.00)
F-statistic:	30.5	53.2	23.75	38.94	19.13	17.13	15.2	14.86
R-squared:	0.709	0.810	0.655	0.757	0.605	0.578	0.549	0.543
Adjusted R-squared	0.686	0.795	0.628	0.738	0.573	0.544	0.513	0.507
Obs.	190	190	190	190	190	190	190	190

Source: Field Survey, 2024. Sig. at 5% (**), and 1% (***). The figures in parentheses are the t-statistics.

The Major Constraints that are Associated with Market Participation of Rice Farmers

The Principal Factor Analysis (PFA) with Promax rotation applied to the constraints faced by participating rice farmers in the FGN-IFAD value chain development Programme (VCDP) in Anambra State, Nigeria, adopted the three-component factor naming system adopted by Obianefo *et al*. (2022) [27] and presented in Table 3.

Out of the twenty-one (21) constrained identified in the study, only twelve (12) whose commonality values scored 0.50 and above were used for the final analysis in SPSS version 25 which was considered peculiar to the ANSVCDP participants. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) value of 0.754 indicates that the sample size and data are adequate for factor analysis. Again, the determinant value of 0.046, being above 0.000, confirms that the model is non-negative definite, meaning the correlations between variables are sufficiently large for PFA. The three factors cumulatively explain 53.9% of the total variance among participants.

The three component factors are:

Market Factor 1

Unhealthy competition (0.861): This high loading indicates that even participating farmers face significant challenges from unfair market practices. Although the FGN-IFAD Programme supports market stability, additional measures might be necessary to foster fair competition, suggesting ongoing issues in market dynamics. This result corroborates with Waziri *et al*. (2019) [45] who found similar challenges in their study. High market change (0.801): Market fluctuations remain a considerable challenge for participating farmers. While the Programme likely helps mitigate some market volatility, the persistence of this constraint indicates the need for further market stabilization efforts. Again, bad influence of the middlemen (0.777): Middlemen still negatively impact the profitability of participating farmers despite the Programme's effort to eliminate these actors. The Programme's efforts to reduce middlemen's influence might need enhancement, possibly through more direct market access initiatives. High household pressure of rice output (0.709): Pressure from household consumption affects marketable surplus. The Programme might need to address household food security more effectively through its nutrition-sensitive agricultural initiatives such as the distribution of Noiler birds, Vitamin A cassava stems and orange flesh sweet potato vine, perhaps through diversification or productivity improvements (Ilona, 2017) [19]. Equally, low market price of the commodity (0.518): Farmers still face issues with low prices for their produce. Despite Programme interventions, low market prices suggest a need for better price support mechanisms or value-addition strategies to enhance income.

Product Factor 2:

Low market value/quality of rice (0.837): This indicates challenges with the quality and market value of rice produced by participating farmers. Quality improvement initiatives within the Programme may need strengthening to ensure higher market value and competitiveness (Makinde *et al*., 2023) [24]. Also, limited or small size of rice output (0.665): Production scale remains a constraint, affecting economies of scale. The Programme should focus on enhancing production capacity, perhaps through better access to inputs and technology. Inflation (0.566): Rising costs of inputs and living expenses affect profitability. The Programme should consider measures to counteract inflationary pressures, such as subsidies or financial support. Lack of storage facilities (0.513): Storage remains a significant issue, leading to post-harvest losses. And investment in storage infrastructure remains crucial to reduce losses and stabilize supply (Anosike, 2021) [5].

Table 3: Major constraints that are associated with participating rice farmers

Sn.	Constraints	Market Factor 1	Product Factor 2	Commodity Factor 3
1	Unhealthy competition	0.861		
2	High market change	0.801		
3	Bad influence of the middlemen	0.777		
4	High household pressure of rice output	0.709		
5	Low market price of the commodity	0.518		
6	Low market value/quality of rice		0.837	
7	Limited or small size of rice output		0.665	
8	Inflation		0.566	
9	Lack of storage facilities		0.513	
10	Unstable price of the commodity in the market			0.822
11	High cost of labour in loading and off-loading products			0.792
12	Bad road network to convey produce to the market			0.54
	Diagnostics			

	Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)	0.754		
	% variance of factor 1	29.49		
	% variance of factor 2	12.66		
	% variance of factor 3	11.72		
	Total % variance of factor	53.87		
	Determinant	0.046		

Source: Field Survey, 2024.

Commodity Factor 3

Unstable price of the commodity in the market (0.822): Price instability still affects participating farmers. This ongoing issue indicates a need for more robust market intervention strategies to stabilize prices (Waziri *et al*., 2019) [45]. Also, high cost of labour in loading and off-loading products (0.792): Labour costs in logistics are a significant burden. Mechanization and improved logistics support could help reduce these costs. And bad road network to convey produce to the market (0.54): Poor infrastructure hinders effective market access. Infrastructure development remains a priority to improve market connectivity and reduce transportation costs (Yapicioglu *et al*., 2017) [46].

The FGN-IFAD value chain development Programme positively impacts commercialization, welfare, and performance but still faces significant challenges. Addressing these constraints comprehensively could lead to more substantial benefits for rice farmers in Anambra State, ultimately enhancing the agricultural sector's productivity and sustainability.

The Major Constraints that are Associated with Market Non-Participation of Rice Farmers

The Principal Factor Analysis (PFA) with Promax rotation was used to identify the major constraints faced by non-participating rice farmers in Anambra State, Nigeria. The result is presented in Table 4.

Out of the twenty-one (21) constrained identified in the study, only fifteen (15) whose commonality values scored 0.50 and above were used for the final analysis as peculiar to the non-ANSVCDP participants. The KMO value of 0.703 indicates the adequacy of the sample for factor analysis, suggesting reliable results. The total % variance of factors was 61.93%. This reflects that the identified factors explain a significant portion of the variance in constraints faced by non-participating farmers. The three component factors are:

Market factor 1:

Unstable price of the commodity in the market (0.847): This high loading suggests that non-participating farmers face significant challenges with price volatility, which affects their income stability and decision-making (Uduji *et al*., 2021) [44]. Participation in the FGN-IFAD Programme likely offers more stable pricing mechanisms or access to better market information, reducing uncertainty for participating farmers. Limited access to extension services (0.769): The lack of extension services implies that non-participating farmers have limited access to agricultural advice and modern farming techniques. The implication is that the FGN-IFAD Programme probably provides better extension services, leading to improved farming practices and higher productivity among participants. Moreso, the lack of standard measurement for sales (0.745): This constraint indicates issues with fair trade and consistency in sales transactions. Equally, participants in the Programme might benefit from standardized measurement systems, ensuring fairer trade and possibly better prices for their produce. Unhealthy competition (0.695): This reflects challenges from unfair market practices or dominant market players. The Programme could help in establishing fair competition by providing a structured market environment. Again, bad road network to convey produce to the market (0.591): Poor infrastructure hinders the ability to transport goods efficiently, leading to higher costs and lower profitability. The Programme might include infrastructure development or support, improving market access for participants, and bad influence of the middlemen (0.569): Middlemen exploiting farmers is a significant issue, reducing farmers' profits. The Programme could reduce dependency on middlemen by facilitating direct market access or cooperative marketing strategies.

Product Factor 2:

High market change (0.903): This indicates a significant issue with market fluctuations impacting farmers' ability to plan and sell effectively. However, the FGN-IFAD Programme likely helps in mitigating these market changes through better market linkages and contracts, and limited or small size of rice output (0.807): This constraint reflects low production capacity, affecting economies of scale. Participation in the Programme might lead to increased output through improved farming methods and input subsidies. Low market value/quality of rice (0.772): Low quality affects marketability and prices received by farmers. The Programme probably focuses on improving rice quality, thereby enhancing market value and farmer incomes, and lack of storage facilities (0.672): Poor storage leads to post-harvest losses, reducing overall profitability. Improved storage facilities provided by the Programme can reduce losses and improve financial outcomes for farmers.

Commodity Factor 3:

Poor or lack of formal education (0.849): This significant loading suggests that lack of education hampers farmers' ability to adopt new technologies and practices. Again, the Programme likely includes educational components, enhancing farmers' knowledge and skill sets. Again, high cost of marketing equipment (0.828): High costs prevent farmers from effectively marketing their produce. The Programme might subsidize or provide marketing equipment, reducing these costs for participants. Also, low demand for the product in the area (0.772): Low local demand impacts sales and profitability. The Programme could help expand market reach beyond local areas, increasing demand. And the inadequate capital for market participation (-0.618): Lack of capital restricts farmers' ability to engage effectively in markets. The Programme probably offers financial support or facilitates access to credit, enabling better market participation.

Furthermore, the study revealed that non-participating farmers face numerous constraints that hinder their commercialization, welfare, and performance.

Table 4: Major constraints that are associated with non-participating rice farmers

	Constraints	Market Factor 1	Product Factor 2	Commodity Factor 3
1	Unstable price of the commodity in the market	0.847		
2	Limited access to extension services	0.769		
3	Lack of standard measurement for sales	0.745		
4	Unhealthy competition	0.695		
5	Bad road network to convey produce to the market	0.591		
6	Bad influence of the middlemen	0.569		
7	High market change		0.903	
8	Limited or small size of rice output		0.807	
9	Low market value/quality of rice		0.772	
10	Lack of storage facilities		0.672	
11	Poor or lack of formal education			0.849
12	High cost of marketing equipment			0.828
13	Low demand for the product in the area			0.772
14	Inadequate capital for market participation			-0.618
15	Extraction Method: Principal Component Analysis.			
	Diagnostics			
	Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)	0.703		
	% variance of factor 1	25.22		
	% variance of factor 2	19.39		
	% variance of factor 3	17.31		
	Total % variance of factor	61.93		
	Determinant	0.00		

Source: Field Survey, 2024.

5. Conclusion and Recommendations

The findings of this study reveal that participation in the FGN-IFAD Value Chain Development Programme (VCDP) significantly influences rice farmers' choice of marketing outlet, and performance in Anambra State. Variables such as age, access to credit, farm size, extension contact, and education, emerged as key determinants of marketing outlet selection, with participating farmers more likely to engage in structured markets to to the programme arrangement. It was equally observed that the non-participating farmers relied more on open markets, influenced by larger farm sizes and absence of programme support. The study further revealed that sex, education, age, and household size were the socioeconomic variables that significantly relates with the performance of participating farmers, but access to credit, extension contact, and input use (seeds and agrochemicals) were critical in enhancing productivity and net returns. This shows the Programme's effectiveness in empowering farmers with the resources and knowledge necessary for market-oriented production.

Among the persistent constraints, ANSVCDP farmers struggled with factors such as unhealthy competition, price volatility, and poor infrastructure among others, while the non-participants faced more severe challenges including limited access to extension services, inadequate capital, poor education, and lack of standardization in market transactions among others. Through the findings, we therefore suggest the need to deepen and scale up VCDP interventions; particularly in areas of market linkages, and infrastructural development to bridge the commercialization gap and improve the standard of living of the rural poor farmers. Policymakers are encouraged to replicate and expand the Programme's support structures across other Southeast states, Nigeria.

6. References

1. Abdulaleem MA, Oluwatusin FM, Kolawole AO. Analysis of costs and returns on maize production among small-scale farmers in Osun State Nigeria. Report and Opinion. 2017;9(5):89-92.
2. Adi SS, Simon BP, Aminu S, Danji MB. Impact of Value Chain Development Programme (VCDP) on the farmers in Ardo-kola Local Government Area of Taraba State, Nigeria. J Agric Vet Sci. 2020;13(3):08-11.
3. Akanle O, Ademuson AO, Adegoke OO, Okewumi EO. Gender and marketing of agricultural produce in Nigeria. Gend Behav. 2019;17(2):12846-58. Available from: https://www.ajol.info/index.php/gab/article/view/188001
4. Alabi OO, Sunday AG, Ebukiba E. Economic impact analysis of Value Chain Development Programme (VCDP) on productivity of rice farmers in Niger State, Nigeria. J Agric. 2023;6(2):76-90. https://doi.org/10.46876/ja.1333493
5. Anosike NM. Assessing the builders' role towards sustainable construction industry development in Nigeria. Int J Innov Res Dev. 2021;10(5). https://doi.org/10.24940/ijird/2021/v10/i5/may21013
6. Ben-Chendo GN, Joseph VN. Comparative analysis of rice productivity of farmers on different land tenure systems in Imo State. Int J Small Bus Entrep Res. 2014;2(3):24-32.
7. Bula YB, Sani MA, Aliyu VO, Inusa EM, Dogo BS. Household consumption and labour participation in Nigeria: Survey-based evidence. Asian Dev Policy Rev. 2023;11(1):12-21. https://doi.org/10.55493/5008.v11i1.4727
8. Chatterjee S, Hadi A. Regression analysis by example. 4th ed. Hoboken: John Wiley & Sons; 2006.
9. Chukwujekwu OA, Nma OO, Ngozi OJ. The effect of input value chain financing on rice farmer's efficiency in IFAD assisted value chain development Programme, Awka. Int J Life Sci Res Arch. 2022;3(1):144-54. https://doi.org/10.53771/ijlsra.2022.3.1.0088
10. De Oliveira RS, Gorgulho BM, De Castro MA, Fisberg RM, Marchioni DM, Baltar VT. Principal component analysis and factor analysis: differences and similarities in Nutritional Epidemiology application. Rev Bras

Epidemiol. 2019;22:e190041. https://doi.org/10.1590/1980-549720190041
11. El-Habil A. An Application on Multinomial Logistic Regression Model. Pak J Stat Oper Res. 2012;8(2):271-91.
12. Fan S, Rue C. The role of smallholder farms in a changing world. In: Gomez y Paloma S, Riesgo L, Louhichi K, editors. The role of smallholder farms in food and nutrition security. Cham: Springer; 2020. p. 13-28. https://doi.org/10.1007/978-3-030-42148-9_2
13. Garson D. Logistic regression with SPSS. Raleigh: North Carolina State University; 2009.
14. Guido T. Principal Components and Factor Analysis. A Comparative Study [Internet]. 2011. Available from: https://www.researchgate.net/publication/233945410_Principal_Components_and_Factor_Analysis_A_Comparative_Study
15. Hair JF, Black WC, Babin BJ, Anderson RE, Tatham RL. Multivariate data analysis. 6th ed. Upper Saddle River: Pearson Prentice Hall; 2006.
16. Haryanto T, Wardana WW, Jamil IR, Brintanti ARD, Ibrahim KH. Impact of credit access on farm performance: Does source of credit matter? Heliyon. 2023;9(9):e19720. https://doi.org/10.1016/j.heliyon.2023.e19720
17. Henning JI, Jammer BD, Jordaan H. Youth participation in agriculture, accounting for entrepreneurial dimensions. South Afr J Entrep Small Bus Manag. 2022;14(1). https://doi.org/10.4102/sajesbm.v14i1.461
18. Ibrahim FD, Adebayo CO, Alegieuno OP, Ibrahim PA. Costs and returns of yam/maize production in Bosso Local Government, Niger State, Nigeria. J Trop Agric Food Environ Ext. 2011;10(3):69-74.
19. Ilona P. Vitamin A cassava in Nigeria: Crop development and delivery. Afr J Food Agric Nutr Dev. 2017;17(2):12000-25. https://doi.org/10.18697/ajfand.78.harvestplus09
20. Ityokumbul VD, Olatide O, Onigbinde D. Effect of Value Chain Development Programme (VCDP) on income and food security of rice farmers in Yewa North and Ijebu North-East, Ogun State, Nigeria [Internet]. 2020. Available from: https://www.researchgate.net/publication/339377235_Effect_of_Value_Chain_Development_Programme_VCDP_on_Income_and_Food_Security_of_Rice_Farmers_in_Yewa_North_and_Ijebu_North-East_Ogun_State_Nigeria
21. Johnson RA, Wichern DW. Applied multivariate statistical analysis. 6th ed. Upper Saddle River: Pearson Prentice Hall; 1998.
22. Kaine AIN. Economic analysis of maize production in Aniocha North Local Government Area, Delta State, Nigeria. Int J Agric Econ Manag. 2016;6(1):9-20.
23. Keghter VS, Malel MF, Birma J, Tijesu OG, Musa SP, Blessing O, *et al*. Profitability and technical efficiency analysis of rice production in Quan' Pan Local Government Area of Plateau State, Nigeria. Turk J Agric Food Sci Technol. 2023;11(6):1096-105. https://doi.org/10.24925/turjaf.v11i6.1096-1105.5827
24. Makinde OG, Akinlabi BH, Adefulu AD, Vyas NNNS. Quality management practices and competitive advantage of selected food and beverage manufacturing firms in Lagos State, Nigeria. Eur J Hum Resour Manag Stud. 2023;6(2). https://doi.org/10.46827/ejhrms.v6i2.1487
25. Meyers LS, Gamst G, Guarino AJ. Applied multivariate research: design and interpretation. Thousand Oaks: Sage; 2006.
26. Obianefo CA, Osuafor OO, Ezeano CI, Anumudu OO. Mediation effect of adopting good agronomic practices on rice productivity in Anambra state, Nigeria. Int J Agric Rural Dev. 2020;23(1):4913-26.
27. Obianefo C, Okoroji N, Obiekwe N, Osuafor O, Shah Z. Economics of good agronomic practices adoption by rice farmers in value chain development Programme, Anambra State, Nigeria. Afr J Food Agric Nutr Dev. 2022;22(113):21308-30. https://doi.org/10.18697/ajfand.113.21425
28. Obianefo CA, Ezeano IC, Isibor CA, Ahaneku CE. Technology gap efficiency of small-scale rice processors in Anambra State, Nigeria. Sustainability. 2023;15(6):4840. https://doi.org/10.3390/su15064840
29. Obianefo CA, Ng'ombe JN, Mzyece A, Masasi B, Obiekwe NJ, Anumudu OO. Technical efficiency and technological gaps of rice production in Anambra State, Nigeria. Agriculture. 2021;11(12):1240. https://doi.org/10.3390/agriculture11121240
30. Obianefo CA, Isibor AC, Umebali EE, Efobi CO. Analysis of the effect of climate-smart agricultural practices (CSAPs) on food security of maize production in Southeast, Nigeria. Int J Multidiscip Res Growth Eval. 2024;5(2):429-40. https://doi.org/10.54660/.IJMRGE.2024.5.2.429-440
31. Ofor-Douglas S. Human resource management as an effective tool for productivity in Nigerian universities. Int J Sci Res Educ. 2021;14(2):223-37.
32. Ogebe F, Olagunju O, Abah D. Access to credit and rice production efficiency of rural households in Benue State, Nigeria. Niger J Agric Agric Technol. 2022;2(1):102-15. https://doi.org/10.59331/njaat.v2i1.18
33. Oluwatusin FM, Sekumade AB. Farm households income sources diversification behaviour in Nigeria. J Nat Sci Res. 2016;6(4):102-11. Available from: https://iiste.org/Journals/index.php/JNSR/article/download/28875/29638
34. Onubogu OH. Gender differences in agricultural productivity among rice farmers in Anambra State, Nigeria: Drivers and strategies for a gender responsive agriculture. Int J Food Sci Agric. 2023;7(1):21-8. https://doi.org/10.26855/ijfsa.2023.03.004
35. Onugu CU, Obianefo CA, Anumba NL. Constraints to adoption of good agronomic practice among rice farmers in Anambra State Value Chain Development Programme. In: Proceedings of the 2nd International Conference on Food Security and Hidden Hunger; 2018 Oct 8-10; Nigeria. p. 55-61.
36. Osabuohien E, Okorie U, Osabohien R. Rice production and processing in Ogun State, Nigeria: Qualitative insights from farmers' association. In: Obayelu AE, editor. Food systems sustainability and environmental policies in modern economics. Hershey: IGI Global; 2018. p. 188-215.
37. Otabor JO, Obahiagbon K. Statistical approach to the link between internal service quality and employee job

satisfaction: A case study. Am J Appl Math Stat. 2016;4(6):178-84. https://doi.org/10.12691/ajams-4-6-3
38. Peng J, Zhao Z, Liu D. Impact of agricultural mechanization on agricultural production, income, and mechanism: evidence from Hubei Province, China. Front Environ Sci. 2022;10:838686. https://doi.org/10.3389/fenvs.2022.838686
39. Sadiq MS. Resource use efficiency of rice farmers participating in Value Chain Development Programme (VCDP) in Niger State of Nigeria. Econ Aff. 2020;65(2). https://doi.org/10.46852/0424-2513.2.2020.1
40. Sadiq MS, Singh IP, Ahmad MM. Effect of IFAD-VCDP on input-output commercialization of rice farmers in Niger State of Nigeria. Alinteri J Agric Sci. 2020;35(2):51-8. https://doi.org/10.47059/alinteri/V35I2/AJAS20075
41. Schoneveld G, Van Der Haar S, Ekowati D, Andrianto A, Komarudin H, Okarda B, *et al*. Certification, good agricultural practice and smallholder heterogeneity: Differentiated pathways for resolving compliance gaps in the Indonesian oil palm sector. Glob Environ Change. 2019;57:101933. https://doi.org/10.1016/j.gloenvcha.2019.101933
42. Shah ZA, Dar MA, Dar EA, Obianefo CA, Bhat AH, Ali MT, *et al*. A multinomial approach to sustainable and improved agricultural technologies vis-a-vis socio-personal determinants in apple (Malus domestica) cultivation. J King Saud Univ Sci. 2022;34(7):102286. https://doi.org/10.1016/j.jksus.2022.102286
43. Tenabe FO, Olayide O. Effect of IFAD value chain development Programme on welfare of smallholder rice and cassava producers in Anambra state, Nigeria [Internet]. 2018. Available from: https://www.researchgate.net/publication/328282907_EFFECT_OF_IFAD_VALUE_CHAIN_DEVELOPMENT_PROGRAMME_ON_WELFARE_OF_SMALLHOLDER_RICE_AND_CASSAVA_PRODUCERS_IN_ANAMBRA_STATE_NIGERIA_FINAL_REPORT
44. Uduji JI, Okolo-Obasi NEV, Asongu S. Analysis of farmers' food price volatility and Nigeria's Growth Enhancement Support Scheme. Afr J Sci Technol Innov Dev. 2021;13(4):463-78.
45. Waziri MS, Abdul SD, Apagu B. Principal component analysis of yield related traits of tropical wheat varieties grown under different irrigation regimes in Bauchi State, Nigeria [Preprint]. 2019. Available from: ResearchGate
46. Yapicioglu B, Mogbo ON, Yitmen I. Innovative strategies for transport policies in infrastructure development: Nigerian stakeholders' perspective. Int J Civ Eng. 2017;15(5):747-61. https://doi.org/10.1007/s40999-017-0172-0