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Effect of FGN-IFAD Value Chain Development Programme on the Commercialization, Welfare and Performance of Rice Farmers in Anambra State, Nigeria

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Abstract

This study on the effect of the FGN-IFAD Value Chain Development Programme on the commercialization, welfare, and performance of rice farmers in Anambra State, Nigeria, randomly sampled 380 respondents. The study employed budgetary technique, and Heckman Double Hurdle regression. The study revealed that rice production was evenly (50.0%) represented by both male and female; while the enterprise is male-dominated (67.4%) among nonparticipants. The participating farmers are approximately 40 years old, whereas the nonparticipants are 51 years old. The majority (50.5%) of participants sell their produce in an off-taker arrangement, whereas the majority (65.8%) of nonparticipants sell in an open market. We observed that farming experience (3.76)***, and extension contact (4.94)*** among others, positively influenced VCDP farmers' decision to participate in commercialization, whereas age (2.91)** and farm size (2.24)** influenced nonparticipating farmers' decision to commercialize. Again, the extent of commercialization was influenced by output/quantity produced (99.81)*** and quantity sold (101.01)*** among others. The same variables (-36.81*** - quantity produced and 40.65*** - quantity sold), along with labour cost (3.37)*** influenced nonparticipants. Equally, VCDP has highly impacted the growth of farm productive assets (0.823), among others, which is moderately (0.572) impacted among the nonparticipants due to the indirect effect of the programme on non-beneficiaries. Furthermore, the study revealed that VCDP farmers recorded a higher return on investment (1.27), compared to the nonparticipants (0.51), which was significantly different at a 60.62*** level of significance. We therefore recommend VCDP programme to be scaled-up to other nonparticipating Southeast states for agricultural sustainability and food security.

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1. Introduction

Agriculture remains a vital sector in Nigeria's economy, providing employment and sustenance for a significant portion of the population. In recent years, there has been a growing recognition of the importance of value chain development in enhancing the welfare, and overall performance of smallholder farmers. One of such initiative is the Federal Government of Nigeria (FGN) and International Fund for Agricultural Development (IFAD) Value Chain Development Programme (VCDP), which aims to improve the livelihoods of rice farmers in Anambra State, Nigeria (Obianefo *et al.*, 2022) [33]. Reiteratively, agriculture continues to play a crucial role in the economic development of many countries in sub-Saharan Africa (Frimawaty, *et al*., 2013; Osmani and Hossain, 2015; Anumudu, *et al*., 2020; Obianefo, *et al*., 2021) [18, 6, 41, 37].

It has been reported that a significant proportion of Nigerians, approximately 70%, depend on the agricultural sector for their livelihood (Ike and Ugwumba, 2015; Egbetokun *et al.*, 2017; Obianefo, *et al*., 2019) [23, 16, 31]. Agriculture plays a vital role in promoting food security, reducing poverty, enhancing livelihoods, and driving rural development and economic growth (Mwangi & Kariuki, 2015) [30]. Particularly in the developing world, agriculture serves as the primary source of income for rural communities, and efforts have been made to improve the well-being of these communities (World Bank, 2008).

However, agricultural practices in developing economies, especially in the context of subsistence-level rice farming, often rely on traditional methods of production, resulting in low agricultural productivity. This subsistence nature of rice production limits farmers' income and profit levels, agricultural productivity, welfare, and overall livelihood standards. To address this issue, there is a need to enhance productivity and sustainability in agriculture globally, with a specific focus on agricultural program interventions (Muzari *et al.*, 2012) [29]. Gbolagade *et al.* (2015) [19] propose that one effective method to bolster rural communities is by implementing intervention programs that generate employment opportunities or provide alternative livelihoods. Such interventions have the potential to enhance agricultural productivity, influence farmers' commercialization index, and elevate the welfare standards and overall livelihoods of smallholder rice farmers who predominantly engage in subsistence farming methods (Chukwulobelu *et al*., 2024) [13]. The study conducted by Challa (2013) [12] underscores the imperative to augment agricultural production to meet the anticipated rise in demand. Therefore, it is crucial to scrutinize the recent performance of the agricultural sector, particularly through the implementation of intervention programs that advocate for the adoption of modern agricultural technologies. The IFAD-assisted Value Chain Development Programme, among other rural interventions, stands out as a project that advocates for the use of modern technology in agriculture to enhance the welfare of rural populations. These technologies, such as weather smart readers, power tillers, standardization tools for weight and measure, and innovative parboiling techniques, facilitated by agricultural program interventions, have contributed to the growth of agricultural output.

Intervention programs like the IFAD Value Chain Development Programme adopt strategies aimed at bolstering agricultural performance and elevating the commercialization index of farmers (Bamidele *et al*., 2019). These strategies encompass the promotion of new and improved varieties of rice seedlings and cassava stems, soil fertility management, weed and pest control, irrigation, and water management, among others (Obianefo *et al*., 2022) [33]. By optimizing input/output relationships, new technologies tend to enhance output and reduce average production costs, thereby increasing productivity and improving the performance of farmers. Consequently, substantial gains in the commercialization index of farmers and better welfare packages are achieved (Loevinsohn *et al.*, 2013; Challa, 2013) [12, 27].

However, the federal and state governments have made a concerted effort to transform the Nigerian agricultural sector, moving away from subsistence farming practices that barely improve the standard of living (Kumane *et al.*, 2015) [26]. These efforts, such as the payment of counterpart funds to IFAD-funded projects, are aimed at achieving food self-sufficiency and earning foreign exchange through the exportation of agricultural products. FMARD/IFAD (2017) attributes these government interventions to increased financial accessibility for the beneficiaries in the form of inputs and technology promotion to alleviate food shortages in the face of a growing population.

The Federal Government of Nigeria, referred to as the Borrower, secured funding from the International Fund for Agricultural Development (IFAD), referred to as the lender, to initiate a program. This program, officially approved on October 26, 2012, has as its primary objective the provision of direct benefits to 17,480 households, including 15,000 smallholder farmers, 1,680 processors, and 800 traders. Additionally, it aims to indirectly impact 22,000 households (FMARD/IFAD, 2017).

Idongesit and Oto (2021) noted that rice production in Nigeria encompasses a wide range of activities, from land preparation, and cultivation up to postharvest management. Notably, this study is distinctive in its comprehensive examination of various livelihood indicators of the VCDP, particularly through the comparison of commercialization abilities between program participants and non-participants involved with rice production. This approach not only addresses a significant gap in the existing literature but also provides valuable insights for policymakers to make informed decisions regarding agricultural development initiatives. Obianefo *et al.* (2023) [36] noted that the programme beneficiaries participate through a government-recognized cooperative organization. These farmers are supported with training, land development, input subsidies, linkages to off-takers, and mechanization equipment. It is worth noting that the IFAD VCDP was initiated to offer solutions to some of the problems confronting the rice value chain actors concerning low productivity, limited access to markets, inadequate infrastructure, and post-harvest losses (FMARD/IFAD, 2017). The primary focus of the program is on poor rural households engaged in the cassava and rice production, specifically those cultivating less than 5 hectares of land in either rice or cassava. The VCDP lays particular emphasis on women and youth, the main goal of the program is to reduce poverty and stimulate economic growth. The program aims to increase incomes and food security for 15,000 rural households involved in the production, processing, and marketing of rice and cassava within the targeted Local Government Areas of the nine participating states in a sustainable manner (Obianefo, 2019) [31]. Moreover, while this study focuses on Anambra State, its findings are expected to have broader implications for Nigeria and Africa as a whole. By shedding light on the effectiveness of the FGN-IFAD VCDP in enhancing the commercialization, welfare, and performance of rice farmers, this research contributes to the advancement of knowledge in this field and offers practical recommendations for improving agricultural development strategies.

The specific objectives are to:

- Describe the socioeconomic characteristics of rice farmers in the FGN-IFAD VCDP programme for better policy-making
- Examine the determinants and extent of commercialization index by rice farmers
- Ascertain the welfare status of the rice farmers in FGN-

IFAD VCDP programme, and estimate the performance (net returns) of the participating and non-participating rice farmers.

1. Review of related empirical studies

Several empirical evidence existed to show the relevance of this study. Amfo *et al*. (2023) [5] on rice marketing outlets, commercialization, and welfare in rural Ghana, observed that rice farmers in rural Ghana sell their produce through different outlets such as farm gates, processing centers, and local, district, or regional capital markets. The study revealed that approximately 62% of farmers primarily produce rice for sale, and around 70% of the rice produced in rural Ghana is eventually sold. Factors such as access to credit, membership in agricultural associations, farm size, production of irrigated rice, and engaging in commercial production were found to positively influence rice commercialization.

Adetomiwa, *et al.* (2021) [2] examined the welfare and productivity impact of adopting bio-fortified cassava among smallholder farmers in Nigeria. The findings indicated that the adoption of bio-fortified cassava led to increased farm yield, farmers' income, and overall welfare. The study also revealed that the distributional impact of the adoption of bio-fortified cassava varied based on factors such as gender and farm size. Again, Ayinde (2016) [8] study aimed to investigate the risks involved in the adoption of vitamin A cassava variety, the risk attitude of cassava farmers, and the factors influencing farmers' risk attitudes toward the production of vitamin A cassava. The study found that risks associated with adopting the improved cassava variety included animal invasion, price fluctuations, and inadequate storage facilities. The majority of farmers (88.3%) were risk-neutral, while only 16% were risk-takers. Additionally, age, income from other activities, and estimated annual income were identified as factors influencing farmers' risk attitudes.

In a study conducted by Abraham *et al.* (2014) [1] on the determinants of commercial production of rice in rice-producing areas of Kwara State, Nigeria. The results from the commercialization index function revealed a household commercialization index of 62% for rice production. Key factors significantly influencing the commercialization of rice production in the study area included educational level ($p<0.05$), farming experience ($p<0.01$), farm size ($p<0.01$), and utilization of modern technology ($p<0.05$). Similarly, Oluwatosin (2023) [40] investigated the determinants of agricultural commercialization among smallholder rice farmers in Ekiti-State, Nigeria. The findings indicated a 64% achievement in the commercialization index. The study revealed that men were more involved in rice production than women, regardless of their commercialization status. Commercializing respondents were observed to produce more rice compared to their non-commercializing counterparts. Determinants influencing the decision to commercialize and intensify commercialization included education, earning income from other crops, access to credit, membership in agricultural production groups, and reduced transportation costs. In a study conducted by Awotide *et al.* (2016) [7] on agricultural technology adoption, commercialization, and smallholder rice farmers' welfare in rural Nigeria using Tobit and Heckman two-stage models. The results indicated that any enhancement in farmers' welfare is contingent upon their participation probability in rice output markets. Additionally, higher yield, income from rice production, gender of household head, and years of formal education emerged as variables positively and significantly influencing households' welfare.

Alhassan *et al*. (2019) [4] on the impact of the IFAD program on the income of rice value chain producers in Agricultural Zone III of Niger State, Nigeria, involved a sample of 123 rice producers and employed descriptive statistics and linear regression for data analysis. The findings revealed that 75.6% of the respondents were male, with a mean age of 38.0 years. Also, Sadiq *et al*. (2021) [45] conducted a study on the Profitability and Constraints of the IFAD/VCD Rice Project Among Smallholder Farmers in Niger State, Nigeria. The study found that the accrued economic revenue, gross margin, and net income from rice production were N543,429.60, N415,753.50, and N384,636.00, respectively. Authors like Obianefo *et al.* (2019) [31] primarily focused on the socioeconomic characteristics, profitability, and challenges faced by rice farmers. The findings showed that the mean age of farmers was 47 years for rainfed farming and 46 years for the dry season. Additionally, the mean farming experience was 11 years for rainfed farming and 15 years for dry season rice farming. The mean farm size was 1.98 hectares for rainfed farming and 1.14 hectares for the dry season. Importantly, the study revealed a significant difference in profit, amounting to N72,794.81, with a t-value of 22.83**.

2. Research Methodology

2.1 Study Area

Anambra State, situated in the southeastern part of Nigeria, consists of 21 Local Government Areas (LGAs): Aguata, Awka North, Awka South, Anambra East, Anambra West, Anaocha, Ayamelum, Dunukofia, Ekwusigo, Idemili North, Idemili South, Ihiala, Njikoka, Nnewi North, Nnewi South, Ogbaru, Onitsha North, Onitsha South, Orumba North, Orumba South, and Oyi. 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. 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.

Regarding the original project implementation, the LGAs involved were Anambra East and West, Ayamelum, Orumba North, and Awka North. These LGAs were selected due to their comparative advantage in rice and cassava production, making them suitable host communities for the value chain programme (IFAD/ANSVCDP, 2017). In 2019, the project received additional financing for a 3-year extension, which included the incorporation of three more LGAs: Ogbaru, Ihiala, and Orumba South.

Obianefo *et al*. (2020b) conducted a study that shed light on the program's activities. These activities encompassed

strengthening farmers' organizations in terms of governance and business development, providing training and capacity building, offering 50% input support to farmers, allocating 70% support for farm machinery, facilitating land development for mechanized agriculture, constructing farm access roads, providing 100% support for market infrastructure and storage facilities, establishing linkages to ready markets, extending 90% support for the construction and rehabilitation of processing centers, and other related initiatives. These efforts aimed to alleviate rural poverty and enhance livelihood opportunities. The program also collaborated with financial institutions such as First City Monument Bank (FCMB), First Bank, and various microfinance banks (LAPO, Ndiolu, Uzondu, Oraukwu, and Ihiala MFB) to deliver value chain financing as a means of ensuring project sustainability. Furthermore, in order to promote sustainability and food security, the program partnered with the Nigerian Agricultural Insurance Corporation (NAIC) to manage risks, reduce loan defaults, and enhance overall management.

2.2 Sampling Procedure

The study will employ a multi-stage sampling technique to determine the appropriate sample size. The first stage involved collecting a sample frame, which is a list of rice farmers in the programme from the program database officer. The sample frame comprises 8,480 farmers (male – 4452, and female – 4029).

To ensure a representative sampling of the VCAs, the Taro Yamane sample size determinantion technique was adopted from Otabor and Obahiagbon (2016) [42] 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 ≈ 380 rice farmers

In the second stage, IFAD VCDP is currently being implemented in eight Local Government Areas (LGAs) of Anambra State, namely Anambra East, Anambra West, Ayamelum, Awka North, Ihiala, Ogbaru, Orumba North, and Orumba South. From each of these LGAs, two communities will be purposively selected due to high dominance of rice farmers, and within each community, four villages will be purposively selected, resulting in a total of sixty-four (64) villages.

In the last stage, approximately 6 rice farmers will be randomly selected from sixty-three (63) villages and two from one village to make the sample exactly three hundred and eighty rice farmers comprising 50% of programme participants and 50% of non-participants. The researcher will keep focus on the sample size (190 participants and 190 non-participants).

2.3 Methods of data collection

Data for the study was primarily sourced. Primary data was collected using a structured questionnaire and interview schedule with the rice farmers. This structured questionnaire was coded in the Kobocollect Android toolkit. The tool kit is a digital data collection approach where the coded information is restricted to reduce malpractices, speed up data collection and data entry process for accurate analysis (Obianefo *et al.*, 2024) [38]. 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 in the field to collect the required data for the study. The data collected includes information on the rice farmers' socioeconomic characteristics, marketing outlet, commercialization information, performance, welfare status, and the outcome of the program interventions.

3.4 Data Analysis

A combination of analytical techniques were used to operationalize the objectives of the study. The statistical technique include descriptive statistics (frequency, percentage, and mean), budgetary technique, and Heckman double-stage selection model. The Heckman double-stage selection model was used to estimate the determinants of commercialization and extent of commercialization as adopted from Anumudu *et al.* (2020) [6] and defined as:

Stage 1: Selection equation

$$d_i = \gamma_0 + \gamma_1 X_{1i} + \gamma_2 X_{2i} + \gamma_3 X_{3i} + \cdots \gamma_8 X_{8i} + \mu_i$$

Stage 2: outcome equation

$$y_i = \beta_0 + \beta X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \cdots \beta_{12} X_{12i} + \delta d_i + \varepsilon_i$$

Where:
y_i denotes the commercialization index for farmer *i*, the index takes the value of 0 if it falls between 0 and 0.49, and 1 if it falls between 0.5 and 1.
d_i denote the selection indicator, which takes the value of 1 if the farmer is observed (included in the sample), and 0 otherwise.
x_{1i}, x_{2i}, x_{3i}, x_{4i}, … x_{8i} denote the independent variables for farmer *i*:

X1 = age (year)
X2 = gender (dummy: 1 = male, 0 = female)
X3 = farming experience (years)
X4 = farm size (ha)
X5 = level of education (years spent in school)
X6 = access to credit (amount received in Naira [N])
X7 = household size (number of people)
X8 = extension contacts (in number of visits)
X9 = primary occupation (1 if farming, 0 if otherwise)
X10 = selling price (Naira)
X11 = quantity sold (in kg)
X12 = farm labour (in man-days)
X13 = transportation cost (in Naira)
ϵ_i is the error term assumed to be uncorrelated with x_i, d_i

δ captures the effect of selection bias. The model assumes that u_i and ϵ_i are distributed normally.

3. Results and Discussion

To enhance understanding of the program's intervention effects, the analysis was conducted comparatively to clearly highlight the differences in economic opportunities between participants and non-participants.

3.1 Socioeconomic Characteristics of Rice Farmers

The results of the socioeconomic characteristics of rice farmers were presented in Table 1, and discussed under the following subheading:

Sex: The data shows that ANSVCDP rice farmers have an equal distribution of males and females (50.0% each), whereas non-ANSVCDP rice farmers are predominantly male (67.4%). This indicates that the ANSVCDP initiative promotes gender inclusivity more effectively than non-ANSVCDP farming, where males dominate. The implication is that gender equality in participation may lead to more diverse perspectives and innovations in rice farming practices within the ANSVCDP group. The result for non-ANSVCDP farmers corroborates the result of Alhassan *et al*. (2019) [4] who reported 86.3% male dominance among non-participants of the ATASP-1 program.

Age: A significant portion (43.7%) of ANSVCDP rice farmers fall within the 30-39 age range, suggesting they are generally in the prime age for active farming. In contrast, non-ANSVCDP farmers have a substantial (35.8%) number of older farmers (60 and above), indicating a potentially aging farmer population. Again, the average age of rice farmers participating in ANSVCD was 40.2 and 51.1. This demographic difference implies that ANSVCDP might be more appealing or accessible to younger farmers, which could ensure sustainability and long-term productivity in the rice sector. The result of the participants was in agreement with the report of Baddianaaha *et al*. (2021) [10] who reported an average of 41 years for their responses.

Marital Status: The majority of farmers in both groups are married (65.3% - participants, and 66.8% - non-participants), but there is a higher proportion of widows in the ANSVCDP group (25.8% vs. 6.3%). This could imply that the ANSVCDP program provides support or opportunities for widowed rice farmers, who might otherwise face economic challenges. Supporting widows can enhance their welfare and stability, positively impacting rice production by maintaining an active workforce. This result corroborates the result of Obianefo *et al*. (2019) [31] who reported that the majority (70%) of their respondents were married.

Educational Qualification: ANSVCDP participants have higher levels of formal education, with a greater proportion having secondary education (48.9%) and primary school (33.7%) compared to non-participants (secondary education (25.3%) and primary school (22.6%). Education is linked to better farming practices and innovation adoption. Thus, higher educational attainment among ANSVCDP farmers could lead to improved farming techniques and productivity (Kabiru, and Arshad, 2019) [24]. ANSVCDP is sensitizing graduates to take agribusiness as a means of livelihood opportunity.

Farming Experience: ANSVCDP farmers have less experience on average (13.69 years) compared to non-ANSVCDP farmers (18.73 years). While more experience is generally beneficial, younger farmers with less experience but better education and support (as provided by ANSVCDP) can also be highly productive, potentially bringing new ideas and methods to farming.

Household Size: ANSVCDP farmers tend to have larger households, with an average size of 9.69 compared to 7.73 for non-ANSVCDP farmers. Larger households can provide more labour for farming activities, which might be an advantage for productivity, especially in labour-intensive activities like rice farming. The average household size for non-participants was in agreement with the 7 people per household reported in Baddianaaha *et al*. (2021) [10]

Extension Contact: ANSVCDP farmers have more frequent contact with extension services (approximately 5 times) compared to non-ANSVCDP farmers (approximately 3 times). Regular extension services provide farmers with up-to-date information on best practices, pest management, and technological advancements, likely leading to improved farming performance and productivity.

Farm Size: ANSVCDP farmers generally manage larger farms, with 72.6% having over 1.5 hectares, while most non-ANSVCDP farmers (94.2%) manage less than 1 hectare. The average farm size for both groups is 1.88 (participants), and 0.58 (non-participants) hectares respectively. Larger farm sizes in the ANSVCDP group suggest a greater capacity for commercial farming, which can lead to higher outputs and economies of scale.

Access to Credit: A higher proportion of ANSVCDP farmers (41.6%) have access to credit compared to non-ANSVCDP farmers (24.7%). Access to credit enables farmers to invest in better inputs, equipment, and technologies, leading to enhanced productivity and commercialization of rice farming.

Loan Amount: ANSVCDP farmers generally receive larger loan amounts, with an average of N73,030.00 compared to N38,621.05 for non-ANSVCDP farmers. Higher loan amounts provide greater financial capacity for improvements and expansions in farming operations. Probably due to the programme on financial literacy, the farmers under the programme have better access to credit compared to non-participants

Main Occupation: The majority of ANSVCDP farmers (77.9%) list farming as their main occupation, compared to only 32.1% of non-ANSVCDP farmers. This indicates a higher level of commitment and focus on farming within the ANSVCDP group, which is likely to translate into better farm management and productivity. Equally, farmers who view farming as their main occupation are likely to be more dedicated and efficient, contributing to higher productivity (Anyiam *et al*., 2019).

However, from the results, the ANSVCDP appears to have a positive impact on the commercialization, welfare, and performance of rice farmers in Anambra State, Nigeria. The programme's support in terms of gender equality, educational opportunities, access to credit, and extension services is likely to lead to sustainable improvements in the rice production sector.

Table 1: Socioeconomic characteristics of rice farmers

	Participants			Non-Participants		
Variables	**Frequency**	**Percentage (%)**	**Mean**	**Frequency**	**Percentage (%)**	**Mean**
Sex:						
Female	95	50.0		62	32.6	
Male	95	50.0		128	67.4	
Age (Years):						
Less than equal to 29	41	21.6		32	16.8	
30 - 39	83	43.7		28	14.7	
40 - 49	40	21.1	40.2	26	13.7	51.1
50 - 59	14	7.4		36	18.9	
60 and above	12	6.3		68	35.8	
Marital status:						
Single	8	4.2		11	5.8	
Married	124	65.3		127	66.8	
Separated	9	4.7		40	21.1	
Widow	49	25.8		12	6.3	
Educational Qualification						
No formal education	0	0		9	4.7	
Primary School	29	15.3		43	22.6	
Secondary school	93	48.9		48	25.3	
Tertiary education	64	33.7		40	21.1	
Postgraduate	4	2.1		50	26.3	
Farming experience						
1 - 5 years	3	1.6		0	-	
6 - 10 years	41	21.6		32	16.8	
11 - 15 years	86	45.3	13.7	36	18.9	18.7
16 - 20	47	24.7		42	22.1	
21 and above	13	6.8		80	42.1	
Household size:						
Less than 6	14	7.4		60	31.6	
6 - 10 People	97	51.1	9.69	76	40	7.73
Above 10 People	79	41.6		54	28.4	
Extension contacts						
1 - 3 Times	33	17.4		125	65.8	
4 - 6 Times	98	51.6	5.37	65	34.2	2.61
Above 6	59	31.1		0	-	
Farm Size:						
0 - 0.50 Ha	2	1.1		81	42.6	
0.51 - 1.0- Ha	11	5.8		98	51.6	
1.01 - 1.50 Ha	39	20.5	1.88	9	4.7	0.58
Above 1.50 Ha	138	72.6		2	1.1	
Access to credit:						
No	111	58.4		143	75.3	
Yes	79	41.6		47	24.7	
Loan amount:						
0 - 50,000	119	62.6		147	77.4	
50,001 - 200,000	42	22.1	73,030.00	28	14.7	38,621.05
200,001 - 350,000	27	14.2		15	7.9	
Above 350,000	2	1.1				
Main Occupation:						
Farming	148	77.9		61	32.1	
Civil service	4	2.1		35	18.4	
Trading	15	7.9		25	13.2	
Artisan	12	6.3		26	13.7	
Others	11	5.8		43	22.6	

Source: Field Survey, 2024.

4.2 Marketing Outlets Operated by Participating and Non-Participating Rice Farmers

Table 2 provides quality information about the different marketing outlets used by ANSVCDP and non-ANSVCDP rice farmers:

- **Farm-gate:** it was uncovered that 28.4% of ANSVCDP farmers sell their rice at the farm-gate, compared to 26.8% of non-ANSVCDP farmers. Both ANSVCDP and non-ANSVCDP farmers show similar percentages for farm-gate sales. Selling at the farm-gate often involves lower transaction costs and immediate cash but typically results in lower prices due to limited bargaining power and market reach. The similar percentages indicate that both groups find this outlet viable, possibly due to convenience or immediate financial needs (Clark, 2020).
- **Open market:** equally, a significantly higher percentage

of non-ANSVCDP farmers (65.8%) sell their rice in open markets compared to ANSVCDP farmers (21.1%). The open market provides a wider customer base and potentially better prices than farm-gate sales, but it also involves higher costs and risks associated with transportation, market fees, and price fluctuations. The high reliance on open markets among non-ANSVCDP farmers might indicate a lack of access to more stable and structured marketing channels.

- **Structured market/off-taker arrangement:** furthermore, a notable difference is observed in the use of structured markets or off-taker arrangements, with 50.5% of ANSVCDP farmers utilizing these channels compared to only 7.4% of non-ANSVCDP farmers. Structured markets and off-taker arrangements often provide farmers with pre-agreed prices, reduced market risks, and reliable buyers, leading to better income stability and potentially higher prices. This substantial use among ANSVCDP farmers was in agreement with Alabi *et al*. (2023) [3] who found that the Value Chain Development Programme effectively connects farmers to more formalized and potentially more profitable marketing channels.

Table 2: Marketing outlets operated by rice farmers

	Participants		Non-participants	
Market outlet	**Frequency**	**Percentage (%)**	**Frequency**	**Percentage (%)**
Farm-gate	54	28.4	51	26.8
open market	40	21.1	125	65.8
Structured market/off-taker arrangement	96	50.5	14	7.4
Total	190	100.0	190	100.0

Source: Field Survey, 2024.

The higher usage of structured markets and off-taker arrangements by ANSVCDP farmers suggests enhanced commercialization of rice farming under the Value Chain Development Programme. By securing stable and often better-priced markets, farmers can invest more confidently in production inputs, leading to improved yields and quality. Also, structured markets provide income stability, reducing the financial vulnerability of farmers (Harkness *et al*., 2021) [20]. This stability can lead to better welfare outcomes for farmers and their families, allowing them to plan and invest in long-term improvements, such as education and healthcare. Thus, the ANSVCDP has significantly influenced the marketing strategies of rice farmers in Anambra State, Nigeria. By facilitating access to structured markets and off-taker arrangements, the program has improved the commercialization, welfare, and performance of participating farmers.

4.3 Determinants of Commercialization and Extent of Commercialization of the Participating and Non-participating Rice Farmers

The Heckman double hurdle model results for the determinants and extent of commercialization of rice farmers in Anambra State, Nigeria, presented in Table 3 offered several insights into the impact of the FGN-IFAD Value Chain Development Programme (VCDP) on participants and non-participants.

The analysis was done in R software with an open directory. The non-significant Inverse Mill Ratio (IMR) in the outcome equation of the Heckman double hurdle model suggests that there is no substantial selection bias affecting the extent of commercialization outcome. Again, the non-significant IMR indicates that the factors influencing the decision to participate in commercialization do not systematically differ from those influencing the extent of commercialization. Equally, a sigma value of 0.010 (ANSVCDP farmers) and 0.046 (non-ANSVCDP farmers) in the Heckman double hurdle model indicates very low variability in the extent of commercialization among participating and non-participating rice farmers. This implies high precision in the model's predictions, suggesting that the factors included in the model effectively explain the extent of commercialization better with participating farmers.

Furthermore, the rho value of 0.399 indicates a positive correlation between the error terms of the selection equation and the outcome equation. This suggests that unobserved factors that increase the likelihood of participating in commercialization also tend to increase the extent of commercialization among participants. Lastly, the rho value of -1.189 indicates a strong negative correlation between the error terms of the selection equation and the outcome equation. This suggests that unobserved factors that increase the likelihood of participating in commercialization tend to decrease the extent of commercialization among non-participants.

Determinants of Commercialization (Selection Equation)

The negative and significant coefficient (β = -1.496) of sex indicates that female farmers are more likely to participate in rice commercialization compared to male farmers. This suggests that the ANSVCDP is effectively targeting and supporting female farmers, likely through specific policies and incentives aimed at increasing their participation in commercial farming. This focus can help in empowering women economically and promoting gender equality in the agricultural sector. This finding contradicts the report of Anumudu *et al*. (2020) [6] who found that male participation is more. Again, the positive but non-significant coefficient (0.234) suggests no clear gender preference in commercialization among non-participants. Howbeit, the programme's focus on gender inclusivity is encouraging more women to engage in commercial rice farming, which could enhance household incomes and economic diversity.

The negative and significant coefficient (β = -0.034) of age at 5% implies that younger farmers are more likely to participate in commercialization under the VCDP. This aligns with the programme's goal to attract younger individuals to agriculture. Again, the positive and significant coefficient (β = 0.016) shows that older farmers are more inclined to commercialize rice production without the programme's intervention, likely due to their accumulated experience and access to productive resources. Notably, the VCDP's efforts to involve younger farmers may lead to a more sustainable and innovative agricultural sector in the

long run.

The negative and significant coefficient (β = -0.347) of education at the 1% level suggests that higher education levels reduce the likelihood of participation. This might indicate that educated individuals may pursue other opportunities or perceive agriculture as less attractive. This result contradicts the result of Oluwatosin (2023) [40] who found a positive relationship with education in and decision to commercialize in their study. The non-significant coefficient (β = -0.017) suggests education does not significantly influence commercialization decisions among the non-ANSVCD rice farmers. There is a need to make agricultural entrepreneurship more appealing to educated youths, possibly through better marketing of its profitability and providing advanced agricultural training.

The positive and significant coefficient (β = 0.191) for farming experience at a 1% level indicates that more experienced farmers are more likely to participate in commercialization by 19.1%. again, the negative and significant coefficient (β = -0.030) for non-ANSVCD rice farmers, suggesting experienced farmers are less likely to commercialize outside the program. VCDP seems to leverage experienced farmers for successful commercialization, possibly providing a mentoring role to less experienced participants. The result for participants corroborates the assertion of Abraham *et al*. (2014) [1] who noted that farming experience positively relates with commercialization decision.

The positive and significant coefficient (β = 0.691) for household size at the 1% level indicates larger households are more likely to commercialize by 69.1%, possibly due to more available labour. The variable is not significant for non-ANSVCDP farmers. Equally, large households provide the labour necessary for commercial farming, emphasizing the need for family-based agricultural support programs.

The positive and significant coefficient (β = 0.611) for extension contacts at a 1% level showed that access to extension services significantly increases commercialization likelihood by 61.1%. Effective extension services are critical in promoting agricultural commercialization among VCDP participants.

The positive and significant coefficient (β = 0.634) for farm size at a 5% level indicates that larger farms are more likely to commercialize outside the programme by 21.0%. Farm size plays a more critical role for non-participants, suggesting VCDP helps smaller farms overcome commercialization barriers. This result was in agreement with Amfo *et al*. (2023) [5] who found that farm size has a positive relationship with commercialization decision.

The positive and significant coefficient (β = 1.566) for access to credit at a 1% level indicates that access to credit strongly promotes commercialization among ANSVCDP rice farmers. Credit access is vital for commercialization, and the VCDP effectively facilitates this for participants through the financial inclusion mainstreaming component of the programme. Anumudu (2020) [6] noted that access to credit and extension services are crucial for commercialization, highlighting areas for policy focus and government investment.

Extent of Commercialization (Outcome Equation)

The coefficient (β = -0.013) of sex was negative and significant at a 1% level of probability for ANSVCDP participants, being male negatively impacts the extent of commercialization, indicating that female farmers might be more intensively commercializing their produce by 1.3%. The VCDP's focus on women could lead to increased household income and improved gender equity in the agricultural sector. The women's extent of commercialization could be engineered by the fact that the programme specifically develops land for women and youth to improve their access to land. The result of this study was not in line with Awotide *et al*. (2016) [7] who found a significant and positive relationship with the gender of the household head in their study.

A negative and significant coefficient (β = -0.001) for farming experience at a 1% level suggests that more experienced farmers in ANSVCDP might diversify rather than intensify commercialization. This diversification has been identified as a security measure in the agricultural sector (Alabi *et al*., 2023) [3]

The positive and significant coefficient of household size (β = 0.001), extension contacts (β = 0.002), and farm size (β = 0.005) all at a 5% level of probability, implied that the said variables increase the extent of commercialization among the programme farmers by 0.01% (household size), 0.02% (extension contacts), and 0.5% (farm size). These results were consistent with the reports of Alabi *et al*. (2023) [3]; Amfo *et al*. (2023) [5] who reported a similar increase to the commercialization index resulting from the aforementioned variables.

The coefficient of labour was negative and significant at 5% and 1% levels for ANSVCDP rice farmers and non-ANSVCDP rice farmers respectively. Though the outcome value is negligible, it implies that the extent of commercialization is reduced as the number of idle labour forces increases (Otekunrin, 2023) [43]. Equally, higher labour costs could be a barrier, suggesting a need for more efficient labour use or mechanization.

The coefficient of transportation cost (β = 0.000) was positive and significant at a 1% level of probability, this implied that as ANSVCDP farmers incur transportation costs, their extent of commercialization increases to a negligible value.

Both groups show a strong negative effect for output or quantity of rice produced (β = -0.081: ANSVCDP farmers and β = 0.006: Non-ANSVCDP farmers) at a 1% level, indicating that higher outputs correlate with lower commercialization levels, suggesting saturation points in the market or issues in selling larger volumes.

Again, both groups showed a strong positive effect on the quantity of rice sold (β = 0.096: ANSVCDP farmers, and 0.354: Non-ANSVCDP farmers) at a 1% level of probability, indicating that the more rice sold, the higher the commercialization extent. This result was in agreement with Anumudu *et al*. (2020) [6] who found positive relationship between the extent of commercialization and quantity sold.

Overall, the findings suggest that the FGN-IFAD VCDP is effective in promoting commercialization among rice farmers, particularly by involving women, and younger farmers, and providing necessary support through credit and extension services. The programme's strategies could serve as a model for other agricultural initiatives aiming to enhance commercialization and welfare in the sector. Null hypothesis two was rejected based on positive and significant relation between and socioeconomic characteristics and commercialization such as farming experience, household size, extension contacts, and access to credit.

Table 3: Determinants of commercialization and extent of commercialization of rice farmers

	Participants			Non-participants		
Selection equation	**Estimate**	**Std. Error**	**t value**	**Estimate**	**Std. Error**	**t value**
(Intercept)	-5.821	1.541	-3.78	-0.755	0.557	-1.36
Sex	-1.496	0.455	-3.29***	0.234	0.209	1.12
Age	-0.034	0.013	-2.56**	0.016	0.005	2.91***
Level of education	-0.347	0.063	-5.49***	-0.017	0.014	-1.23
farming experience	0.191	0.051	3.76***	-0.030	0.014	-2.16**
Household size	0.691	0.119	5.79***	-0.023	0.027	-0.85
Extension contacts	0.611	0.124	4.94***	0.079	0.056	1.41
Farm size	0.210	0.304	0.69	0.634	0.283	2.24**
Access to credit	1.566	0.447	3.50***	-0.191	0.225	-0.85
Outcome equation	Estimate	Std. Error	t value	Estimate	Std. Error	t value
(Intercept)	0.842	0.013	63.06	0.764	0.128	5.98
Sex	-0.013	0.002	-6.29***	-0.021	0.017	-1.27
Age	0.000	0.000	-0.92	0.000	0.001	-0.26
Level of education	0.000	0.000	-0.33	0.000	0.001	0.14
Farming experience	-0.001	0.000	-3.23***	0.000	0.002	0.14
Household size	0.001	0.000	2.43**	0.001	0.002	0.78
Extension contacts	0.002	0.001	2.83**	0.003	0.005	0.49
Farm size	0.005	0.002	2.99***	-0.027	0.039	-0.69
Access to credit	0.003	0.002	1.58	-0.005	0.014	-0.36
Labour	0.000	0.000	-2.41**	0.000	0.000	-3.37***
Transport cost	0.000	0.000	3.12***	0.000	0.000	1.01
Output	-0.081	0.001	-99.81***	-0.235	0.006	-36.81***
Quantity sold	0.096	0.001	101.01***	0.354	0.009	40.65***
Selling price	0.000	0.000	-1.58	0.000	0.000	-1.30
Error terms:	Estimate	Std. Error	t value			
Inverse of Mills Ratio	0.004	0.005	0.81	-0.054	0.097	-0.56
Sigma	0.010			0.046		
Rho	0.399			-1.189		

***Source*:** Field Survey, 2024. Sig. @ 5% (**), and 1% (***)

4.4 Examining the Welfare Status of Participating and Non-Participating Rice Farmers

The welfare status of rice farmers participating in the ANSVCDP (FGN-IFAD Value Chain Development Programme) and non-participating farmers in Anambra State, Nigeria, is evaluated using the Relative Importance Index (RII) technique adopted by Kassem *et al.* (2020) [25]. The results are presented in Table 4 and indicate various impacts on welfare metrics for both groups.

The decision for specific welfare indicators was reached as below 0.500 represents low impact, 0.500 – 0.690 represents moderate impact, and above 0.690 implies high impact. Each welfare status is discussed below:

Improvement in nutritive food had a moderate RII for both participants (0.675), and nonparticipants (0.608). this result revealed that participation in the ANSVCDP has led to a slightly better improvement in access to nutritive food for participants compared to non-participants, indicating that the programme has a modest positive effect on food security and nutrition. Also, an Increase in on-farm income had moderate RII for both participants (0.688), and non-participants (0.600). However, the programme was seen to have contributed moderate increase in on-farm income for participants. The slight difference suggests some level of financial benefit from programme participation. These results were in agreement with Ogbalubi and Wokocha (2013) [39] who noted that programme intervention improves the food security of rural households.

Growth of farm productive assets had a high RII (0.823) for participants and moderate RII (0.572) for non-participants. This suggests that participants showed a significantly higher improvement in farm productive assets, indicating that the programme effectively supports asset accumulation and capital development, which are critical for sustainable agricultural productivity. The study by Muhammad, *et al.* (2013) noted that beneficiaries of Fadam III have an improvement in productive asset acquisition.

Improved social network also had moderate RII for participants (0.577), and non-participants (0.556). Both groups experienced similar moderate improvements in social networking, which could be linked to community activities and interactions fostered by the programme. Farmers sometimes are taken for peer learning among themselves. Equally, improvement in happiness and comfort (mood) showed a high RII for participants (0.799), and moderate RII (0.620) for non-participants. The programme significantly enhances the well-being and overall happiness of participants, indicating that economic benefits may translate into improved mental and emotional health of farmers (Oyeleke, and Tanga, 2017) [44].

Reduction in inequality concerning production revealed a moderate RII for both participants (0.585), and non-participants (0.585). However, there is no significant difference between the two groups in terms of reducing production inequalities, suggesting that other factors may be at play in addressing equity issues. Again, reduced financial stress had a moderate RII for both participants (0.605), and non-participants (0.614), Despite the programme's 50% input subsidy to farmers, both groups experience similar reductions in financial stress, indicating that while the programme helps, there are other substantial factors affecting financial stress levels. This result was consistent with Adetomiwa *et al.* (2021) [2] who reported that rural interventions increased the adoption rate of farmers to grow their income and welfare

status.

Access to agricultural insurance cover had moderate RII for both participants (0.608), and non-participants (0.593). Though, the programme provides a slight edge in access to agricultural insurance, which can protect against crop losses and other risks. Increase in income had a high RII for participants (0.806), and moderate RII (0.627) for non-participants. A significant increase in income for participants highlights the programme's effectiveness in enhancing financial well-being through increased productivity and market access. Equally, access to good sanitation had moderate RII (0.642: participants), and (0.577: non-participants). However, improved access to sanitation among participants points to ancillary benefits of the programme that contribute to better health and living conditions (Donkor *et al*., 2022) [15].

Access to electricity and energy showed a moderate RII for both participants (0.648), and non-participants (0.597). Participants have slightly better access to electricity and energy, facilitating better living standards and potentially improving productivity. Off-farm income/diversification revealed a moderate RII for both parties, participants had 0.572, and nonparticipants had 0.575. Both groups show similar moderate impacts on income diversification, indicating that the program may need to place more emphasis on encouraging and supporting off-farm income activities (Donkor *et al*., 2022) [15]. Improvement in educational qualification had moderate RII (0.605: participants, and 0.606: non-participants) for both groups. Since the program has a similar moderate impact on educational improvements for both groups, suggesting a need for focused educational interventions.

Access to healthcare showed a moderate RII for both groups, participants reported a value of 0.579, and non-participants reported a value of 0.605. Non-participants slightly have better access to healthcare, highlighting a potential area for the programme to strengthen its health-related initiatives. Access to clean and drinkable water showed moderate RII for both participants (0.601), and non-participants (0.611), Both groups experienced similar moderate impacts, indicating a critical area that requires further attention to ensure sustainable water access. However, VCDP has undertaken many borehole projects to benefit both direct and indirect beneficiaries in the rural communities of implementation Alabi *et al*., 2023) [3]. Again, improvement in housing showed moderate RII improvement for both participants (0.568), and non-participants (0.605). implicatively, the non-participants show a slightly better improvement in housing, suggesting that housing improvements might not be directly influenced by the programme and could be driven by other socio-economic factors.

Table 4: Welfare Status of Participating and Non-Participating Rice Farmers

		Participants			Non-Participants		
S.n.	**Welfare status**	**Relative index**	**Std. Dev.**	**Remarks**	**Relative index**	**Std. Dev.**	**Remarks**
1	Improvement in nutritive food	0.675	0.214	Moderate impact	0.608	0.284	Moderate impact
2	Growth of farm productive asset	0.823	0.160	High impact	0.572	0.277	Moderate impact
3	Increase in on-farm income	0.688	0.216	Moderate impact	0.600	0.291	Moderate impact
4	Improved social network	0.577	0.287	Moderate impact	0.556	0.272	Moderate impact
5	Improvement in happiness and comfort (mood)	0.799	0.155	High impact	0.620	0.279	Moderate impact
6	Reduction in inequality concerning production	0.585	0.292	Moderate impact	0.585	0.285	Moderate impact
7	Reduced financial stress	0.605	0.280	Moderate impact	0.614	0.286	Moderate impact
8	Access to agricultural insurance cover	0.608	0.268	Moderate impact	0.593	0.291	Moderate impact
9	Increase in income	0.806	0.167	High impact	0.627	0.278	Moderate impact
10	Access to good sanitation	0.642	0.277	Moderate impact	0.577	0.273	Moderate impact
11	Access to electricity and energy	0.648	0.285	Moderate impact	0.597	0.270	Moderate impact
12	Off-farm income/diversification	0.572	0.283	Moderate impact	0.575	0.281	Moderate impact
13	Improvement in educational qualification	0.605	0.281	Moderate impact	0.606	0.281	Moderate impact
14	Access to healthcare	0.579	0.293	Moderate impact	0.605	0.295	Moderate impact
15	Access to clean and drinkable water	0.601	0.279	Moderate impact	0.611	0.281	Moderate impact
16	Improvement in housing	0.568	0.266	Moderate impact	0.605	0.283	Moderate impact
	t-statistics for the mean difference	2.47***					

***Source*:** Field Survey, 2024.

Furthermore, the t-statistics for the mean difference is 2.47***, indicating that the differences in welfare status between participating and non-participating farmers are statistically significant at the 1% level.

The FGN-IFAD VCDP has positively impacted the welfare status of participating rice farmers in Anambra State, Nigeria. The programme's success in enhancing productive assets, income, and overall well-being suggests that similar initiatives could be replicated or scaled up to further support agricultural commercialization, improve farmer welfare, and promote sustainable agricultural development in Nigeria. However, targeted interventions in healthcare, education, and off-farm income diversification are necessary to ensure comprehensive and inclusive development. The null hypothesis three was rejected because significant difference existed in the welfare status of rice farmers.

4.5 Estimation the Performance (Net Returns) of the Participating and Non-Participating Rice Farmers

Table 5 presents the performance (net returns) of participating and non-participating rice farmers in the FGN-IFAD value chain development programme in Anambra State, Nigeria. The table compares key financial metrics for two groups of participants based on farm sizes (1.89 hectares) and 0.58 hectares for non-participants. The average cropping season was 1 and 2 for non-participants and participants respectively.

The revenues realized from the sale of rice by the participants was ₦3,599,535.00, and ₦755,573.00 for non-participants. Larger farm size (1.89 Ha) yields significantly higher revenue compared to smaller farm size (0.58 Ha). This indicates that economies of scale are beneficial in rice farming, and participation in the FGN-IFAD programme helps farmers

achieve better commercialization by expanding their farm sizes (Obianefo *et al*., 2022) [33]. The substantial revenue differences indicate that the program helps farmers access better markets and achieve higher prices for their produce. Strengthening market linkages and ensuring fair pricing can further enhance commercialization efforts.

The total variable costs resulting from production expenses relating to the cost of seed, fertilizer, urea, agrochemical, the wage for labour, packaging material, transportation, and logistics was ₦1,219,828.28 for participants and ₦479,235.50 for non-participants. Although larger farms incur higher variable costs due to increased input use, the proportionate increase in revenue outweighs these costs, indicating efficient use of resources and better cost management in larger farms.

Again, the total fixed costs which were a result of depreciation value for farming equipment such as Cutlass, Hoe, Wheelbarrow, Thresher, Power tiller, water pump, storage cost, and other equipment were ₦366,820.00 for participants and ₦21,020.00 for non-participants. Fixed costs are substantially higher for larger farms, likely due to the need for more equipment and infrastructure. However, these costs are spread over larger production volumes, reducing the cost per unit of output and improving overall profitability. Summation of the variable and fixed cost of production resulted in a total cost of ₦1,586,648.28 for participants and ₦500,255.50 for non-participants. Equally, total costs are higher for larger farms, but the significant revenue generated offsets these costs, indicating that scaling up operations within the programme's framework is financially viable.

Furthermore, the gross profit (revenue less variable cost) for participants was ₦2,379,706.72, and ₦276,337.50 for non-participants. Larger farms achieve a substantially higher gross profit, showcasing the potential benefits of larger-scale farming operations under the programme. Equally, the net returns (gross profit less fixed cost) were ₦2,012,886.72 for participants and ₦255,317.50 for non-participants. The net returns for larger farms are significantly higher, emphasizing that participation in the FGN-IFAD programme enhances the profitability of rice farming (Ayuba *et al*., 2020). This supports the commercialization objective of the programme by demonstrating that larger-scale farming is more lucrative. The return on investment (net returns divided by total cost) was 1.27 for participants, and 0.51 for non-participants. The implication is that larger farms have a higher ROI, indicating more efficient use of invested resources. Again, the result implied that participants earned N1.27 for every N1 investment, whereas the non-participants earned N0.51 for every N1 investment. The program's support enables farmers to achieve better returns on their investments, highlighting the effectiveness of the FGN-IFAD initiative in improving financial performance (Ume *et al*., 2022) [46].

Table 5: Estimation of the Performance (Net Returns) of Rice Farmers

	Participants (1.89 Ha)			Participants (0.58 Ha)		
Item description	**Quantity**	**Unit price (N)**	**Amount (N)**	**Quantity**	**Unit price (N)**	**Amount**
Revenue:						
Quantity sold (tons)	7.57	475,500.00	**3,599,535.00**	1.33	568,100.00	**755,573.00**
Variable cost:						
Seed	214.81	500.00	107,403.03	106.55	700.00	74,587.17
Fertilizer	445.05	560.00	249,226.07	134.07	600.00	80,440.79
Urea	531.73	680.00	361,573.70	163.54	850.00	139,012.79
Agrochemical	15.35	4,230.00	64,935.48	4.41	4,370.00	19,284.76
Labour	85	3,310.00	281,350.00	28	4,960.00	138,880.00
Packaging material	186	590.00	109,740.00	19	270.00	5,130.00
Transport cost			15,600.00			11,900.00
Logistics			30,000.00			10,000.00
Total variable cost			1,219,828.28			479,235.50
Fixed cost:						
Dep. Cutlass	6	370.00	2,220.00	6	420.00	2,520.00
Dep. Hoe	6	650.00	3,900.00	4	820.00	3,280.00
Dep. wheelbarrow	2	3,980.00	7,960.00	1	2,420.00	2,420.00
Dep. Thresher	1	304,180.00	304,180.00	0	64,720.00	-
Dep. Power tiller	1	33,870.00	33,870.00	0	61,860.00	-
Dep. Pump	1	5,990.00	5,990.00	1	2,100.00	2,100.00
Storage Cost			7,700.00			9,300.00
Others equipment Dep.			1,000.00			1,400.00
Total Fixed Cost			366,820.00			21,020.00
Total Cost			1,586,648.28			500,255.50
Gross profit			2,379,706.72			276,337.50
Net returns			2,012,886.72			255,317.50
Return on investment			1.27			0.51
Significant difference in net returns		60.62***				

Source: Field Survey, 2024.

Interestingly, the significant difference in net returns was 60.62***, suggesting that the significant difference in net returns between the two groups underscores the impact of farm size on profitability. This significant difference in net returns was in agreement with the result of Obianefo *et al*. (2019) [31] who found a significant difference in profit among the study participants. The programme's emphasis on scaling up operations likely contributes to this difference, suggesting that encouraging farmers to expand their land holdings can lead to better financial outcomes when the best agronomic practices are adopted. The positive outcomes for participants suggest that training and extension services provided by the

program are effective. Expanding these services to reach more farmers, including non-participants, can improve overall sector performance.

The FGN-IFAD value chain development programme significantly enhances the commercialization, welfare, and performance of rice farmers in Anambra State. The comparative analysis of participating farmers with different farm sizes shows that larger farms achieve higher revenue, profitability, and ROI, underscoring the benefits of economies of scale. The program's support in terms of financial resources, training, and market access plays a crucial role in these outcomes. To further improve the agricultural sector, policies should focus on scaling up operations, resource efficiency, financial support, market access, and inclusive training programs. The null hypothesis five was rejected because significant differences existed in the performance of rice farmers in the study.

4. Conclusion and Recommendations

The information from the study clearly revealed that the FGN-IFAD Value Chain Development Programme (VCDP) significantly contributed to improving the commercialization, welfare, and performance of rice farmers in Anambra State, Nigeria. Participating farmers had better access to structured markets and off-taker arrangements, which not only support their market stability but also improved household income. The Heckman double hurdle model revealed that key determinants such as farming experience, household size, access to extension services, credit, and farm size significantly influenced both the decision to commercialize and the extent of commercialization among participating farmers. The programme effectively empowered women and youth, promoted gender inclusiveness, and encouraged the participation of younger and more dynamic farmers in commercial agriculture.

On performance metrics, the programme participants performed better than the non-participants across all financial indicators such as net returns, gross profits, and return on investment which confirmed the commercial viability of larger-scale rice farming enabled by VCDP support. The significant difference in profitability and return on investment revealed by the findings demonstrate the program's impact in enhancing farm-level efficiency and market readiness. These results validate the programme's objective of transforming subsistence farmers into commercial producers and improving rural livelihoods through market integration and capacity building. Therefore, the study concludes that the VCDP has delivered measurable success in transforming rice farming from a low-income activity into a profitable enterprise, to justify its continuation and expansion.

The author(s) therefore suggest that FGN-IFAD VCDP interventions should be scale-up to other States in Southeast Nigeria to ensure full region agricultural progress.

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