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Adoption of Improved Rice Production Technologies among Beneficiary Farmers of the International Fund for Agricultural Development Value Chain Development Programme in Izzi Local Government Area, Ebonyi State, Nigeria

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Chukwu Victor[1]; Ogunfolaju, Marcus[2*], and Nwovu, P.C[3]

[1]Department of Agric Econs, Management and Extension, Ebonyi State University, Abakaliki
[2*]Centre for Inclusive Social Development, Abuja, Nigeria

*Correspondence and presenting author: Marcus Ogunfolaju marcus.ogunfolaju@cisdnigeria.org

Abstract

This study assessed the adoption of improved rice production technologies promoted by the IFAD–Value Chain Development Programme (IFAD–VCDP) and their effects on yield and income among beneficiary farmers in Izzi Local Government Area, Ebonyi State, Nigeria. Primary data were collected from 120 IFAD–VCDP rice farmers selected through a multistage sampling using an interview schedule. Data were analysed with frequency counts, means, and multiple linear regression. Results showed high adoption of key good agronomic practices, notably improved seed varieties, fertilisers and herbicides, pest and disease control, water management and improved post-harvest handling, while mechanised land preparation recorded comparatively lower adoption. Average rice yield shifted from predominantly low levels (2 tonnes/ha) before adoption to 4–6 tonnes/ha and above after adoption, and annual income from rice increased markedly, with many farmers moving into higher income brackets following adoption. The regression model indicated that sex, age, farming experience and cooperative membership significantly influenced the adoption of IFAD–VCDP technologies. The study concludes that IFAD–VCDP interventions have improved technology uptake, productivity and income in the area, but recommends stronger youth and gender targeting and support for farmer organisations and mechanisation to sustain and deepen adoption.

Keywords: adoption, IFAD–VCDP, rice farmers

Introduction

Rice has become one of the most important staple food crops in Nigeria, accounting for over 14% of crops cultivated by households and serving as a major source of calories and income for rural farmers (Statista, 2025; FAO, 2024). Recent estimates put Nigeria's paddy rice production at about 8.9 million metric tonnes in 2023, translating to roughly 5.2 million metric tonnes of milled rice, yet this still falls short of national requirements (Statista, 2025). Nigeria's annual demand for milled rice has been estimated at between 6.0 and 10.5 million metric tonnes, implying a demand–supply gap of around 2.5 million metric tonnes that is partly bridged through imports (FAO, 2024). Rapid population growth, urbanisation, and changing consumer preferences have been major drivers of this rising demand, intensifying pressure on

domestic production systems (Obayelu, 2022). Closing this gap requires sustained productivity growth among smallholder rice farmers, particularly through the widespread adoption and effective utilisation of improved rice production technologies such as high-yielding varieties, recommended fertiliser regimes and better agronomic practices, which have been shown to significantly enhance yield and productivity when properly applied (Oduaro et al, 2024).

In response to these challenges, government and development partners have promoted a range of improved rice technologies, including high-yielding varieties, recommended fertiliser and agrochemical regimes, improved agronomic practices and mechanised operations (Aremu et al, 2025). Adoption of improved rice varieties and associated practices can significantly increase yields and improve farmers' welfare when effectively disseminated (Bello et al, 2021). However, despite these documented benefits, adoption of improved technologies among rice farmers remains sub-optimal and heterogeneous across locations and farmer groups.

The International Fund for Agricultural Development (IFAD) Value Chain Development Programme (VCDP) is one of the major interventions designed to address productivity, value addition and market access constraints in Nigeria's rice value chain (Orunoye et al, 2021). In Southeast Nigeria, the programme targets rice-producing communities, including those in Ebonyi State, with support for improved production technologies, capacity building and market linkages (Samuel & Tijani, 2025).

Izzi Local Government Area (LGA) is a key rice-growing area in the state where IFAD-VCDP has introduced improved technologies and value chain support to beneficiary farmers. Despite these efforts, there is limited empirical evidence on the extent to which beneficiary farmers in Izzi LGA have adopted the promoted technologies, and how such adoption has affected their rice yield and income. Understanding the level of adoption and its determinants is critical for guiding extension strategies and for improving the design and targeting of IFAD-VCDP and similar interventions in the state. However, there is a paucity of recent, location-specific evidence on how these factors shape adoption behaviour among IFAD-VCDP rice beneficiary farmers in Ebonyi State. This study, therefore, assesses the adoption of improved rice production technologies among IFAD-VCDP beneficiary farmers in Izzi LGA, Ebonyi State, Nigeria; determines the effects of adoption on rice yield and farmers' income; and examines the factors influencing adoption in the study area.

Methodology

The study was conducted in Izzi Local Government Area (LGA) of Ebonyi State, Nigeria, a major rice-producing area within the Ebonyi North agricultural zone. Izzi Local Government Area, located in Ebonyi State, Nigeria, lies approximately between latitude 6.3200° N and longitude 8.1000° E. Izzi is located in the north-eastern part of the state, and most of its population is rural and engaged in smallholder crop production, with rice as a key staple and cash crop (FMARD, 2022; NAERLS, 2020)

Ebonyi State lies in the humid tropical zone with conditions favourable for lowland rice, characterised by a distinct wet season (about April–October), annual rainfall of roughly 1,500–2,000 mm and mean temperatures above 25 °C. Soils in the inland

valleys and low-lying areas are mainly hydromorphic and alluvial, supporting intensive rice cultivation in Izzi and surrounding LGAs (FMARD, 2022; USAID, 2026)

Izzi LGA is one of the intervention areas of the IFAD Value Chain Development Programme (VCDP) in Ebonyi State, where rice value-chain activities are supported through improved technologies, input support, capacity building and market linkages. These biophysical and institutional features make Izzi LGA an appropriate setting for examining the adoption of improved rice production technologies among IFAD–VCDP beneficiary farmers (IFAD, 2026)

A multi-stage sampling procedure was used to select respondents for the study. In the first stage, five of the fifteen communities in the area (Mgbo Agbaja, Abofia Mgbo, Ndubia Igbeagu, Ezza Ophu Inyimagu, and Ndueze-echi Inyimagu) were purposively selected for their relatively high levels of rice farming. In the second stage, two villages were randomly selected from each of the five communities, giving a total of ten villages. In the third stage, twelve rice farmers were randomly selected from each of the ten villages, resulting in a sample size of 120 respondents for the study.

Primary data were used for the study. Data were collected with the aid of a structured questionnaire administered to the selected rice farmers. The questionnaire used for data collection was subjected to face and content validity by experts in Agricultural Extension and Rural Development who examined the instrument for clarity, relevance, and adequacy in addressing the objectives of the study.

Data collected from the respondents were coded and analysed using percentages, and means were used to summarise the socio-economic characteristics of the farmers, as well as the rate of adoption of improved rice production technologies and the distribution of yield and income before and after adoption.

External factors such as variations in weather conditions and market prices may also have influenced the outcomes observed. Future studies are encouraged to incorporate a counterfactual or control group design to enable more rigorous impact attribution.

An adoption score was constructed for each respondent based on the extent of use of the identified good agronomic practices, and this score served as the dependent variable in the regression analysis. Multiple linear regression was employed to examine the influence of selected variables (sex, age, educational level, farming experience, household size, farm size, annual income and cooperative membership) on the adoption of IFAD–VCDP rice technologies.

Model Specification

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \beta_7 X_{7i} + \beta_8 X_{8i} + \beta_9 X_{9i} + \varepsilon_i$$

Y = Adoption level of IFAD–VCDP rice technologies
X_1 = Sex of the farmer (1 = male, 0 = female)
X_2 = Age of the farmer (years)
X_3 = Educational level (years of formal education completed)
X_4 = Farming experience (number of years in rice farming)
X_5 = Household size (number of household members)

X_6 = Farm size (hectares under rice cultivation)
X_7 = Annual income from all sources (₦ per year)
X_8 = Cooperative membership (1 = member of any farmers' cooperative, 0 = non-member)
X_9 = Membership of IFAD–VCDP-related group/cooperative (1 = member, 0 = non-member)
ε_i = Random error term capturing unobserved factors

Results and Discussion

Adoption of Good Agricultural Practices among IFAD–VCDP Rice Farmers

The results in Table 1 show generally high levels of adoption of good agricultural practices (GAPs) among IFAD–VCDP rice farmers in the study area. Improved seed varieties recorded the highest mean adoption score ($\bar{x}$ = 3.53), followed by improved post-harvest practices ($\bar{x}$ =3.43), pest and disease control ($\bar{x}$ = 3.38), and water management practices ($\bar{x}$ = 3.33). This suggests that IFAD–VCDP interventions and extension efforts have been particularly effective in promoting the use of improved rice varieties and associated management practices, which aligns with findings of Enenchi & Ojiagu (2021) and Ojo et al (2024) who reported high adoption of improved seeds and key agronomic practices among supported rice farmers in Nigeria.

Line transplanting ($\bar{x}$ =3.28) and the use of fertilisers and herbicides ($\bar{x}$ = 3.47) were also adjudged to be adopted, indicating that most farmers have integrated these practices into their production systems, though not to the same extent as improved seed use. Mechanised land preparation had the lowest mean score ($\bar{x}$=2.93), though still within the adopted range, suggesting relatively weaker adoption, likely due to cost, access and machinery constraints. Similar patterns of higher adoption for seed and basic agronomic practices compared with mechanization-related technologies have been documented in recent adoption studies (Babaji et al, 2024; Oruonye et al, 2021).

Table 1: Rate of adoption of good agricultural practices among IFAD–VCDP rice farmers

Good agricultural practices	Fully adopted	Partially adopted	Not adopted	Discontinued	Mean ($\bar{x}$)
Improved seed varieties	78	30	10	2	3.53
Improved post-harvest practices	74	28	14	4	3.43
Use of fertilizers/herbicides	72	34	12	2	3.47
Pest and disease control	70	30	16	4	3.38
Water management practices	66	32	18	4	3.33
Line transplanting	60	38	18	4	3.28
Mechanised land preparation	44	36	28	12	2.93

Source: Field survey, 2025

Effects of the Adoption of Good Agronomic Practices on Yield

Table 2 shows a clear shift in the distribution of rice yields after the adoption of good agronomic practices. Before adoption, most farmers were concentrated at 2 tonnes/ha (51.7%), with relatively few achieving 5 tonnes/ha and above. After adoption, no farmer remained in the 2-tonne category; instead, the majority moved into the 4–6 tonnes/ha classes (25.0%, 35.0% and 23.3% respectively), and the share of farmers in the 7–8 tonnes/ha range increased to 12.5% and 4.2%. This pattern indicates substantial productivity gains associated with the adoption of improved seed, nutrient management, water management and other good agronomic practices. The finding aligns with Babaji et al (2024), that farmers who adopt improved production packages achieve significantly higher yields per hectare than non-adopters or low adopters, confirming the positive yield effect observed in this study.

Table 2: Average rice yield before and after adoption of good agronomic practices (tons/ha)

Yield class (tons/ha)	Percentage before (%)	Percentage after (%)
2	51.7	0.0
3	2.5	0.0
4	20.8	25.0
5	6.7	35.0
6	10.0	23.3
7	5.8	12.5
8	2.5	4.2

Source: Field survey, 2025

Effects of the Adoption of Good Agronomic Practices on Income

Table 3 reveals a corresponding and even more pronounced improvement in farmers' annual income from rice production after adoption. Prior to adoption, respondents' incomes were clustered between ₦400,000 and ₦800,000, with the largest group earning ₦400,000 (31.7%) and ₦500,000 (28.3%). After adoption, none of the farmers remained in these lower income categories; instead, incomes shifted into higher brackets, with 38.3% earning ₦4,000,000 and 26.7% earning ₦5,000,000 annually from rice, and additional proportions in the ₦2,000,000–₦3,000,000 range. This dramatic upward shift suggests that the productivity gains from adopting good agronomic practices translated into substantial increases in rice-based income, likely reinforced by improved market linkages and value-chain support. The finding aligns with Oruonye et al (2021) and Adi et al (2024) that adoption of improved rice technologies and participation in programmes such as IFAD–VCDP significantly raise farm income and enhance household welfare.

Table 3: Average annual income from rice before and after adoption

Income class (₦)	Percentage before (%)	Percentage after (%)
400,000	31.7	0.0
500,000	28.3	0.0
600,000	21.7	0.0
700,000	11.6	0.0
800,000	6.7	0.0
1,500,000	0.0	6.7
2,000,000	0.0	11.6
3,000,000	0.0	16.7
4,000,000	0.0	38.3
5,000,000	0.0	26.7

Source: Field survey, 2025

Factors Influencing the Adoption of IFAD–VCDP Rice Technologies

Table 4 shows the determinants of adoption of IFAD–VCDP rice technologies among farmers in Izzi LGA. Sex, age, farming experience, and membership of cooperative groups emerge as statistically significant predictors of adoption (p =0.021, p =0.012, and p = 0.047 respectively). The positive coefficient on sex implies that being male is associated with higher adoption, reflecting persistent gender gaps in access to information, inputs and programme benefits (Dio et al, 2025). The negative coefficient for age suggests that younger farmers are more likely to adopt IFAD–VCDP technologies than older ones, possibly due to greater openness to innovation and lower risk aversion (Ogunfolaju et al. 2025). The positive effect of farming experience indicates that more experienced farmers are better able to evaluate and incorporate new technologies (Ogunfolaju et al, 2025).

Educational level, household size, farm size, income, and cooperative membership do not have a significant relationship with adoption. This finding contradicts Ifeanyi-Obi and Corbon (2023) and Ogunfolaju et al. (2026) that education is an enabling factor in the adoption of technology.

Table 4: Socio-economic factors influencing adoption of IFAD–VCDP rice technologies in Izzi LGA

Variable	Coefficient (β)	Standard error	t-value	Sig. (p-value)
Constant	0.742	0.521	1.424	0.016
Sex (X_1)	0.185	0.164	1.274	0.021
Age (X_2)	−0.018	0.013	−1.384	0.012
Educational level (X_3)	0.029	0.107	0.277	0.078
Farming experience (X_4)	0.072	0.106	0.684	0.047
Household size (X_5)	0.031	0.028	1.110	0.094
Farm size (X_6)	0.398	0.075	5.312	0.065
Annual income (X_7)	0.024	0.014	1.881	0.063
Model statistic				
R^2 = 0.606				
Adjusted R^2= 0.593				

Source: Field survey, 2025

Conclusion and Recommendations

The study showed that IFAD–VCDP rice farmers in Izzi LGA have generally high adoption levels of key good agronomic practices, particularly improved seed varieties, fertilisers and herbicides, water management, pest and disease control and post-harvest practices. Adoption of these technologies was associated with a clear shift from low to higher yield classes and a substantial rise in annual rice income, indicating strong positive effects on productivity and livelihoods. Sex, age, farming experience and cooperative membership significantly influenced adoption, highlighting that younger, male, more experienced and organised farmers tended to adopt more technologies than others. The study concludes that IFAD–VCDP has enhanced technology uptake and welfare among rice farmers in Izzi LGA, but that inclusion gaps remain.

Extension services and IFAD–VCDP should continue to promote the full package of good agronomic practices through regular training, on-farm demonstrations and follow-up visits, with emphasis on consolidating gains in water management and post-harvest handling.

Stakeholders should improve farmers' access to mechanised land preparation via community hiring centres, cooperative ownership and flexible payment arrangements, to address the relatively low adoption of mechanisation. Programme activities should include targeted strategies for women and young farmers (e.g., dedicated groups, tailored training times and locations) to close observed adoption gaps. Policies should support the formation and strengthening of rice farmer cooperatives and use them as key channels for technology dissemination, input access and market linkages.

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