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The Impact of the Fadama II Intervention on Rural Households in Kogi and Kwara States, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author AAT designed the study, performed the statistical analysis, wrote the protocol and wrote the introduction. Author MBM managed the analyses of the study and wrote the materials and methods. Author MOR managed the literature searches and wrote the first draft of results and discussions of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

The Fadama II project was designed to reduce poverty by improving the living condition of the rural poor, contribute to food security and increase access to rural infrastructure. This study estimates the direct impacts of the project on poverty reduction in respect of the project beneficiaries.

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The study employed a multistage sampling technique to select 480 households from Fadama II Local Government Areas (LGAs) and 120 households from non-Fadama II LGAs in Kogi and Kwara states of Nigeria. Poverty index as well as propensity score matching (PSM) were used to determine the direct impact of the project on the beneficiary households.
The results showed that average per capita daily calorie intake for the beneficiaries was higher than the minimum of 2,250 kilocalories per person per day recommended for the country. The average per capita daily protein intake for the beneficiaries was also higher than the 35g minimum per person per day recommended from animal material. The poverty index indicated that the percentage of households below poverty line was lower among the beneficiaries.
The results from PSM estimates on household income showed that Fadama II had a statistically significant positive impact on incomes of participants in both states as expected given the large and significant impact it had on their productive assets.
Overall, the study concluded that Fadama II had impacted positively on the beneficiaries and therefore recommended that Fadama programme be sustained and expanded through greater support from donor, local, state and federal governments of Nigeria.

Keywords: ADB; fadama II project; poverty; propensity score matching.

1. INTRODUCTION

The Fadama Development project (FDP) is an African Development Bank (ADB) financed project with counterpart funding contribution from the State and Local Governments of Nigeria. The project was designed to be implemented in six years period (2005 – 2011), but received an extension and terminated in December, 2012. Fadama Development Project II financed with loan from the African Development Bank covered the six states of Kogi, Katsina, Jigawa, Plateau, Kwara and Borno [1].

The project sector goal was to reduce poverty by improving the living conditions of the rural poor, contributing to food security and increasing access to rural infrastructure. Specifically, it was designed to enhance agricultural production, productivity and value addition of smallholder farmers and rural entrepreneurs in Fadama areas on a sustainable basis. It has 3 components namely; Capacity Building and Advisory Services, Rural Infrastructure Investment as well as Project Management and Coordination.

(a) The capacity building and advisory sub-component provides for advisory services in response to the needs of Fadama resource Users. It assists in establishing linkages between Fadama users and input suppliers, market, training, and learning events. It also makes available other activities to promote the sharing of knowledge. The beneficiaries are also required to contribute 10% under this component [2].
(b) Production input support sub-component
Production Support sub-component was created in the year 2009 in order to bridge the gap occasioned by food shortage. The sub-component intervened through the provision of inputs such as fertilizer, improved seeds, mechanical knapsack prayers, pumping machines, processing machines, etc. It was to provide subsidized inputs to farmers thereby lessening the farmers' cost of production and ultimately affording them increased output as well as income on a sustainable basis.

c) Rural Investment
This component was created with the aim of financing the construction or rehabilitation of eligible small-scale infrastructure projects, specified as priorities in community development plans. Here, the beneficiaries are required to pay 10 percent of the cost of proposed rural infrastructure, such as rural roads, culverts, market infrastructure, post-harvest infrastructure, etc.

d) Project Management
This was put in place to ensure effective coordination of all project activities. This concerns the day-to-day running of the project activities. Subsumed under this component are: Monitoring and Evaluation Sub-component; Procurement Sub-component; Finance Sub-component; and Environmental Sub-component.

The Project was implemented in ten Local Government Areas (LGAs) in each state. In Kogi State, the participating LGAs are Adavi, Bassa, Ibaji, Idah, Kogi, Kabba-Bunu, Lokoja, Mopamuro, Olamaboro and Omala [3], while in Kwara State, the participating LGAs are Asa, Baruten, Edu, Ekiti, Ilorin-East, Irepodun, Isin, Moro, Oyun and Patigi [4].

Review of the project implementation status in Kogi state indicates almost 100% achievement in input support programme, 53% achievement in Fadama access road construction, 50% in Fadama access road rehabilitation, 100% achievement in boreholes, 62.4% achievement in open wells, while marginal achievement (25%) was recorded for tube wells in the state [3].

While in Kwara State, almost 100% achievement in input support programme, 80% achievement in the area of infrastructure sub-projects and an average achievement of 57.14% was recorded in the area of Capacity Building and Advisory Services. The project recorded 100% achievement in road construction, road rehabilitation, boreholes, and open wells, while marginal achievement (25%) was recorded for tube wells in the state [4].

This study aimed at quantifying the direct impacts of the intervention on the income, productive assets, livestock assets, and consumption of the participants in Kogi and Kwara States of Nigeria. Studies on the impact of Fadama II project have been carried out by researchers across the states of the Federation where Fadama II project had been implemented [5-10]. According to these studies, Fadama II overall had positive and significant impact on household income and productive assets of beneficiaries. They also found that Fadama II project had reduced poverty level and thereby increased the standard of living particularly among the participants. However, most of them are either short- or medium-term impact studies as they were conducted during the life of the project especially in the study areas. Hence, the need for this study, which reveals the long term direct impact of the project, as it was conducted at the end of the project.

2. MATERIALS AND METHODS

2.1 The Study Area

The study was conducted in Kogi and Kwara States of Nigeria. Both states are found in the central region of Nigeria. Agriculture is the mainstay of the economy of both states and the principal cash crops in Kogi are notably coffee, cocoa, palm oil, cashews, groundnuts, maize, cassava, yam, rice and melon; while the principal cash crops in Kwara are cotton,

cocoa, coffee, Kolanut, tobacco, beniseed and palm produce. The majority of the people of the state are farmers.

The topography is mainly a plain land with annual rainfall of between 1000mm and 1500mm and average temperature of between 30ºC and 35ºC. The climate is of two distinct types, the wet season and dry season. The wet season is from April to October, while the dry season is from November to March. It has intervals of cold and dry harmattan in the early part of it and hot and low humidity in later part.

2.2 The Sampling

A multistage sampling technique was used in selecting the households for this study. In order to analyze the impact of Fadama II project on beneficiaries, the sample frame was stratified into three strata: (i) Fadama II project participants; (ii) respondents who live in Fadama II project communities but did not participate directly in the project (but who may benefit indirectly), and (iii) respondents who live in communities outside the Fadama II LGAs but with socio-economic and biophysical characteristics comparable to the Fadama II project communities and in the same state. First, all the ten participating LGAs in each state were purposively covered. Next, we stratified the sampling frame in each Fadama II LGA into two strata: (i) Fadama II project direct participants and (ii) respondents who live in Fadama II project communities, but did not participate directly in the project but whose socio-economic and biophysical characteristics are comparable to the Fadama II project beneficiaries in the same LGA.

The advantage of this stratification is that it enabled estimation of the direct effects of Fadama II. By comparing outcomes for Fadama II direct beneficiaries with outcomes for similar (in terms of initial assets endowments, education, etc.) non-participating households in the same communities, we obtain an estimate of the direct impacts of the intervention. However, this may not provide an estimate of the full impact of the project since the non-participating households in the Fadama II communities may have benefited from spillover effects. Comparing Fadama II beneficiaries to similar households in similar non-project communities provides a better estimate of the total impact of the project on participants (assuming that spillovers are not affecting households in non-project communities).

At the final stage, 12 respondents were selected from each stratum using simple random sampling technique; thereby resulting in a sample comprises 120 beneficiaries, and 120 non-beneficiary households in each state. Hence, a sample of 480 households was obtained from Fadama II LGAs with 240 from each state. To control for Fadama III that came on stream within the period of Fadama II it was ensured that none of the respondents were Fadama III beneficiaries.

Selection of 60 non-beneficiaries living outside Fadama II communities in each state followed the same procedure as the selection of non-beneficiaries in Fadama II LGAs.

2.3 DataCollection

A structured questionnaire was used for data collection. Recall method was used to collect some data on major assets and major component of the household expenditure. Household respondents had no difficulty recalling the required information because their livelihood strategies have not changed significantly from what used to be.

2.4 Data Analysis

The fundamental evaluation problem in estimating the effects of an intervention is the attribution problem and constructing counterfactuals (what would have happened to participants and non-participants without the programme). Estimation methods employed in the literature include longitudinal comparisons of participants' outcomes, that is before and after treatment; cross-sectional comparisons of participants' outcomes versus non-participants; social experiments; difference-in-difference estimator; matching, that is, comparing outcomes of participants and nonparticipants who are similar in observed characteristics; econometric methods, which account for impacts of observable and unobserved characteristics; and combinations of these. In this study, before-and –after treatment (BAT) and propensity score matching (PSM) methods were used to estimate the impacts of Fadama II project on the beneficiaries. PSM was used to evaluate the impact of participation on household income, consumption, productive and livestock assets, while BAT was used to evaluate impacts on yield and income.

BAT is in general most commonly used estimator [11]. An advantage of this estimator relative to other estimators is that it can be implemented even when data are available only on participants [12]. However, BAT is likely to produce biased estimates of treatment effects because it does not separate such effects from possible confounding factors. In this study, the difference in participants' outcomes before and after the project was tested for statistical significance using Student t-statistic.

PSM methods involve identifying a sample of non-participants that are as similar as possible to participants in their predicted likelihood of participation and then comparing mean outcomes. The strengths of the approach are reduced dependence on parametric assumptions and reduced bias from comparing non-comparable observations. The main weakness is that only selection on observables is addressed and selection bias resulting from unobservables may still remain [11].

Calorie/protein consumption and food expenditure were also used as proxies for measuring food security. Consumption consists of household's produced and purchased food whether raw, boiled, roasted or fried. Daily food intake was calculated by converting household food consumed into calorie and protein equivalents [13]. Based on the World Bank rule of thumb approach of two-thirds total consumption expenditure the poverty level was calculated.

2.5 Analytical Framework

A propensity score model controls for self-selection that normally arises when technology adoption is not randomly assigned and self-selection into adoption occurs. The main parameter of interest in non-experimental framework is the average treatment effect for the treated population (ATT), expressed as:

$$\tau ATT = E(Y_1 - Y_0|D = 1) = E(Y_1|D = 1) - E(Y_0|D = 1), \quad (1)$$

Where Y_1 denotes the value of the outcome when the household is a participant, and Y_0 is the value of the same variable when the household does not participate. The problem that arises with unobservability is by virtue of the fact that $E(Y_1| D = 1)$ can be estimated but not $E(Y_0| D = 1)$. Although $\tau = E(Y_1| D = 1) - E(Y_0| D = 0)$ can normally be estimated, it is potentially a biased estimator of τ_{ATT}. This kind of bias is a central concern in non-experimental studies [14].

The propensity score matching (PSM) model can be used to account for sample selection bias due to observable differences between treatment and comparison groups [15-17]. PSM controls for self-selection by creating the counterfactual for the group of participants. PSM constructs a statistical comparison group by matching every individual observation on participants with individual observations from the group of non-participants with similar characteristics. In effect, the matching procedure creates the conditions of a randomized experiment in order to evaluate a causal effect as in a controlled experiment [16]. To achieve this, the matching approach employs the conditional independence assumption (CIA), which states that technology selection is random and uncorrelated with the outcome variables, once we control for *Z*. The CIA or "strong unconfoundedness" can be given as:

$$Y_1, Y_0 \coprod D|Z \qquad (2)$$

The effect of participation on the outcome variables can then be expressed as:

$$\tau ATT(Z) = E(Y_1 - Y_0|Z) = E(Y_1|D = 1, Z) - E(Y_0|D = 0, Z) \qquad (3)$$

The average participation effect can then be represented as:

τ=E{τ (Z)}.

Under the condition of random program participation, outcomes for similar households in different status (i.e., participants vs. non-participants) can be compared, with similar households' defined according to the values of *Z*. The propensity score reduces the dimensionality of the conditioning problem associated with *Z* by comparing households with similar probabilities of adopting the new technology, given the relevant controls Z [15]. The conditional probability to adopt the new technology, given the control of *Z*, is as follows:

$$p(Z) \equiv p(D = 1|Z) = E(D|Z) \qquad (4)$$

Where D = {0, 1} is the indicator of exposure to treatment, and *Z* is the multidimensional vector of pre-treatment characteristics. As indicated above, the propensity score is a function such that the conditional distribution of *Z*, given *p* (*Z*), is the same in both groups, that is, conditional top(*Z*), *Z* and *D* are independent. This balancing property of propensity score can be expressed as DZ **|** p (Z).

Hence, if the unconfoundedness assumption holds, all biases due to observable components can be removed by conditioning on the propensity score [18]. Given the propensity score, which can be estimated by any standard probability model, the ATT can be estimated under the CIA as follows [19]:

$$\tau ATT = E\{Y_1 - Y_0|D = 1\} = E\{E\{Y_1 - Y_0|D = 1, p(Z) = E\{E\{Y_1|D = 1, p(Z)\} - E\{E\{Y_0|D = 0, p(Z)\}|D = 1\}. \qquad (5)$$

Another important requirement for conducting the matching method is the common support condition (CSC). It is only in the overlapping subset of the comparison and treatment groups that comparable observations can be matched [20]. The overlap condition is defined as follows:

$$0 < P(D = 1 | Z) < 1.$$

By the overlap condition, the propensity score is bounded away from 0 and 1, excluding the tails of the distribution of *p (Z*). This assumption ensures that persons with the same *Z* values have a positive probability of being both participants and non-participants. If there are regions where the support of *Z* does not overlap for the different groups, matching is only justified when performed over the common support region. A violation of the CSC is a major source of bias due to comparing incomparable individuals [20]. Individuals that fall outside the region of common support have to be discarded and so the treatment effect cannot be estimated. After estimating the propensity scores, the next stage involves matching the participants with non-participants of similar propensity scores. Several techniques have been suggested in the literature to find the "closest" neighbor as a matching partner. Five approaches have been commonly used to match treatment and control groups. Although all the approaches should normally yield the same results asymptotically, the choice of a matching approach could become important in small samples [20]. These approaches include the nearest-neighbour matching; kernel-based matching, stratified matching, radius matching, (All these are based on the propensity score) and multivariate covariate matching (MCM) that allows for the inclusion of the propensity score as well as of other covariates that may be strongly related with both outcome and selection variables (such as region and the use of other technologies) in the matching procedure. The nearest neighbor matching algorithm is however adopted for this study.

The propensity scores were computed using binary Probit regression models. Probit model was estimated for each state to compute probabilities of participation (propensity scores) used to compare Fadama II beneficiaries with non-beneficiaries of Fadama II project. The dependent variable in each of these models is a binary variable indicating whether the household was a beneficiary of the Fadama II project or not, while the independent (matching) variables are gender, household size, age, and years of formal education.

The steps used this study in evaluating the impact of the project based on propensity scores matching are as follows [21]:

Step 1. The samples were pooled together and a probit model of program participation was estimated as a function of socioeconomic variables in the data that are likely to determine participation.
Step 2. The predicted values of the probability of participation from the probit regression were created; these are the propensity scores. (a propensity score for every sampled participant and nonparticipant).
Step 3. Some of the nonparticipant sample were excluded at the outset because they have a propensity score that is outside the range (typically too low) found for the treatment sample. The range of propensity scores estimated for the treatment group corresponded closely to that for the retained subsample of nonparticipants.
Step 4. For each individual in the treatment sample, we found the observation in the nonparticipant sample that has the closest propensity score, as measured by the absolute difference in scores [22].
Step 5. The mean value of each of the indicators for the five nearest neighbors was then computed. The difference between that mean and the actual value for the treated observation is the estimate of the gain due to the program for that observation.
Step 6. To estimate the impact of the project on the beneficiaries, the mean value and its standard deviation of these individual gains were computed and statistical test (t-test) was used to determine statistical significance of the difference between participants and non-participants.

2.6 Limitations of the Study

Previous studies [23,5,9] employed sample sizes running into thousands in order to guarantee a larger population of participants and non-participants for whom impacts are assessed. Therefore, one limitation of the study was the sample size used in the study. Also, the inability to obtain reliable baseline data to allow the use of difference-in-difference (DD) method, which nets out pre-project differences between participants and non-participants from the final difference, as done in previous studies [9], in evaluating the impact of Fadama II is considered as the other limitation of this study.

3. RESULTS AND DISCUSSION

3.1 Socioeconomic Characteristics of Respondents

In Kogi state, 67% of the beneficiaries and 72.1% of the non-beneficiaries in Fadama II participating LGAs were males, while in Kwara state, results reveal that 69.2% of the beneficiaries and 67.1% of the non-beneficiaries were males.

In Kogi, majority of the beneficiaries (34.7%) fell within the age range of 41-50, while the majority of non-beneficiaries fell within the age range 51-60. In Kwara, the results reveal that 54.1 % of the beneficiaries were at most fifty years of age, while 67.1% of the non-beneficiaries were. This implies that the respondents in the area were still in their active age bracket.

In Kogi, 90.1% of the beneficiaries and 80.1% of the non-beneficiaries were married, while in Kwara, 93.3% of the beneficiaries and 92.9% of the non-beneficiaries were married.

In Kogi, majority (63.6%) of the beneficiaries had more than six members in their households, while 52.9% of the non-beneficiaries in the participating LGAs had between 5-6 persons. In Kwara, majority (60.8%) of the beneficiaries, and majority (52.9%) of the non-beneficiaries had more than six members.

In Kogi state, 42.1% of the beneficiaries and 36.8% of the non-beneficiaries had secondary education. Whereasin Kwara state, 48.8% of the beneficiaries and 34% of the non-beneficiaries had secondary education.

The results in Table 1 reveal that crop enterprise was the major source of income to 57.5% of the beneficiaries and 64.2% of the non-beneficiaries in Kogi state. Table 2 shows that in Kwara state, crop enterprise was the major source of income to 59.1% of the beneficiaries and 62.5% of the non-beneficiaries. The high contribution of crop enterprise as a source of income may be attributed to the focus of the project towards crop development.

3.2 Impact Analysis Results

Table 3 shows the income accrued to various activities with and without the project in Kogi and Kwara states. The results reveal that income with Fadama was higher than without among the beneficiariesin both states. In Kogi, income from crop, livestock, and fish enterprises was ₦211, 005, ₦33, 000 and ₦10,889 respectively with Fadama, while it was ₦111, 275, ₦16, 898 and ₦7, 151 without Fadama. Similarly in Kwara, while the income with Fadama was ₦240, 000, ₦30, 400 and ₦8, 817, respectively; it was ₦119, 275, ₦26,

857 and ₦7, 151 without Fadama. These results imply positive impact of the intervention on income of the beneficiary respondents.

Table 1. Sources of income of respondents in Kogi State

Source of income	Beneficiaries (%)	Non-beneficiaries (%)
Crop	57.50	64.20
Livestock	7.50	5.83
Fishery	0.83	11.70
Petty trade	5.00	4.17
Salary/wages	22.50	5.83
Artisan	3.33	6.67
Others	3.33	1.67
Total	100.00	100.00

Source: Field survey

Table 2. Sources of income of respondents in Kwara State

Source of income	Beneficiaries (%)	Non-beneficiaries (%)
Crop	59.10	62.5
Livestock	8.30	8.33
Fishery	1.70	8.33
Petty trade	9.20	4.17
Salary/wages	13.30	11.70
Artisan	1.70	3.33
Others	6.70	1.67
Total	100.00	100.00

Source: Field survey.

Table 3. Mean Income from different activities (in Naira)

Activity	Kwara	Kogi
Crop income without Fadama	119,275	111,275
Crop income with Fadama	240,000*	211,005*
Livestock income without Fadama	26,857	16,898
Livestock income with Fadama	30,400*	33,000*
Fish income without Fadama	5,450	7,151
Fish income without Fadama	8,817	10,889
Income from other sources	14,555	24,504

*Source: Field survey; * Statistically significant at 5% level*

Table 4 implies a positive and significant impact of the intervention on the yields of major arable crops in the study areas. In Kogi, the mean yield of maize (3,113kg) with Fadama was significantly greater than 1,367kg without Fadama, and similarly the mean yield of rice (1,661kg) with Fadama was significantly greater than 901kg without.

In Kwara State, the project also impacted significantly on the yields of major arable crops in the area. The mean yields of maize (4, 461kg) and rice (1,532kg) with Fadama were significantly greater than 1,969kg and 864kg of maize and rice without Fadama, respectively; the average yields of sorghum and soyabean with Fadama were significantly greater than without Fadama. These large and significant positive impacts of the project might be due to

the significant increase in productive assets and benefits enjoyed in the areas of input support programme, infrastructure, capacity building and advisory services by the participants.

Table 4. Impact Fadama II on yield of major arable crops (kg/ha)

Crop	Beneficiaries in Kogi	Beneficiaries in Kwara
Maize		
Without Fadama	1,367	1,969
With Fadama	3,113*	4,461*
Rice		
Without Fadama	901	864
With Fadama	1,66 1*	1,532*
Sorghum		
Without Fadama	611	523
With Fadama	1,002	921*
Cowpea		
Without Fadama	1,008	1,227
With Fadama	1,422	1,368
Soya bean		
Without Fadama	71	63
With Fadama	213	122*
Millet		
Without Fadama	56	49
With Fadama	89	91

*Source: Field survey. * Significant at 5% level*

3.3 Propensity Score Matching Method Results

3.3.1 Impact of fadama ii project on household income

Fadama II aimed to generate income for beneficiaries. Table 5 shows the estimates of the impact of Fadama II on household income, consumption, productive assets and livestock assets in Kogi state. The results show that the participants earned extra average income of ₦10, 938 and ₦15, 765 more than the non- participants within and outside Fadama II communities, implying that Fadama II impact positively on the poor who participated in the programme. As expected the direct impact is statistically significant at 5 percent level, given the large and significant impact of the project on productive assets of the beneficiaries.

Table 5. Impact of Fadama II on rural households in Kogi State

Outcome variable	Treated	Control	Difference	S.E	T-Stat
Household Income	41,778	30,840	10,938	5,016	2.18
Household Income*	41,792	26,027	15,765	10,040	1.57
Household consumption	1,258	1,187	71	341	0.21
Productive Assets	746,442	223,347	523,095	164,623	3.18
Livestock Assets	109,152	86,268	22,884	20,873	1.10

*Source: Data Analysis *Control comprises nonparticipants in nonfadama II communities*

In Kwara, Table 6 reveals the participants earned extra average income of ₦21, 119 and ₦21, 828 more than the non- participants within and outside Fadama II communities, respectively. These impacts are large and statistically significant at 5% level of significance; implying that Fadama II had impacted positively on the poor who participated in the programme. These are consistent with the findings of [10] which showed that Fadama II had positive and significant impact on income among arable crop farmers in Kwara state. This result suggests spillover effect of the project on the non-beneficiaries in Fadama II communities in the state.

Table 6. Impact of Fadama II on rural households in Kwara State

Outcome variable	Treated	Control	Difference	S.E	T-Stat
Household Income	41,739	20,621	21,119	5,330	3.96
Household Income*	45,430	23,602	21,828	5,867	3.72
Household Consumption	3,678	1,780	1,898	1,043	1.82
Productive Assets	611,604	13,075	598,529	107,761	5.56
Livestock Assets	104,491	18,603	85,988	21,443	4.01

*Source: Data Analysis *Control comprises nonparticipants in nonfadama II communities*

3.3.2 Impact of FadamaII on household consumption

Table 5 shows the estimate of impact of Fadama II on household consumption in Kogi State. The results show that participants on average consumed ₦71 more than the non-participants within Fadama zone, implying that Fadama II impact positively on the consumption of the poor who participated in the programme. However, the result is not statistically significant.

Table 6 shows the estimate of impact of Fadama II on household consumption. The results show that in Kwara, the participants consumed extra average of ₦1, 898 more than the non-participants within Fadama zone, implying that Fadama II impact positively on the consumption of the poor who participated in the programme. Result from PSM estimates shows a significant effect of the programme on participants at 10% level. This shows that Fadama II had achieved its objective of improving household welfare among participants in Kwara state.

3.3.3 Impact of FadamaII on productive assets

Fadama II project aimed to support asset acquisition for beneficiaries. Table 5 shows the estimate of impact of Fadama II on productive assets in Kogi State. The participants earned extra average productive assets of ₦523, 095 more than the non-participants within Fadama zone, implying that Fadama II impact positively on the poor by improving their productive asset more than the non-participants. Result from PSM estimates shows a significant effect of the project on participants at 5% level.

Table 6 shows the estimate of impact of Fadama II on productive assets in Kwara State. The participants earned extra average productive assets of ₦598, 529 more than the non-participants within fadama zone, implying that Fadama II impact positively on the poor by improving their productive assets more than the non-participants. Result from PSM estimates shows a significant effect of the project on participants at 5% level. These results are suggesting that the project had achieved its objective of increasing the productive assets of the beneficiaries since the project's impact on asset acquisition is significant in both states. These findings are consistent with those of previous studies [8,9].

3.3.4 Impact of FadamaII on livestock assets

Table 5 shows the estimate of impact of Fadama II on livestock assets in Kogi state. The participants earned extra average livestock assets of ₦22, 884 more than the non-participants within Fadama zone, implying that Fadama II impact positively on the poor by improving their livestock assets more than the non-participants. However, the results are not significant.

Table 6 shows the estimate of impact of Fadama II on livestock assets in Kwara state. The participants earned extra average livestock assets of ₦85, 988 more than the non-participants within fadama zone, implying that Fadama II impact positively on the poor by improving their livestock assets more than the non-participants. Result from PSM estimates shows a significant effect of the programme on participants at 5% level.

3.4 Impact of FadamaII on household welfare

The average household's consumption expenditure, calorie/protein intake, and poverty level in Kogi and Kwara States are shown in Tables 7 and 8, respectively. The food expenditure items included food produced and food purchased by the households. The non-food expenditure items in Table 7 shows that average household per capita daily total consumption expenditures were ₦269 and ₦218 for the Fadama II beneficiaries and non-beneficiaries, respectively. The average daily expenditure on food was higher than the corresponding values for non-food expenditures. Households of participants had per capita daily food consumption of ₦214 compared with that of non-participants having a figure of ₦183.

Table 8 shows that the household per capita daily consumption expenditures were ₦251 and ₦217 for the Fadama II beneficiaries and non-beneficiaries in participating LGAs, respectively. The average daily expenditure on food was higher than the corresponding values for non-food expenditures. Households of participants in Fadama II LGAs had per capita daily food consumption of ₦205 compared with that of non-participants in participating LGAs having afigure of ₦183.

Daily food intake was calculated by converting household food consumed into calorie and protein equivalents [3]. In Kogi state, the average per capita daily intake for the beneficiaries was 2,608 kilocalories per person per day, which was higher than the minimum of 2,250 kilocalories per person per day recommended for the country. However, the average per capita daily intake for non-beneficiaries in participating LGAs (2114 kilocalories per person per day) was lower than the minimum per person daily recommendation. The per capita daily protein intake was higher for the beneficiaries (39g) than for the non-beneficiaries in Fadama LGAs (30g) and higher than the 35 g minimum per person per day recommended from animal material [24].

In Kwara state, the average per capita daily intake for the beneficiaries was 2,558 kilocalories per person per day, which was higher than the minimum of 2,250 kilocalories per person per day recommended for the country. However, the average per capita daily intake for non-beneficiaries in participating LGAs (1679 kilocalories per person per day) was lower than the minimum per person daily recommendation. The per capita daily protein intake for the beneficiaries was higher than the 35g minimum per person per day recommended from animal material [24].

Based on the World Bank rule of thumb approach of two-thirds total consumption expenditure the poverty level was calculated as shown in Tables 7 and 8. The poverty line so generated for Kogi (Kwara) state was ₦161 (₦157), about $1 USD. Based on this poverty line, 30 (32) percent of the beneficiaries were below the poverty line. However, the proportion of households (56 percent) below the poverty line was higher among non-participating households. This shows that Fadama II activities have helped to reduce the level of poverty among participants in the study area. These results are consistent with the findings of previous studies [23,5,6,10].

Table 7. Calorie and protein consumption and consumption expenditure in Kogi State

	Beneficiaries	Non-beneficiaries
Per capita per day calorie (kcal)	2608	2114
Per capita per day protein (g)	39.1	30.3
Total expenditure	269	218
Non-food expenditure	56	37
Food	214	183
Poverty level (%) based on ₦157 poverty line	30	47

₦160 = 1$; Source: Data Analysis

Table 8. Calorie and protein consumption and consumption expenditure in Kwara State

	Beneficiaries	Non-beneficiaries
Per capita per day calorie (kcal)	2558	1679
Per capita per day protein (g)	37.1	24.8
Total expenditure	251	217
Non-food expenditure	44	33
Food	205	183
Poverty level (%) based on ₦157 poverty line	32	48

₦160 = 1$ Source: Data Analysis

4. CONCLUSIONS AND RECOMMENDATIONS

The Fadama Development project (FDP) is an ADB- financed project with counterpart funding contribution from the State and Local Governments of Nigeria. Kogi and Kwara states are among the six covered by the project.

The project sector goal was to reduce poverty by improving the living condition of the rural poor, contribute to food security and increase access to rural infrastructure. Specifically, it was designed to enhance agricultural production, productivity and value addition of smallholders and rural entrepreneurs in Fadama areas on a sustainable basis. It has 3 components namely; Capacity Building and Advisory Services, Rural Infrastructure Investment as well as Project Management and Coordination. This study was undertaken with the broad objective of quantifying the impacts of Fadama II implementation on the lives of the participants in Kogi and Kwara states.

Compared to nonbeneficiaries, the project had reduced poverty and increased nutritional intake among the beneficiaries. It had significantly raised the value of productive assets of the beneficiaries. Consequently, it had a large and statistically significant impact on the incomes of beneficiaries in both states. Overall, the study has shown that Fadama II had

impacted positively on the target population in the study area. It had succeeded in raising the value of productive assets and reducing poverty among the beneficiaries. These impacts would have been greater in magnitude if all the components of the project were fully and promptly implemented. The study is therefore suggesting the sustenance and expansion of the Fadamaprogramme because of its positive impact on the welfare of the beneficiaries through greater support from donor, local, state, and federal governments of Nigeria.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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