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Poverty Status Analysis of Irrigation Farming Households in Nigeria

A.O. Kolawole, F.M. Oluwatusin*, A. Ajiboye, O.A. Aturamu, K.A. Abdu-Raheem and F.E. Akokoh

Department of Agricultural Economics and Extension Services, Faculty of Agriculture, Ekiti State University, P.M.B 5363 Ado-Ekiti Nigeria.
femi.oluwatusin@eksu.edu.ng

Abstract: Poverty is a challenge facing the globe especially the developing nations. In fact, it appears to be inextricably linked to food insecurity, as such have been intertwined to form one of the specific Sustainable Development Goals (SDGs) that must be met by all nations. The study investigated whether irrigation farming households under River Basin Development Authority (RBDA) are better off when compared with their counterparts without access to RBDA facilities in Southwest Nigeria. A multi-stage sampling procedure was used to select One-hundred and eighty-five (185) Beneficiaries' farmers of the River Basin Development Authority (BRBDA) and fifty (50) Non-beneficiaries' farmers of the River Basin Development Authority (NBRBDA). Descriptive statistics were used to describe the socio-economic characteristics of the respondents. Also, the Foster, Greer and Thorbecke's (FGT) formula was used to measure the poverty status of the households while Logit regression model was used to determine the factors influencing irrigation farming households' poverty status. There was a high-income inequality between BRBDA (₦38,650.27 per month) and NBRBDA (₦85,737.5 per month). The poverty lines estimated for both the BRBDA and NBRBDA farmers were ₦ 1,288.34 and ₦ 1,737.5 respectively. There were poorer farmers (42.2%) among the BRBDA unlike their counterparts (34%). The corresponding poverty gaps were 0.18 and 0.024 for BRBDA and NBRBDA respectively, whereas the poverty severity indexes were 0.08 and 0.02 for BRBDA and NBRBDA respectively. The Logit regression estimates showed that all the socio-economic variables with exception of income and output significantly (P<0.001) influenced the poverty status of the NBRBDA. But gender was the only variable that significantly influenced the poverty status of BRBDA. Although irrigation is an important tool to alleviating farmers' poverty status, there were poorer farmers among the BRBDA farmers unlike their counterparts despite government intervention and provision. A viable market linkage and credit provisioning system are a necessary step to improve irrigation performance towards alleviating the poverty status of irrigation farming households in Nigeria.

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1. Introduction

Agriculture remains the mainstay of the world economy and the largest single user of freshwater. It accounts for about 75 % of current human water use (Siebert, Burke, Faures, Frenken, Hoogeveen and Portmann, 2010). This has however made the Nigerian agriculture largely uncompetitive in major crops when compared with international markets (World Bank, 2014; FAO AQUASTAT, 2018), requiring large food imports to sustain her teaming population. Between the years 2015 and 2018, drastic reforms were made, and this increases productivity and attracts investment through incentives for agricultural commodity producers. Jobs were created, and there was a sharp increase in food production and thus reduction in food imports (FMARD, 2018). The economy of Nigeria being a monolithic one relies heavily on oil revenues, which account for about 90 percent of total exports and for nearly 75 percent of government revenues (World Bank, 2014). The country's Gross Domestic Product (GDP) was estimated at US$569,000 million in 2014 and the contribution from agriculture was low (about 20 percent). Agriculture provides occupation to 31 percent of the economically active population (Federal Ministry of Water Resources, FMWR, 2014) and thus, the largest employer of labour in Nigeria, especially because 45 percent of the economically active population is unemployed (World Bank, 2014; FAO AQUASTAT, 2018).

Farming systems in Nigeria are mainly smallholder-based and agricultural landholdings are scattered. This preponderance of smallholder farmers is characterized by their use of simple and low-input technology which further results in low-output labour productivity. This however limits the production of farmers, thus, making them to augment their rainfed production with dry season farming. Agricultural produce by smallholders' farmers is high in the rainy season, and this result in a glut, but during the dry season, there is usually the scarcity of some of the farm produce thereby leading to a high price due to the forces of supply and demand. This seasonality of production has trapped farmers into a vicious cycle of poverty. Ending poverty is the main challenge for achieving equitable and sustainable development and water plays an integral role in relation to human health, livelihoods, economic growth as well as sustaining ecosystems. The Federal Government of Nigeria through the River Basin Development Authority (RBDA) has helped to some extent to harness our water resources and optimize agricultural resources for food self-sufficiency. Hence, it is of importance to investigate whether irrigation farming households under River Basin Development Authority (RBDA) are better off when compared with their counterparts without access to RBDA facilities in Southwest Nigeria. This study, however, determines the poverty status of irrigation farming households, and the factors influencing their poverty status under different schemes (irrigation users under the government scheme and self-financing or private scheme).

2. Materials and Method

This study was carried out in Southwest Nigeria, specifically, the Ogun-Oshun River Basin Development Authority (O-ORBDA). It operates in the Southwest region covering states like Ogun, Oyo, Osun and Lagos States. The area covered by the Ogun-Oshun basin has an estimated land area of 66,264 square kilometers for irrigation. It is usually drained by two main rivers - Ogun and Oshun (after which it is named) - and several tributaries and smaller rivers, the most important among which are the Sasa, Ona, Ibu, Ofiki, Oni, and Yewa. The Headquarters of the Authority is located on a 236ha estate along *Alabata* Road, off Ibadan- Abeokuta highway, Abeokuta in Ogun State.

The most important economic activity in this area is irrigated agriculture and the entire basin is of high agricultural potential. The common farming system is mixed crop and livestock production and farmers mainly grow vegetable crops and rice using simple irrigation methods such as sprinkler, drip, and bucket. There are about 1,028 registered farmers with O-ORBDA.

A multistage sampling procedure was employed to select irrigation farmers in the study area. The Ogun-Oshun River Basin Development Authority was purposively selected due to their operation and role in Southwest Nigeria for irrigation farming. Cochrane formula [4] for probability proportionate sampling recommended 18 percent of the population. This proportionately limited the number of Beneficiaries' farmers of the River Basin Development Authority (BRBDA) interviewed to be one hundred and eighty-five (185) out of one thousand and twenty-eight (1028) BRBDA. So, 185 BRBDA (Table 1) were randomly selected from 4 strata (that is, the four States covered by O-ORBDA). Also, fifty (50) irrigation farmers (Table 1) that were not under any river basin Authority, that is NBRBDA, were purposively selected from Ekiti State. This was to serve as a control sample for ascertaining households' poverty status vis-à-vis the influence of public participatory irrigation on farmers' livelihood. The overall farmers interviewed for the study were two hundred and thirty-five (235).

Primary data were collected through a well-structured questionnaire and interview schedule, while secondary data were obtained from the RBDA office. Data collected includes; household socio-economic characteristics, types of crops cultivated, farm activities, households' expenses and constraints to irrigation farming.

Descriptive statistics such as frequency count mean and charts were used to describe the socio-economic characteristics of irrigation farmers; identify the types of crops cultivated and the constraints to irrigation farming. Foster, Greer and Thorbecke (FGT) formula was used to measure the poverty status of irrigation farmers, while Logit regression analysis was used to determine the factors influencing the irrigation farmers' poverty status.

Table 1: Distribution of Irrigation Farming Households by Location in Southwest, Nigeria

S/N	State	Location / Site	Local Government	Respondents
1	Ogun	Alabata	Odeda	3
		Mokoloki	Obafemi Owode	12
		Oke-Odan	Yewa South	10
		Ijaka	Yewa	10
		Igan Alade	Sango	10
		Oyan	Odo Otin	10
		Owiwi	Ewekoro	5
2	Oyo	Sepeteri	Saaki East	15
		Ofiki	Saaki West	15
		Iseyin	Iseyin	15
		Ikere	Iseyin	10
		Ilero	Oyo Town	15
		Igboijaye	Itesiwaju	10
3	Lagos	Itoikin	Ikorodu	30
4	Osun	Iwo	Iwo	5
		Asa	Osogbo	5
		Ipetu-Ijesa	Oriade	5
5	Ekiti	Ago-Aduloju	Ado-Ekiti	50
	Total			**235**

Source: Field Survey, 2019

Model Specifications

Foster, Greer and Thorbecke (FGT) Poverty Measurement

The poverty line was measured based on the Cost of Basic Needs (CBNs) which was derived from the lowest expenditure quartile and poverty indices using the FGT formula Foster, Greer, and Thorbecke (1984). Foster et al. have suggested a useful general index for poverty measures. Their class of poverty indices takes the following form:

$$P_{\propto} = \frac{1}{N}\sum_{i=1}^{q}\left[\frac{Z_p - Y_i}{Z_p}\right]^{\propto} \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where;

Zp = poverty line,

Yi = expenditure of the i^{th} poor household

N = total number of households and

q = number of households whose expenditures are below the poverty line.

Thus, if $\propto = 0$, index $P\propto$ becomes: $P_0 = q/N$, which has been referred to as the head-count index; if $\propto$ is 1, poverty gap index and if $\propto$ is 2, poverty severity index.

Logistic Regression Model (LRM)

LRM was used to analyze the factors influencing the irrigation farmers' poverty status. The model was stated according to Gujarati (2003), i.e. the probability that i^{th} household is poor or non-poor is given by:

$$P_i = E\left(Y = {}^{1}/_{X_i}\right) = \frac{1}{1 + e^{-(\beta_0 + \beta_i X_i)}} \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Thus, poverty status was the dependent variable which was binary (1 if the household is poor and 0 if the household is non-poor). The independent variables were the variables relating to irrigation use and households' socio-economic characteristics.

For ease of exposition, the probability that a given household is poor is expressed as:

$$P_i = \frac{1}{1 + e^{-(Z_i)}} \quad \text{(3)}$$

Probability for not poor was $1 - Pi$. Thus, this is the ratio of the probability that a household is poor to the probability that it is non-poor.

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} \quad \text{(4)}$$

The natural log of Equation 4 is:

$$L_i = ln \left[\frac{P_i}{1 - P_i}\right] = Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 \ldots + \beta_n X_n \quad \text{(5)}$$

Where *Pi* is a probability of being poor (it will either be 0 or 1), *Zi* is a function of *n* explanatory variables (*X*) which are also expressed as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + e_i \quad \text{(6)}$$

β_0 is an intercept, $\beta_1, \beta_2, \beta_n$ are the slopes of the equation, Li is the log of the odds ratio, which is not only linear in *Xi* but also linear in the parameters, Xi is a vector of the relevant independent variable.

$X_1 = Age\ (years)$
$X_2 = Gender\ (1 = male, 0 = female)$
$X_3 = Marital\ Status\ (0 = single, 1 = married)$
$X_4 = Household\ size\ (number)$
$X_5 = Education\ (years)$
$X_6 = Area\ of\ land\ irrigated\ (ha.)$
$X_7 = Irrigation\ farming\ experience\ (years)$
$X_8 = Labour\ (Naira)$
$X_9 = Income\ (Naira)$
$X_{10} = Irrigation\ (Naira)$
$X_{11} = Other\ inputs\ (Naira)$
$X_{12} = Output\ (Naira)$
$X_{13} = Membership\ of\ water\ group\ (Yes = 1, No = 0)$
ei = Error term

3. Results and Discussion

Socio-economic Characteristics of the Respondents

Table 1 shows the descriptive analysis of socio-economic variables of the Beneficiaries' farmers of the River Basin Development Authority (BRBDA) and Non-beneficiaries' farmers of the River Basin Development Authority (NBRBDA). The mean age of the BRBDA and NBRBDA were 41.7 and 40.3 years respectively. This implies that younger respondents actively participate in irrigation farming more than their older counterparts. This could be as a result of the labour intensiveness associated with irrigation farming. This study, however, conforms to that of Njiraini and Guthuga (2013) that analyzed whether small-scale irrigators are water-use efficient in Kenya where they computed a mean age of 43 years. Mean age of 40 years was also computed by Adujna, Ermias, Mekonnen, and Miheret (2014) on their study that analyzed the role of small irrigation in poverty reduction. In contrast with the mean age of this result, was the study of Andreas (2014) on input use efficiency in the Madibira smallholder farmers' irrigation scheme in Tanzania where older farmers participate in irrigation farming.

The majority (82.2% BRBDA and 94% NBRBDA) of irrigation farmers were male. The implication of the dominance of male respondents in irrigation farming could be that a quite number of female farmers may not be actively involved in the production process of agricultural produce, but rather the processing or value addition process/marketing. Quite a number of studies supported this claim that men are more involved in irrigation farming than their women counterparts. Such of these studies include that of Ajiboye et al. (2016) that recorded high percentage of male farmers involve in dry season farming in Kwara State, Nigeria. Also, is Adugna et al. (2013), Njiraini and Guthuga (2013), Dauda et al. (2009) and Andreas (2014) whose percentages of female farmers securing plots for farming are very low.

The average household size of BRBDA and NBRBDA were approximately 4 members. Most times, large family sizes could be of advantage in terms of family labour availability, if the household head allows their children to work on their irrigation plot. This can, however, increase the efficiency of input used by reducing the cost of hired labour. In contrast, large households tend to survive on the output from their farmland, to meet their daily needs, especially food. It may also shrink the income from irrigation farming. This result conforms to that of Njiraini and Guthuga (2013) that computed small family size in their study on whether small-scale irrigators are efficient in Lake Naivasha Basin, Kenya.

The average years spent acquiring formal education among BRBDA and NBRBDA were 11.8 years and 5.7 years respectively. This implies that the majority of BRBDA had secondary education while their other counterparts had primary education. The high literacy level of BRBDA could be due to official and bureaucratic processes involved in the operation of the River Basin Development Authority, whereby farmers need education to apply to the authority for a piece of land for irrigation farming. Similar studies showed that most of the farmers participating in irrigation schemes have at least primary education, while few have either secondary or college education. Similar findings are reported by Njiraini and Guthuga (2013), who found that most of the respondents have primary education.

The mean area of land irrigated by NRBDA farmers (3.3 ha.) was far higher than BRBDA farmers which was 1.29ha. This depicts the small farm holding nature of the irrigation farmers in Southwest Nigeria. It can be inferred from this study that BRBDA farmers have limited access to land. This probably is meant to give opportunities for more farmers to have access to irrigation land and facilities provided by BRBDA. The work of Naceur et al. (2011) estimated low mean area of land irrigated while Chebel and Frija (2016) got a higher mean area of land irrigated. Their studies could have captured more farmers that operated on large-scale irrigation farming, unlike this research that focused on smallholder irrigation farmers.

The BRBDA and NBRBDA that rented their plots were 83.7 and 82 percent respectively. This implies that the irrigation facilities were sited on parcels of land owned by the government or other sources. In other words, this could be termed as a user-allocation system. The implication of this is that it may not encourage the further development of the irrigable lands, particularly when the allocation of land is done on a seasonal basis. Farmers may often have little commitment to the land in terms of reclaiming the fertility of the land. This could be that farmers are not sure if they would be allocated to the same plot in the following season. About 10 percent of farmers acquired their land through leasehold. This implies that if leases are allocated land on an annual or seasonal basis, there is a probability that they are allocated a different plot, or they are not allocated a plot at all. Farmers that inherited their plots (6.5% BRBDA and 8% NBRBDA) could invest on their lands by keeping the soil productive through effective soil or nutrient management. This mode of acquisition is referred to as the farmer-occupier system, which is one of the criteria for allocating lands to indigent farmers around the basin network. The implication of the farmer-occupier system is that it may encourage the operation and maintenance of the scheme's irrigation infrastructure.

It can be deduced from the mean values of BRBDA and NBRBDA farming experience (17.9 and 14.5 years) that irrigation farmers in Southwest Nigeria are highly experienced in their farming operations. It is expected that farmers' managerial know-how and decision making be enhanced. The work of Chebil and Frija (2016) also found a high mean farming experience in their study. BRBDA farmers employed more of family labour (43.8%) to do their farm work, while NBRBDA farmers utilized more of hired labour (50%). The usage of family labour can help farmers to minimize their cost of labour, although family labour needs to be inputted as a cost of production. About 20 % of irrigation farmers work on their farmland alongside with hired labour to help complement their efforts for maximum productivity. The mean income (₦ 85,737.5) realized from irrigation farming by NBRBDA was outrageously higher than that of the BRBDA farmers (₦ 38,650). This implies that irrigation farming is a good source of income for rural households.

Table 2: Analysis of Socio-economic Variables

Variables Brbda				Nbrbda		
Age (years)	**Frequency**	**Percentage**	**Mean**	**Frequency**	**Percentage**	**Mean**
21-30	30	16.2		9	18	
31-40	63	34.1		13	30	
41-50	61	33	**41.7**	16	32	**40.3**
51-60	20	10.8		6	12	
>60	11	5.9		4	8	
Gender						
Male	152	82.2		47	94	
Female	33	17.8		3	6	
Household Size						
<3	26	14.1		5	10	
3-5	146	78.9	**3.7**	42	84	**3.93**
>5	13	7		3	6	
Education (years)						
≤6	27	14.6		32	64	**5.7**
7-12	109	58.9	**11.8**	18	36	
>12	49	26.5		0	0	
Land Irrigated (Ha.)						
<0.5	20	10.8		7	14	
0.5-1.49	86	46.5		15	30	
1.5-2.49	51	27.6	**1.29**	10	20	
2.5-3.49	13	7		3	6	**3.3**
≥3.5	15	8.1		15	30	
Mode of Land Acquisition						
Rent	155	83.7		41	82	
Inheritance	12	6.5		4	8	
Leasehold	18	9.8		5	10	
Farming Experience (years)						
<10	30	16.2		18	36	
10-19	90	48.6	**17.9**	15	30	**14.5**
20-29	36	19.5		11	22	
30-39	24	13		5	10	
≥40	5	2.7		1	2	
Labour Type						
Family	81	43.8		5	10	
Hired	68	36.8		25	50	
Both	36	19.5		20	40	
Income (Naira)						
<20,000	19	10.3		14	28	
20,000-39,999	121	65.4	**38,650.27**	13	26	**85,737.5**
40,000-59,999	15	8.1		2	4	
60,000-79,999	19	10.3		8	16	
>79,999	11	5.9		13	26	

Source: Field Survey, 2019

Crops Irrigated

Under the BRBDA scheme, the majority (82.2%) of the farmers cultivated maize while 64 percent of NBRBDA intercropped maize with other crops like cucumber, watermelon, pepper, onions, Corchorus (*ewedu*), okra, Amaranthus, tomato and garden egg (Table 3). This implies that most of the crops cultivated were vegetables. Depending on the use to which maize is put, it could be regarded as a vegetable crop also, if it is not processed. The reasons attributable to the comparative advantage for vegetable production among irrigation farmers in the Southwest could be that vegetables are high-value crops that can give more income within a short period. It requires lesser water and energy, and the farmers want the quickest and easiest means to sell their produce through the local market. It can be deduced from this result that the majority of the BRBDA practiced mono-cropping, unlike their counterparts. This must have resulted from the way RBDA designed their irrigation settings. Also, the types of irrigation methods employed on the farmland determined to a large extent the kind of crops cultivate. Some crops may perform well or have maximum yield under the sprinkler system than the drip system and vice versa. For instance, farmers in Itoikin (Ikorodu Local Government Area) in Lagos State practiced the flooding system, thus, this makes mixed cropping to be easier for them to practice (Oluwatusin et al., 2020). Furrow irrigation method too can allow NBRBDA farmers to practice mixed cropping.

Uncertainty in irrigation water supply resulting from the high cost of energy and unreliability of the pumps at the river basin can as well favour the cultivation of vegetable crops. Farmers that practiced mixed cropping are likely those that practiced the flooding or furrow methods of irrigation. However, such farmers under this condition may have reduced production risk through the diversification of their crop enterprises. Several researchers that worked on irrigation farmers supported this claim about the predominance of vegetable crop production among irrigation farmers. Njiraini and Guthuga (2013) reported that the farmers in their study area mainly grow vegetable crops.

Table 3: Types of Crops Irrigated

Crops Irrigated	**Brbda**		**Nbrbda**	
	Freq.	**%**	**Freq.**	**%**
Maize	152	82.2	32*	64.0
Rice	14*	7.6	-	-
Cucumber	4	2.2	2*	4.0
Water melon	4	2.2	2*	4.0
Pepper	15*	8.1	26*	52.0
Onion	2	1.1	4*	8.0
Corchorus	6*	3.2	20*	40.0
Okra	10*	5.4	7*	14.0
Amaranthus	15*	8.1	24*	48.0
Tomato	8*	4.3	10*	20.0
Garden Egg	5*	2.7	3*	6.0

Source: Field Survey, 2019. *multiple responses

Water Sources

The majority (89.7%) of BRBDA utilized water from the dam while the remaining (10.3%) relied on water from the river for irrigation (Table 4). This implies that BRBDA are guaranteed water supply throughout the dry season period, as RBDA dams can only decline in water level but do not dry up. About 82 percent of NBRBDA subsisted on water from the river to irrigate their farmland. At extreme dry season condition, river in *Ago-Aduloju* dries off and this limit further production of farmers except for those that have access to borehole (12%) and well (6%) as their sources.

Table 4: Sources of Water for Irrigation

	BRBDA		**NBRBDA**	
Sources	**Freq. %**		**Freq.**	**%**
Dam	166	89.7	-	-
Borehole	-	-	6	12.0
Well	-	-	3	6.0
River	19	10.3	41	82.0
Total	**185**	**100.0**	**50**	**100.0**

Source: Field Survey, 2019

Water and Energy Charges

The results in Table 5 give an overview of the disparity between the water charges and the energy costs. The water fee for BRBDA in Southwest was ₦ 10,000 and the average cost of diesel for irrigating their farmland was estimated to be ₦ 34,400 per production cycle. The charges are not based on the type of irrigation system but are fixed arbitrarily by the RBDA. The water charges do not also cover the cost of the diesel for the pumps. However, it must be appreciated that an attempt to increase water charges to an economic level (charges meeting running and operational costs) would meet opposition and could discourage the farmers. This does not apply to NBRBDA farmers since they are responsible for meeting their irrigation expenses which can never be lower than the subsidized rate given to BRBDA by the government.

Table 5: Water and Energy Cost

States	Cost of Diesel/ha ₦	Water Charges/ha ₦	Differences/ha ₦
Ogun	31,833.33	10,000	21,833.33
Oyo	42,925	10,000	32,925
Osun	28,000	10,000	18,000
Lagos	20,000	10,000	10,000
$\bar{X}$	34,400	10,000	

Source: Field Survey, 2019

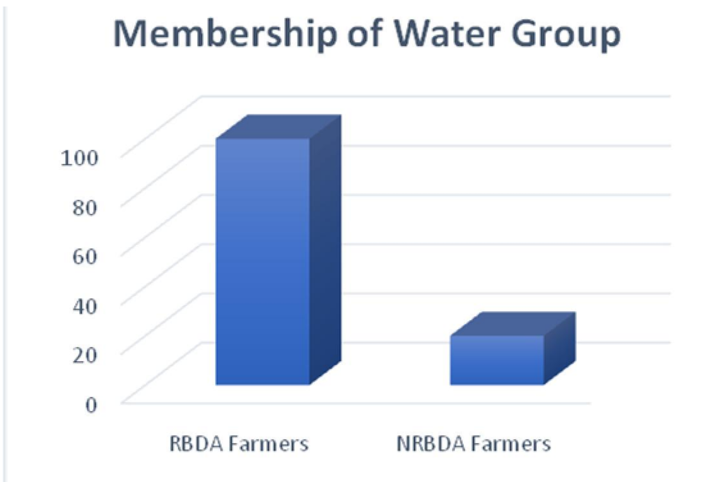

Figure 1: Water Group Membership

Membership of Water Group

The results in Fig. 1 shows that all the farmers that are under the RBDA belong to a water group while about 80% of NBRBDA were not members of any water group. Group formation among BRBDA was necessary to share the excessive burden of the cost of energy for pumping and water abstraction into their farmland. Since the amount paid to RBDA for land use and irrigation facilities does not cover the cost to power these facilities, this necessitates their pulling of resources together. On the other hand, NBRBDA are more individualistic and bear their irrigation cost themselves.

Poverty Status of Irrigation Farmers

In order to assess the poverty status of farmers under different irrigation schemes (BRBDA and NBRBDA), the per capita expenditure method was used. Households were grouped into poor and non-poor in relation to their level of per capita expenditure. The result shows that more than half of the sampled respondents (BRBDA and NBRBDA) lived above poverty lines of ₦ 1,288.34 and ₦ 1,737.5 respectively (Table 6a). There were poorer farmers (42.2%) among the BRBDA, unlike their counterparts who financed their irrigation assets themselves (34%). This implies that 42.2% of BRBDA spent below ₦ 1,288.34 per day and 34 percent NBRBDA spent below ₦ 1,737.5 per day. Since there are more non-poor irrigation farmers in the study area, irrigation farming is still very important in reducing the poverty status of farmers in Southwest Nigeria.

Table 6a: Poverty Status of Irrigation Farmers

		Poor		Non-poor		
Irrigation Farmers	Poverty Line (₦ per household/day)	N	%	N	%	Total
BRBDA	1,288.34	78	42.2	107	57.8	185
NBRBDA	1,737.50	17	34.0	33	66.0	50

Source: Field Survey, 2019

The corresponding poverty gap by irrigation use was 0.18 and 0.024 for BRBDA and NBRBDA respectively, whereas the poverty severity index was 0.08 and 0.02 for RBDA and NRBDA farmers respectively (Table 6b). Thus, poverty is widespread among BRBDA in Southwest Nigeria.

Table 6b Poverty Indices by Access to Irrigation

Irrigation Farmers	Head Count Index (α = 0)	Poverty Gap (α = 1)	Squared Poverty Gap (α = 2)
BRBDA	0.42	0.18	0.08
NBRBDA	0.34	0.024	0.02

Source: Field Survey, 2019

It is expected for farmers that are provided with irrigation assets to be non-poor, unlike farmers that incurred their irrigation expenses. This is an indication of bottlenecks in the operation of RBDA, thus limiting the performance of their farmers. No wonder about 42.2 percent of BRBDA still lived below the poverty line.

Determinants of Poverty

The Logit model was used to identify factors pushing in or pulling out irrigation farmers of poverty. Some variables were dropped due to multicollinearity among some continuous and discrete variables. For instance, under BRBDA model, irrigation cost and membership of the water group were dropped. Irrigation cost for BRBDA was constant, and that they all belong to the water group. Payment for irrigation facilities does not necessarily equalize payment for water supply to farmland. Farmers under RBDA must, however, form a group to incur some overhead cost like the cost of diesel, to ensure that their farms are being irrigated.

Furthermore, under NBRBDA model, only variable ‘gender’ was removed from the model. This could be due to the 94% dominance of male farmers constituting NBRBDA. From the Logit model results (Table 7), the positive coefficient exhibited by age across the two models is an indication of the prevalence of poverty among older irrigation farmers in Southwest Nigeria. This implies that as the age of the farmer's increases, the probability of being poor increases. The probable reason may be due to reduction in production as age increases. This result is consistent with the study of Adugna et al. (2013), Sabir et al. (2006) and Gyekye and Akinboade (2001). But inconsistent with the findings of Ayalneh and Korf (2009) which stated that households headed by older people have a greater likelihood of being non-poor. The coefficient of age was not significant for BRBDA model, but significant at 1% level for NBRBDA model.

The negative significance (1%) of the variable ‘gender’ implies that female irrigation farmers are more trapped into the vicious cycle of poverty in Southwest, unlike their male counterparts. Likewise, the positive coefficient value of ‘marital status’ (BRBDA model) connotes that married farmers had more probability of being poor. This could probably be due to the demand accompanied by marriage and the upbringing of children. This, however, was not a limitation to NBRBDA farmers as they use their marital advantage (use of family labour) to pull themselves out of poverty. This could also be a result of a low dependency ratio. This ratio allows one to measure the burden weighing on members of the labour force within the households. Household size negatively affected the probability of a household to be poor. It shows that large household size reduces poverty. This finding contradicts the work of Adugna et al. (2013), Alemu et al. (2009) and Ayalneh and Korf (2009).

The variable ‘education’ conforms with the *apriori* expectation, as it is expected that the years spent acquiring formal education supposed to increase the chances of not being poor. The variable ‘education’ was found to be negatively related to poverty status and significant at 1% level for NBRBDA model. As area of land irrigated by BRBDA increases their probability of being poor increases. On the other side (NBRBDA farmers), it seems that access to more decreases the probability of being poor. That is BRBDA incur more cost in accessing land. Setting up irrigation facilities increases with an increase in the area of land cultivated by BRBDA. However, BRBDA have the potential to be non-poor if irrigation facilities are adequately provided by RBDA.

Irrigation farming experience was found to be negatively related to poverty status and was significant at 1% level for NBRBDA farmers. This implies that experience in irrigation farming is a factor to pull farmers out of poverty. This conforms with the *apriori* expectation because farmers with more farming experience are expected to have acquired knowledge about better methods of farming to increase their productivity. The more of labour and other inputs used by irrigation farmers, the more their probability of not being poor. While the more their output, the more the probability of not being poor. This could be due to good marketing and pricing of agricultural produce at the harvest period.

The variables income and membership of the water group by irrigation farmers were positively related to their poverty status. This implies that an increase in the income of farmers brings about an increase in poverty. Membership of water group supposed to help farmers to share the burden of irrigation cost, thus reducing production risk and pulling them out of poverty but it was not so in this study. The positive sign reveals that membership of water group promote poverty.

Table 7: Logit Model Results for Determinants of Poverty Status

Variable	Brbda		Nbrbda	
	Coefficient	**P>/z/**	**Coefficient**	**P>/z/**
Constant	-959.657	0.00	-64.313	0.00
Age (X1)	18.093	0.318	0.364	0.00***
Gender (X2)	-71.493	0.00***	-	-
Marital Status (X3)	512.586	0.446	-1.705	0.00***
Household Size (X4)	-720.171	0.749	-12.577	0.00***
Education (X5)	-24.996	0.703	-1.054	0.00***
Area of Land Irrigated (X6)	93.358	0.900	-22.122	0.00***
Farming Experience (X7)	-1.107	0.989	-2.995	0.00***
Labour (X8)	70.148	0.643	14.322	0.00***
Income (X9)	0.0619	0.675	0.000461	0.996
Irrigation (X10)	-	-	0.000124	0.00***
Other inputs (X11)	0.00254	0.98	0.000804	0.00***
Output (X12)	-0.00378	0.978	-0.00015	0.998
Water Group (X13)	-	-	26.308	0.00***
Loglikelihood	-0.06429		-1.00e-07	
LR chi2(9)	251.77		62.40	
Prob>Chi2	0.0000		0.0000	
Pseudo R2	0.9995		1.000	

Source: Field Survey, 2019. **Note:** *** indicates 1% significance level

Constraints to Irrigation Farming

The results in Table 8 gives the numerous arrays of constraints to irrigation farming in Southwest Nigeria. Though in some schemes under RBDA, farmers' survey was generally poor due to the low commitment and interest of the farmers. The level of cooperation among farmers (18.4 percent BRBDA and 80 percent NBRBDA) was weak and where cooperation exists, they are not either effective or active. Active cooperation is needed by farmers using the Centre Pivot irrigation method so that the coverable area of land (5ha) must be cultivated and cost of operation, pumping water for 24 hours must be adequately met. This was evident from the distribution of irrigation farmers interviewed all over the states in Southwest Nigeria covered by RBDA. The irrigation facilities or infrastructure especially the sprinkler, some Centre Pivot irrigation infrastructures, with many pumps need repair or replacement as a major constraint (84 percent) to efficient irrigation. This predominant problem could further lead to poor maintenance and water delivery, weak technical and management capacity, technical deficiencies in the infrastructure provided for farmers by RBDA.

The cost of energy in irrigation farming is also worrisome as 81.1 percent and 70 percent BRBDA and NBRBDA respectively lamented about the cost incurred on fuel (diesel) to power the Centre Pivot system and pumping machines. Aside from energy as an input is also the high cost of inputs like improved seeds, agrochemicals, fertilizer, and labour. This problem affected about 67.6 percent of BRBDA and 60 percent NBRBDA.

At the end of production, it is also problematic for 77.3 percent BRBDA farmers and 48 percent of NBRBDA to market their products due to the high cost of transportation, low market prices and spoilage of farm produce. This makes farmers not to break-even. This could have resulted in the more reason why less than half of the farmers live below the poverty line. Farmers could have been better off if support and advisory services are being provided by RBDA to help 73 percent non-informed BRBDA about the best irrigation practices, value addition, market information and other vital information that can boost their productivity. Only 10 percent of NBRBDA could access credit to enhance their production, while others have no access to credit. This implies that most of the farmers self-financed every operation on their farmland.

About 82 percent of NRBDA farmers were adversely affected by climate change, thus leading to their water sources drying off. This is, however, risky if there are no alternative sources of water to irrigate their farmland. An outbreak of pest and diseases is a constraint to about less than half of RBDA farmers since most of them cultivates their crop under a single irrigation scheme. This implies that the failure of one farmer to prevent pests and diseases will infest other farmers around him.

Table 8: Constraints to Irrigation Farming

	Brbda		Nbrbda	
Challenges	**Freq.**	**%**	**Freq.**	**%**
Low level of farmers cooperation	34*	18.4	42*	80.0
Poor operation and maintenance of irrigation facilities	155*	83.8	2*	4.0
High cost of energy	150*	81.1	35*	70.0
High cost of inputs	125*	67.6	30*	60.0
High cost of marketing	143*	77.3	24*	48.0
Poor support and advisory or extension services	135*	73.0	36*	72.0
Pest and disease outbreak	90*	48.6	5*	10.0
Dryness of water sources	-	-	41*	82.0
High cost of irrigation facilities	20*	10.8	38*	76.0
Lack of credit facilities	148*	80.0	45*	90.0

Source: Field Survey, 2019. *Multiple responses

4. Conclusion and Recommendations

This study showed that the RBDA farmers are not better off than their counterparts who are not benefiting from irrigation facilities provided by the government. There were more poor RBDA irrigation farmers despite government provision. The operation and maintenance cost of irrigation facilities which are borne by the farmers are too exorbitant. It appears that farmers have little incentives to use water in an efficient way in the absence of ownership rights, a water price and the lack of a coordinated marketing system and maintenance culture of irrigation facilities. In this sense, a public-private partnership could trigger better management of irrigation facilities among farmers. A shift in technology to one that will use lesser power can help to reduce the cost of irrigation and boost the production of more high valued crops (maize and vegetables) which were commonly grown in the study area. An efficient marketing system and a better pricing of agricultural produce from irrigation farming need to be enhanced by the government through a better agricultural marketing board in Southwest Nigeria. Also highly subsidized farm inputs should be made available to farmers in order to enhanced agricultural production. All these will help to improve the welfare of irrigation farmers.

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