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FACTORS AFFECTING FARMERS' ABILITY TO PAY FOR IRRIGATION FACILITIES IN NIGERIA: THE CASE OF OSHIN IRRIGATION SCHEME IN KWARA STATE

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ABSTRACT

Over the years, large sums have been invested into the irrigation sub-sector of Nigerian agriculture. However the outcomes of these spending have been that of dismal failures. This study therefore examined a public-private partnering initiative for providing irrigation facilities to farmers in Nigeria using farmers under the Oshin Irrigation scheme in Kwara state as a case study. Specifically, the study investigated factors influencing farmers' ability to pay for irrigation facilities. The study sample comprised farmer households under the Oshin irrigation scheme. Data gathered for the study were analyzed using the descriptive statistics and logistic regression. The results showed that most of the farmers respondents are agile youths whose monthly household incomes averaged ₦24,421.12 during dry season production season. Factors identified as determinants of farmers ability to pay for irrigation facilities include the age of farmers, the type of education acquired by the farmer, farmers household income and the size of farmers household. The study therefore recommends a public-private partnership structure for irrigation service delivery in Nigeria, the need to incorporate other income generating activities like fish production alongside crop production in commercial irrigation initiatives and the need to educate farmers.

Key words: logistic regression, descriptive statistics, public-private partnering initiative, fish production

Introduction

Over the years, many resources have been sunk into the development of Nigeria's water resources for agriculture. As far back as in the 1970s, government constructed large number of dams and pumping stations, especially in the drier northern part of the country. By 1990, 162 dams had been constructed with a total storage capacity sufficiency to irrigate 725000 hectares of farmlands, as well as other her agricultural uses, domestic, and industrial purposes. As at 1990, the total amount released for water resource development in the country totaled ₦5.1 billion. The amount was then gradually increased in the new millennium until it peaked at ₦64.3 billion in 2005. The amount later fell slightly to ₦55.3 billion in 2006 (see Table 1) (Federal Ministry or Water Resources, 2006). Over the years, the Nigerian government established the Rural Basin Development Authorities (RBDAs) and dams to provide irrigation water to crops so as to boost food production in the country. Also established by the government is the on-going small-scale Fadama (in-land valley lands which are low-lying and seasonally flooded) development programs. The World Bank implements the Fadama program while the bank is assisted by the Agricultural Development Projects Authorities under the National Fadama Development Project (NFDP).

Despite these large resources invested into the nation's agricultural sector, the nation's agriculture is still practiced largely at a very small scale level due to inadequate infrastructures, ineffective marketing practices and low human capacity resulting in low productivity of resources. This culminates eventually to poverty

With regards to irrigation bottlenecks in the nation's agriculture, various remedial measures have been advocated as panacea to tackling the problem. A major one being water charging/pricing (Gavan *et al*, 2006). The water charging/pricing ideology is usually premised on the perspective of improving efficiency in resource allocation in the context of growing scarcity and competition for water. However, while efficiency incentives and financial functions of water pricing/charging have been widely discussed and dictated, issues relating to the ability of the end users to pay for irrigation resources have received no attention in Nigeria.

This study therefore examined the determinants of farmers' ability to pay for irrigation facilities in Nigeria using farmers under the Oshin, Oke-Oyi Lower Niger River Basin Authority scheme in Kwara State, Nigeria as a case study.

Privatization and Commercialization Policies in Nigeria: The Place of Irrigation Agriculture

As a short remedial measure, government in the 1980s adopted the privatization and commercialization policy reforms, with a view to bringing private sector innovative and efficient management to bear in the provision of economic and social infrastructures, as well as reduce cost of public utilities. While privatization of public entities featured prominently in the telecommunication transport, and power sectors, the irrigation sector has over the years been isolated from private involvement, probably because of the many associated attendant risk (Kessides, 1993). The involvement of the private sector in the maintenance of public utilities especially that of the irrigation infrastructure is imperative and germane for Nigeria. This is more so as the problem of water infrastructure in Nigeria is principally that of infusing adequate capital for the maintenance and improvement of existing infrastructures and the construction of new-ones. The huge experimental success recorded in the telecommunications sector in the country, which now serves as the reference point for private sector participation adds impetus to the imperativeness for the clarion call for the private participation in water infrastructure provision (Magnus, 2007).

In Nigeria, commercializing irrigation could be seen as an alternative source of water for dry season farming. This is more so as the bulk of the nation's populace are peasants. The country also has a rapidly growing urban population to be fed coupled with dwindling government revenue. Trends in country nowadays are hinged on private participation in governance; hence, the need to commercialize irrigation infrastructure. It is in view if this that the current study examined farmers' ability to pay for irrigation services in Nigeria. The study therefore ends to address the following research questions. What fraction of the farmers incomes are farmers able to lay aside as funds for financing their irrigation agriculture?. Are farming practices under irrigation viable? What are the farmer's socio-economic characteristics and other factors that affect farmers' ability to pay for commercialized irrigation scheme?

Objective of the Study

The main objective of the study was to examine the determinants of farmers' ability to pay for irrigation facilities in Nigeria, using farmers under the Oshin, Oke-Oyi Lower Niger River Basin Authority irrigation scheme in Kwara State, Nigeria as a case study. The specific objectives were to:

(i) Examine the socio-economic factors that influence farmer's ability to pay for commercialized irrigation facilities.

(ii) Determine the cost and return structure to farming practices under the scheme

(iii) Determine the factors that influence farmer's ability to pay for commercialized irrigation facilities under the scheme.

Justification of the Study

The crave for farm production during the off-production/dry season necessitated the current study. Considering the fact that recent reforms in Nigeria are hinged on private participation in governance, a study as this which examined the ability of farm households to pay for commercialized irrigation facilities is important, as it does not only empirical measures of farmers potential to pay for commercial irrigation facilities, it could also serve as a pointer to initiating commercialized irrigation schemes in the country, at most to halt the dwindling irrigation opportunities for farmers in the country. If the commercialization of irrigation is well conceived, it will help reduce government expenditures on irrigation and also encourage rapid development of irrigation infrastructures in Nigeria. The study also stands to benefit the country in her drive to ensuring self-sufficient in food production, as it will identify those variables (areas) that require urgent attention of the various stakeholders in the nation's irrigation agricultural sub-sector.

Case, Data, and Model

Study Area and Data

This study was conducted at Oshin, Oke-Oyi in Kwara State of Nigeria. Kwara state lies on latitude 7^0 15^0 N and longitudes 6^0 18^0 E and covers a land area of about 32,500km$^{2.}$. The state serves as a 'bridge' state between the Northern and Southern-western Nigeria and shares boundaries with Ondo, Oyo, Osun, Niger and Kogi States in Nigeria, and an international border with the republic of Benin. The state has a population of about 2.37 million people (NPC, 2008).

Kwara State has two distinct climatic seasons annually: the dry and wet seasons. The wet season falls between April-October while the dry season runs between November-March of each year. The annual rainfall ranges from 1000-1500mm, while maximum average temperature ranges between 30^0C and 35^0C. The natural vegetation consists broadly of rain forest and wooded savannah while the land forms consist of undulating hills, valleys and plains which are transversed by the River Niger and its tributaries. The state has sizeable expanse of arable, rich fertile soils which is used for the cultivation of a wide variety of staples like yam, cassava, maize, cowpea, fruits and vegetables. Rice and sugarcane are significant cash crops (Kwara State Ministry of Information, 2007). The state is also classified into four (4) agro-ecological Zones A, B, C and D by the Kwara State Agricultural Development project based on agronomic and cultural characteristics (Kwara State Agricultural Development Project, 2007).

Oshin, Oke-oyi scheme is a small scale irrigation scheme under the lower Niger River Basin Authorities. It was initiated in 1994 and it is located at Oke-oyi, Ilorin East Local Government of Kwara State covering a land area of the scheme site initially comprise a constructed 47 centimeter long weir built across the Oshin river at Oshin to impound water for the irrigation of about 100 hectares of farmland during the dry periods of the year. This initial weir was constructed via direct labor of the schemes in-house workers. Another weir was also built in 1998 downstream the Oshin River. The main wier and other improvements made on the former weir in 1998 has capacitated the scheme to supply water of about 7 million cubit meters volume. Currently, the project is been rehabilitated as two more weirs are to be constructed so as to increase its irrigation agriculture capacity from irrigating the initial 100hectares to irrigating more farmlands. Current charges for the use of irrigation facilities under the Oshin scheme are ₦ 1000 per hectare per season (Kwara State Niger River Basin Bulletin, 2008).

Data Collection

The target population for this study was the farm households under the Oshin irrigation scheme. The study sample comprised only a one stage sampling procedure involving the random selection of sixty farmers from the sampling frame of farmers under the irrigation scheme. The study is based on cross sectional farm data which was sourced mainly from primary source. The primary data sources comprised the use of well structured questionnaires to solicit response from farm household. This was supplement with secondary data like literature, journals and bulletins. The structured questionnaire was

used to collect relevant information about farm household socio-economic characteristics and the farming practices of the farmers under the Oshin irrigation scheme

Analytical Techniques

The tools of analysis for the study were the descriptive statistics and the regression logit model. The descriptive statistics employed were the frequency distribution tables, mean, and co-efficient of variation which were used to analyses respondents' socio-economics characteristics and their farming practices under the Oshin irrigation scheme. The logistic regression model was be used to determine the mean farmers ability to pay for irrigation facilities. The logistic regression model which is based on the cumulative probability function was adopted because of its ability to deal with a dichotomous dependent variable. According to Roopa (2000), logistic regression is a technique, which allows for estimating the probability that an event will occur or not through prediction of a binary dependent outcome from a set of independent variables. Hanemann's (1989) model was adapted for this study as used by Branka and Kelly (2001) in a study on willingness to pay for improved conservation of environmental species in the USA, Yusuf *et al* (2005) on willingness to pay for improved household solid waste management in ibadan north local government area, Oyo State and Adepoju and Omonana (2007) on the determinants of willingness to pay for improved water supply in Osogbo metropolis.

Logistic Regression Model

Following Menard (1995), and Agresti (1996), the study logistitic model is specified as

$$P_i = E(Y_i = 1 / X_i) = e^{(ß_0 + ß_1 X_1 + ß_2 X_2 \ldots\ldots ß_i X_i)} / 1 + e^{(ß_0 + ß_1 X_1 + ß_2 X_2 \ldots\ldots ß_i X_i)} \quad (1)$$

Where P_i is a probability that dependent variable Yi = 1 if the farmer is able to afford the irrigation facilities charges and 0 if otherwise , $ß_0$ is the intercept which is constant, $ß_1$ is the coefficient of the factors that determine farmers' likelihood to pay for irrigation facilities at the Oshin irrigation site. X_i is a set of independent factors/variables. The factors hypothesized include X_1= Age of farmer in years, X_2 = type of educational acquired by farmer whether formal or informal. This variable was dummied as 1 for formal education and 0 for informal education, X_3 = land size cultivated by the farmer, X_4 = household size of farmer, X_5 = farmer household income in naira (₦) and X_6 farmer household expenditure in naira (₦) and X_7 = charges for using irrigation facilities at the irrigation site in naira (₦)

The chi-square was used to measure the goodness of fit of the model and the significance of the model used.

Results and Discussion

Socio-Economic Profile of Respondents

The age of farmers to a large extent affect their labor productivity and output. It also affects the adoption of innovation in traditional farming. Table 2 presents the distribution of the respondents by their socioeconomics characteristics. The Table shows that many of the most of the respondents are youths (66.5%) with ages less or equal to 40 years. The rest of the respondents are over 40 years of age. The average age is 28.4 years with an age co-efficient 0.43. The result therefore indicates that a good proportional of the study respondents are youths. Hence there is probability these youths would be able to work at large scale production levels if availed such opportunity. The fact that most of the respondents are youths could imply that farming under the Oshin scheme is a viable. This is more so since youths would most likely undertake only paying jobs.

Education is known to facilitate farmers understanding and use of improved crop production practices. About three-quarters of the respondents have not had any form of formal education. However the remaining respondents have had one form of formal education or the other, at least primary school education. Table 2 also indicates that about half of the respondents have households that comprised of between 1-5 members, while the other halve of the respondents have households that consist of over 5 members. The average household size is made up of 8 members with a coefficient of variation of 0.51. The income receipt of farm household to a large extent affects the farmers' ability to pay for irrigation facilities. As household income increases the household becomes more capacitated to pay for irrigation facilities. Table 2 shows that respondent 2007 seasons' farm income on a monthly basis. More than half of the respondents earned about ₦20,000.00 monthly from their crop harvest sales during the 2007 cropping season. The rest of the respondent earned about ₦40,000.00 as monthly incomes during the cropping season. The result implies that farmers' receipts from their farming activities are reasonably fair. However, the farm incomes earn by farmers could be considered to be low considering the high inflationary conditions in the country.

Farming Practices of Respondents

The kind of crops cultivated under irrigation by respondents to a large extent determines their farm's income receipts. Cash crops are expected to provide higher returns than their food crops counterparts. Table 3 shows the farming practices of respondents under the Oshin irrigation scheme. The table indicates that most respondents cultivate more than one type of crop on their farms. Crops cultivated were mainly vegetables including pepper, tomato, cucumber, water melon, spinach (*Amaranthus spp*), jute, okra, garden egg and ogwu. The other crops were food crops including cowpea and maize. About one-third of the respondents cultivated food crop mixtures. The fact that a sizable number of the respondents cropped vegetables that are expensive in the market could imply that farmers under the Oshin irrigation scheme are capable of sacrificing some amounts as payment/charges for their use of irrigation facilities.

Respondents Perception about Commercial Irrigation

Information regarding farmers' perception as to whether or not to embrace a public-private/ commercialized irrigation initiative could help pacify issues relating to whether farmers are willing and able to pay for irrigation facilities. Table 4 shows the likert scale results of respondents' perception about public-private/commercialized irrigation scheme. The Table shows that most of the respondents (79.9%) believe strongly in the need for public-private partnering in the provision of irrigation services to farmers. According to the respondents, public-private partnering schemes like the one at Oshin, should be replicated to surrounding towns and villages, more so that such scheme will be involve less financial burden on government, but yet better the lots of the masses.

Costs and Returns Structure

In any production process, costs are incurred in the production process and income or returns are earned from the sales of output. Table 5 presents the summary of costs and returns estimates to the crop production practices of farmers under the Oshin Irrigation scheme. The returns to farmers' labor and management (RLM) were estimated for the respondents' farms. A total sale of the farmers crops were valued at the prevailing prices for each of the crops, the summary Table showed that on the average, the respondents' enterprises were profitable. The respondents farms generated on average gross revenue and gross margin of ₦76,833.67 and ₦41,278.3 per hectare while the fixed costs was incurred from

depreciation resulting from the use of hoes, cutlasses and tubes for irrigation. The costs imputed for non-cash incomes like family labor and the farmers' farmland area were ₦2034.9 and ₦1500 per hectare, respectively. The variable costs averaged ₦13324.33 per hectare. The labor expenses took the lion share of the total variable costs. This is expected so since most of the respondents farms were the fadama types, which are usually characterized with heavy weed infestation problems, thereby requiring large amounts of labor for weeding operations. The study results further indicates that respondents crop production activities under the Oshin scheme yielded positive average returns to the farmers' labor and management (RLM). The implication of this is that respondents' farms are viable.

Factors Determining Farmers' Ability to Pay for Irrigation Facilities

The factors hypothesized as those affecting farmers' ability to pay for irrigation facilities were regressed against the likelihood of farmers paying for irrigation. Table 6 presents the logistic regression results. From the Table, the Chi-square is 469.262, which implies that the parameters included in the logistic model are significantly different from zero at the 1 per cent level. The result showed that the co-efficient of age, land size, amount charged for the use of irrigation facilities, household income and household expenditure have the expected a priori signs. The remaining variable type of education acquired by the farmer, is negatively signed. However, only out of these variables, the age of the farmers, the type of education acquired by the farmer and the size of the farmers' household are significant at 5 per cent level of significance. This implies that the variables have significant influences on the farmers' ability to pay for irrigation facilities.

In the case of the result obtained for the household income variable which indicated a significant influence of the household income variable on farmers' ability to pay for irrigation facilities and the result is consistent with the World Bank (1993) report. The report suggests that a 10 per cent rise in household income would result to about 1 per cent increase in the probability that a household would chose to use a private water service. The charges for the use of irrigation facilities variable are not significant. This implies that the sum that is charged farmers for the use of irrigation facilities under the Oshin scheme does not influence farmers' ability to pay for irrigation under the Oshin irrigation scheme. This may probably be so, since the charges on irrigation at the Oshin site is low (₦1000 per hectare).

Conclusion and Recommendations

This study examined farmers' ability to pay for irrigation facilities under a public-privately irrigation scheme at Oshin, Oke-Oyi, Kwara State, Nigeria. Although the study sample is small, the Oshin project deals with typical farmers. The study result showed that most of the farmer respondents surveyed were agile youths whose receipts from their crop sales averaged ₦76.833.67. The age of farmers, the type of education acquired by the farmers, household income and the size of the farmers' household were revealed to determine farmers' ability to pay for irrigation facilities. The result indicates that farmers are able to pay a mean sum of ₦1077.64 per hectare which is below the ₦1000 per hectare charged at the Oshin irrigation site.

Based on the results of the study, it is suggested that other sources of livelihood derivable from irrigation schemes be initiated and availed to farmers. This will help improve the income status of the farmers thereby empowering them with good incomes to partake in public-private irrigation farming schemes. Education is also an important determinant of farmers ability and willingness to pay for irrigation facilities when farmers are educated, they can better appreciate the need for public-private partnering irrigation scheme, instead of none as it is the case in the country. Lastly irrigation scheme such as the one at Oshin should be extended to other parts of Nigeria, especially the drier northern part of the country and the country as a whole. The scheme is long overdue in these areas especially since it is youth friendly as revealed by the current study. Such schemes will go a long way to reduce the mass of unemployed youths roaming our streets and also stem the tide of rural-urban migration in the country.

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Table 1: Nigerian's Water Resources Statistics for the Period 1999-2006

Year	Appropriation ₦	Amount Released ₦	Amount Accesses ₦
1999	8,306,692,666	5,061,927,500	5,061,927,500
2000	13,375,868,540	6,734,127,053,46	6,734,127,053.46
2001	63,752,000,000	44,626,400,000	44,626,400,000
2002	81,621,035,001	17,870,542,243.50	17,870,542,243.50
2003	25,000,000,000	18,573,093,296.39	18,573,093,296.39
2004	37,531,569,831	47,703,552,894.21	31,939,605,887.9
2005	70,323,457,333	64,242,223,802.92	63,953,898,197.64
2006	75,761,000,946	55,326,247,945	11,571,209,495.20
Total	**375,671,624,317.00**	**260,138,114,735.00**	**188,759,594,175**

Source: Federal Ministry of Water Resources (2006)

Table 2: Socio-Economic Profile of Respondents

Character	Frequency	Percentage (%)
Age in years		
10-20	1	1.7
21-30	9	15
31-40	31	51.6
41-50	11	18.4
51-60	4	6.7
>60	4	6.6
Total	60	100.0
Mean	**40.41**	
Co-efficient of Variation	**0.43**	
Educational level		
Quaranic Education	13	21.6
Adult Education	27	45
Primary Education	0	0.0
Secondary Education	11	18.4
Tertiary Education	9	15
Total	60	100.0
Household Size		
1-5	31	51.6
6-0	27	45
11 and above	2	3.4
Total	60	100.0
Mean	**4**	
Co-efficient of Variation	**0.14**	

Household Income in naira (1US Dollar=120 naira)		
<10,000	13	21.7
10,000-20,000	24	40
20,000-30,000	4	6.7
30,000-40,000	14	23.3
40,000 and above	5	8.3
Total	60	100.0
Mean	**24,421.12**	
Co-efficient of Variation	**0.34**	

Source: Field Survey (2008)

Table 3: Cropping Practices of Respondents

Crop Combination	Frequency	Percentage (%)
Maize/Cowpea	20	33.33
Vegetable/Maize	16	26.66
Tomato/Okro	21	35
Melon/Pepper	3	5
Total	60	100

Source: Field Survey (2008)

Table 4: Likert Scaling of Respondents Perception about Public-Private/Commercialized Irrigation Scheme for Farmers

Attitude Category	Frequency	Percentage (%)
Most Favourable	19	31.66
Favourable	29	48.33
Least favourable	12	20
Total	60	100

Source: Field Survey (2008)

Table 5: Summary of Cost and Returns Structure to Irrigation Farming (₦/ha)

Items	Average
(a) Gross Revenue (G.R)	**76.833.67**
Less	
(b) Total Variation Cost (TVC)	35555. 33
Seeds	3003.1
Agro-chemicals eg fertilizer, insecticide	10000.0
Hired labour	14773.2
Marketing/Transport	7779.03
Equals	
(c) Gross Margin (GM)	**41278.3**
Less	
(d)Imputed interest on capital	1923.1
Less	
(e)Imputed rental value of land	1500.0
Less	
(f)Depreciations on hoes, cutlass, and other farm tools	2280.4
Less	
(g)Imputed cost of family labour	2034.9
Equals	
(h) **Returns to Farmer's Labour & Management (RLM)**	**33539.9**

(1US Dollar=120 naira)
Source: Field Survey (2008)

Table 6: Determinants of Ability to Pay for Commercialized Irrigation Facilities

Variable	Regression Co-efficient	Standard error	t-value
Constant	-0.16814	0.6747	-0.17379
Age	-0.00492*	0.0204	-2.40784
Educational Status	-0.00190*	0.0067	-2.83840
Farm size	0.01165	0.13841	0.08418
Household size	-3.68171*	0.16952	-3.14805
Household Income	0.00008*	0.00002	4.22119
Household expenditure	0.02071	0.3127	-0.66234
Connection charges	-1.020	-1.682	-0.89

Chi-square = 469.262

*Variable is Significant at 5 per cent level