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ASSESSMENT OF THE FOOD SECURITY IMPACT OF KAMPE IRRIGATION DAM AMONG FARM HOUSEHOLDS IN KOGI STATE, NIGERIA

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Abstract

Food insecurity is an overriding problem of most developing countries like Nigeria. For the Millennium Development Goal of halving the proportion of hungry people by 2015 to be achieved, a projection of 22 million people must achieve food security every year. In consonance of the above, empirical evidence pertinent to food security policy formulation and implementation is required. Data used for this study was collected from a total of one hundred and fourty irrigation and non-irrigation farming households using a two-stage sampling technique. The main tools of analysis for this study include descriptive statistics and logistic regression model. The study was carried out to identify determinants of food security status among Kampe irrigation dam farming households in Kogi State, Nigeria. The result of the study indicate that 61.4 % of the irrigation beneficiary surveyed were food secure. The 38.6 % food insecure households had a food security Gap of 17.8 % and a food severity measure of 3.2 %, while 44.3 % food insecure irrigation non-beneficiaries had 20.5 % food insecurity gap and 4.2 % food insecurity. Factors that determine the respondent’s food security status were identified. These factors includes farm household size, farm size, total amount spent on input, as well as total farm income all contributed to food security in the study area. Conclusion, access to irrigation alone does not guarantee food security. The study recommend that, adequate policy should be put in place to address farm income, off-farm income, input cost, farm household family size as well as farm size.

Keywords: Food security; irrigation; Farming households; Kogi State; and Nigeria.

INTRODUCTION

In view of the importance of food in man’s life, food is rated as the most basic of all human needs (Adebayo, 2012). More than 800 million people throughout the world and particularly in developing countries do not have enough food to meet their basic nutritional need (Omotesho *et al.*, 2006). Worldwide, about 852million men, women, children are chronically hungry due to extreme poverty while up to 2 billion people lack food security intermittently due to varying degree of poverty (Adebayo, 2012). While, successful agricultural development has resulted in a significant reduction of poverty and an improvement in food security in most developing countries of Asia and Latin America. In many parts of Sub-Saharan Africa, despite numerous macroeconomic, political, and sectoral reforms, poverty, environmental degradation and food insecurity appear to be on the rise (Lire, 2005). In many African countries, food security at both the national and the household level is dismal. Though there are more under nourished individuals in India alone than Africa, it is in Africa that one finds the highest prevalence of under nourishment (Babatunde *et al.*, 2007).

Furthermore, the problem of food insecurity especially during the hungry period among farming households in Nigeria is long standing (Obamiro *et al.*, 2005). In Nigeria, the percentage of food insecure households was reported to be 18% in 1986 and over 40% in 2005 (Babatunde *et al.*, 2007). This is because rural households in Nigeria face a high level of income variability (access to food variability) due to factors beyond their control such as poor storage and infrastructural facilities couple with poverty, that make them particularly vulnerable to shocks such as seasonal changes in food production (Ayantoye *et al.*, 2011).

Dependence on rain fed agriculture coupled with the erratic nature of rainfall is one of the main causes of widespread food insecurity in the country (Lire, 2005). According to water users, the most positive impact of irrigation compared to rain-fed agriculture is the improved food security. Reports indicated that to realize this, there is need for reliable water supply which also serves to lengthen the growing season (Susanne *et al.*, 2007). Irrigation has long played a key role in feeding expanding populations and is undoubtedly destined to play a still greater role in the future. It not only raises the yields of specific crops, but also prolongs the effective crop-growing period in areas with dry seasons, thus permitting multiple cropping (two or three, and sometimes four, crops per year) where only a single crop could be grown otherwise (Oni *et al.*, 2011).

Irrigated agriculture provides 40% of world food production on only 17% of total cultivated land. The World Food Summit in 1996 estimated that 60% of the extra food required to sustain the world in the future must come from irrigated agriculture (Opeyemi, 2013). Much of this increase must come from improvements in existing schemes, as new sites for development are scarce. According to the empirical data, irrigation decisively improves the life situations of the people concerned, both in smallholder households and in the households of persons employed on commercial farms (Susanne *et al.*, 2007).

The question of whether irrigation is beneficial to food production is highly controversial. However, research shows the actual contribution of irrigation agriculture to global food production, maintenance of food security, rural livelihoods and overall well-being of society, is debatable because of both negative and positive impacts may be experienced where irrigation development is in place (Edna, 2008). Also, Hussain,2004 and Bhattarai *et al.,* 2002, explained that the benefits of irrigation area realised through increased yields; diversification of crops; crop intensity; switching from low-value market oriented production; stabilization of agriculture output; farm incomes; farm and non-farm employment or wages, consumption; lower food prices; and asset accumulation. Edna, 2008, also explained that irrigation has the potential to provide higher yields than rain-fed agriculture. In irrigation projects, the doubling and tripling of yields is achievable, which contribute significantly to food production and food security within three years of the first project intervention.

There are studies that examined the link between irrigation and food security status, however, we are not aware of such studies in the study area as at the time of this study. An understanding of the dimensions of food security and its association with irrigation project can provide pertinent information to enable successful food security programs. This knowledge can also inform development practitioners and policy makers to better target interventions that mitigate the severity of the problem in the rural area at large. It is hypothesized that those who participate in irrigation farming are in a better position with regard to food consumption than non-participants.

Hence, this study seeks to understand the factors influencing food security status in Kampe irrigation intervened area of Kogi State, Nigeria. Identification of the food insecure groups and achieving a better understanding of the determinants of food security are crucial for designing effective food security programs.

Therefore, this study attempts to carry out an assessment of the food security impact of Kampe irrigation dam among farm households in Kogi State, Nigeria by focusing on the following objectives of, (i) identifying the household socio-economic characteristics in the study area, (ii) finding out the incidence, depth and severity of food insecurity among the irrigation beneficiary and non-beneficiary households, and (iii) identifying the factors influencing food security status in the study area.

MATERIALS AND METHODS

Kampe Dam Irrigation Project (KODIP) is located in Yagba West Local Government Area of Kogi State, Nigeria. It lies between longitudes 6^0 37' and 6^0 42 E of Greenwich and latitudes 8^0 34' and 8^0 38'N of the Equator. The project was first conceived in 1979 while the construction works started in 1983. The dam was constructed on Oyi river at Omi. It involved the construction of 42 meter-dam with a water reservoir capacity of about 250 million cubic meters. The irrigation network consists of 39 km length of main canal and about 300 km length of feeder canals and complimentary drainage lines. The dam will be capable of irrigating about 4100 hectares when all the phases are completed. Given the abundant water resources in the country and its potential for increasing agricultural production in Nigeria, the Federal Government established the River Basin Development Authority (RBDA).

Phase 1 of the now completed comprises the main dam, spillway, headwork, and 16 km out of the 39 km length of the main canal commanding 2000 hectares of irrigable land. This phase allows for agricultural production of maize, vegetables, sorghum, and rice all the year round. The state possesses substantial agriculture potentials. Presently, in most of the RBDAs, the area of land under cultivation is far below the irrigable land. The dam operate far below it capacity. Kampe irrigation scheme (LNRBDA) has developed for irrigation 1,000ha but only 100ha is presently irrigated. This is similar in all the RBDAs schemes (Babatunde *et al.*, 2013).

The original goal of the project was to supply irrigation water to the estimated population in the project area dominated by farm families. The economic significance of the venture at inception cannot be overemphasized, this was with the aim to achieve a dramatic increase in farmers output. The project was designed to support agricultural and economic development in the region. Generally, the expectations of the government from the project were very high. It was expected to counter food import, with focus on import substitution (Ibitoye, 2012).

The population for this study comprise of farming households in Kampe irrigation dam project catchment area of Kogi State, Nigeria. Farmers occupying about the same distance area away from the irrigation dam site. This study was carried out between March and August, 2013. A two– stage sampling technique was used in selecting the sample for the study. The first stage involved dividing the population into two clusters namely irrigation beneficiaries and irrigation non-beneficiaries. A random selection of seventy samples from each of the clusters was selected. A total of one hundred and forty respondents were selected.

METHODS OF DATA ANALYSIS

Measuring food security

To measure household food security, a food security index was constructed. This involved two steps: identification and aggregation. Identification is the process of defining a minimum level of nutrition necessary to maintain healthy living—the "food security line", below which households are classified as food-insecure. Aggregation on the other hand derived food security statistics for the households. Daily per capita calorie consumption was estimated by dividing the estimated daily calorie supply to the household by the household size adjusted for adult equivalence using the equivalent male adult scale.

Head Count Method = q/n …… …… i

q = number of food insecure households,

n = Total number of respondents.

i. Head count method = would be used to measure food security status.
ii. Food insecurity Gap measures = would be used to measure the depth of food insecurity,
iii. Squared food insecurity Gap = would be used to measures severity of food insecurity.

$$IFI = \frac{FIH}{TH} X\,100 \quad \dots\dots.. \quad \dots\dots..ii$$

Where, IFI = Incidence of Food insecurity index,

FIH = No. of food insecure Household,

TH = Total Households under study.

Food insecurity Gap measure

$$FIGi = \frac{\sum TCRi - TCCi}{TCRi} / FIHX\ 100 \ldots iii$$

Where,

FIG = Food insecurity Gap *ith* food insecure household

TCR_i = Total calorie Requirement for *ith* food insecure household, recommended minimum daily energy (calorie) level 2260 kcal).

TCC_i = Total calorie consumption by *ith* food insecure household measure.

$$TFIGi = \sum \frac{TCRi - TCCi}{TCRi} FIH \ldots\ldots\ldots.iv$$

Total food insecurity Gap

$$TFIG = \sum \frac{TCRi - TCCi}{TCRi} FIH \ldots.. \qquad \ldots\ldots\ldots..v$$

(i) Severity of food insecurity Gap.

$$SFIG = \sum (TFIG)2/FIH \ldots\ldots\ldots\ldots\ldots...vi$$

Examination of factors influencing Food security

A logit regression model used to analyze the factor influencing food security status of the respondents. These factors could have positive or negative impact on household food security. The model was specified as follows:

Model Specification

$Yi = F(X_1, X_2, X_3, X_4, X_5, X_6, U,)$ ………vii

Where,

Y = Dependent variable (food security Index – food secure = 1, food insecure = 0)

Explanatory variables;

X_1 = Household head age (Years)

X_2 = Household size (actual number)

X_3 = Years spent in school (years)

X_4 = Household farm size (hectares)

X_5 = Total annual input cost (Naira)

X_6 = Total annual farm income (Naira)

X_7 = Participants of irrigation (assigned =1 otherwise = 0)

U = Error term

RESULTS AND DISCUSSION

SOCIO-ECONOMIC CHARACTERISTICS OF RESPONDENTS

The major socio-economic characteristics of the respondents covered in the survey were presented in Table 1.

Analysis of the socioeconomic characteristics of farm households as shown in Table 1, indicates that irrigation farming is a male dominated enterprise in the study area. This agrees with Susanne *et al.*, (2007), that women were consistently underrepresented in water user groups. According to (Aseyehegn *et al.*, 2012), male-headed households hardly faced labour shortage for irrigation as well as rain-fed farming due to physical, technological, socio-cultural and psychological fitness of farm instrument to males than females. There were no forms of gender discrimination with respect to access to water as indicated (Ernest *et al.,* 2013), the intense physique required and high cost involved in constructing gardens at the dam site left many women "stressed up" and therefore a disincentive to women direct involvement in the irrigation scheme

The modal age group of the farmers falls between ages 31-40 for both irrigation farmers and non-irrigation farmers. The overall modal age group of these farmers is 31-40 years with the lowest age group being 51-60 years of age. The results show that majority of the farmers are in their energetic years of age. The study further shows that most of the sampled farmers in the study area were married (87.9%). Aseyehegn *et al.* (2012), however, found in his study that age is statistically insignificant suggesting age has very little influence on the participation decision in irrigation farming.

The study further shows that most of the irrigation farmers had large family size; about 48.6% had between 1-5 household members, 38.6 % have 6-10 household members while the percentage was 60.0% and 38.6% respectively for irrigation non-beneficiary farm households. Overall, 54.3% have family size of 1-5 members. Oni *et al.,* (2011) reveal that as household size increases it puts pressure on available food for the household to be food secured

With regards to education, the study shows that all of the irrigation beneficiaries had primary and below education, 71 % of the irrigation non-beneficiary respondents had post primary school formal education. Most of the farmers practice farming at subsistence level, as an overall of 70.0% had farm size of 0.1-1.0 hectares. 27.1 % cultivated 1.1-2.0 hectares. 68.6% of the irrigation farmers cultivated between 0.1-1.0 hectares of land. (Aseyehegn *et al.,* 2012) in his study said education plays a key role for household decision in technology adoption. It creates awareness and helps for better innovation and invention. Farmers with little education are often insufficiently prepared for either irrigation tasks or land management. They often lack knowledge about sustainable land management and integrated plant protection (Susanne *et al.,* 2007).

Table 1, shows the distribution of the average annual farm income of respondents. The result shows the income range with the highest frequency of occurrence was ₦ 51,000-N 100,000. The respondents had 41.4 % and 70.0% for the modal income range for irrigation beneficiary and irrigation non-beneficiary households' respectively. 32.9 % of the beneficiary households had income range of ₦ 101,000 – ₦ 150,000, while for irrigation non-beneficiary households 14.25. Also, the average annual income for all the households was ₦ 104,513.00, 52.8 % of the irrigation beneficiary households had equal to and greater than the average, while only 22.9 % of non-beneficiary household had up the total average income of the sample.

Access to irrigation contribute to increasing crop production and family incomes, improved irrigation access significantly contributes to rural poverty reduction through improved employment and livelihoods within a region (Bhattarai *et al.,* 2002).Increased farm consumption and increased permanent wealth (permanent asset accumulation due to irrigation). This has significant implications for reducing intrinsic food insecurity in a region (Bhattarai *et al.,* 2002).

The results for some of the important parameters for food insecurity were presented in table 2, a t-test to test the significant different between these variables among irrigation beneficiaries and non-beneficiaries were carried out. The result of the t-test showed that there was a significant difference among the irrigation beneficiaries and irrigation non-beneficiaries respondents (0.010) total farm income. The t-test result also reveals that there was significant difference in the adult average daily calorie (0.059) among irrigation beneficiaries and irrigation non-beneficiaries.

The food insecurity incidence, food insecurity gap, as well as food insecurity severity with 0.160, 0.995 and 0.900 respectively were found not to have significant difference among the sampled irrigation beneficiaries and irrigation non-beneficiaries.

Determinants of food security status among Irrigation beneficiary households

Logistic regression results in Table 3, were used to estimate the determinants of food security at the household level. In analyzing factors that affect the food security status of the households, a logit regressing model was estimated using dummy variable (1,0) for food security as the dependent variable. The study hypothesize that irrigation dam can play a significant role in improving household food security status. The independent variables were significantly related to the farm household food security status.

In the regression, age of household head has not been found to be a statistically significant factor even at 10% level of significance. Household size of the irrigation beneficiary was found to be a statistically significant factor at 5 % level of significance. Total annual farm household income, this variable was positive and statistically significant at 10%. Total annual Input cost**:** The variable has positive coefficient and significant at 5 %. This implies that the higher the amount spent on farm input (s), the higher the chances of better output, hence, the higher the chances of food security. Significant determinants of irrigation farm household food security status were age (Exp(B)=1.041), total input cost (Exp(B)=3.646), while household off farm income and total farm income are (Exp(B)=1.000).

(Bhattarai *et al.*, 2002; Aseyehegn *et al.*, 2012), reveals farm income in irrigated areas was higher than the income in unirrigated regions. The difference in farm income between these two regions has large implications for farm capital accumulation, food security and wealth creation across the two regions. Irrigation and irrigation dams have both positive consequences on food security, asset ownership and income of households. Increased in agricultural production through diversification and intensification of crops grown, increased household income because of on/off/non-farm employment, source of animal feed, improving human health due to balanced diet and easy access and utilization for medication, soil and ecology degradation prevention and asset ownership are contributions of irrigation (Aseyehegn 2012).

CONCLUSION AND RECOMMENDATIONS

This study shows that in spite of the food security status of the irrigation beneficiary in the study area, calorie consumption was just at the threshold of adequacy and the many of the irrigation farm households beneficiaries were still not food secure. This is shown from the fact that the many of the irrigation farm households are subsisting on less than the minimum required calorie per capita per day. The difference between the food secured among the irrigation beneficiary and the irrigation non beneficiary was not statistically significant. For irrigation to play significant role, the study recommend the following: In view of the negative impact of large family size on the food security situation of rural households in the study areas, farming households should be educated on the need to adopt the modern family planning techniques so that they bear the number of children which their resources can accommodate. Farming households should also be empowered to not only increase their farm size but to also be efficient in their farming activity. Farmers should also be helped through access to soft loan that will enable them acquire the necessary inputs required for expansion and so that they can have farm income to be food secure.

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Table 1: Socio-economic Distribution of Respondents

Socio-economic	Beneficiary	Non	All household

indicators	household		Beneficiary			
	Frequency	%	Frequency	%	Freq	%
Gender						
Male	70	100	60	85.7	124	92.9
Female	0	0.0	10	14.3	16	7.1
			Mean		**Std dev**	**0,304**
Age						
20-30	18	25.7	13	18.6	31	22.1
31-40	27	38.6	24	34.3	51	36.4
41-50	10	14.3	22	31.4	32	22.9
51-60	15	21.4	7.1	15.7	26	18.6
			Mean	**47.75**	**Std dev**	**10.94**
Marital status						
Single	4	5.7	13	18.6	17	12.1
Married	66	94.3	57	81.4	123	87.9
			Mean	**1.99**	**Std dev**	**0.12**
Household size						
1-5	34	48.6	42	60.0	76	54.3
6-10	27	38.6	27	38.6	54	38.5
11-15	4	5.7	1	1.4	5	3.5
16-20	5	7.1	0	0.0	5	3.5
			Mean	**9.86**	**Std dev**	**3.22**
Education status						
pry Sch& Below	70	100	20	28	82	58.6
SSCE/GCE	-	-	30	42.8	38	27.1
NCE/OND/Nursing	-	-	17	24.3	17	12.1
HND/University Graduate	-	-	3	4.3	3	2.1
			Mean	**2.81**	**Std dev**	**0.99**
Farm Size						
0.1-1.0	48	68.6	49	70.0	98	70
1.1-2.0	18	25.7	21	30.0	38	27.1
>2	4	5.7	0.0	0.0	4	2.9
			Mean	**2.59**	**Std dev**	**0.97**
Annual income						
1 – 50,000	4	5.7	5	7.1	9	6.4
51,000-100,000	29	41.4	49	70	78	55.7
101,000-150,000	23	32.9	10	14.2	33	23.6
151,000-200,000	9	12.8	5	7.1	14	10.0
>200,000	5	7.1	1	1.4	6	4.3

Source: Field Survey, 2013.

Table 2: Summary of food insecurity indices for the irrigation beneficiary and irrigation non-beneficiary respondents in the study

Variables	Beneficiaries	Non-Beneficiaries	All households	T-test
Adult average daily calorie intake	2393.55	2565.50	2479.52	0.059
Food Insecurity incidence	0.386	0.443	0.414	0.160
Depth of food insecurity	0.174	0.202	0.189	0.995
Severity of food insecurity	0.031	0.041	0.036	0.900
Average annual Household income	₦120,782.57	₦88,243.57	₦104,513.00	0.010

Source: Field survey, 2013

Table 3: Estimates of the logistic regression of the determinants of food security status of the irrigation farm households

Variables	B	S.E.	Wald	Sig.	Exp(B)
Household head age	0.40	0.033	1.496	0.221	1.041
Household size	-.235	0.113	4.366	0.037**	0.790
Household off-farm income	0.000	0.000	2.432	0.934	1.000
Household farm size	-1.630	0.884	3.400	0.065***	0.196
Total annual input cost	1.320	0.675	1.967	0.082***	3.646
Total annual farm income	.000	0.000	5.382	0.020**	1.000
Participation in irrigation	14.43	6.014	2.399	0.910	0.995
Constant	-21.167	170.20	0.000	0.999	0.000

Source: Field Survey, 2013. Dependent variable: food security status
*indicate significant at 1 % level
** indicate significant at 5 % level
*** indicate significant at 10 % level
Likelihood Ratio Chi-Square 19.878 (5)
Correct prediction 67.1 %
Likelihood value 73.473