IMPACT OF HADEJIA VALLEY IRRIGATION PROJECT ON POVERTY STATUS OF BENEFICIARIES IN JIGAWA STATE, NIGERIA

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ABSTRACT
The study was carried out to examine the impact of Hadejia valley irrigation project on poverty status of beneficiaries in Jigawa State, Nigeria. The study used multi-stage random sampling and selected 207 project beneficiaries and 146 non-beneficiaries out of a list of 7036 respondents making a total of 353 as the sample size for the study. Data were obtained using a structured questionnaire and analyzed; using descriptive statistics, t-test statistics and p-alpha poverty measure (Foster-Greer-Thorbecke Index) method. The results shows that beneficiaries and non-beneficiaries had a mean age of 47 and 45 years, a mean household size of 15 and 21, educational levels of 8 and 7 years and off-farm income that ranged from a mean of ₦137,797.00 to ₦ 237,104.00. The study also revealed a mean of 30 and 24 years of irrigation farming experience, farm sizes of 3.2 and 2.1 hectares, ₦33,641.00 and ₦55, 709.00 spent in hiring labour, farm distances of 3 and 0.9 kilometres, 5 and 3 extension visits per season, a mean of ₦52,771.00 and ₦50,205.00, ₦50,205.68 and ₦32,422.33 as credit and subsidy, respectively. Membership of cooperative associations indicated a mean of 0.8 and 0.5. The result of the poverty measures indicated that 17% of beneficiaries were classified to be living below the poverty line of ₦12,489.00 while 36% of non beneficiaries lived below the poverty line of ₦9,961.20. The poverty head count, depth and severity were 0.72, 0.12 and 0.088 for beneficiaries and 0.8, 0.28 and 0.23 for non-beneficiaries respectively. This meant that 72% and 80% of beneficiaries and non-beneficiaries were above the poverty line. But, 12% and 28% of beneficiaries' and non-beneficiaries' expenditure were required to bring them up to the poverty line. The results further show that poorest accounted for 9% and 28% of the beneficiaries and non-beneficiaries. The study concludes that Hadejia valley irrigation project had impacted on poverty status among its beneficiaries. It was therefore, recommended that the project beneficiaries should form farmers' co-operatives and other farmer organizations for the purpose of knowledge transfer, input, output, marketing and distribution, savings mobilization, farm credit sourcing, supply and appropriate technologies that would release labour from irrigation to reduce the cost incurred in production.

Keywords: Beneficiaries, Impact, Irrigation, Poverty, Project, Status, Valley.

INTRODUCTION
Central to the quest for policies and programmes that will reduce poverty is issue of the conceptualization of poverty. Conceptually, three dominant views are identified as the meaning of poverty in the literature. The first view sees poverty as a severe deprivation of some basic human needs at the individual or household level. While this conceptualization of poverty makes the quantitative analysis of poverty straightforward and permits comparisons over time

and between countries, it fails to recognize non-material forms of deprivation such as illiteracy and social discrimination among others.

The second view has a direct link with the work of Sen (1999) and it defines poverty as the failure to achieve basic capabilities such as being adequately nourished, living a healthy life, possession of skills to participate in economic and social life, permission to take part in community activities to mention but a few. This conceptualization forms the basis for the belief that poverty is multi-dimensional. Although, the capabilities framework offers many advantages over the income/consumption conceptualization, yet it is argued that it requires a greater variety of data and that no consensus exists on how capability deprivation at the household level is to be computed.

The third conceptualization of poverty came into limelight in the 1990s and has a fundamentally different approach to the understanding of poverty: subjective poverty assessments. The core of this view of poverty is that poverty must be defined by the poor themselves or by the communities that poor people live in. This study aimed to fill this important gap in irrigation literature in terms of clarifying poverty status among beneficiaries by analyzing its impacts in the study area.

Foster *et al.* (1984) reported that the most frequently used poverty measurements are: a) the Head Count Index, b) Poverty Gap Ratio, and c) Poverty Severity Index. Further, a poverty measure is an index that shows the magnitude of poverty in a society. The ability to distinguish between the poor and the non-poor requires an objective measurement of poverty. In quantifying poverty, the practice is to first of all specify some measure of the standard of living (both the direct consumption aspects and the basic needs/non-consumption aspect) in order to distinguish different individuals, households and countries from each other, and secondly, to establish or choose a 'cut off' (that is the poverty line), which separates those identified as poor from the non-poor (Ekpo and Uwatt, 2005).

Poverty reduction is the most difficult challenge facing Nigeria and its people and the greatest obstacle to pursuit of sustainable socio-economic growth. Inadequate growth is the main cause of poverty in Nigeria. The lack of growth is compounded by the volatility of the oil sector which affects a range of activities in the economy. Unemployment is an added problem which has escalated the proportion of the poor. Other factors that have contributed to the evolution of poverty in the country include: problem in the productive sector, widening income inequality, weak governance, social conflict, gender, inter-sectoral and environmental issues (FOS, 2005).

Important determinants of living conditions of households and their members will be the economic activities in which they are engaged and the returns they are able to reap there from. For many households in Nigeria, especially in the rural areas, agriculture is the main activity. Previous and current analyses have shown that poverty is disproportionately concentrated among households whose primary livelihood lies in agricultural activities. Agriculture has been focused as a central element of poverty reduction strategy. It is, therefore, important to understand the factors responsible for poverty in this sector. Participation in agriculture was found to be more predominant in rural areas, with about 86 per cent of household engaged in the sector.

In 2004, the national statistics showed that 68.9 million (54.89%) people were affected by poverty in Nigeria, but this problem has continued to get degenerated as the number of people living in poverty increased from 112.47 million (69%) in 2010 to 119 million (70%) in 2015 (National Bureau of Statistics, NBS, 2010; 2012). While, in the geo-political

zones/regions National Bureau of Statistics (NBS, 2012), reported that the poverty level in Nigeria was lowest in the South-West geo-political zone (59.1%) and that the North-West geo-political zone had recorded the highest poverty rates in the country with 77.7% and 62% of the farmers are poor.

On a zonal basis, the Northern states were more engaged in agriculture than their southern counterparts. A look at Northern states such as Benue (47 percent), Jigawa (38%), Borno (35%) and Southern States such as Lagos (0.79%) and Osun (7.9%) and Ogun (9.9%) is revealing (FOS, 2005). The study was carried out and achieved the following specific objectives: described the socio-economic and institutional characteristics of beneficiaries non-beneficiaries of the project, and determine the impact of the project on the poverty status of beneficiaries and non-beneficiaries in the study area.

MATERIALS AND METHODS
The Study Area
The study area was Jigawa State, Nigeria located between 11^0-13^0 N longitude and 8^0E latitude. Hadejia valley irrigation project (HVIP) is under Hadejia-Jama'are River Basin Development Authority (HJRBDA) owned by the Federal Government of Nigeria which uses a barrage at Gamsarka to provide irrigation water to the sector areas.

Sampling Techniques
The first stratum was the selection of Auyo and Kirikasamma local government areas (LGAs) for the field study. Sixteen different villages were selected for the study; eight were from Auyo LGA similarly, eight private farms located in Kirikasamma LGA (along the tributaries of rivers Hadejia and Kafin-Hausa were selected as non-project area (non-sectors) which represented the second stratum. The third phase of the fieldwork component was the main fieldwork survey in which an in-depth collection of data took place in 2017. In this study, proportionate random sampling of beneficiaries (207) and non-beneficiaries (146) was conducted through a multi-stage random sampling approach adopted, which tended to require larger samples than single-stage designs in order to achieve high degree of precision. Three hundred and fifty three (353) beneficiaries and non-beneficiaries were interviewed as the sample size of the study.

Analytical Techniques
The procedure for analyzing the data generated was the use of statistical package called Statistical Programs for Social Scientists (SPSS). The following tools of analysis were employed to achieve the stated objectives of the study, descriptive statistics and Foster-Greer-Thorbecke methods.

Descriptive statistics
The descriptive statistics employed in this study include the use of means, percentage, graphs, standard deviation and frequency count to summarize, classify and tabulate the data on beneficiaries' and non-beneficiaries' socio-economic, institutional characteristics and other variables in the study. They were used to achieve the specific objectives of the study.

Foster-Greer-Thorbecke index method
Further, to achieve objective of determining the impact of the project on the poverty status of beneficiaries and non-beneficiaries in the study area, the mathematical model developed by Foster-Greer-Thorbecke (1984), which is also called the P-alpha class of poverty measures was used. The model is specified as:

$$P_\alpha = \frac{q}{N} \sum_{i=1}^{q} \left(\frac{Z_i - Y_i}{z}\right)^{\alpha} \qquad \ldots (1)$$

where;

Z = poverty line, q = number of households below the poverty line, N = number of households in the reference population, Y_i = average expenditure f respondents' households, α = Foster-Greer-Thorbecke (FGT) index which takes the values of 0, 1, 2. In using this model, consideration was given to the differences in the needs of the respondents due to the different household size and consumption. The household expenditure per adult equivalent was used as the welfare measure. There are wide choices of adult equivalent scales and different scales are used in different countries. The most commonly used is that of Organization for Economic Co-operation and Development (OECD) because of its simplicity of use and wide familiarity. That scale is expressed as:

$$\text{Expenditure} = Exp/n^{0.7} \qquad \ldots (2)$$

where;

Expenditure = total household expenditure; N = household size, and 0.7 = exponential formation representing other adults in a particular household.

A cut-off point needs to be selected to serve as a poverty line across the distribution of the household expenditure per adult equivalent. The use of an absolute line such as X dollars in Purchasing Power Parity (PPP) is rejected due to frequent fluctuations in the country's exchange rate hence, a relative poverty line set at one third (1/3) of the mean consumption-expenditure was used in identifying the core poor (Anyanwu, 1997). The components and derivation of the FGT model are:

1. Simple Head Count Ratio (HCR): This gives the percentage of the sample living in the household with expenditure per capita less than the poverty line. In other words, it measures the number of poor as a percentage of the total population. The poverty aversion parameter equals 0 from equation (1), if $\alpha = 0$, the poverty index becomes:

$$P = q/N \qquad \ldots (3)$$

2. Poverty Depth (PD): The Poverty Depth or Expenditure Gap Ratio expresses the average shortfall expenditure as a fraction of the poverty line itself. It can be used to determine the percentage of the expenditure required to bring each individual below up to the poverty line. A useful index is obtained when the HCR is multiplied by the income or expenditure gap ratio or it is used when the poverty aversion parameter is equal to 1 (Foster *et al.,* 1984):

$$P_1 = \frac{q}{N} \sum_{i=1}^{} \left(\frac{Z - Y_I}{Z}\right)^{1} = HI \qquad \ldots (4)$$

3. Poverty Severity Index (PS): This is the means of the squared proportion of the poverty gap expressed as:

$$P_2 = \frac{q}{N} \sum_{i=1}^{} \left(\frac{Z - Y_I}{Z}\right)^{2} \qquad \ldots(5)$$

This index attaches greater weight to the poverty of the poorest people than to those just below the poverty line.

RESULTS AND DISCUSSION

Socio-economic and Institutional Characteristics of Beneficiaries and Non-beneficiaries

The first objective of the study was to describe the socio-economic and institutional characteristics of the respondents. These were: age, level of formal education, household size, farm size, non-farm income, cost of hired labour, irrigation farming experience, membership of water users' association, reaches, subsidy on inputs, access to credit and extension visit. The results as presented in Table 1 shows that the age distribution of the respondents was between a mean of 47 and 45 years, the households had a mean of 15 and 21 persons, mean difference in the educational levels of 8 and 7 years for beneficiaries and non-beneficiaries, respectively. Also, respondents received an off-farm income that ranged from a mean of ₦137,797.00 and ₦ 237,104.00 between beneficiaries and non-beneficiaries in that order. Apart from non-farm income and cost of hired labour, all other variables of the beneficiaries were higher than that of non-beneficiaries. The implications of these finding on one hand were that greater household size of beneficiaries might have contributed to supply of farm labour which reduced the cost of hired labour. On the other hand, beneficiaries participated less in off-farm employment that might have reduce income from other activities apart from irrigation.

The results further revealed a mean of 30 and 24 years of irrigation farming experience, a mean of 3.2 and 2.1 hectares of farm size, ₦33,64.00 and ₦55,709.00 spent in hiring labour by both project and non-project beneficiaries, respectively. Further, project beneficiaries had farms located 3 kilometers from water source (Dam) while non-project beneficiaries had farms located 0.9 kilometers from water source perhaps, river Hadejia. The findings demonstrated that the project beneficiaries received a mean of 5 extension visits while non-project beneficiaries received a mean of 3 visits per season.

Table 1 also, disclosed that a mean of ₦52,771.00 and ₦50,205.00 were received as credit, and ₦50,205.68 and ₦32,422.33 were also received as subsides on farm inputs by both project and non-project beneficiaries, respectively. Results of membership of cooperative societies indicated a mean of 0.8 and 0.5 number of membership of social organization registered under the scheme, that is, Water Users' Association and *Fadama* Users' Association for the non-project area.

Analysis of Poverty Status among Beneficiaries and Non-beneficiaries

In order to determine the poverty status of households in the study area, a cut-off point was selected to serve as a poverty line across the distribution of the households' expenditure per adult equivalent. The use of an absolute line such as X dollars in Purchasing Power Parity (PPP) was rejected due to frequent fluctuations in the country's exchange rate hence, a relative poverty line set at one third (1/3) of the mean consumption-expenditure was used in identifying the core poor (Anyanwu, 1997). The most commonly used is that of Organization for Economic Co-operation and Development (OECD) because of its simplicity of use and wide familiarity. The scale which is ben expressed as Expenditure = $Exp/n^{0.7}$ means that Expenditure = total household expenditure; N= household size, and 0.7 = expenditure formation representing other adults in a particular household. In estimating the poverty indices, this study measured the well-being of beneficiaries and non-beneficiaries of Hadejia Valley Irrigation Project (HVIP) by their total consumption-expenditure and by their household size using the adult equivalent scale.

Table 1: Socio-economic and Institutional Characteristics the Respondents

Variables	Frequency	Mean	SD	Min.	Max
Age					
Beneficiaries	207	47	9.4	18	75
Non-beneficiaries	146	45	11	27	72
Household size					
Beneficiaries	207	21	11	0	18
Non-beneficiaries	146	15	9	0	52
Level of education					
Beneficiaries	207	8	7	0	15
Non-beneficiaries	146	7	7	0	25
Non-farm income					
Beneficiaries	207	137,797	222, 554	1,500	1,500,000
Non-beneficiaries	146	237,104	298,047	10,000	2,000,000
Irrigation farming					
Farming experience					
Beneficiaries	207	30	13	2	60
Non-beneficiaries	146	24	11	0	50
Farm size					
Beneficiaries	207	3.2	8	1	12
Non-beneficiaries	146	2.1	2	0.5	7
Cost of hired labour					
Beneficiaries	207	33,641	25,408	10000	280,000
Non-beneficiaries	146	55,709	58,460	0	400,000
Reaches					
Beneficiaries	207	3	2	0	2.4
Non-beneficiaries	146	0.9	0.2	0	2
Extension visit					
Beneficiaries	207	5	3	1	20
Non-beneficiaries	146	3	0.912	1	4
Credit					
Beneficiaries	207	52,771	81,646	0	500,000
Non-beneficiaries	146	50,205.68	51,325.79	0	400000
Subsidy on inputs					
Beneficiaries	207	32,422.33	35,138.21	0	500,000
Non-beneficiaries	146	11,917.81	17,850.92	0	800,000
Water/*Fadama* Users' Association					
Beneficiaries	207	0.845	0.363	0	1
Non-beneficiaries	146	0.52	0.501	0	1

Having established the individual number of household consumption-expenditure, one third (1/3) of the mean consumption-expenditure of the whole sample under study was used to establish a poverty line at ₦12,489.00 for beneficiaries and ₦9,96.20 for non-beneficiaries per month per adult equivalent as shown in column 4 as presented in Table 2. From the Table 2, the p-alpha (poverty index) class of poverty measures was used in determining the head count, depth and severity of poverty among beneficiaries and non-beneficiaries as indicated in columns 8, 9 and 10. However, the poverty measures indicated that 17% of beneficiaries out of 207 sampled were classified to be living below the poverty line of ₦12,489.00 while 36% of non-beneficiaries correspondingly lived below the poverty line of ₦9,961.20. The poverty head count, depth and severity were 0.72, 0.12 and 0.088 for beneficiaries and 0.8, 0.28 and 0.23 for non-beneficiaries. This meant that 72% and 80% of beneficiaries and non-beneficiaries were above the poverty line, respectively. But, 12% and 28% of beneficiaries' and non beneficiaries' expenditure were required to bring them up to the poverty line. Equally, the poorest accounted for 9% and 28% of the beneficiaries and non-beneficiaries.

Nevertheless, the poverty lines of ₦12,489.00 and ₦9,961.20 per month were far below the range set by FOS (2005) that is ₦23,733.00. Also, the use of these three (3) measures of poverty clearly indicated that the rates of poverty among beneficiaries and non-beneficiaries of the irrigation project were comparatively low when compared with the total population of the people that are poor in Jigawa State provided by the FOS (2005) that is 95.07, 0.443 and 0.2463.

Analysis of Beneficiaries' and Non-beneficiaries' Poverty Status
In analyzing the poverty status of the beneficiaries, Y was considered as the total expenditure per household equivalent. Each household's expenditure was divided by the household size raise to power 0.7 being the adult equivalent scale expressed total expenditure per household equivalent was summed up to give ₦7,775,716.00; mean expenditure expressed as total household expenditure divided by the sample size (₦7,775, 716.00/207 = ₦37,467.20). Also, the variable Z was considered as the poverty line of a value 1/3 of the mean expenditure (1/3 (₦37,467.20 = ₦12,489.00). Total expenditure of the poor was expressed as total of all those that are below the poverty line to give a total of ₦110,962.70; average expenditure of the poor was also expressed as total expenditure of the poor divided by the number of those below the poverty line to give a total of ₦110,962.7/36 = ₦3,467.60; the heads count ratio expressed as total number of the poor (q) divided by the sample population (n) to give 35/207 = 0.17; poverty gap ratio was expressed as difference between average expenditure of the poor and poverty line (₦ 12,489.00 – ₦3,467.60/₦12,489.00 = 0.72 or 72%); poverty depth was also expressed to multiplying the poverty gap ratio by the head count ratio to give 0.17 x 0.72 = 0.12 or 12%, and poverty gap ratio expressed by multiplying the head count ratio by the square of the poverty gap ratio to give $0.17 \times (0.72)^2 = 0.09$ or 9%.

The non-beneficiaries poverty status was analyzed taking into consideration by summing up the total expenditure per household equivalent to give ₦4,363,013.00; mean expenditure expressed as total household expenditure divide by the sample size to give ₦4,363, 013.00/146 = ₦29,883.70; the variable Z was expressed as poverty line, that is, 1/3 of the mean expenditure to give 1/3 (₦29,833.70 = ₦ 9,961.20. the total Expenditure of the poor was expressed as total of all those that are below the poverty line to give a total of ₦105,501.00. the average expenditure of the poor was expressed as Total expenditure of the poor divided by number of those below the poverty line to give a total of ₦105,501.00/53 = ₦1,990.50; head count ratio expressed as total number of the poor (q) divided by the sample population (n) to give 53/146

Journal of Agripreneurship and Sustainable Development (JASD)
www.jasd.daee.atbu.edu.ng; Volume 2, Number 2, 2019
ISSN (Print): 2651-6144; ISSN (Online): 2651-6365

= 0.36; poverty gap ratio expressed as difference between average expenditure of the poor and the poverty line to give ₦9,961.20 minus ₦1,990.50/₦9,961.20 = 8.0 or 80%; poverty depth expressed by multiplying the poverty gap ratio by the head count ratio to give 0.36 x 0.8 = 0.28 or 28%, and finally, poverty severity expressed by multiplying the head count ratio by the square of the poverty gap ratio to give 0.36 x $(0.8)^2$= 0.23 or 2z3%.

Table 2: Poverty Status of Beneficiaries and Non-beneficiaries in the Study Area (n = 353)

Category	Y (₦)	ME(₦)	Z (₦)	TEP (₦)	AEP(₦)	HCR=P_O	PGR	PD P_1	PS P_2
Beneficiaries	7775716	37467.2	12489	110963	3467.6	0.17	0.72	0.12	0.088
Non-Beneficiaries	4363013	29883.7	9961.2	105501	1990.5	0.36	0.8	0.28	0.23

Note: TEP = total expenditure; Z = poverty line; ME = mean expenditure; AEP = average expenditure; HCR = head count ratio; PGR = poverty gap ratio; PS = poverty severity.

Analysis of the poverty incidence, depth and severity the project beneficiaries had indexes that include 0.72, 0.12 and 0.09, respectively. This meant that 12% and 9% chances of poverty occurrence and severity. In the case of non-beneficiaries the indexes were: 0.8, 0.28 and 0.23 which meant that there was a correspondingly 28% and 23% possibility of poverty occurrence and severity (Figure 1). The results therefore, showed that access to irrigation infrastructure provided by the HVIP had impacted on the dimensions of irrigation via production, income, employment that led to increased yield, cropped area, and crop productivity, on and off-farm employment that might have led to reduce poverty severity among beneficiaries compared to non-beneficiaries of the project. The inferences of this study revealed that lack of basic necessities like food, shelter; better education and health were more in non-project than project area as suggested by percentage of those living below the poverty lines and the poorest among the respondents.
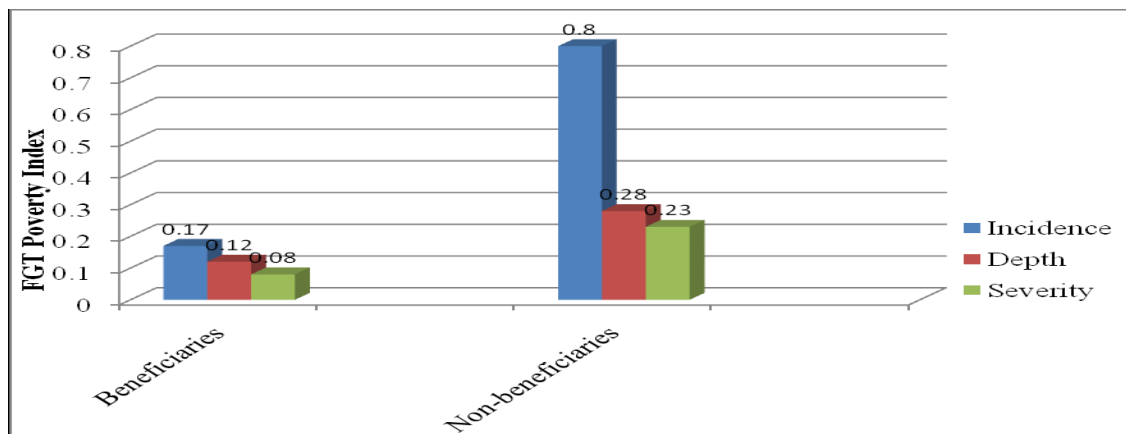

Figure 1: *Poverty status of beneficiaries and non-beneficiaries in the project area*

From the result of the F-test and Foster-Greer-Thorbecke (1984) which is also called the p-alpha class of poverty measures, it was concluded that Hadejia Valley Irrigation Project had impacted on poverty reduction among its beneficiaries. These findings were also consistent with Musa (2004) who reported that participation in the Dan-Nakola Irrigation Project

significantly improved the living condition of the beneficiaries through increased crop output and income.

CONCLUSION AND RECOMMENDATIONS

The study concludes that the beneficiaries participated less in off-farm employment. About 17% of beneficiaries were classified to be living below the poverty line of ₦12,489.00 and 36% of non-beneficiaries below the poverty line of ₦9,961.20. The Hadejia valley irrigation project as a development and social impact intervention project had achieved the goal for its establishment. The study recommends that:

i. Government should provide irrigation structures by completing the project to have full impact in the area.

ii. Farmers should intensify family planning services efforts and activities to improve knowledge, acceptance and practice of family planning in the project area.

iii. Measures should be taken by the project authority to address inadequate access to extension training.

iv. The project beneficiaries should form farmers' co-operatives for the purpose of knowledge transfer, input, output, marketing and distribution, savings mobilization, farm credit sourcing, supply and appropriate technologies that would release labour from irrigation to reduce the cost incurred in production.

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