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

ANALYSIS OF FARM INCOME OF BENEFICIARIES AND NON-BENEFICIARIES OF HADEJIA VALLEY IRRIGATION PROJECT IN JIGAWA STATE, NIGERIA

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ABSTRACT
The study examined the impact of Hadejia Valley irrigation project (HVIP) on farm income of beneficiaries in Jigawa State, Nigeria. From the list of 7036 respondents, 207 project beneficiaries and 146 non-beneficiaries were selected using a multi-stage random sampling making a total of 353 as the sample size of the study. Data were obtained using structured questionnaire and analyzed using descriptive statistics and F-test statistics. The results showed that beneficiaries and non-beneficiaries had a mean age of 47 and 45 years, a mean household size of 15 and 21 persons, educational levels of 8 and 7 years and mean off-farm income of ₦137,797.00 and ₦237,104 .00, respectively. The study also established 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 for beneficiaries and non-beneficiaries, respectively. In the study area, the average total cost of production per hectare of beneficiaries and non-beneficiaries were ₦527,179.00 and ₦363, 191.00, and net farm income of ₦814,852.00 and ₦403,753.00 realized, respectively. The result of the F-test statistics on cost of production indicated $F_{1,410}$ of 68.3> F at critical value of 3.86 at p = 5. 66E07 and farm income $F_{1,410}$ of 726.3 >F at critical value of 3.86 at p = 8.56E-93 (P<0.05) level of significance. This suggested a significant impact of Hadejia valley irrigation project on farm income of the respondents. The study concludes that the project has had positive impact on the farm income of the project beneficiaries. It therefore, recommends that government should encourage income sources diversification; measures should be taken by the project authority to address inadequate access to extension. The project beneficiaries should form farmers' co-operatives and measures should be taken by the project authorities to promote cost-saving technologies that encourage release of labour from irrigation to reduce the cost of production.

Keywords: Beneficiaries, Farm, Hadejia, Income, Irrigation, Project.

INTRODUCTION
Irrigation projects have positive impacts on agricultural production and the reduction of poverty for farmers (Lipton, 2007). Access to irrigation provides farmers with reliable water source at critical times in the crop's life cycle, removing the dependence and inherent uncertainty of rain-fed and lake-based agricultural systems in arid and semi-arid regions. This reduction in risk faced by farmers is likely not only to increase mean agricultural returns but, also to reduce their vulnerability to income fluctuations.

Owusu *et al.* (2011) studied the impact of irrigation on the social welfare in the rural savannah region of Ghana and found that irrigation water availability had positively affected the socio-economic conditions of the people. The net farm income after irrigation has shown significant increase. Bacha *et al.* (2011) studied the impact of Indris irrigation system at Ambo district Ethiopia on poverty reduction and found significantly higher poverty indicators without irrigation settings as compared with irrigation settings.

Therefore, agricultural productivity growth can drive rural growth and catalyze a pro-poor development process (Thirtle *et al.,* 2001). It determines the price of food, which then determines wage costs and the competitiveness of tradable goods leading to a confluence of effects that determine the real income effects of increased output for farming households (World Bank, 2007). Furthermore, agriculturally driven growth generates a larger welfare effect than non-agriculturally driven growth, especially for the poorest 20% of the population (World Bank, 2007). Irz *et al.* (2001) find that the most direct contribution of agricultural (sector) growth is through generating higher incomes for farmers. However, economy-wide, farm to non-farm income multipliers vary considerably as Haggblade *et al.* (1991) reveals an income multiplier of 1.71 for the Muda Valley irrigation development project in Malaysia. But, Goldman and Squire (1982) implied that a dollar increase in agricultural income will generate an additional 71 cents in rural non-farm goods and services. Bhattarai *et al.* (2002) estimate that the aggregate irrigation multiplier operating in India is about 3.15, which means that each US$100 benefit generated by irrigated cropland will generate another US$215 in the local economy as an induced effect. While the irrigation multipliers may vary from country to country, it helps to make the point that agricultural productivity growth delivers large benefits to the rural communities, including the poor and a large share of these benefits accrues via indirect channels and in the long term.

This study, therefore, was aimed to fill this important gap in irrigation literature in terms of clarifying the contribution of the Hadejia valley irrigation project (HVIP) on farm income between beneficiaries and non-beneficiaries in the study area. The specific objectives of the study include: described the socio-economic and institutional characteristics of project beneficiaries and non-beneficiaries and also determined the impact of the project on the farm income of the project 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.

Analysis of variance (ANOVA)

Analysis of variance (ANOVA) was used to determine the impact of the project on the farm income of the respondents. ANOVA compares mean values through a process that involves separating the total variance of a data set into distinct components, typically the variance within distinct groups (sometimes referred to as the within-group variance or error variance) which is treated as unexplained, and the between-group variancewhich is a function of a size of the differences in the mean values of the various groups and is treated as explained by underlying differences between the groups. The most basic linear model is of the form (de Smith, 2012):

$$Y_{ij} = \mu + T_j + e_{ij} \quad ...(1)$$

where;

The observed or measured value *y* (observation *j* in group *i*) is a linear combination of an overall mean value, μ, plus a treatment or group effect, *T*, plus some unexplained random variation or error, e. It is assumed that the error component has a mean value of 0, a common variance across groups.

RESULTS AND DISCUSSION

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

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

Journal of Agripreneurship and Sustainable Development (JASD)
www.jasd.daee.atbu.edu.ng; Volume 2, Number 2, 2019
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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.

Impact of Hadejia Valley Irrigaion Project (HVIP) on Farm Income of Beneficiaries

As presented in Table 2, the costs of seeds/planting materials incurred in naira per hectare by beneficiaries and non-beneficiaries were ₦71,525.00 and ₦55,387.00. The difference in the costs might not be unconnected to the rising inflation and the acreage cultivated especially with respect to beneficiaries in the study area.

The average cost of the quantity of fertilizer used by the sampled respondents in kilogram per hectare was estimated at ₦202,300.00 and ₦60,823.00 for beneficiaries and non-beneficiaries, respectively. This showed that beneficiaries spent more money on fertilizer compared to non-beneficiaries perhaps, because of the size of cropped area cultivated and /or as a result of untimely distribution which forced them to source the input in an open market at a higher price.

Table 2 further shows that an average sum ₦49,536.00 and ₦53,987.00 was spent by beneficiaries and non-beneficiaries, respectively. The higher costs of chemicals used by the non-beneficiaries could be due to the vegetables grown compared to the project beneficiaries. The results also established average cost of labour for the beneficiaries (₦33,641.00) and non-beneficiaries (₦55,709.00). This high cost in the case of non-beneficiaries might not be unconnected to high labour requirements of vegetables compared to cereal (rice and maize) crops grown by the beneficiaries. With regards to fuel costs of the respondents, the findings shows average sums of ₦42,858.00 and ₦60,406.00 were spent by the beneficiaries and non-beneficiaries, respectively. This implied that beneficiaries utilized gravity system compared to non-beneficiaries that use diesel pumps. The results finally discloses that depreciation on farm implements such as hoes, axes, rakes, cutlasses and pumping machines was considered as fixed cost. Depreciation on implements was based on salvage value of the cost of purchasing the implements and a useful life of 2 years and a straight line method was used to compute it. As shown in Table 2, average sum of ₦127,320.00 and ₦76,879.40 were spent as fixed costs by beneficiaries and non-beneficiaries, respectively. This indicated that there was an increase in the cost in both cases perhaps, due to inflation in the value of naira.

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Table 1: Socio-economic and Institutional Characteristics of 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

Source: Field survey (2017)

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Table 2: Cost of Inputs used by the Project Beneficiaries and Non-beneficiaries (n = 353)

Variables (₦/ha)	Beneficiaries	Non-beneficiaries
Seeds	71,525	55,387
Fertilizer	202,300	60,823
Chemical	49,536	32,987
Labour	303,212	40,635
Fuel	60,406	42,857
Fixed cost:	127,320	76,879
Total cost	814,299	309,568

Source: Field survey (2017)

Analysis of F-test on Cost of Inputs Between Beneficiaries and Non-beneficiaries

Table 3 shows the calculated $F_{(1,410)}$ value (68.3) for beneficiaries, the F value that was needed to exceed (F critical = 3.86) in order to have a significant difference and the probability (p-value) that the calculated F value obtained by chance (random error) alone. This probability was large (p = 5.66E+07) so there was highly significant difference in terms of costs of inputs between beneficiaries when compares to non-beneficiaries.

Table 3: Cost of Inputs Between Beneficiaries and Non-beneficiaries (n = 353)

Sources of Variation	SS	df	MS	F	P	F-critical
Between groups	1500304402	1	1.50E+09	68.3	5.66E+07	3.86
Within groups	9001826407	410	21955674			
Total	**1.05E+16**					

Source: Field survey (2017)

Table 4 indicates that the costs incurred in naira per hectare by beneficiaries and non-beneficiaries were ₦71,525.00 and ₦55,387.00 for seeds/planting material input costs. The difference in the costs might not be unconnected to the rising inflation and the acreage cultivated especially with respect to beneficiaries in the study area. The average cost of the quantity of fertilizer used by the sampled respondents in kilograms per hectare was estimated at ₦202,300.00 and ₦37,368.90. This showed that beneficiaries spent more money on fertilizer compared to non-beneficiaries perhaps, because of the size of cropped area cultivated and/ or as a result of untimely distribution which forced them to source the input in an open market at a higher price. The results also show that averages sum of ₦30, 536.00 and ₦ 32, 987.00 was spent on chemicals. The higher costs of chemicals used by the non-beneficiaries could be due to the vegetables grown compared to the project beneficiaries. The sums of ₦322,212.00 and ₦40,635.00 were spent on labour, ₦60,406.00; and ₦42,857.00 on fuels. The gap in cost of labour could be due to the size of cropped area cultivated by the beneficiaries whereas cost of fuel could be because non-beneficiaries utilized pumps to lift water for irrigation. These gave the total variable costs of ₦686,979.00 and ₦232,689.00 for beneficiaries and non-beneficiaries, respectively.

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Table 4: Net-farm Income of Beneficiaries and Non-beneficiaries (n = 353)

Input (₦/ha)	Beneficiaries	Non-beneficiaries
A.		
Seeds	71,525	55,387
Fertilizer	202,300	60,823
Chemical	30,536	32,987
Labour	322,212	40,635
Fuel	60,406	42,857
Total variable cost	686,979	232,689
B.		
Fixed cost:	127,320	76,879
C.		
Total cost (A + B)	814,299	309,568
D.		
Revenue:		
Rice	1,048,437	66,381
Maize	463,719	169,040
Wheat		66,140
Tomato		456,620
Onion		87,640
Others		79,120
Total revenue:	1,512,157	766,944
Net farm income:	697,858	457,376

Source: Field survey (2017)

In this study, depreciation on farm implements such as hoes, axe, rakes, cutlasses and pumping machines was considered as fixed cost. Depreciation on implements was based on salvage value of the cost of purchasing the implements and a useful life of 2 years and a straight line method was used to compute it. As shown in Table 4, an average sum of ₦127,320.00 and ₦87,879.00 were the fixed costs of beneficiaries and non-beneficiaries respectively. This indicates that there was a higher fixed cost in the case of beneficiaries perhaps, due to the size of cropped area cultivated by beneficiaries in the project area.

Further, the total costs of production were ₦814,299.00 and ₦309,568.00 for beneficiaries and non-beneficiaries in the study area. The total revenues realized from the sales of crops were ₦1,512,157.00 and ₦766,944.00 for beneficiaries and non-beneficiaries respectively. These provide net farm incomes of ₦697,858.00 and ₦457,376.00 for the respondents. Impliedly, beneficiaries realized higher net farm income than non-beneficiaries in the area studied.

Analysis of Results of F test of Net Farm Income of Beneficiaries and Non-beneficiaries

In order to have a significant difference between beneficiaries' and non-beneficiaries' net farm income and the probability (p-value) that the calculated F value was obtained by chance (random error) alone, Table 5 shows the calculated $F_{(1,410)}$value (726.3). The F value

exceeded F critical (3.86). The probability is very small (p = 8.56E-93), so there was highly significant difference in terms of net farm income between beneficiaries and non-beneficiaries of the project.

Table 5: Results of Net Farm Income of Beneficiaries and Non-beneficiaries (n = 353)

Source of Variation	SS	Df	MS	F	P-value	F-critical
Between Groups	2.04E+13	1	2.04E+13	726.3491	8.56E-93	3.864239
Within Groups	1.15E+13	410	2.81E+10			
Total	**3.19E+13**	**411**				

Source: Field survey (2017)

CONCLUSION AND RECOMMENDATIONS

How does irrigation affect mean farmer income usually goes through higher yield, cropping intensity and value of the crop mix. The major objective of this study was to examine the Impact of Hadejia Valley Irrigation Project (HVIP) on farm income of beneficiaries and non-beneficiaries in Jigawa State. From the result of the F test statistic, it could be concluded that the project has positive impact on the beneficiaries' farm income. Therefore, it recommends that:

i. Government should encourage income sources diversification.
ii. Measures should be taken by the project authority to address inadequate access to extension.
iii. The project beneficiaries should form farmers' co-operatives.
iv. Measures should be taken by the project authorities to promote cost-saving technologies that would release labour from irrigation to reduce the cost incurred in production.

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