Effects Of Inland Valley Rice Development Project On Household Poverty Indicators Of Rice Farmers In Ahafo-Ano South District In The Ashanti Region Of Ghana.

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Abstract: The Inland Valley Rice Development Project (IVRDP) was introduced as a poverty intervention project with the aim of increasing income of participating rice farmers. This study analyzed the effect of income from the IVRDP on household poverty indicators such as nutrition, health and education of children of school-going age. Purposive sampling technique was used to select six rice growing communities in Ahafo-Ano South district in the Ashanti Region of Ghana and random sampling technique was also used to select 120 respondents. Primary data were collected through personal interview and secondary data were obtained from the baseline survey conducted by the regional office of the IVRD-Ministry of Food and Agriculture (MOFA) in Kumasi. The techniques of descriptive statistics, complete enterprise cost accounting method and binary logit regression were employed. The study revealed that rice income has been increasing since the year 2005 with the exception of 2007. There was an improvement in the nutrition, health and education of children of school going-age of the rice farmers in the Ahafo-Ano South district in the Ashanti Region. The income from the rice project had no significant relationship with the improvement in nutrition (*P*=0.4528) and health (*P*=0.1120) of the households of the rice farmers. However, the rice income had significant (*P*=0.0670) and positive effect on the improvement in the education of children of school-going age of the rice farmers.

Index Terms: Ahafo-Ano South District in Ashanti Region, Improvement in Education of school-going age, Ghana, Improvement in Health, Income, Inland Valley Rice Development Project, Improvement in Nutrition, Poverty intervention, Rice farmers,

1. INTRODUCTION

Throughout the ages, the rates of poverty reduction have been associated with agricultural performance – particularly to the rate of growth of agricultural productivity. In the nutshell, this indicates that the countries that have been able to increase their agricultural productivity the most have also achieved the greatest reductions in poverty (Thomson, 2003). As a result of this finding rice farming was identified as one of the agricultural sectors that have huge potentials to reduce poverty among farmers in the Ahafo-Ano South district of Ashanti region, Ghana. Rice is increasingly gaining importance as a staple food in Ghana next to cassava (7.2 Million tonnes), yams (3.0 million tonnes), plantain (2.0 million tonnes) and maize (1.0 million tonnes). Rice is now the third cereal grown in the country after maize and sorghum (0.4 million tonnes). Rapid population growth mainly in the urban areas and the relative ease of preservation and cooking of rice has favourably influenced the trend for more rice consumption (Hara *et al*, 2001). Despite increased domestic rice production over the years to about 280,000 tonnes, around two-thirds of the national rice requirements are still imported. Discovering the huge potential in rice production, Ghana's vision 2020 socio-economic development initiative placed emphasis on inland valley rice production as an important source for achieving national food security, contributing to reduction of poverty and imports.

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The reduction in rice importation is to be substituted by a local production of 72,000 million tonnes milled rice which would create jobs to increase rural incomes. In this regard, steps have been taken to ensure that rice farmers are provided with high yielding improved varieties" (Hara *et al*, 2001).A project work by Hara *et al* (2001) indicates that the microeconomic objective of inland valley rice development project seeks to increase incomes of smallholder rice producers, women and men rice traders and processors in the country by increasing the production of good quality local rice while the macroeconomic objective aims at reducing rice importation. In order to achieve these objectives, the project was structured to focus attention on (i) Land Management, (ii) Credit for Crop Development; (iii) Capacity Building; (iv) Adaptive research and surveys; and (v) Project Co-ordination. The project was aimed at benefiting about 10,000 households (60,000 people) and creating additional 8,500 seasonal jobs. It was also expected to contribute to increased domestic milled rice production estimated at about 13,000 metric tonnes per year as well as to contribute to foreign exchange savings valued at about US$ 3.7 million per annum. Increased production induced by the project was expected to lead to increased employment and income generation opportunities and, therefore contribute substantially to poverty reduction in the rural areas by focusing its support on the smallholder rice producers and processors, especially women. Currently, Inland Valley Rice Development Project (IVRDP) covers about 25 selected project sites in seventeen (17) Districts in five (5) regions namely; Ashanti, Brong-Ahafo, Central, Eastern and Western in the country. The project covers three districts in Ashanti region: Ahafo-Ano South, Ejisu-Juaben and Ejura- Sekyedumasi. Inland Valley Rice Project has been introduced as poverty intervention project to increase the productivity and income of the participating rice farmers. As indicated by a study in Uganda in which the cultivation of New Rice for Africa (NERICA) variety has

resulted in higher incomes of poor farmers (Kijima et al., 2008), it was expected that Inland valley rice development project would contribute to higher incomes of farmers. Rice is a cash crop but different from other cash crops such as cocoa, tobacco and coffee in that it can be consumed at home. Thus, it is an important crop from the standpoint of food security at the level of farmers as well. Mendola (2006) has observed that the adoption of high yielding varieties (HYV) of crops has a positive effect on household wellbeing in Bangladesh. Despite the sector goals stated for Inland Valley Rice Development Project, its impact is normally not assessed from the national or even farmer participant point of view. Therefore, this study focuses on the objective of the project rather than the sector goals. In order to assess the output of the inland valley rice development project against its microeconomic objective, this study was carried out with the following primary objective: to analyze the effects of the Inland Valley Rice Development Project (IVRDP) on the household poverty indicators of the participating rice farmers in Ahafo-Ano South District in the Ashanti Region of Ghana. This primary objective was addressed through the following specific objectives: (i) to describe the socio-economic characteristics of the participants of the rice project in the Ahafo-Ano South District, (ii) to determine the impact of the IVRP on rice yield, area cultivated and number of crop cycles and (iii) to estimate the effects of the Inland Valley Rice Development Project on selected household poverty indicators such as nutrition, health and education of children of school-going age of the rice farmers in the Ahafo-Ano South District in the Ashanti Region of Ghana.

2. DATA AND METHODOLOGY

Purposive sampling technique was used to select six rice growing communities in Ahafo-Ano South district namely: Adugyama, Potrikrom, Biemso No 1, Biemso No2 and Dunyan Nkwanta and random sampling technique was also used to select 120 respondents. All the respondents were participating rice farmers of Inland Valley Rice Development Project. The primary data were collected from the sample respondents by personal interview method using a well structured and pre-tested questionnaire. The data were collected on the socio-economic characters of respondents, such as family size and composition, asset position, occupational pattern and educational level, children in school, gender, income from rice project and other sources of income. The data on existing livelihood systems, income generation from farm and off-farm activities, activities performed by men and women, asset ownership, and decision-making aspects were collected from the selected farmers. Secondary data were collected from the baseline survey conducted before the implementation of the project by the Ministry of Food and Agriculture (MOFA).

2.1. Analytical Tools

For data analysis, descriptive analytical tools, complete enterprise cost accounting method and logistic regression were employed. The logistic regression models were employed to study the factors influencing improvement in nutrition, health and children of school going-age. Eviews was the statistical software used to estimate the regression models. The estimated regression models were specified as follows:

$$\text{Log}\left(\frac{IMPNUT}{1-IMPNUT}\right) = \text{N} = \beta_0 + \beta_1\text{GEND} + \beta_2\text{AGE} + \beta_3\text{HHS} + \beta_4\text{EDU} + \beta_5\,\text{INCRIC} + \beta_6\text{INCOS} + \varepsilon_t \quad (1)$$

The a-priori expectations are: $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7 > 0$; $\beta_3 < 0$

$$\text{Log}\left(\frac{IMPHTH}{1-IMPHTH}\right) = \text{N} = \beta_0 + \beta_1\text{Age} + \beta_2\text{HHS} + \beta_3\text{EDU} + \beta_4\text{HH} + \beta_5\,\text{INCOS} + \beta_6\text{INCRIC} + \varepsilon_t \quad (2)$$

The a-priori expectations are: $\beta_3, \beta_4, \beta_5, \beta_6 > 0$; $\beta_1, \beta_2 < 0$

$$\text{Log}\left(\frac{IMECH}{1-IMECH}\right) = \text{N} = \beta_0 + \beta_1\text{AGE} + \beta_2\text{CHSCH} + \beta_3\text{EDU} + \beta_4\,\text{INCOS} + \beta_5\,\text{INCRIC} + \varepsilon_t \quad (3)$$

The a-priori expectations are: $\beta_1, \beta_3, \beta_4, \beta_5 > 0$; $\beta_2 < 0$

Where IMPNUT= Improvement in nutritional status of the household. This was measured by the following proxy indicators: the ability to provide at least three meals daily, ability to provide meat, fish, eggs and/or beans in the diet of the household and ability to provide fruits daily. The respondent answering “yes” to all or two of the above indicators was designated as: ‘improvement’ and answering “yes” to one or none was designated as: ‘no improvement’. To illustrate a binary choice models, this is collapsed into a binary variable where y=1, if a rice farmer reports improvement and y=0, if a rice farmer reports no improvement.

IMPHTH = Improvement in health status of the household. This was measured by the following proxy indicators: the ability to afford health care delivery, ability to seek health care when seriously sick and ability to seek health care from hospital or clinic. The respondents answering “yes” to all or two indicators was designated as ‘improvement’ and answering “yes” to one or none was designated with ‘no improvement’. To illustrate a binary choice models, this is scored into a binary variable where y=1, if a rice farmer reports improvement and y=0, if a rice farmer reports no improvement.

IMPECH = Improvement in education of children of school going-age of the household. This was measured by the following proxy indicators: ability to pay school fees in full and on time, ability to buy school uniform and sandals, ability to buy books and ability to give money to the children of school-going age to buy food when they are in school. Respondents answering “yes” to all or three were designated as ‘improvement’, and answering “yes” to one or none was designated as ‘no improvement’. To illustrate a binary choice models, this is scored into a binary variable where y=1, if a rice farmer reports improvement and y=0, if a rice farmer reports no improvement.

GEND= Gender (1=male, 0=female)
AGE= Age of the respondents (in years)
HHS=Household size (Number of family members)
EDU=Educational level (measured in years)

INCRIC=Income from the rice project (GHS per 0.6ha per annun)
INCOS=Income from other sources including other crop farming, animal rearing and off-farm income
CHSCH=Number of children of school going-age
HH is a dummy=1 if respondent is household head or 0 otherwise
εt= Random-error

2.2. Statement of Hypotheses

i) Nutritional status of household

a) H_0: $\beta_1 = 0$; i.e. gender of head of household has no effect on household nutrition.
H_1: $\beta_1 > 0$; i.e. gender of head of household has positive effect on household nutrition.

The above hypothesis holds for the following variables: age of respondents, educational level of respondents, income from rice project, and amount of income earned from other sources.

b) H_0: $\beta_3 = 0$; i.e. household size has no effect on household nutrition.
H_1: $\beta_3 < 0$; i.e. household size has negative effect on household nutrition.

ii) Health status of household

a) H_0: $\beta_3 = 0$; i.e. educational level of respondent has no effect on health of the household.
H_1: $\beta_3 < 0$; i.e. educational level of respondent has a positive effect on health of the household.

The above hypothesis applies to the following variables: respondent being the head of the household, income from rice project and amount of income earned from other sources including income from other crop farming, livestock farming, remittances and off-farm income.

b) H_0: $\beta_1 = 0$; i.e. age of respondent and household size have no effect on health of the household.
H_1: $\beta_1 > 0$; i.e. age of respondent and household size have a negative effect on health of the household. This hypothesis also applies to household size.

iii) Education of children of school-going age

a) H_0: $\beta_1 = 0$; i.e. age of respondent has no effect on children's education.
H_1: $\beta_1 > 0$; i.e. age of respondent has a positive effect on children's education.

The same hypothesis applies to the following variables: educational level of respondent, income from rice project and amount earned from other sources of income including income from other crop farming, livestock farming, remittances and off-farm income

b) H_0: $\beta_2 = 0$; i.e. number of children of school-going age has no effect on children's education.
H_1: $\beta_2 < 0$; i.e. number of children of school-going age has a negative effect on children's education.

3. RESULTS AND DISCUSSION

3.1. Socio-economic Profile of the Respondents

The socio-economic variables discussed in this section among others include age of respondents, respondents' level of education, gender of respondents and marital status of respondents, years in rice farming, household size, children in school, income from the rice project and other sources of income as depicted in Table 1. It was found that the average was 42 years indicating that majority of the respondents belonged to the middle-age. This result implies that rice farming in the study area is dominated by old people. It was observed that 53.0% of the respondents were illiterates, while the remaining respondents studied up to different standards with the highest educational level being vocational. This is a true reflection of the results that one out of five children is in school. Majority (84%) were males while 16% were females and a large proportion of the farmers (representing 90% of total farmers interviewed) were married. This implies that more males are involved in the rice project than the females. The women in the study area are generally involved in the cultivation of vegetables. These farmers, on the average, had 9 years experience in rice production. This means that farmers had appreciable experience in rice farming therefore IVRDP was not new to the farmers in the study area. The average household size was almost 6 people who provided supplementary labour. This household on the average had one (1) member in school. The existing studies have shown that children in rice growing communities forfeit their education for labour daily to drive away birds from rice farms. The study also revealed that the farmers generate income from other sources apart from the rice production as expressed by 79% of the farmers interviewed. It was realized that other sources of income were crop farming, livestock rearing and remittances. Majority of the rice farmers constituting 92% reported that crop farming other than rice farming constitute their other source of income followed by remittances with livestock farming taking the least percentage representing 2 per cent. The GLSS V (2008) report indicated that the average annual household income in Ghana is about GH¢1,217.00 whilst the average per capita income is almost GH¢400. Using the consumer price index (CPI) of 2005 as a base year to deflate the cost and income of rice production indicates an increase in the net average income from the rice production from 2005 to 2008 in the study area. However, the net average income from the rice project declined in 2007 due to a moderate occurrence of the El Nino-Southern Oscillation weather phenomenon. Rice farmers recorded the highest average income GH¢884 in 2008 with the lowest income of GH¢465 in 2005 (Table 2). This result lends support to existing study by GLSS V (2008) which indicated that the sources of household income comes from agricultural activities, wage income from employment, income from self employment and remittance. The average income earned from the rice project (GHS 660.50) was less than that of other sources of income (GHS 726.0). The average income a farmer earned from rice production per growing season was 9.1% less than the income earned from other sources. This study revealed that, according to the Ghana Living Standard Survey V(2008), 44% of the rice farmers had crossed the lower poverty line of GH¢ 288 and only 30% had crossed

the upper poverty line of GH¢370.90 as far as the income from the rice project was concerned.

Table 1: *Descriptive statistics of socio-economic characteristics of respondents*

Variable	Category	Values
Age (years)	Maximum	53.00
	Minimum	27.00
	MEAN	42.23
Years in Rice farming	Maximum	30.00
	Minimum	5.00
	MEAN	9.45
Household Size	Maximum	10.00
	Minimum	3.00
	MEAN	6.0
Children in School	Maximum	5.00
	Minimum	0.00
	MEAN	1.00
Income from rice (GH¢)	Maximum	982.00
	Minimum	100.00
	MEAN	660.50
Income from other sources (GH¢)	Maximum	1090.00
	Minimum	111.70
	MEAN	726.50

Variable	Category	Percentage (%)
Gender	Male	84.00
	Female	16.00
Education	None	53.00
	Primary	22.00
	Junior High/Middle	17.00
	Commercial or Vocational	8.00
Marital Status	Married	90.00
	Widowed	4.00
	Never married	4.00
	Divorced	2.00
Other sources of Income	Yes	79.00
	No	21.00
Sources of income	Crop farming	92.00
	Livestock	2.00
	Remittances	6.00

Table 2: *Rice Income per 0.6 ha*

Year	Minimum (GH¢)	Maximum (GH¢)	Average Rice Income (GH¢)	Standard Deviation
2008	468.750	2377.083	884.0	464.4
2007	306.349	1481.480	573.0	102.9
2006	290.307	1465.450	620.0	264.5
2005	149.0	1021.0	465.0	109.3

The nutritional status of the household of the rice farmers discusses the number of meals consumed daily, ability to provide meat, fish, egg, milk etc in their diet daily; ability to provide fruits for the household daily. The discussion focused on comparing the nutritional indicators before the joining the rice project and now. Table 3 shows that higher proportion of the interviewed farmers representing about 96 per cent can now afford to provide three meals for their household daily as against 54 per cent rice farmers who were able to do so before the joining the rice project. This represents an increase in the number of rice farmers who can provide 3 meals daily. Again, before the inception of the IVRDP, no rice farmer was able to provide 4 meals for the household but about 2 per cent of them can now provide four meals daily because they have improved income. Two respondents revealed that they are worse off now because they can provide only one meal per day. The study revealed that these two farmers are migrant farmers who have now been stripped off their land by their landlords therefore; they can no longer cultivate food crops to feed their families. The only land left for them is the one for rice cultivation.

Table 3: *Number of Meals Consumed by the Respondents per Day.*

Number of Meal	"Before"		"After"	
	Respondents	%	Respondents	%
1	0	0	2	1.67
2	55	45.8	1	0.83
3	65	54.2	115	95.8
4	0	0	2	1.67
Total	120	100	120	100

Nutritionist normally determine the quality of meal by the nutritional value and one such value is the protein content and for this reason, the respondents' (rice farmer) ability to provide protein-giving food such as meat, fish, eggs, milk or beans daily is important to determine whether the quality of the food consumed by the household has improved after the rice project or otherwise.

Table 4. *Ability to Provide Protein Foods Daily in their Meals*

Variable	Description	Response	Before Percentage (%)	After	After
Nutrition	Ability to provide meat, fish, eggs or beans daily	Yes	32.5	90	90
		No	67.5	10	10
	Fruit intake (Daily)	Yes	25	77	77
		No	75	23	23

It could be seen from table four that ninety per cent (90%) of the farmers can provide meat, fish, eggs, milk or beans daily for their households as against thirty-two per cent (32%) before the participating in the rice project. There has been about fifty-eight per cent (58%) increment. This represents a very high increment of the interviewed rice farmers who can provide quality food for their households now. Fruit intake, on the other hand, had seen an appreciable increase as about seventy-seven per cent (77%) of the respondents can provide fruits as part of daily meal for their households as against twenty-five per cent (25%) who could do so daily for their household before taking part in the rice project. The commonest disease identified before and after the adoption of the rice project was malaria. The prevalence of malaria was relatively smaller (51.7%) for the period before the rice project than

the period after the adoption of the project (73.3). This could be attributed to the introduction of the swamp rice varieties which needed constant supply of water and this stagnant water in the project sites could be good grounds for breeding mosquitoes. The rest of the diseases identified showed a decrease in their prevalence after the adoption of IVRDP. This shows that the farmers are better off now in contracting the identified diseases than before their participation in the rice project. It was expected that as farmers could afford fruit intake and protein-giving food intake as a result of increased income there would be a decrease in disease incidence but farmers were rather worse-off with respect to malaria incidence. This could be attributed to the finding of Alderman and Garcia (1994) who reported that community illness prevalence strongly affects health regardless of household income.

Table 5: *Common Diseases amongst the Respondents and health facilities*

Variable	Types	Before (%)	After (%)
Disease:	Malaria	51.7	73.3
	Diarrhoea	5.0	5.8
	Skin diseases	0.0	1.7
	Dental problems	0.8	0.0
	Worms	3.3	1.7
	Stomachache	24.2	1.7
	Cough	10.8	6.7
	Nasal congestion	2.5	1.7
	Anaemia	5.8	3.3
Health Facilities:	Traditional healer	40	3
	Drug store/Pharmacy	44	8
	Public clinic/hospital	13	86
	Missionary clinic/hospital	2	0
	Private hospital	1	3

When asked where they seek health care when sick, the survey data revealed that before the rice project the farmers used to patronize the services of traditional healers (herbalists) because they could not afford the cost of seeking hospital or clinic services as evidenced by only 2 per cent of them who were able to afford hospital or clinics services (table 5). However, after joining the IVRP, about 86% of the interviewed farmers can now afford the services of hospital or clinics; an indication that farmers are well off after participating in the rice project (table 5). This improvement could not be solely attributed to the income of the Inland Valley Rice Development Project because of the introduction of social intervention on health like National Health Insurance Scheme (NHIS) during the period of this study. It could be inferred that farmers now spend less on health care because of NHIS. According to Figure 1 sixty-five per cent (65%) of the respondents spend only 1-5% of their income on health care now as against twenty- eight per cent (28%) who used to spend 1-5% on health care yearly. Majority (54%) used to spend 6% to 10% of their income on health care of the household yearly before the adoption of the rice project. This indicates that rice farmers spend less of their income on health care now probably as a result of their membership in the NHIS but not necessary the income from the rice project.

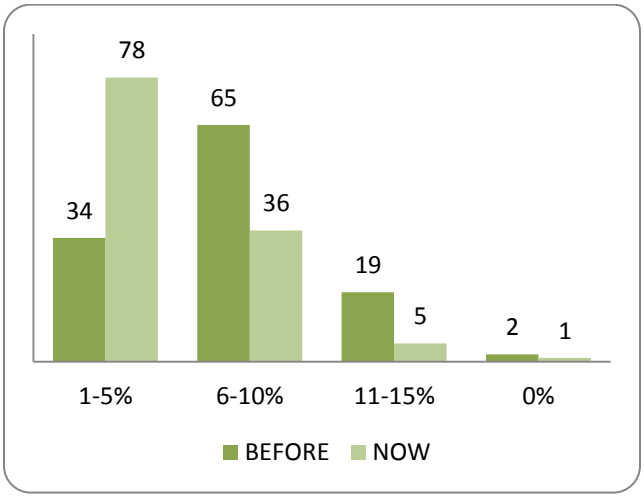

Figure 1: *Percentage of farmers' income spent on health care 'before' and 'now/after'*

The NHIS has made it possible for the majority of people who were not seeking hospital medication to do so now because the premium of NHIS is less costly, therefore, people do not spend much on health care. Maxwell *et al* 2000 found out in their study conducted in Accra-Ghana that increased in income caused an increase in expenditure on health. It can be said that there was no health care intervention like NHIS during their study on expenditure on health care. On the issue of education, ability to pay children's school fees, the mode of school fees payment, improvement in their ability to buy books, improvement in buying school uniform, school shoes and sandals and improvement in their ability to give 'pocket money' to their wards to buy food when in school were examined. Children of school going age in this study refer to children who are in nursery up to the tertiary level. Farmers' ability to pay for children's school fees has improved from 58% before the rice project to 83% after the project (table 6). On the other hand, rice farmers' ability to pay school fees of their children on time and in full has increased after joining the rice project by 49% probably as a result of improvement in their income level as earlier discussed.

Table 6: *Ability to pay for children's school fees*

Variable	Category	Before (%)	After (%)
Ability to pay school fees	Yes	58	83
	No	34	9
	No response	8	8
Mode of fee payment	Full payment	34	83
	Installment	58	9
	No response	8	8

3.2. Rice Production

Table 3 indicates that only 10% of the farmers were able to get yields equal to or greater than the project target of 4.5 metric tonnes of paddy rice per hectare before the introduction of IVRD project. It also showed that only 14% were able to achieve or exceed the project target of 4.5 metric tonnes of paddy rice per hectare after the

introduction of the project. Apparently, there was only 4% change in yield after the implementation of the project. The percentage of rice farmers who could cultivate land sizes between 0.6-1.0 ha increased from 54% 'before' the project to 79% 'after' the adoption of the project. Before the IVRDP was introduced, only 3% of the farmers could cultivate a land size more than 1.0 hectare. This increased slightly to 5% after the implementation of the project. Forty three (43%) of the rice farmers could cultivate a land size of 0.1-0.5 hectares before the introduction of the project but this reduced to 17% under the project. Under the traditional method of cultivating rice in the Ahafo-Ano South District before the introduction of the Inland Valley Rice Development Project, most of the varieties cultivated were upland rice. Therefore, rice farming was under rain-fed and crop cycle was once a year. With the introduction of the Inland Valley Rice Development Project, it was expected that rice could be grown more than once a year but this expectation is yet to be realized due to the absence of dams for farmers to irrigate their rice farms. It was observed that the dams are yet to be completed. As a result of this constraint, only 4% of the rice farmers interviewed claimed that they are able to cultivate rice twice a year due to the closeness of their farms to streams with which they could irrigate their rice farms. The study revealed that the rice farmers still rely on rainfall for rice cultivation; therefore, failure of the rains means crop failure because the rice varieties introduced by the project were swam rice.

Table 7: *Status of Yield, Area cultivated and Crop cycles before intervention and after.*

Variable	Category	Before (%)	After (%)
Yield of rice	Greater than or equal to target of 4.5 metric tons per hectare	10	14
	Below target of 4.5 metric tons per hectare	90	86
Area Cultivated	0.1-0.5 hectares	43	17
	0.6-1.0 hectares	54	79
	1.1-1.5 hectares	3	5
Number of Crop cycles per year	Once	-	96
	Twice	-	4

The study also revealed that the change in rice yield between the period before the implementation of IVRDP and afterwards was statistically significant at 1% as depicted in Table 8. It also showed that the change in cultivated area between the period before the project and afterwards was statistically significant at 1%. This implies that rice farmers have been able to increase their farm size and yield significantly after the implementation of the inland valley rice development project.

Table 8: *Significant Test*

Variables	Sample size	T	Significance (2tailed)	Mean difference
Yield in metric tonnes per hectare	120	-19.3	0.000***	-0.758
Area cultivated	120	4.16	0.000***	0.283

*** *Significant at 1%*

3.3 Effect of Inland Valley Rice Development Project on Household Poverty Indicators

The effect of inland valley rice development project on household poverty indicators such as household nutrition, health and education of children of school-going age was estimated by using the income from the rice project and selected socio-economic characteristics of the rice farmers.

3.3.1 Effect of Inland Valley Rice Development Project on Household Nutrition

Table 10 also indicates that the gender was positive and statistically significant at a level of 10% (*P*=0.0909) on improvement in nutrition. This might be attributed to the fact that more males were involved in the survey which is linked to their ability to vigorously engage in rice production and hence increase their income level. This result confirms CWIQ (2003) report that malnutrition and malnourishment remain a major health problem for women and children in the district. In the same vein, the respondents earning income from other sources contributed positively to the improvement in nutrition and it was statistically significant at a level of 1% (*P*=0.0000). Income from the rice project had no significant effect on improvement in nutrition.

Table 9: *Estimation of the effect of inland valley rice development project on improvement in Nutrition.*

Variables	z-Statistics	Marginal Effect
AGE	-0.629108	-0.015297539
GEND	1.690493*	1.185311856
HHS	-0.543834	-0.072578161
INCOS	4.367147***	2.628072344
INCRIC	0.750674	0.000884
EDU	0.263323	0.110267776
McFadden R–squared	0.308636	Probability(LR stat) 5.86E-05***
***Significant at 1%	* Significant at 10%	

(See Appendix A)

3.3.2 Effect of Inland Valley Rice Development Project on Health of the Household

As shown in Table 11 the amount earned from other sources of income has a positive relationship with

improvement in health and it was statistically significant at 10% (*P*=0.0590). According to Handa and King (1997) improvement in income leads to improvement in health. However, income from the rice project was not statistically significant (*P*=0.1120) and therefore, it had no effect on health improvement. The level of education of respondents was statistically significant at a level of1% (*P*=0.0063) and it bears a positive relationship with improvement in health as Case and Deaton (2003) stated in their studies that both income and education have independent protective effects on health. Age had a negative relationship with improvement of health of the household and it was statistically significant at a level of 5% (*P*=0.0439).The rate at which health capital declines with age is partly a biological process over which people have little control. It is also affected by the extent to which health capital is used in consumption and in work (Muurinen and Le Grand, 1985). Respondent being the head of a household was statistically significant at 5% (*P*=0.0482) and it had a positive effect on improvement in health status. The positive effect of household head on health status of the household in this study could be attributed to the fact that most of the farmers interviewed were male household heads and their contribution to the household health expenditure might be enormous. According to Spring (1995) female-headed households generally earn less money than male-headed households.

Table.10: *Regression Results for Improvement in health*

Variables	z-Statistics	Marginal Effect
AGE	-2.014750**	-0.021984571
INCOS	1.888429*	0.542213697
INCRIC	1.589160	0.000882767
HHS	-0.891187	-0.051804588
HH	1.975169**	0.627012595
EDU	2.729649***	0.661577781
McFadden R-squared	0.109184	Probability (LR stat) 0.006970***

***Significant at 1%** Significant at 5% * Significant at 10%
(See Appendix B).

3.3.3 Effect of Inland Valley Development Project on Education of Children of School-going Age.

The age of the respondents had a positive effect on the improvement of the education of their children. It was statistically significant at 5% (*P*=0.0265). It could be inferred that the more the respondents advance in age, the more they would probably be able to give quality education to their children due to their ability to work and earn income. The level of education of the respondents is significant at a level of1% (*P*=0.0032) and positively affected the improvement of the children's education. It could be inferred from the regression results in Table 12 that educated people tend to give quality education to their children. The incomes earned from the rice project and other sources had positive effects on improvement in education of respondents' children of school-going age and both were statistically significant at a level of 10% (*P*=0.0670) and 1% (*P*=0.0096) respectively. This result confirms the empirical study by Scherr (1995) who found out that improvement in income led to improvement in children's education in an assessment on the impact of tree crop production as a poverty intervention in Kenya. The number of children in school was significant at a level of 5% (*P*=0.0377) and had a positive relationship with the improvement of education of children. This study revealed that the respondents had, on average, one child in school which might not put much pressure on the household budget. However, the higher the number of children in school, the higher the expenditure of the household income on education of children and that could consequently put much pressure on the household budget and for that matter the a-priori expectation of this independent variable was negative.

Table 11: *Estimation of the effect of inland valley rice development project on improvement in Education of children of school-going age.*

Variable	z-Statistic	Marginal Effect
AGE	2.219182**	0.008757099
INCOS	2.590880***	0.000967242
INCRIC	1.831406*	0.000459537
EDU	2.943827***	0.027517885
CHSCH	2.078095**	0.106112141
Mac Fadden R-Squared	0.280561	Probability(LR stat) 2.01E-05***
*** Significant at 1%	**Significant at 5%	*Significant at 10%

(See Appendix C)

4 CONCLUSION

The study showed that gender and income from other sources had significant effect on the improvement in nutrition of the respondents' household at 10 % (P=0.0909) and 1% (0.000) respectively but rice income did not. The age of the respondents, a respondent being a household head, a respondent earning income from other sources and respondents' educational level significantly affected the improvement in health of the household at the level of 5% (*P*=0.0439), 5% (*P*=0.0482), 10% (*P*=0.0590) and 1% (*P*=0.0063) respectively but rice income has no significant (*P*=0.1120) effect on improvement of the health of the household. The age of the respondents, educational level, number of children in school, income from other sources and the rice project had significant effect on improvement in education of children of school going age at the level of 5% (*P*=0.0265), 1% (*P*=0.0032), 5% (*P*=0.0377), 1% (*P*=0.0096) and 10% (*P*=0.0670) respectively. Economically, the project objective of increasing the incomes of rice farmers in order to reduce poverty has not been fully realized as this study has shown. The study also revealed that an increase in the income of a household does not automatically have a positive impact on household poverty indicators such as health and nutrition if the delivery of such services is not of the best quality. The study revealed that the output of the project, in this case rice yield per hectare, had been affected negatively by the delay of delivering project inputs such as irrigation facilities despite the fact that the farm size had increased appreciably. In other words, project output is directly proportional to project inputs. If project inputs are not delivered on time it may affect the project outputs and their effects appreciably. However, the study revealed that the implementation of the project might pose serious health and environmental threats on the people in the project catchment area and erode the benefits of the project if those negative externalities are not factored out. This is because malaria cases went up after the implementation of the project in the project areas. It

could be attributed to the intensification of swamp rice cultivation which could provide breeding grounds for mosquitoes.

5 POLICY IMPLICATIONS

- Women should be encouraged to participate in poverty intervention projects since majority of the participating farmers in the project were males.
- Majority of the participating farmers were illiterate, therefore more field demonstrations should be organized to educate farmers.
- Agricultural projects should be designed to suit the project sites in order to achieve the target results.
- Projects should be designed in such a way that the negative externalities would not outweigh and erode the benefits or gains of the project.
- Participating farmers of any poverty intervention projects should be encouraged to engage in diversification in order to overcome economic and financial shock in case of project failure.

6. END SECTIONS

6.1 Appendices

APPENDIX A: *Regression Results of Improvement in Nutrition*

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.558039	1.585123	-0.352048	0.7248
AGE	-0.017651	0.028057	-0.629108	0.5293
GEND	1.367667	0.809034	1.690493	0.0909
HHS	-0.083744	0.153988	-0.543834	0.5866
INCOS	3.032390	0.694364	4.367147	0.0000
INCRIC	0.001020	0.001359	0.750674	0.4528
EDU	0.127232	0.483180	0.263323	0.7923

Mean dependent var	0.866667	S.D. dependent var	0.341360
S.E. of regression	0.283748	Akaike info criterion	0.659629
Sum squared resid	9.097982	Schwarz criterion	0.822233
Log likelihood	-32.57773	Hannan-Quinn criter.	0.725663
Restr. log likelihood	-47.12094	Avg. log likelihood	-0.271481
LR statistic (6 df)	29.08640	McFadden R-squared	0.308636
Probability(LR stat)	5.86E-05		

Obs with Dep=0	16	Total obs	120
Obs with Dep=1	104		

APPENDIX B: *Regression Results of Improvement in Health*

Variable	Coefficient	Std. Error	z-Statistic	Prob.
INCRIC	0.001492	0.000939	1.589160	0.1120
EDU	1.118159	0.409635	2.729649	0.0063
HHS	-0.087557	0.098248	-0.891187	0.3728
HH	1.059739	0.536531	1.975169	0.0482
AGE	-0.037157	0.018442	-2.014750	0.0439
INCOS	0.916417	0.485280	1.888429	0.0590
C	-0.440172	0.988777	-0.445168	0.6562

Mean dependent var	0.591667	S.D. dependent var	0.493586

S.E. of regression	0.467102	Akaike info criterion	1.321488
Sum squared resid	24.65485	Schwarz criterion	1.484092
Log likelihood	-72.28928	Hannan-Quinn criter.	1.387522
Restr. log likelihood	-81.14954	Avg. log likelihood	-0.602411
LR statistic (6 df)	17.72054	McFadden R-squared	0.109184
Probability(LR stat)	0.006970		
Obs with Dep=0	49	Total obs	120
Obs with Dep=1	71		

APPENDIX C: *Regression Results of Improvement in Children's Education*

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-2.775446	1.322908	-2.097989	0.0359
AGE	0.065268	0.029411	2.219182	0.0265
INCOS	0.007209	0.002783	2.590880	0.0096
INCRIC	0.003425	0.001870	1.831406	0.0670
EDU	0.205095	0.069669	2.943827	0.0032
CHSCH	-0.790870	0.380574	-2.078095	0.0377

Mean dependent var	0.840336	S.D. dependent var	0.367843
S.E. of regression	0.318608	Akaike info criterion	0.732669
Sum squared resid	11.47072	Schwarz criterion	0.872793
Log likelihood	-37.59383	Hannan-Quinn criter.	0.789569
Restr. log likelihood	-52.25434	Avg. log likelihood	-0.315915
LR statistic (5 df)	29.32101	McFadden R-squared	0.280561
Probability(LR stat)	2.01E-05		
Obs with Dep=0	19	Total obs	119
Obs with Dep=1	100		

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