

## **An Assessment of the Irrigation Scheme on Registered Rice Farmers of the Upper Benue Rice Basin Development Authority in Dadin Kowa, Gombe State, Nigeria**

**Abdullahi Hassan<sup>1</sup>, Matthew O. Adewumi<sup>2</sup>, Abraham Falola<sup>2</sup>,  
Matthew Durojaiye Ayeeni<sup>2</sup>**

<sup>1</sup>Department of Agricultural Economics and Extension, Federal University  
Kashere P.M.B. 0182, Kashere, Gombe State, Nigeria

<sup>2</sup>Department of Agricultural Economics and Farm Management, University of Ilorin  
P.M.B. 1515, Ilorin, Kwara State, Nigeria

Corresponding author: Abdullahi Hassan, email: [abdullahihassan0@gmail.com](mailto:abdullahihassan0@gmail.com)

### **Abstract**

The Upper Benue River Basin Development Authority (UBRBDA) of Nigeria Federal Government is in charge of Dadin Kowa Dam that supplies irrigation water to registered rice farmers in Dadin Kowa, Gombe State. Irrigation methods were more profitable than the rainfed, yet some farmers remained unregistered in the scheme. The study aimed to assess the irrigation scheme intending to compare registered and non-registered rice farmers. A two-stage sampling technique drew a total of 157 respondents from the two groups of farmers who were interviewed using the structured questionnaire. Descriptive statistics examined the socioeconomic characteristics of the respondents, supports received from UBRBDA and the factors that discourage their participation. The budgetary analysis compared the costs and returns of the farmers. Results showed that the majority of the farmers were men, married with children, in active labor age with a non-formal education and adequate farming experience who worked for small sized farmlands. Some were full-time while others had other off-farm work. The study also revealed N 107,262.20/ha and N 97,513.04/ha gross revenue and N 53,320.87/ha and N 47,547.52/ha gross margin for registered and non-registered farmers, respectively. Water supply ranked first while fertilizer supply was last as to farmers' satisfaction with UBRBDA supports. Long distance to the irrigation site was ranked first among the factors that hindered participation. The higher gross revenue and gross margin of registered farmers than their counterpart could be the result of the impact of UBRBDA's irrigation scheme. The study provides recommendations to improve the system and encourage farmers' participation.

**Keywords:** costs, dam, labor, satisfaction, supports

## Introduction

One of the goals of irrigation farming is to provide the adequate amount of water at the right time to ensure sustainable agriculture. A massive deal of investment has been allocated for the development of irrigation systems with economic benefits (Burney et al., 2013; Cassman & Grassini, 2013; Wichelns, 2014; Isma'il et al., 2014). About 40 percent of the total world food crops produced is through irrigation, but only 17% of it has been irrigated (Hasnip et al., 1999). This situation means that 60% of food crops are under the rainfed system. Inkoom and Nanguo (2011) stressed that irrigation becomes the lifeline for sustainable agriculture. About 70% of worldwide water diverted from rivers or pumped from underground is for irrigation. The level of output obtainable under irrigated land is twice or even triple than that of rainfed land (Mwakalila & Noé, 2004). The marginal productivity of irrigated land is, therefore, higher than that of rainfed. For more than 30 years, the expansion of irrigation acreage has contributed to increasing food production (Mwakalila & Noé, 2004), income and employment (Ojo et al., 2011). Agricultural experts expect a continuous expansion of irrigation agriculture to meet future food requirements in most developing countries (Ojo et al., 2011).

In Nigeria, agriculture is important to its economy being considered as its “new oil” boosting the lives of the rural population (Obasanjo, 2014). A survey showed that 39% of the land mass is potentially suitable for agriculture (Nigerian National Committee on Irrigation and Drainage, 2009). Out of this proportion, between 4.0 and 4.5 million hectares of the land area (approximately 4.5 to 5.0% of the land) is suitable for irrigated agriculture. However, the water available can only support 1.1 million hectares, the remaining 3.4 million hectares being fadama.

Irrigation system plays a critical role in Nigeria's agriculture (Gbenga & Olarenwaju, 2014). Irrigated rice systems are scattered across Nigeria from major rivers, dams, and other water bodies or lakes. However, many farmers still depend on large irrigation systems built in the 1970s and 1980s that have remained operational, but many such systems have collapsed over time due to lack of proper

maintenance (Johnson et al., 2013). The benefit of irrigation in Nigeria does not limit to food supply alone, but it also provides employment to farmers during the slack period of rainfed agriculture (Ojo et al., 2011; Isma'il et al., 2014). Putting into account the rainy (April to October) and the dry (November to March) distinct seasons of Nigeria (Osiname, 2001), farmers are usually less busy on the farm during the dry season. Hence, provision of irrigation facilities that offer all-year-round farming serves as an alternative source of employment and an additional source of income throughout the year. There is a necessity to increase the irrigation agriculture tremendously because of growing demand for food especially rice, vegetables and other crops during off farming season (Oriola, 2009).

The benefits brought about by the introduction of irrigation are undeniable. It has been possible to increase and protect harvest and grow crops that are difficult to cultivate under the condition of extreme drought (Miyan, 2015). Irrigation tries to meet the additional requirement of crops during the wet season and supply water to farmland during the dry periods. Hence, irrigation development is essential to the sustainable growth of agricultural production in Nigeria. In particular, irrigation increased crop yields and agricultural production in Zaria Area of Nigeria thereby improving the economic status of farmers in the area (Isma'il et al., 2014). Irrigation also calls for greater use of labor, leading to higher quality of life for farmers, increasing their income and eliminating the uncertainty that comes from the variable yearly and seasonal rainfall (Oriola, 2009). Hence, creating a more efficient water management approach has the potential to increase substantially agricultural production, incomes, and employment opportunities.

The federal government of Nigeria created the River Basin Development Authorities (RBDAs) in 1976 (eWASH, 2009). The goal of the RBDAs is to harness the country's water resources and optimize its agricultural resources. The Upper Benue River Basin Development Authority (UBRBDA) is one among the eleven authorities that operates in all the geographical areas of all the major tributaries of the Benue River upstream including the Gombe State (Mu'azu, 2011).

Among the functions of the UBRBDA is to undertake the comprehensive development of both surface and underground water resources for multipurpose use with emphasis on providing irrigation infrastructure. Another function of the authority is to construct and maintain dams and irrigation systems. The body also operates to supply water to all users for a fee to be determined by the authority as approved by the Minister and to hand over to the farmers all lands for cultivation under the irrigation scheme. The body also functions to construct, operate and maintain roads and bridges that transport the farm products, and to develop and keep the current comprehensive water resources master plan, identifying all water resources requirements in the area of operation (Mu'azu, 2011). The authority also undertakes the large-scale multiplication of improved seeds for distribution to farmers and afforestation schemes.

Dadin Kowa community of Gombe State is notable for rice production in Nigeria due to the presence of Dadin Kowa and Balanga dams that ensure all year rice production (Annor-Frempong et al., 2010). The Dadin Kowa Dam is in the northeast of Nigeria. The dam is located about 35 kilometers to the east of Gombe town, constructed in 1987 to supply drinking water for the population in the area. The dam made of earth rock-fill embankment has a maximum height of 42.0 m and a length of 520 meters. In 2004, the Enplan Group, which is an indigenous firm of Nigerian consulting engineers and planners, conducted an appraisal of the status of selected public irrigation sector schemes including the Dadin Kowa Dam (Enplan Group, 2004).

Based on the result of the 2004 assessment, the Dadin Kowa Dam was in very good condition but unutilized. The dam with about 2.8 billion cubic meters reservoir capacity was, therefore, lying idle. The spillway gates were in a permanently open position to keep the reservoir level low. The irrigation intake gate was also permanently open to discharge water back to the downstream channel (Enplan Group, 2004). With the goal to utilize the Dadin Kowa Dam, the federal government allocated budget in 2009 for the installation of its hydro-electrical generation component and for the completion of the irrigation canal to irrigate the farmland.

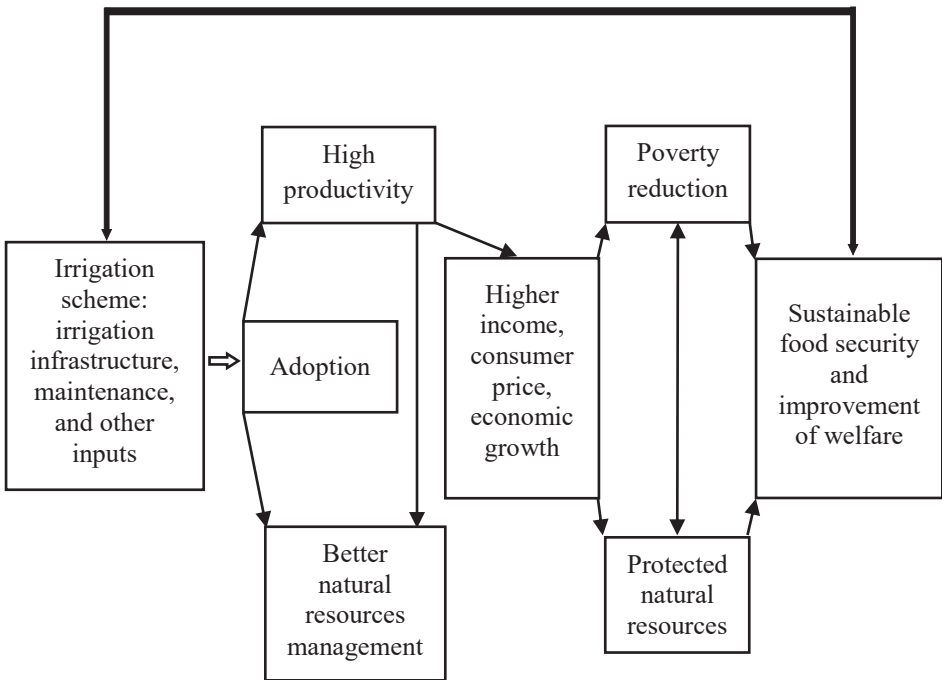
In 2011, Mu'azu also conducted a case study of the Upper Benue basin and reported that the dam can irrigate about 25,000 hectares net downstream that can produce about 200,000 tons of grains equivalent twice a year and can generate about N6 billion gross. However, only 100 hectares were under irrigation due to the noncompletion of the irrigation scheme because the contract for the continuation of work on the central canal was still in progress. On the same year, Mohammed (2011) also conducted a study comparing the costs and returns of rice production under rainfed and irrigation methods in the Upper Benue River Basin in Dadin Kowa. The findings showed that irrigation methods were more profitable than the rainfed. Hence, irrigation is an alternative solution.

On the other end, there are farmers in Nigeria who lack the necessary knowledge of crop water requirement, irrigation scheme particularly on the schedules, and dexterity to maintain and operate the irrigation pumps (Ogunjimi & Adekalu, 2002). Consequently, improper and insufficient irrigation scheduling reduces yield (Ojo et al., 2011; Isma'il et al., 2014).

The challenge facing Nigeria is to eradicate poverty, attain food security and ensure sustainable management of the environment through accelerated investment in the country's irrigation system. A river basin as a system is concerned with making decisions and actions that are useful with regards to developmental process. It has the natural resources of human capital which are the basics of integrated planning which can be in the form of basin perspective rather than single project view. It has the advantage of harnessing all potentials ranging from structural, construction and engineering and the non-structural process, agronomy, vegetative and soil management within the basin for overall success and benefits. It is crucial to understand the roles and engagement of stakeholders in all the activities of the basin operations and management because they have valuable knowledge. If they are to participate in decision-making, they are more likely to support future decisions and program implementation.

The stakeholders are interested in river basin resource development. They include the Government Ministries, Department, and Agencies, River Basin Agencies, Non-governmental organization and community members. Nigeria is the most populated country in

Africa according to 2006 population census and the United Nation population estimate in 2009 was 154,729,000. The Nigerian Central Bank governor stated that 70% of Nigerians were living below poverty line (Oriola, 2014). Therefore, it is vital to develop a river basin system and make agriculture more productive and sustainable through efficient irrigation practice. It employs about two-third of the population as more than 70% of the people live in rural areas. Figure 1 presents the framework for understanding how reform in irrigation will influence higher productivity and better natural resource management for higher income and help in reducing poverty, protect the environment and attain food security.



**Figure 1. Irrigation and food security framework (Adopted from Oriola, 2009).**

Small-scale farmers cultivating small farmlands are the ones that supply rice to about 90% of Nigeria’s food, yet, a majority of them depend only on rainfed farming rather than on irrigation systems

(Gbenga & Olarenwaju, 2014). An assessment of the irrigation scheme on the farmers of the Upper Benue River Basin Development Authority is essential at this time since the conduct of the last evaluation. The appraisal can also determine the profit of registered farmers and the factors that discourage the participation of the non-registered farmers in the scheme. This information could provide some insights for improvement of the system to augment the income of farmers given the present conditions of the irrigation scheme.

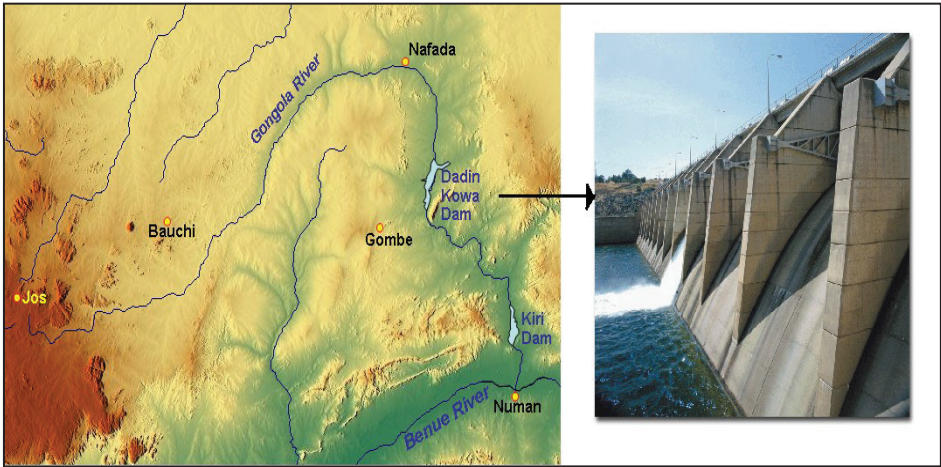
Hence, this study aimed to assess the irrigation scheme on registered rice farmers of the Upper Benue River Basin Development Authority in Dadin Kowa, Gombe State, Nigeria. The specific objectives were to describe the socioeconomic characteristics of the respondents, examine costs and returns of both the registered and non-registered rice farmers, assess the supports received from UBRBDA irrigation scheme by the registered farmers, and determine factors that discouraged non-registered farmers from participating in the system. The findings may serve as a basis to improve the present condition of the irrigation scheme in the area.

## **Materials and Methods**

### ***Study area***

The study was carried out in Dadin Kowa, a town in Yamaltu-Deba Local Government Area of Gombe State in North-eastern Nigeria (Figure 2). It is about 37 km to the east of Gombe town. It lies between Latitudes  $9^{\circ} 30'$  -  $12^{\circ} 30'$  North of the Equator and Longitudes  $8^{\circ} 45'$  -  $11^{\circ} 45'$  East of Greenwich meridian. The average rainfall is 800 - 900 mm per annum, mean temperature ranges from  $30 - 33^{\circ}\text{C}$  and the area experiences a relative humidity of 18 - 90 percent. The people in the area are mostly small-scale farmers and rice, maize and vegetables are the principal crops grown (Gombe State Government, 2009). The Upper Benue River Basin Development Authority (UBRBDA) is a Nigeria Federal Government organization in charge of Dadin Kowa Dam that supplies irrigation water to registered rice farmers in the area (Mohammed, 2011).





**Figure 2. Map showing the Benue River and Gombe State with a picture of the Dadin Kowa Dam (Source: googlemap.com).**

### ***Sampling procedures***

A two-stage sampling procedure was used for this study. The first stage involved stratification of rice farmers into registered and non-registered. In the second stage, structured questionnaires were used to collect information from the registered rice farmers under the UBRBDA irrigation scheme and non-registered farmers. A hundred questionnaires were administered randomly to each group making a total number of 200 questionnaires. However, 82 questionnaires were only retrieved from the registered rice farmers while 75 were retrieved from the non-registered rice farmers, making a total number of 157 questionnaires used. Descriptive statistics examined the socioeconomic characteristics of the respondents, supports received from UBRBDA and the factors that discourage participation in the scheme. The survey questionnaire was used to determine the socioeconomic characteristics of the respondents such as the age, gender, marital status, household size, education, farming experience, farm size, secondary occupation, and estimated income from other off-farm sources. Ethical issues in the research had been addressed by seeking the consent of the rice farmers before the questionnaires were administered.



The study also used the questionnaire to obtain the satisfaction level of the farmers to the UBRBDA supports that include water supply, canal maintenance, extension service, land preparation, farmland, improved seeds supply, and fertilizer supply. The factors that discouraged participation in Upper Benue River Basin irrigation scheme were also determined using the questionnaire. The farmers were interviewed to reinforce the data collection. The study also compared the costs and returns of the registered and non-registered farmers using the budgetary analysis.

### *Analytical techniques*

The frequency distribution table, means, and percentage were the descriptive statistics used. Budgetary analysis and t-test were also utilized in this study. Budgetary analysis according to Olukosi and Erhabor (1988) involved the evaluation of the costs and returns of production. The analysis determines the profitability of rice production per hectare. Since the fixed capital constitutes a negligible portion of the total costs of production, this study used the gross margin analysis for the costs and returns of rice production, expressed as:

Gross Margin (GM) = Total Revenue (TR) - Total Variable Cost (TVC)

According to Ezeh and Nwachukwu (2010), t-test is a decision-making procedure for comparing two sample means, given as:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{X_1 X_2} \cdot \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

where:

$$S_{X_1 X_2} = \sqrt{\frac{(n_1 - 1)S^2_{X_1} + (n_2 - 1)S^2_{X_2}}{n_1}}$$

and  $X_1$  = mean variable for registered rice farmers;  $X_2$  = mean variable for non-registered rice farmers;  $S^2_{X_1}$  = sample variance for registered rice farmers;  $S^2_{X_2}$  = sample variance for non-registered rice farmers;  $n_1$  = number of registered farmers;  $n_2$  = number of non-registered farmers. The  $S_{X_1X_2}$  is called the pooled standard deviation. It is assumed that the two groups of farmers are homogeneous. Levene's test was used to determine the equality of variances and to verify the assumption.

## Results and Discussion

### *Socioeconomic profile of farmers*

Table 1 shows the socioeconomic profile of the respondents. The mean age for registered and non-registered farmers was 40.0 and 47.9, respectively. The coefficient of variation is 23% for registered and 20% for non-registered farmers. Despite variation in ages, the result indicates that bulk of the respondents were energetic and hence within the agricultural production age if empowered. The result is also similar to the findings of other studies which showed that rice farmers were predominantly agile and within their active labor age (Ayoola et al., 2011; Okeke et al., 2012; Yahaya et al., 2013; Adamu & Bakari, 2015). Age would influence negatively the rice production which implies that older rice farmers have less vigor for farming (Ayoola et al., 2011).

The majority of the registered and non-registered farmers were men. The greater physical strength of men than the women could explain why men should be the ones to engage in farming. Also, the culture of women in Nigeria may be the reason that rice farming is a men-dominated livelihood. Household confinement among women in Nigeria is a custom known as *Prudah* particularly in Northern areas. Thus, women seclusion in Nigeria curtails the freedom of women (Wall, 2002; Dauda et al., 2009) to engage in farming. The result is in line with the studies showing that men dominated the farming activities in Nigeria (Okeke et al., 2012; Yahaya et al., 2013; Adamu & Bakari, 2015).

**Table 1. Socioeconomic characteristics of the respondents.**

<b>Variables</b>	<b>Option</b>	<b>Registered (%) (N=82)</b>	<b>Non-registered (%) (N=75)</b>
<b>Age (years)</b>	25- 35	20.7	17.3
	36 – 45	41.5	17.3
	46 – 55	25.6	48.1
	>55	12.2	17.3
	Mean	40.0	47.9
	SD	9.5	10.0
	CV	23	20
<b>Gender</b>	Men	92.7	94.7
	Women	7.3	5.3
<b>Marital status</b>	Married	87.8	93.3
	Single	7.3	4.1
	Divorce	3.7	1.3
	Widowed	1.2	1.3
<b>Household size (persons)</b>	1-5	37.8	22.7
	6-10	30.5	17.3
	11-15	23.2	30.7
	> 15	8.5	29.3
	Mean	8.2	14.2
	SD	4.7	10.0
	CV	57	70
<b>Educational status</b>	Non-formal Education	57.3	52
	Primary Education	13.4	29.3
	Secondary Education	25.6	16.0
	Tertiary Education	3.7	2.7
<b>Years of experience</b>	1-5	7.3	1.3
	6-10	25.6	18.7
	11-15	30.5	24
	> 15	36.6	56
	Mean	15.4	18.5
	SD	7.8	7.9
	CV	50	42
<b>Farm size (ha)</b>	≤ 1.0	40.2	58.6
	1.1 – 2.0	59.7	41.3
<b>Secondary occupation</b>	Artisan	25.6	22.7
	Civil Service	11.0	9.3
	Trading	24.4	21.3
	Farming	39.0	46.7
<b>Estimated income from another source (N)</b>	≤ 5,000	12.2	20
	5001 – 10,000	24.3	22.7
	10,001 – 15,000	48.8	46.7
	> 15,000	14.6	10.7
	Mean	10,500	9,800
	SD	4914.64	3966.4
	CV	46	40

Source: Field Survey, 2015

The majority of both groups of farmers were married with children and having a mean household size of 8.2 for registered and 14.2 for non-registered farmers. The coefficient of variation is 57% for registered and 70% for non-registered farmers. Despite variation in household sizes, the results may imply that the farmers who have children in Dadin Kowa where rice production is the main livelihood (Annor-Frempong et al., 2010) tend to maintain a permanent residence and continue to engage in rice-farming if conditions are suitable. The study of Ojo et al. (2011) among farmers in Ibadan and Lagos, Southwestern Nigeria under the irrigation system of the government also showed a similar result. The findings of this study also imply that majority of the farmers may make use of family labor to increase their income as also stressed by Yahaya et al. (2013) in their study with rice farmers in Nasarawa State, Nigeria. Adamu and Bakari (2015) also found that large family size could be an added advantage for family labor supply.

Being the primary providers for the household, married men dominating in rice-farming could be an advantage to increase farm profit since they tend to work full time and exert their maximum effort to sustain the family. Whereas, married women within their reproductive age had been constrained by their participation in rice-farming as a result of marital responsibilities as well as the cultural and religious practice of *Prudah*. The finding agrees with the study of Ayoola et al. (2011) in Northern Guinea Savanna of Nigeria that showed the negative influence of the marital status of women on their output in farming. Hence, the marital status of the farmers may also have an effect on the extent of their participation in farming.

The educational distribution of the respondents shows that more than half of the registered and non-registered farmers have the non-formal education. Next in number were the farmers with secondary and primary education while few farmers obtained a post-secondary education. The results indicate that the literacy level of the rice farmers is relatively lower than the findings of Yahaya et al. (2013), Ojo et al. (2011), and Okeke et al. (2012) showing that majority of the rice farmers have obtained the secondary education. The low literacy of rice-farmers can be an obstacle to getting a high farm income. Knowledge of the

basic crop water requirement, irrigation scheduling, and skills in maintaining and operating irrigation systems is very important to optimize the yield. Ojo et al. (2011) and Isma'il et al. (2014) stressed that improper and insufficient irrigation scheduling reduces yield, hereby affecting the income of the farmers. Based on the results of their study among rice-farmers in the Northern Taraba State of Nigeria, Adamu and Bakari (2015) also stressed that farmers with a high level of education earn a higher profit than those with low literacy.

On average, the farming experience of registered farmers was 15.4 years with a coefficient of variation of 50% which was lower compared to the non-registered (18.5 years) with a 42% coefficient of variation. Despite variation in their years of farming experience, most farmers in Dadin Kowa may have adequate skills in rice production. In the finding of Ayoola et al. (2011), farmers' experience influenced significantly the rice productivity in Northern Guinea Savanna of Nigeria. In the study of Adamu and Bakari (2015), farmers with more years of experience operate at the high level of profit efficiency.

The data in this study indicate that the farmers' production is at small scale level despite the variation in farm sizes. Nmadu and Garba (2013) showed a positive relationship between farm size and profit efficiency. Increasing farm size by 10% increases farm profit by 11% with other variables held constant (Adamu & Bakari, 2015).

About 39% of the registered farmers and 46.7% of the non-registered were full-time farmers. The rest of the respondents were part-time farmers who had the secondary occupation as artisans, traders, or civil service workers. The amount of time spent on labor has been a significant factor that can affect rice production. In the study of Mohammed (2011) in Dadin Kowa, results disclosed that labor significantly influenced the output of rice production. The average monthly incomes from off-farm sources for registered and non-registered farmers were N 10,500 and N 9,800 respectively. The coefficient of variation was 46% for the registered farmers and 40% for the non-registered. Ojo et al. (2011) found that part-time farmers tend to augment their income from other off-farm work. However, more non-registered part-time farmers in this study did not have other sources of revenue compared to registered counterparts.

***Costs and returns of farmers***

Table 2 shows the costs and returns of farmers in Dadin Kowa. The analysis shows the average gross revenue of N 107, 262.20 and N 97, 513.04 for registered and non-registered rice farmers, respectively. As reported by Mohammed (2011), labor cost constitutes the highest among all the variable costs of rice production. For the registered farmers, costs were incurred mostly on labor during planting, weeding, and harvesting. Much of the labor costs for the non-registered were incurred during land preparation, weeding and harvesting as well. The gross margin obtained for the registered farmers was N 53,320.87/ha and N 47, 547.52/ha for the non-registered. The mean difference between the gross margin of the two groups was N 5773.35. Hence, there is a difference in the profitability of the registered and non-registered farmers in Dadin Kowa. Registered rice farmers, therefore, have more profit than their counterpart non-registered. The result does not agree with the finding of Adamu and Bakari (2015) that showed an inverse relationship between labor cost and rice farm profit. In this study, the labor cost of registered farmers was higher than the cost of non-registered farmers, but the gross margin was greater for those registered in the irrigation scheme. The result implies that profit is greater for registered farmers than their counterpart non-registered farmers.

**Table 2. Costs and return analysis of registered and non-registered farmers.**

<b>Variables</b>	<b>Registered</b>	<b>Non-registered</b>
Gross Revenue	107,262.20	97,513.04
Seeds	3,440.85	2,810.00
Chemicals	2,323.17	2,160.00
Fertilizer	16,473.17	14,500.00
Transport	2,836.46	1,956.33
Hired Labour	22,215.24	19,680.19
Irrigation Cost	6,652.44	-
Fuel Cost	-	8,860.00
Total Variable Cost	53,941.33	49,965.52
<b>Gross Margin</b>	<b>53,320.87</b>	<b>47,547.52</b>

Source: Computation from Field Survey Data, 2015

Rice production remained greater with irrigation as long as farmers would spend for the other needed variables. Fertilizers of high quality for instance when adequately supplied and properly applied could increase farm profit (Adamu & Bakari, 2015). Fertilizer supply for registered farmers from the irrigation scheme is crucial to rice production. An adequate supply of fertilizer significantly influenced the output of irrigated rice production as Mohammed et al. (2014) reported.

Considering the other variables, higher cost of agrochemicals is one of the severe constraints on rice production (Yahaya et al., 2013). In this study, the costs for chemicals for the two groups of farmers did not substantially differ, yet, registered farmers in irrigated scheme obtained more profit than their counterparts. The result implies that participation in the scheme had helped them increase their income due to increased rice production with the availability of agrochemicals. Supplying improved seeds to registered farmers had also helped increase rice production despite the high cost for irrigated farm. Utilization of improved seeds requires monitoring as well since underutilization of this variable significantly influenced rice production as Mohammed et al. (2014) reported. The findings are in line with the studies of Mohammed (2011) and Yahaya et al. (2013) that the farmers with irrigated fields were more profit efficient than their rainfed counterpart. However, Mohammed (2011) recommends both methods but prefers irrigated in alternative situations.

Table 3 shows the t-test result on farm income of registered and non-registered rice farmers. The mean difference of N 5,773.35 farm income of the registered and non-registered rice farmers was significant at 1% level of probability. The result confirmed that the registered rice farmers obtained more income compared to non-registered rice farmers due to the impact of the irrigation scheme. Table 4 shows Levene's test for equality of variances. The difference between the means of registered and the non-registered group was significant at 1% probability level.



**Table 3. T-test result on farm income of registered and non-registered rice farmers.**

Category	Mean	Mean difference	Standard error	t-value
Registered	53768.35			
Non-registered	47995.00			
<b>Difference</b>		<b>5773.35</b>	<b>1354.09</b>	<b>4.264***</b>

Source: Analysis from field survey data. \*\*\* Significant at 1% level

**Table 4. Levene's test of variances.**

	Mean difference	Std. error difference	Standard error	t-value
Equal variances Assumed	5773.35	1563.42	<b>1354.09</b>	<b>3.754***</b>

Source: Analysis from field survey data. \*\*\* Significant at 1% level

### ***Support received by farmers from UBRBDA irrigation scheme***

Table 5 shows the support received from UBRBDA by the registered farmers and the percent distribution as to their satisfaction. The results depict that among the support rendered by the scheme, water supply obtained the highest rank with regards to farmer's satisfaction. The result is not similar with a study on another irrigation system in Southwestern Nigeria that revealed unavailability of water supply associated with the lack of adequate knowledge on irrigation scheduling (Ojo et al., 2011). However, the need to improve the water supply for registered farmers in Dadin Kowa should still be given attention since there were still about 17% of the farmer population that expressed dissatisfaction to the water supply. The low literacy of the majority of the farmers in Dadin Kowa may be a factor to examine because the lack of knowledge on initial water holding capacity may not allow evaluation of water requirement that eventually would lead to the inadequate water supply as Ojo et al. (2011) emphasized. Water can limit plant growth and development (Sokoto & Muhammad, 2014), thus, providing the adequate amount at the right time plays a pivotal role to ensure high productivity. In one of the studies in Africa, production

could equal to the total current demand for rice following improved water management in the area (Rodenburg et al., 2014).

**Table 5. Assessment of supports received from the irrigation scheme.**

Supports	Satisfied	Undecided	Unsatisfied	Ranking
Water Supply	65 (79.27)	0 (0.00)	17 (20.73)	1 <sup>st</sup>
Canal Maintenance	59 (71.95)	10 (12.20)	13 (15.85)	2 <sup>nd</sup>
Extension Service	57 (69.51)	15 (18.29)	10 (12.20)	3 <sup>rd</sup>
Land Preparation	53 (64.63)	17 (20.73)	12 (14.64)	4 <sup>th</sup>
Farmland	40 (48.78)	8 (9.76)	34 (41.46)	5 <sup>th</sup>
Improve Seeds Supply	32 (39.02)	15 (18.29)	35 (42.69)	6 <sup>th</sup>
Fertilizer Supply	31 (37.80)	9 (10.98)	42 (51.22)	7 <sup>th</sup>

Source: Field survey, 2015

Next in rank with regards to farmer’s satisfaction to the irrigation scheme of UBRBDA was canal maintenance. In the assessment of Mu’azu (2011) in the Upper Benue Basin, the construction of the central canal was still in progress with an aim to irrigate more farmlands at that time. Hence, the satisfaction of the majority of the registered farmers to water supply in this study could also be the result of the completion of the canal and its proper maintenance provided by the authority. Maintenance of dams and their canals is an essential service that the UBRBDA should pay attention because many irrigation systems built in the 1970s and 1980s have collapsed over time due to lack of proper maintenance (Johnson et al., 2013). Many registered farmers also expressed satisfaction with extension services and land preparation provided by the scheme.

However, more than 50% of the farmers were not satisfied with the fertilizer supply of the scheme being ranked last as to the level of satisfaction. There were also farmers who expressed dissatisfaction with seed supply that obtained the 6<sup>th</sup> rank among the support of UBRBDA. The problems that came out in this study are almost similar with the findings of Mohammed et al. in 2014 with regards to the resource use among the farmers in Dadin Kowa, particularly on fertilizer and seed supply. In the most recent study of Mohammed et al. in 2014, resource use among the farmers in the area was not efficient suggesting to

increase the input of land fertilizer but to decrease the seed supply. In their study, farmers tend to overutilize the seed supply to compensate for the low supply of fertilizer in rice production. Hence, these two problems need immediate attention to help maximize the profit level. The third significant problem of the registered farmers was the small size of farmland allocated to them. The non-satisfaction of registered farmers to the size of the farm in this study is in line with the findings of Mohammed (2011) who found that reduce land holding per respondent was the major problem of rice farmers.

***Factors that discouraged non-registered farmers from participating in the scheme***

Table 6 shows the factors that discouraged participation of the non-registered farmers in Upper Benue River Basin Development Authority’s irrigation scheme. Multiple responses were obtained from the farmers. Sixty percent of the respondents reported that long distance to the irrigation site discourages them from participating in the scheme while 40.0% of them lamented that lack of awareness of the scheme discourages them from participation. About 33.3% also reported that it is the high cost of registration that discourages them from participation. About 16.0% of the non-registered farmers expressed that too many protocols laid down discourage them to participate while 12.0% of them are discouraged because of irregular services of the authority.

**Table 6. Factors that discouraged participation in upper Benue river basin irrigation scheme.**

<b>Factors</b>	<b>Frequency</b>	<b>Percentage</b>	<b>Ranking</b>
Long distance to irrigation site	45	60.0	1 <sup>st</sup>
Lack of awareness	30	40.0	2 <sup>nd</sup>
High cost of irrigation	25	33.3	3 <sup>rd</sup>
Too many protocols	12	16.0	4 <sup>th</sup>
Irregular services	9	12.0	5 <sup>th</sup>

Source: Field survey, 2015

Small-scale rice farmers registered in another irrigation system in Nigeria complained of the high labor requirement, stiff competition for the limited farmlands, frequent pump breakdown, and low stream flow (Ogunjimi & Adekalu, 2002). The same study showed that the lack of awareness of farmers was also a problem that affected the agricultural yield.

## **Conclusion and Recommendations**

The empirical evidence presented in the study indicates that registered farmers had higher gross revenue and gross margin than their non-registered counterpart which is the result of the impact of the Upper Benue River Basin Development Authority's irrigation scheme. Meanwhile, the factors that discourage participation in the irrigation scheme the most are the long distance from the farmers' residence to the irrigation site and lack of awareness.

Factors that discouraged non-registered farmers from participating in the scheme should be considered and promptly addressed so as to accommodate more farmers into UBRBDA irrigation scheme. There is a need to increase the size of farmland allocated to each farmer in addition to inputs delivery. Management of the authority should revisit their cost of rendering services, and some stringent conditions and protocols laid down towards the use of irrigation facilities so as to attract more farmers into the scheme. The authority should also provide an additional source of power so as to increase the time and duration of water distribution to the farmers.

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