

Dadin-Kowa Irrigation Project: A Catalyst for Rural Development in Gombe State

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Abstract

States increasingly seek to optimize the utilization of scarce water resources as a catalyst for rural development. Successive governments in Nigeria have been laying greater emphasis on irrigation projects as a means of improving food production, and rural livelihoods. This paper examined the contribution of Dadin-Kowa Irrigation Project on rural development in Gombe State (2015-2023). The paper uses a mixed method approach where both structured questionnaires and in-depth interviews were employed in collecting data. A representative sample of 381 respondents was proportionally selected from the three wards surrounding the irrigation project and questionnaires were administered randomly in each ward. Key relevant officials such as the Chairman of the Water Users Association, the Sectional Head of the Irrigation Project, the Gombe State Chief Produce Officer, the Chairman of Gombe State Primary Healthcare Development Agency were interviewed and the official records of the Upper Benue River Basin Development Authority, Dadin-Kowa area office and that of Gombe state Ministry of Education was used to supplement the quantitative data. The paper found that Dadin-Kowa Irrigation Project has made contribution to rural development as it substantially improved food production and the livelihood of the rural dwellers in the area. This was further corroborated by the result of the paired sample t-test which reported the significant contribution of the Project on rural development after 2015 with a mean difference of 0.4972 on food production and 0.8278 on rural livelihood respectively.

Keywords: Irrigation project, Food Production, Rural Income, Livelihood, Rural development

Introduction

The importance of irrigation projects to many countries in terms of agricultural production, food supply and improvements in rural livelihoods cannot be overemphasized. The emphasis on irrigation schemes has been one of the major trends in agricultural and rural development globally. Irrigation today provides water to one-fifth of the world's cultivated land from which one-third of food crops are harvested. Irrigation offers important opportunities for enhancing crop yield and production in developing countries (Mandri-Perrott & Bisbey, 2016). In order to take advantage of the positive impacts of irrigation, small, medium, and large-scale irrigation schemes have been established in different regions of Nigeria.

The growing need for irrigation schemes especially in northern Nigeria is further heightened by the incessant drought, weather variations and undependable nature of rain-fed agriculture to boost the potential for dry season

farming. The Federal Government in 1973 embarked on the establishment of large-scale irrigation projects with huge capital investments in machinery and infrastructure, resettlement of people displaced by the schemes, supplying key inputs and services for modern agricultural production and rural development (Barau, Atala & Agbo, 1999). However, this development has become more pronounced with the rising need for food occasioned by demographic pressure and the consequent Sahelian Drought of 1972-74 that culminated in the establishment of three pilot public irrigation schemes- the Bakolori Irrigation Scheme, Kano River Irrigation Scheme and the Chad Basin Scheme (Musa, Baba & Beili, 2015; & NINCID, 2015). The subsequent success of the piloted irrigation schemes in mitigating the adverse effect of the drought further led to the establishment of River Basin Development Authorities (RBDAs) to harness and manage water resources potentials for agricultural purposes through the

construction of dams, irrigation canals, drainage and other irrigation facilities (Musa, Baba & Beili, 2015). Furthermore, Agricultural Development Projects with large irrigation schemes were accordingly established by the Federal Government in collaboration with the World Bank in different parts of the country such as Funtua, Gusau, Gombe, Ayangba and Lafia Agricultural Development projects among others. The main objectives of these projects were to ensure increased agricultural productivity and the general improvement of the living standard of the rural populace (Nkom, 1981).

In Gombe State, there are three major irrigation projects; Cham Irrigation Project, Balanga Irrigation Project and Dadin-Kowa Irrigation Project. The Dadin-Kowa Irrigation Project is the largest in the Northeast with about 300 kilometers of surface area. It is a multipurpose irrigation project established in 1988 by the Federal Government in its concerted effort for agricultural and rural development in what is now known as Gombe state. The project is under the management and control of the Upper Benue River Basin Development Authority which was designed to irrigate farmlands, generate electricity, and also serve as a source of water to the entire Gombe metropolis and other settlements around the project area for both human and animal consumptions, and to promote fish farming and flood Control (Jungudo, 2012). The project is expected to increase aggregate food production for the country while at the same time providing employment opportunities and reducing poverty among rural dwellers.

Several researches were conducted on various irrigation projects in Nigeria and beyond. These researches include among others, Daniel (2015), Sulaiman (2016), Makusidi (2015), Dube 2016, Tekana and Oladele (2011), Peter (2011), Opeyemi, Babatunde, Oladipo and Adenuga (2016), revealed that irrigation dam schemes were either underutilized or abandoned due to poor funding such that they could not adequately improved food production as well as the rural livelihood. Adelodun and Choi asserted that irrigation schemes like Hadeja-Jama'are River Project was below 50% utilized; Zobe Dam has limited irrigation activities, in Bakolori

Irrigation Project, the cultivated area was not commensurate with the amount of water in the Dam (Adelodun and Choi, 2018). Dadin-Kowa Irrigation Project is not an exception, despite its establishment for over thirty years with its designed capacity of irrigating 44,000 hectares of farmland for agricultural production and promoting fish farming, the project is being underutilized below its capacity as it has not moved beyond its pilot phase (Upper Benue Area Office Dadin-Kowa, 2019).

However, the Federal Government's Agricultural Promotion Policy which was pursued in 2015 to revive irrigation and dam projects across the country including the Dadin Kowa Irrigation Project to improve food production and rural livelihood. It is on the basis of this that the paper examines the contribution of the Dadin-Kowa Irrigation Project on rural livelihood in Gombe State 2015-2023. The paper hypothesized that the irrigation project had significant contributions to rural livelihood in Gombe State between 2015 and 2023.

Conceptual Review

Conceptually, rural development is multidimensional and multifaceted phenomenon that cut across various disciplines. It consists of two words, "rural" and "development," both of which are ambiguous. The term "rural" not only lacks a precise definition, but it is also ambiguous. Rural areas are typically identifiable as human settlements with limited infrastructure, housing, and a low level of development. Rural populations reside in settlements with a population of 5,000 to 10,000 individuals (Ashley and Maxwell, 2001). The concept of development on the other hand, is wide and multi-faceted involving many dimensions. People talk of economic development, social development, and political development among others. As a concept development received an extensive comment from scholars, its meaning has changed from its previous limited understanding, which focused solely on economic growth measured by the Gross National Product. It has now been expanded to include a more comprehensive perspective, encompassing various dimensions that includes changes in structures, attitudes, and institutions, along with the promotion of economic growth, the reduction of inequality,

and the eradication of absolute poverty (McMichael & Weber, 2021).

Rural development has become a prominent issue in the development literature. It also constitutes a significant concern for international organization like World Bank, United Nation, European Union, African Union and other development partners. It is an integral part of overall development efforts, targeting a large number of individuals who live in rural areas and are in great need of assistance. According to Otigba (2013), rural development is a strategy designed to improve the economic and social life of the people in the rural areas. He added that rural development constitutes a process of planned change for which one approach or the other is adopted for the improvement and or transformation of the lot of the rural populace. In the same vein, Adelakun (2013) believed rural development generally to be the process of improving the quality of life and economic well-being of people living in relatively isolated and sparsely populated areas. He stated further that rural development has traditionally centered on the exploitation of land-intensive natural resources such as agriculture and forestry. However, changes in global production networks and increased urbanization have changed the character of rural areas. Increasingly, tourism and recreation have replaced resource extraction and agriculture as dominant economic drivers.

In another related perspective, Ewuim (2010) evaluated rural development from the point of improvement of socio-economic and financial sides of the rural dwellers to the reduction of poverty, inequality and unemployment among the people thereby giving them a sense of belonging. Similarly, Mabogunje (2016) stated that rural development is concerned with the improvement of the living standards of the low-income population living in rural areas on a self-sustaining basis, through transforming the socio-spatial structures of their productive activities. Williams (1981) on the other hand provides a more broader and practical view of rural development involving a set of economic and social development activities undertaken by governments and international agencies, public and private which takes different forms and sometimes combined with one another such

like; credit programmes, irrigation schemes, farm settlements, extension services, marketing cooperatives, the provision of chemical fertilizers, herbicides and pesticides and high-yielding varieties of seeds. The purpose of which is to increase agricultural productivity and improvement of living standards.

The above conceptualizations and interpretations portend that rural development has traditionally linked to agricultural development. The reason is because majority of the population lives in rural areas and agriculture serves as their major occupation. Thus, any attempt focusing on the development of their primary source of livelihood, it would automatically lead to the development of the rural population and improves their overall quality of life.

Materials and Method of the Study

The paper adopted a descriptive survey research design to enable the collection of data from the sample of a larger population and determine the relative incidence, distributions and interrelations of variables related to the contribution of the Dadin-Kowa Irrigation Project on rural development in Gombe state. The population of the study encompasses the 66,570 households of three wards that were selected using the purposive sampling technique. The choice was informed by their respective proximity and predominant agricultural activities under the irrigation scheme which are; Difa / Lubo / Kinafa (16,910), Gwani / Shinga / Wade (21,152) and Hina / Dadinkowa (28,508) ward (National Population Commission, Gombe State, 2023). However, a sample size of 381 respondents was arrived at using the Research Advisors (2006) Sample Size Table with a 0.05 margin of error which was proportionally distributed across the wards (Difa / Lubo / Kinafa (97), Gwani / Shinga / Wade (121) and Hina / Dadinkowa Ward (163) and the respondents were randomly selected in each ward to give each respondent equal chance of being included in the research.

The research heavily depends on the primary sources of data that were collected through a structured questionnaire (on food production and livelihood) administered to farmers under the irrigation scheme, and in-depth interviews with key relevant officials

such as the Chairman of the Water Users Association, the Sectional Head of the Irrigation Project, the Gombe State Chief Produce Officer, the Chairman of Gombe State Primary Healthcare Development Agency as well as the official records of the Upper Benue River Basin Development Authority, Dadin-Kowa area office and that of Gombe state Ministry of Education. The research employed mixed methods of data analysis where the questionnaire data were analyzed quantitatively using frequency and percentage tables based on time series, while the interview data were transcribed and analyzed qualitatively using a thematic approach to complement the quantitative data. The research hypothesis was

tested via a Paired Sample t-test to compare the mean scores of respondents on food production and rural livelihood before 2015 and between 2015 and 2023, to determine the significant contribution of the irrigation project on rural development.

Results and Discussion

A total of 381 questionnaires were administered to the three selected wards, out of which only 360 were successfully retrieved and valid. Hence, the analysis will be basically restricted to the number of valid questionnaires retrieved and the interview conducted.

The above table indicates that the irrigation

Table 1: Views of Respondents on the Contribution of Dadin Kowa Irrigation Project on Food Security in Gombe State

Responses	Frequency	Percentage
Positive	309	82.4
Negative	66	17.6
Total	360	100

Source: Field survey, 2023

project has positive impact on food security because majority (82.4%) of the respondents ascertained it. The interview with the Chairman of Water Users Association revealed that the irrigation project has impacted positively and is continuously impacting on food security in the area as it enables farmers to cultivate food crops twice in the dry season. The Sectional Head of Irrigation also corroborated that Dadin-Kowa as it is, is the food basket of not only Dadin-Kowa but the entire Gombe state...Dadin-Kowa rice production attracts buyers from neighboring states courtesy of the irrigation project. Furthermore, the Chief Produce Officer of

Gombe state Ministry of Agriculture and Animal Husbandry in an interview, revealed that the Irrigation Project is the major catalyst or driver of food security of the state. He noted that the irrigation project helps farmers to avoid problems associated with drought and high pest infestation which brings about better agricultural productivity. He also commends the effort of both state and federal government on agricultural policies that is geared toward increase agricultural productivity in the state (Interview, April, 2023).

The responses on the table 2 above, indicate that

Table 2: Average Annual Bags of Rice Cultivated by Respondents before 2015

Responses	Frequency	Percentage
Less than Five	17	4.7
Between Five and Twenty	106	29.4
Between 21 and 35	159	44.2
36 Bags and above	78	21.7
Total	360	100

Source: Field survey, 2023

majority of respondents (44.2%) cultivated between 21 and 35 bags annually in the periods before 2015. The Sectional Head of the Irrigation Project in an interview added that the average aggregate annual rice productivity of

the project in the periods before 2015 was ranged between 1,100 and 1,300 tons of rice (Interview, April, 2023).

The Table 3 above showcased that majority

Table 3: Average Annual Bags of Rice Cultivated by Respondents between 2015 and 2023

Responses	Frequency	Percentage
Less than Five	14	3.9
Between Five and Twenty	53	14.7
Between 21 and 35	95	26.4
36 Bags and above	198	55
Total	360	100

Source: Field survey, 2023

(55%) of the respondents harvests 36 and above average bags of rice annually between 2015 and 2023. This signifies that (compared to the periods before 2015) there is increase in yield of the respondents between 2015 and 2023. The increase can be attributed to the Federal Government's Agricultural Promotion Policy which revived the irrigation project via extensive services and maintenance of the irrigation facilities, educating farmers on modern farming techniques as well as provision

of improved farm inputs like fertilizer, herbicides, pesticides, high yielding and extra early variety of seeds to boost food production in the country. The data obtained from interview with the Sectional Head of the Irrigation Project further corroborated the increased agricultural productivity of the scheme between 2015 and 2023, as the average tons of rice produced within the period ranged between 1,500 and 1,700 (Interview, April 2023).

Table 4: Views of the Respondents on whether the Irrigation Project has improved their Income Level

Responses	Frequency	Percentage
Improved	321	89.2
Not Improved	39	10.8
Total	360	100

Source: Field survey, 2023

Table 4 indicates that the level of income of 89.2% of the respondents has improved courtesy of the irrigation project. The position of the respondents above was further accentuated by the data from interview with the Chairman of Water Users Association who stated that the income of farmers under the irrigation scheme has significantly improved,

particularly given the recent increase in yield, value and the high demand for local rice in the country occasioned by the government embargo on rice importation. This has vehemently catapulted the proceeds of rice farmers and attracted many into such lucrative ventures (Interview, April 2023).

Table 5: Average Annual Income of the Respondents from Rice Farming Before 2015

Responses	Frequency	Percentage
Less than N 100,000	48	13.3
Between N100,000 and N200,000	67	18.6
Between N201,000 and N300,000	112	31.1
Between N301,000 and N400,000	72	20
Above N400,000	61	16.6
Total	360	100

Source: Field survey, 2023

Table 5 presents the average annual income of respondents derived from rice production during the periods before 2015. It has illustrated that 31.1% respondent's average income level ranged between N201,000 and N300,000 and this was slightly followed by fractions of 20% (N301,000-N400, 000), 18.6% (N100,000-

N200,000), 16.6% (Above N400,000) and then 13.3% (less Below N100,000) of the respondents. This implies that the majority of respondent's average income from rice harvests before 2015 was in between N201,000 and N300,000

Average Annual Income of the Respondents from Farm Produce between 2015 and 2023

Responses	Frequency	Percentage
Less than N 100,000	18	5
Between N100,000 and N200,000	40	11.1
Between N201,000 and N300,000	64	17.8
Between N301,000 and N400,000	71	19.7
Above N400,000	167	46.4
Total	360	100

Source: Field survey, 2023

The indicates that majority (46.4%) of the respondent's average annual income realized from rice harvests under the irrigation project in the period (between 2015 and 2023) was above N400,000. This has comparatively shown that the rice farmers economic returns were higher than those before 2015. By implication, the

frequency and percentage of respondents' income level has increased within the period and this can be attributed to the Federal Government Agricultural Promotion Policy and the subsequent increase in the farmers' yield and agricultural productivity as well as the price of the rice and farm produce generally.

Table 7: Views on whether Livelihood of the Respondents Improved under Dadin Kowa Irrigation Project

Responses	Frequency	Percentage
Yes	314	87.2
No	46	12.8
Total	360	100

Source: Field survey, 2023

The above table revealed that the livelihood of majority (87.2%) of respondents have improved under the irrigation project. The Chairman of

the Water Users Association of Dadin Kowa Irrigation Project in his response further confirmed that ... the irrigation scheme has

significantly improved the livelihood of farmers which is obvious in the kind of dresses they wore, houses they lived in, and other livelihoods. In addition, the Sectional Head of the Irrigation Project also attested that the general living standard of the people around the project area has transformed in comparison with

the pre-project standards. The inception of the scheme has ultimately stimulated various transformations in the area such as the erection of modern structures, road networks, marketplaces, and attracted so many economic activities (Interview, April 2023).

Table 8: Views on the ways the Irrigation Project Improved the Livelihood of the Respondents

Responses	Frequency	Percentage
Basic Needs	116	32.2
Business Investment and Expansion	37	10.3
Other Financial Responsibilities	29	8.1
All of the Above	170	47.2
No response	8	2.2
Total	360	100

Source: Field survey, 2023

This table showcased that the irrigation scheme has improved the livelihood of the respondents in various ways. To the majority (47.2%), their livelihood was transformed through attainments of basic needs (of food, shelter and clothing etc.), while others moved further to diversify into other businesses like trading, rearing of animal and accomplish other financial responsibilities. This is due to the fact that majority of the respondents' average income level was above N400, 000 annually which in turn, translate to the transformation of their livelihoods by the aforementioned ways. In

addition to this, The Chairman of the Water Users Association in an interview corroborated that the irrigation project has changed the livelihood of people in the area given the agricultural boom in the area, high economic returns and better wellbeing. According to him, unlike in the past, farmers build modern houses, owned modern means of mobilities of various kind, modern grinding and milling machines and some even diversified their sources of income to trading, transportation and other businesses (Interview, April 2023).

Table 9: Views on the Contribution of Dadin Kowa Irrigation Project in Providing Better Education to their Children

Responses	Frequency	Percentage
Yes	313	86.9
No	47	13.1
Total	360	100

Source: Field survey, 2023

This table indicates that the Dadin Kowa Irrigation Project has facilitated the securing of better education to the families of the majority (81.6%) of respondents. This was further proven by the Chairman of the Water Users Association who stated that many farmers under the irrigation scheme have obviously sponsored their family members in various schools including tertiary institutions like Federal College of Horticulture, Dadin Kowa and

Gombe State University. He acknowledged that it was as a result of the project proceeds, he was able to enrolled and obtained a diploma in FCH, Dadin Kowa and currently two of his family members enrolled too (Interview, April 2023). Furthermore, the data obtained from Education Management Information System (EMIS) of Gombe state Ministry of Education showcases that the level of school enrolment in the period after 2015 has increased. For instance, the

primary school enrolment in 2014 was 6722 while that of 2023 is 13568 and that there are additional new primary schools cited in the area. Moreover, the junior secondary school enrolment as of 2014 was 1753 while that of 2023 is 5561. The above submission therefore, implies that there is increase in school enrolment after 2015 with specific reference to

2023 data. This may be attributed to the establishment of additional new schools between 2015 and 2023 and the increase in the income of people in the area. This affords them the opportunity to send more children to school, and thus access better education (EMIS, Ministry of Education, Gombe state, 2023).

Table 10: Views of the Respondents on the Contributions of Dadin Kowa Irrigation Project in Accessing Better Healthcare Services to their families

Responses	Frequency	Percentage
Positive	322	89.4
Negative	38	10.6
Total	360	100

Source: Field survey, 2023

This table depict that the Dadin Kowa Irrigation Project has contributed to the accessibility of better healthcare services to the rural communities in the area as majority (89.4%) of the respondents affirmed it immense contribution in accessing improved healthcare services to their families. To corroborate this, the Chairman of the Water Users Association stated that various healthcare facilities were cited in rural communities for better accessibility of healthcare services to the populace courtesy of the irrigation scheme (Interview, April 2023). Furthermore, the Chairman of the Gombe state Primary Healthcare Development Agency have also confirmed that ...in Yamaltu-Deba local

government area, there are two major hospitals and one of which was cited around the project area that is Zambuk. In Hina, there is Cottage Hospital and Model Hospital in Dadin Kowa. Other villages like Difa, Wade, Lubo, Gwani East and Shinga etc. have maternity clinic each. Moreover, Dad Kowa Dam is reported to be the major source of disease called river blindness which is caused by black flies' concentration in the dam, and that one of the three eye diagnostics centers in Gombe state was provided in Hina Cottage Hospital for the rural communities in the area. All these efforts were geared toward making healthcare services available and accessible to the people around the project area (Interview, April 2023).

Paired t-Test Result on Food Production before 2015 and between 2015 to 2023

Variables	Mean	MD	N	Sig
Average bags produced After 2015	3.3250	0.4972	360	.000
Average bags produced Before 2015	2.8278			

Source: Field survey, 2023.

This table presents the paired sample t-test result on food production which is measured by average bags of rice produced by farmers before 2015 and between 2015 and 2023. It shows that the mean average bags produced by respondents between 2015 and 2023 (3.3250) is higher than the mean average bags produced by respondents

before 2015 (2.8278) and the mean difference is 0.4972 with 0.000 significance which is less than 0.05 level of significance. This implies that the Dadin Kowa Irrigation Project has a significant contribution to food production between 2015 and 2023.

Paired t-Test Result on Average Income Level before 2015 and between 2015 and 2023

Variables	Mean	MD	N	Sig
Average Income After 2015	3.9139	0.8278	360	.000
Average Income Before 2015	3.0861			

Source: Field survey, 2023

The result of the paired t-Test shows that the mean scores on income level of the respondents between 2015 and 2023 (3.9139) is greater than that of before 2015 (3.0861) and the mean difference is 0.8278 with 0.000 significance, that is less than 0.05 level of significance. This signifies that there is significant impact of Dadin Kowa Irrigation Project on rural income between 2015 and 2023. And that increase in rural income has direct impact on rural livelihood. To buttress this, Jhingan (2013) stressed that increase in rural income as a result of agricultural surplus tends to improve rural livelihood where farmers start consuming food of higher nutritional values, build better houses rather than mud houses, pay electricity bill, have good furniture, radio, television, motor etc. they also receive direct satisfaction or utility from such services as schools, hospital, banking, transport and communication facilities.

From the foregoing paired sample t-Test results the mean scores on food production and livelihood as measured by income and farm productivity level of respondents between 2015 and 2023 were higher than that of before 2015. This signifies that the paper accepted the hypothesis that Dadin- Kowa Irrigation Project had a significant impact on the livelihood of rural dwellers between 2015 and 2023 and that the Federal Government Agricultural Promotion Policy has improved the viability of Dadin Kowa Irrigation Project where farmers' agricultural productivity and income level has significantly increased. This boosted food production and improved rural livelihood in the area.

Thus, the above results revealed that Dadin-Kowa Irrigation Project has impacted positively food production between 2015 and 2023 and that the average tons of rice produced between 2015 and 2023 (ranged between 1,500 and 1,700 tons) was higher than the average tons produced before 2015. This has further

corroborated that there was a significant impact of the Dadin-Kowa Irrigation Project on food production between 2015 and 2023. Moreover, the irrigation project has a significant impact on rural livelihood between 2015 and 2023. Farmers secured their basic needs of food, shelter and clothing and undertook other financial responsibilities as well as access to better education and healthcare services for their families.

The paper also found that the major challenges of farmers under Dadin-Kowa Irrigation Project in the period under study were inadequate access to credit facilities, and the challenge of accessing varieties of improved seed and modern farming tools. Other minor challenges identified include; inadequate and untimely supply of fertilizer, pests, crop disease, insufficient water supply for irrigation and overflowing. The research further noted that Hippopotamus is also part of the major challenges but with little attention in Dadin Kowa Scheme. The hippopotamus usually come out in the night to feed on grasses and crops and by so doing destroy farms in the area which reduces the economic returns of the farmers.

Conclusion and Recommendations

Development and modernization of rural agriculture such as the irrigation scheme, contribute immensely to not only countryside but also a catalyst for national development. These agricultural schemes tend to boost the production of food for the teeming population at both urban and rural settings, supply raw materials to the growing industrial sector and also serve as a major source of employment to the increasing population particularly those in the rural areas. The viability of irrigation projects in promoting rural development in Nigeria have obviously accentuates the enormous efforts of the federal and state governments as well as donor agencies in such

agrarian schemes. Consequently, the findings of this study therefore, reinvigorate the significant impacts of the irrigation project on rural transformation in Gombe state 2015 to 2023. However, in spite of the conspicuous challenges bedeviling the schemes, it remained the hallmark of rural development as the majority of the people resides in rural areas and derived their livelihood through agriculture and related activities.

The study, based on the above submissions, recommends that (since Dadin Kowa Irrigation Project has the capacity of irrigating 44 thousand hectares of land) the federal government should or in partnership with donor agencies like World Bank and FAO to further expand the canals to a wider coverage so as to accommodate more hectares in the downstream as envisioned in the initial conception of the project. Furthermore, in the upstream, the sprinkler system should be installed to enable the abstraction of water to upland for those that were displaced by the dam. This could largely help to engage many farmers and ultimately increased food production and improved rural livelihood. Other recommendations include;

1. The state government should in collaboration with Upper Benue River Basin Development Authority and relevant non-governmental organisations come up with an intervention programme that will help farmers with subsidized farm inputs like fertilizer, pesticides, herbicides and varieties of improved seed.
2. Gombe State Agricultural Development Project should in Partnership with Upper Benue River Basin Development Authority and other relevant agencies promote the mechanization of agriculture in the area, through the increased provisions of modern farming tools like tractor, harrower, planter as well as harvester. Moreover, extension services should be strengthened to educate farmers with modern farming ideas and techniques.
3. It is recommended that government should give special attention to the provision of credit facilities to the farmers under the irrigation scheme. The leadership of Water Users Association should cooperatively source out for soft loans from Central Bank of Nigeria (CBN) through NIRSALs' Anchor Borrowers Programme and other micro finance institutions and commercial banks to cater for the challenge of inadequate access to credit facilities among farmers.
4. The state government should as a matter of exigency device a means to stop the Hippopotamus from coming down to Dadin Kowa Irrigation Scheme to address the problem of crop destruction in the area.

Suggestion for further studies

Irrigation is the main focus of this study; further studies should dwell on aspects like rural water supply and rural electrification which are also part of the major components of Dadin-Kowa Dam. It is also suggested that similar study should be conducted in other irrigation projects in the state such as Balanga and Cham Irrigation projects.

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