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ORIGINAL RESEARCH ARTICLE

The Benefits and Constraints of Irrigation Farming in Northern Nigeria: A Case Study along River Jare in Bakori Local Government Area, Katsina State

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ABSTRACT

In Nigeria, the Federal Government has recently started shifting its attention to agriculture as a means of stimulating the economy against the continuous decline in oil revenue, which is a response to the global shift from hydrocarbons towards the actualisation of the green energy revolution agenda. More emphasis is being put on developing the enormous potential that lies in agriculture, both as a viable option for diversifying the economy and as a major employer of labour to reduce unemployment rates. In many states of the Federation, particularly those in the northern part, food security is of paramount importance due to the high population nature of the region. As such, conscious efforts are being made to develop the agricultural sector to ensure food sufficiency, the provision of income, and employment generation for the teaming population. This paper analyses the benefits and constraints of irrigation farming activities along the River Jare in the Bakori local government area, Katsina State. Data for the study were generated through direct field observations and a structured questionnaire, which was administered to the seasoned farmers at the sampled sites in the study area. The results revealed the major benefits of irrigation farming along the river, which include improving the livelihoods of the farmers through increased income as 47% earned between **₦300,000 and ₦500,000** from the irrigation with an average of **₦312,000**, and employment creation as 68% of the farmers sourced their labour through hired/contract method. On the other hand, the results also showed several constraints, such as the changing climate as identified by 64% of the farmers and this affects water availability in the river, the increasing rate of gully erosion along the river banks as mentioned by 16% of the farmers, pests, and diseases was mentioned by 10%, and high cost of farm inputs as well as fluctuations in the market price of farm produce were both mentioned by 5% of the farmers as major challenges to irrigation farming in the study area. Sustainable government intervention that includes the provision of soft loans, training of the farmers on new irrigation techniques, and soil conservation practices to reduce the rate of gully erosion along the river is recommended. Moreover, dredging and proper management of the Bakori dam are also recommended, which ultimately reduces the pressure on the river.

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INTRODUCTION

Irrigation refers to the artificial application of water to land for the purpose of supplying crops and other plants with water to satisfy their water requirements (Chait, 2019). Irrigated agriculture is not only crucial for the supply of food and raw materials, but it also accounts for the largest water consumption globally (Juan et al., 2019). Uniformity is the key to maximising irrigation efforts, in which the producer has a lot of control over how much water to supply and when to supply it, but the irrigation system determines uniformity (Robinson, 2017).

Irrigation farming contributes to agricultural development and food security in many ways (Kpotun, 2010). First, irrigation farming allows for multiple crops throughout the year. Meaning that the land could be cultivated continuously, resulting in higher agricultural output. Secondly, irrigation enables the cultivation of new and high-value crops, which not only boosts farmers' incomes but also diversifies the range of available products, thereby enhancing food security.

There is a supply and demand for water in every irrigation region, according to the "Food and Agriculture Organisation" (FAO, n.d.). The amount of water required fluctuates over time and is influenced by crop growth, crop types, and climate. The plants may receive too much water when the supply outpaces the demand, which stunts their growth. Additionally, it is usually expensive because

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there is a chance that water will spill and into the drainage system. Conversely, in the case that the supply falls short of the demand, drought may strike the irrigation region, ultimately resulting in lower crop yields.

Numerous academic studies have examined the relationship between irrigation and poverty, leading to a worldwide agreement that the development of irrigation is a successful strategy for reducing poverty (Pamela, 2024). And "in Sub-Saharan Africa, empirical evidence has shown that irrigation can have positive impacts on agricultural production and farm incomes".

Nigeria possesses huge potential for irrigation with several dam projects spreading all over the country. However, a great percentage of these dams that the government has invested in are either abandoned for years or underutilised (Vincent and Safina, 2017).

Given that crops are highly susceptible to both short- and long-term droughts, farming primarily depends on the availability and accessibility of water to varied degrees, which occasionally does not fulfill the specialised requirements of crops (Ibrahim et al., 2018). It is essential to understand that irrigation supplements the water provided by rainfall, helping to improve crop yields and quality. Therefore, irrigation serves as a reliable source of moisture when rainfall is insufficient, making it economically viable to cultivate crops under other favourable agronomic conditions, ultimately leading to increased yields.

A water source provides the necessary amount of water for an irrigation system. The most popular water sources for irrigation include lakes, rivers, reservoirs, and subsurface water (FAO, n.d.). River Jare is a perennial river in Bakori Local Government, Katsina State, that flows throughout the year, although the amount of water passing any given location along the river varies (Ladan and Sule, 2017), and this may be due to the nature of the terrain and the depth of the water table at different locations along the river (Observation, January 2024). Over time, the Jare River's flow varies; it is shallow during the dry season and reacts swiftly to rains in the catchment area. The catchment area of the river is large because it spans cross villages within Bakori Local Government, and a great percentage of the population depends on the river as a source of water for irrigation farming, rearing of animals, and other miscellaneous purposes.

In the study area, people engage in irrigation farming for the cultivation of crops like wheat, rice, tomato, carrot, cabbage, sweet potato, Irish potato, pepper, cucumber, lettuce, and so on (Observation, January 2024). River Jare is an old and historical river that spans a long distance of 9 kilometres, covering villages in Bakori LGA and emptying into the Kano River through Kafur LGA of Katsina State. For decades, the neighbouring communities have been benefiting from the river for several purposes, which include other forms of agricultural activities like fishing, rearing of animals, and farming. To some extent, they also use the river as a source of drinking water (Observation, January 2024).

The River Jare supplies large hectares of land with irrigation water during the dry-season farming period of four to five months (November – March). According to Mahmud's (2016) assessment, Katsina State's irrigation farming is at risk since its water supply is running out. This is because the Jare River in Bakori local government has run dry due to a remarkable spike in irrigation farming, a situation that has seriously worried the wheat farmers along the river. Moreover, a shortage of water and aridity were identified as two of the main obstacles to agricultural development by Ladan and Sule (2017) in their assessment of the constraints on agricultural development in the Bakori Local Government. Furthermore, they noted that irrigation along the Jare River was becoming difficult as some of the farmers had to dig deep to access the water.

While irrigation farming holds significant potential for enhancing livelihoods, irrigation farmers along the River Jare encounter various challenges that hinder their productivity. This study aims to explore both the benefits and challenges experienced by irrigation farmers along the river. The findings of the research will provide a clearer understanding of how irrigation farming impacts the lives of the farmers and the difficulties they face in achieving higher productivity. Moreover, the findings will offer insights that could inform policies and interventions to boost the effectiveness of irrigation farming in the region.

MATERIALS AND METHODS

Study Area

The local government area (LGA) known as Bakori was established on May 15, 1989, on land that had previously been incorporated on September 21, part of Funtua LGA. Bakori LGA was curled out to become Danja LGA (Ladan and Sule, 2017). It is located between latitudes 11°55'30"N and 12°43'0"N and longitudes 7°30'0"E and 7°43'30"E. Bakori is situated in the southern part of Katsina State, 208 kilometres from the state capital on the Kano to Funtua trunk 'A' road. It presently covers a land area of 679 km2. Bakori Local Government Area is bordered by Faskari to the west, to the north by Kankara, to the northeast with Malumfashi, to the east by Kafur and to the south by Danja, and to the southwest by Funtua Local Government Areas (See Figure 1)

Climate

The region experiences two different seasons, the dry and the rainy, and is a part of the tropical continental climate. There is a four-month wet season and an eight-month dry season in the region. Rainfall occurs primarily from May to September each year, with an average yearly rainfall ranging from 500 to 1000 mm (Ladan and Sule, 2017).

Adefila (2014) remarked that the relative humidity has always been very low; it is about 40 percent in January and gradually rises to about 60 percent in July. The climate of the region is governed by two principal winds, namely, the

Tropical Continental Air Mass (Tc) and the Tropical Maritime Air Mass (Tm). The Tropical Maritime air mass is responsible for bringing rain to the area during the wet season, while the Tropical Continental air mass brings dryness (Harmattan), which is a cold, dry, and dusty wind blowing from the Sahara Desert. The vegetation and the soils are in some way related because they are affected by the climate, geology, and relief of the area. The soil, to a large extent, determines what grows, and it enriches the plant cover.

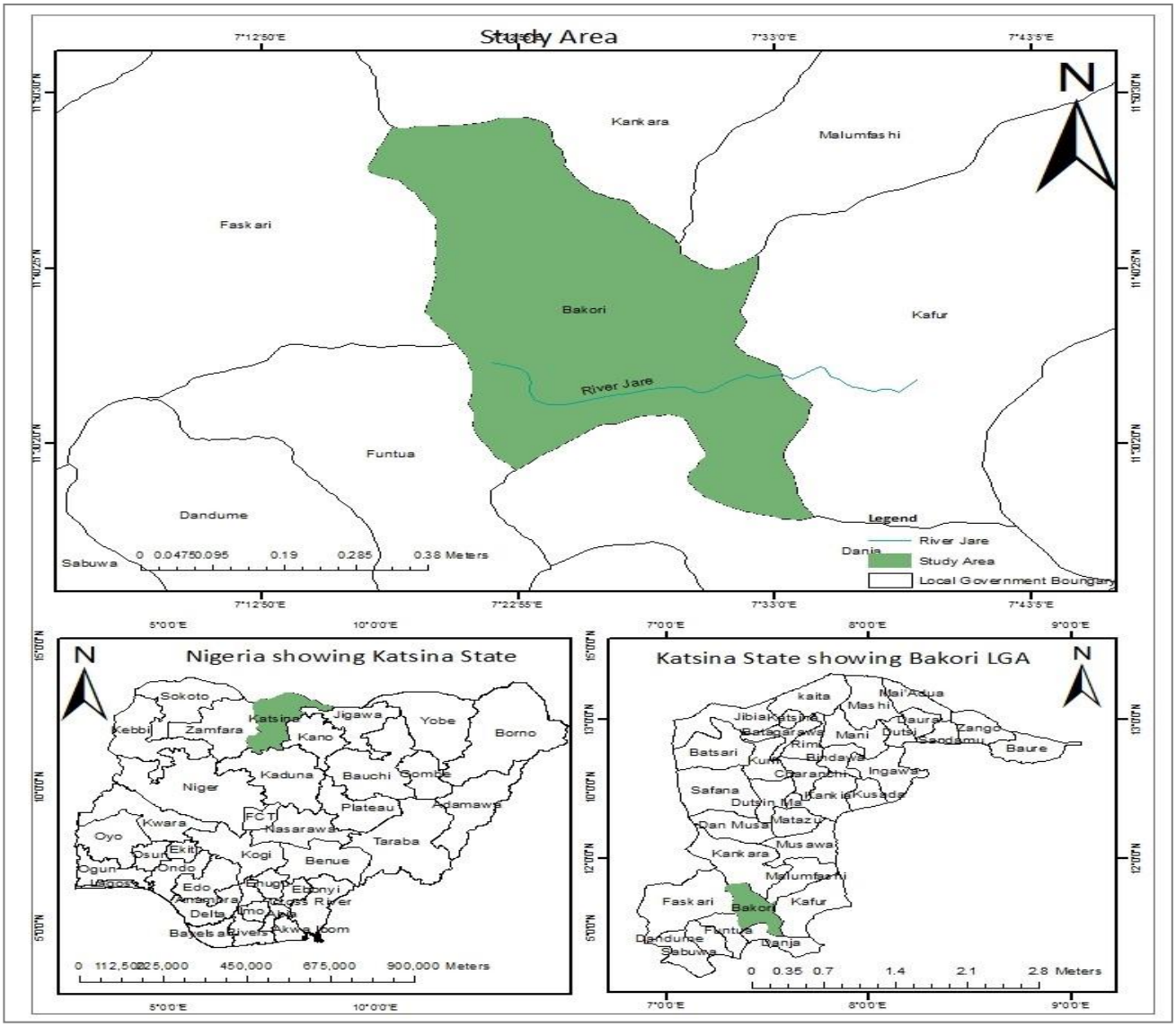

Figure 1: Study Area

Drainage of the Study Area

From field observation (2024), the study area is characterised by two drainage basins based on stream frequency and drainage density. The first one is characterised by a large number of unbranched first-order tributes, producing high stream frequency and drainage density. This includes the main River Jare, which is characterised by intense gullies. The second type consists of basins with low stream frequency and drainage density; such rivers are Figi, Dambaso, Kabomo, Sandada, Shuwaki, and Dangwazai. They are all tributaries of the River Jare.

People and Socioeconomic Activities

The local economy of the Bakori local government is primarily agricultural-based, involving both rain-fed crop cultivation and irrigation farming at the Bakori dam site and riverside. Other populations engage in cattle and ruminant animal rearing, fishing, and trading. Staple crops are Guinea corn, maize, etc., and cash crops include cotton, groundnut, and soybeans (Ladan and Sule, 2017). The Bakori local government features a major grain market called Kasuwar Sama, which is frequented by traders from throughout Katsina State and the nation. Agricultural crop commodities are provided by small and large-scale farmers from the local government (Mahmud, 2014).

Ethical Approval

The research "The Benefits and Constraints of Irrigation Farming in Northern Nigeria:, A Case Study along River Jare of Bakori Local Government Area, Katsina State. Nigeria." ensured voluntary participation, informed

consent, and the protection of participants' confidentiality and anonymity. The study avoided harm, respected participants' rights, and ensured inclusivity regardless of gender or socioeconomic status. Findings were reported with transparency and integrity, contributing to the knowledge of irrigation farming in the study area. Ethical approval was sought from the village heads of the selected communities before commencing the study.

Reconnaissance Survey

There is a need to create familiarity with people in the study area, most especially the targeted population, which is the irrigation farmers. A reconnaissance survey of the area was conducted in order to get familiar with the people and ascertain the environment. These, among other things, helped in collecting vital information and getting a bird's-eye view of the area.

Materials

The map of Bakori LGA was generated from the administrative map of Nigeria at the cartography unit of the Department of Geography and Environmental Management, Ahmadu Bello University, Zaria Kaduna State. The map was used to identify the study locations along the Jare River in Bakori LGA. A Sony SELP16502 digital camera with an optical lens of 16–50mm was used to snap pictures of evidence of agricultural production at Jare River (Bakori LGA) sites during the field survey, which were documented and incorporated into the study, further proving the dynamic nature of agricultural activities along the river. A structured questionnaire was used to generate data from the irrigation farmers during the field data collection in the selected communities.

Questionnaire Development and Validation

A well-structured questionnaire was used as the instrument to collect data from the irrigation farmers in the study area. The questionnaire was designed by the researcher and validated by trained and certified enumerators. The questionnaire included precise questions that were tailored to address the research problem.

Sample Size

The procedure for choosing the sample size proportionate involved the use of the following expression:

$$n = \left(\frac{x}{X}\right) * N,$$

Where:

n = Sample size
x = Number of cabbage farmers in a village
X = Total number of farmers in the selected villages
N = Total sample size

Data Collection

Data for the study were generated through a field survey of the five selected communities along the River Jare. The communities were selected purposefully due to their proximity to the river. On that basis, Unguwar Dinya, Unguwar Kanawa, Unguwar Gabas, and Unguwar 'yan Lambu were selected. The structured questionnaire was used to generate data for the study (see Supplementary Data). A multi-stage sampling technique was adopted. First, a purposive sampling technique was used to select the communities. Second, a random sampling technique was adopted to select the farmers who engaged in irrigation farming along the river in the study area. In each of the five communities that were chosen, fifteen (15) irrigation farmers were sampled to respond to the questionnaire, and this gives a total of seventy-five (75) respondents used for the study. In order to avoid bias, only farmers with proximity to the river were selected. The questions answered by the respondents were categorised based on socioeconomic characteristics, types of crops cultivated, methods of crop production, the benefits of the Jare River to irrigation farming activities, and the challenges and constraints being faced by the farmers. The questionnaire was self-administered with the help of a local assistant.

Analysis

Various statistical methods were employed to examine and synthesize the acquired data. Data analysis and summarization were performed using both descriptive and inferential statistics.

RESULTS AND DISCUSSION

Demographic and Socio-Economic Characteristics of Respondents

The demographic and socioeconomic characteristics (Table 1) of respondents from the five sampling communities for the study revealed that, in terms of gender, 93% of the respondents were males and only 7% were female. The reason for this large gap is not unconnected with the religion and culture of the people in the study area, where males are the primary heads of the family and, as such, are responsible for providing food and other basic necessities. In terms of age, the largest proportion of the respondents fall between 31 and 40 years of age, or about 47%. This indicated that a middle-aged group of people were in charge of irrigation farming activities in the study area.

There are three types of religions in the study area. The results obtained from the field survey revealed that the majority of the respondents are Muslims, accounting for about 80%, while Christians account for 16%, and traditionalists have the lowest percentage (4%).

In terms of educational qualifications, twenty-seven (27) of the respondents had no formal education but had Qur'anic education alone (Table 1). The percentages of respondents with primary, secondary, and tertiary education were 13%, 47%, and 13%, respectively. Among

the respondents in the study area, there are two marital characteristics. The marital status indicates that 87% were married, with one, two, or three wives, and 13% were unmarried. The number of children born into the families differs, as 8% had between one and two children, 23% had between four and six children, 31% had between seven and ten children, and 38% had more than ten children. The occupational status of the respondents showed that 40% of the respondents engaged in irrigation farming during the rainy season, while 60% practiced both rain-fed and irrigation farming.

Table 1: Demographic and socio-economic attributes of the respondents.

Characteristics	Frequency	Percentage %
Educational Qualification		
Qur'anic education only	20	27
Primary School education	10	13
Secondary School Education	35	47
Tertiary level education	10	13
Age		
20 - 30	16	21
31 - 40	35	47
41 - 50	15	20
Above 50	9	12
Marital Status		
Unmarried	10	13
Married	65	87
Religion		
Islam	60	80
Christianity	12	16
Traditional	3	4
Number of Children		
One – three children	5	8
Four – six children	15	23
Seven – 10 children	20	31
Over Ten children	25	38
Occupational Status		
Irrigation Farming	30	40
Both rain-fed and irrigation Farming	45	60
Sources of capital for farming		
Personal savings	60	80
Loans	15	20
Gender		
Male	70	93
Female	5	7

Source: Field survey 2024.

Benefits of River Jare to Irrigation Farming

Table 2 below summarises the benefits of the River Jare to irrigation farming in the study area.

from the field survey conducted, it was discovered that the river has been immensely beneficial to the farmers for many years as 100% of them mentioned that they utilised water from the river for their irrigation activities. 100% of them mentioned that they utilised water from the river in their irrigation activities. Different respondents spent varying periods engaging in irrigation farming along the river. 52% of them spent more than 10 years, 28% spent 7–9 years, 12% spent at least 1–3 years, and 8% spent between 4 and 6 years. On the issue of water availability

and its accessibility along the river, 73% of the respondents mentioned that the water is always accessible whenever it is available, while 27% mentioned that the water may be available but not always accessible. This is attributed to the nature of the terrain as well as the depth of the water table at different locations along the river. There are rocks visible at some locations, while at other places they are fine-grain sand.

On the type of irrigation method employed by the farmers, there are two major methods of irrigation farming practiced by the respondents in the study area. These are manual and fuel-operated pumps. About 96% of the respondents are using the fuel-operated pumping method of irrigation to draw water from the river, while only 4% are using the manual method, as shown in Table 2. Moreover, from the table, it was revealed that the majority of the farmers source their labour from hired labour, which involves paying labourers to do the farm work, and this accounts for about 68%, followed by family labour accounting for 20%, and cooperative labour having 12%.

Table 2: Benefits of River Jare to Irrigation Farming

Benefits	Frequency	Percentage %
Using River Jare for irrigation		
Yes	75	100
No	0	0
Years spent using River Jare for irrigation farming		
1 - 3	9	12
4 - 6	6	8
7 - 9	21	28
10 above	39	52
Water availability and accessibility along the river		
Always available and easily accessible	55	73
Always available but not easily always accessible	20	27
Not always available and accessible	0	0
Types of irrigation methods used		
Manual (using bucket)	3	4
Pump irrigation	72	96
Sources of labour		
Family	15	20
Hired/contract	51	68
Cooperative	9	12
Types of crops produced		
Wheat	21	28
Maize	25	34
Irish potato	8	10
Tomato	12	16
Cabbage	9	12
Level of productivity		
High	51	68
Moderate	21	28
Low	3	4
Uses of the harvest		
Domestic consumption	15	20
Market	60	80
Income generated after the irrigation (₦)		
Less than 100,000	6	8
100,000 - 300,000	25	33
300,000 - 500,000	35	47
Above 500,000	9	12

Source: Field Survey, 2024

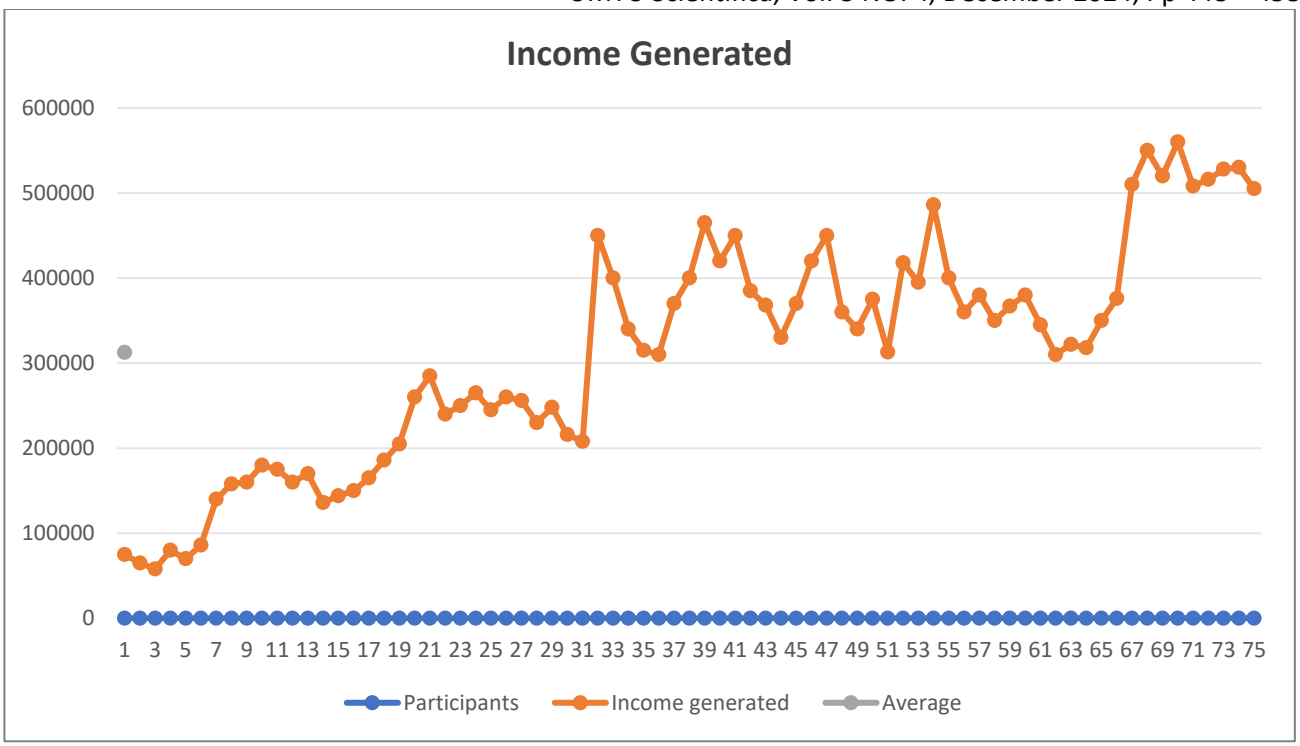

Figure 2: Income generated with average

The types of crops produced were also accessed during the field data collection. Maize accounts for 36%, followed by wheat (28%). 16% of the farmers grow tomatoes, 12% grow cabbage, and 10% grow Irish potatoes. These constitute the major crops produced by the farmers. There are other crops, which are mainly vegetables, such as onions, lettuce, carrots, peppers, etc.

The production of maize and wheat is primarily done for market and household consumption, but the majority of the farmers produce the mentioned crops for market sales in order to augment their income. The level of productivity indicates 68% of the farmers are recording high productivity or yield, and this is not unconnected with the high fertility nature of the soil, the favourable climatic conditions, or the availability of water at various locations along the river. 28% recorded moderate yields, and 4% had low yields.

Figure 3: A wheat farm in the study area (January, 2024)

Benefits

This section deals with the benefits driven by using the River Jare for irrigation farming activities.

Improving the livelihood of the farmers

The overall benefit of the river has been improving the livelihood of the irrigation farmers through an increase in their income. This is evident, as it was discovered from the field survey that the majority of the farmers have their income level raised. The land area cultivated by each farmer varies, hence the income generated. The results from Table 2 reveal that about 47% of the farmers realised between ₦300,000 and ₦500,000, followed by those earning between ₦100,000 and ₦300,000, which account for 33%, those earning above 500,000 where about 12%, and finally, those earning less than ₦100,000 account for about 8%. Previous studies, such as Tijjani et al. (2022), have likewise noted that irrigation farming improves farmers' yield as well as their income, although it requires increased access to production inputs, improved knowledge, and adequate irrigation resources for achieving food security and eradicating poverty.

Provision of employment

From the field survey, 68% of the respondents mentioned that they sourced their labour through hiring labourers. This indicated that irrigation farming along the river provides employment opportunities to other people in the study area, where they can earn money by engaging in direct labour at the respective irrigation farms within the communities and ultimately reduce poverty.

Household food security/food sufficiency

With a stable water source, farmers can produce food more reliably, reducing the risk of food shortages and ensuring a steady supply of food for communities. Although only about 20% of the respondents mentioned that they utilised their harvest for domestic household consumption, this is due to the fact that most of the food for household utilisation is grown during the rainy season, so the 20% is only to augment the already-stocked food.

Economic development

Irrigation farming plays a key role in driving economic growth and improving rural livelihoods. By providing a consistent water supply, the Jare River helps the farmers grow more crops and diversify their production, leading to increased incomes and the overall economic growth of these communities.

The results of the one-way ANOVA test reveal a highly significant difference in the income generated between the irrigation farmers using manual and pump irrigation methods, with a p-value of 5.43E-14, which is far below the 0.05 significance threshold. This signifies that the choice of irrigation method has a strong and statistically significant effect on the income level of farmers in the study area. Specifically, the extremely small p-value indicates that the observed variation in income between the two groups of farmers is not due to random chance, and there is a clear, measurable impact of the irrigation method on farmers' earnings.

Table 3: One-Way ANOVA Results Comparing Income Generated by Farmers Using Manual and Pump Irrigation Methods

SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Manual Irrigation	17	2242000	131882.4	2.69E+09		
Pump Irrigation	58	21199000	365500	9.9E+09		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	7.18E+11	1	7.18E+11	86.22446	5.43E-14	3.972038
Within Groups	6.07E+11	73	8.32E+09			
Total	1.32E+12	74				

Constraints/Challenges Faced by Irrigation Farmers

Constraints in this study refer to the barriers and impediments to effective and profitable irrigation farming. The result reveals the following as the major constraints:

Climate change

The most critical of them all is climate change, which has been attributed to the reduced amount of rainfall that recharges the river from its primary source. Furthermore, the rate of evaporation is also higher due to the increasing temperature, which is causing the river to dry off in some locations a few months after the rainy season. Majority of the farmers expressed concerns about it; this is evident as about 64% identified climate change as their biggest threat to irrigation farming. Abdullahi et al. (2022) noted that maize and rice are among the crops affected by climate change in areas around Bakori LGA

Gully erosion

Another constraint is gully erosion along the river banks, which accounts for 16%. It was observed during the field study that gully erosion has been increasing to the extent that some of the farmers in the study area lost reasonable portions of their farmlands, and in some cases, when the river overflowed, it inundated their farmlands, causing great damage to the crops.

Figure 4: Gully erosion at some locations along the river (January 2024)

Pests and diseases

Pests and diseases, especially of the vegetable crops, mainly tomatoes, are another threat to successful irrigation farming in the study area, as they account for about 10% of the respondents. This validated the findings of Ibrahim et al. (2018), who mentioned that infestation of pests and diseases, particularly tomatoes and leafy vegetables, constitutes the greatest threat to effective irrigation farming.

High costs of farm inputs

From the field survey, it was also discovered that high costs of farm inputs such as fertiliser, high-yield seedlings, and agrochemicals had constituted another constraint to irrigation farming. This accounts for about 5% of the respondents. The result is similar to Adefila (2014), who identified the rarity and high cost of agrochemicals as one of the major constraints to agricultural development in southern Katsina State. Emmanuel et al. (2024) recommend giving farm inputs, including fertiliser, better seed, and subsidised loans, to farmers, as doing so would increase the productivity of vegetable crops.

Fluctuation in market prices

Fluctuation in market prices of irrigation farm produce accounts for 5% of the respondents from the field study. Looking at the socioeconomic characteristics of the farmers, an unstable market price will result in great discouragement for the farmers, as the majority of them source their capital from personal savings. And this could ultimately lead to an increase in unemployment as more labourers will have no work.

Another constraint on the productivity of irrigation farming is conflict between the farmers and herders, which has been an issue of concern for years. Naturally, human beings respond to stimuli. Tamim (2019) noted that where conflicts arise, it will take a toll on stability, and survival will be the ultimate goal. This will affect the productivity of irrigation farming. Banditry has emerged as one of the most pressing constraints on the prospects of food security, not only in Katsina State but in Nigeria at large. This has negatively impacted food availability, accessibility, sustainability, and utilisation (Yusuf and Abdulrahman, 2021). Apart from the challenges mentioned above, there are others, which include insufficient capital, poor storage facilities, and theft of farm produce, among others.

Possible solutions to the constraints

From the field survey and the different opinions of the farmers obtained about the possible solution to the constraints they faced, about 55% of the respondents mentioned organised sensitisation workshops about the causes and consequences of climate change, as this will provide the farmers with sustainable farming practices and soil management practices to combat both climate change and also reduce the rate of gully erosion along the river banks. Akinyemi et al. (2021) noted that the advancement of farmers' education can be achieved through continual updating of their knowledge of climate-smart agricultural practices and farming techniques, either facilitated by farmers' groups or agricultural institutions. A low-interest

loan from the government was mentioned by 20% of the respondents; this loan will supplement their personal savings and ultimately increase their output. Reducing the cost of farm input, particularly fertiliser, and chemicals, accounts for 20% of the respondents. Finally, market control of farm produce accounts for 5% of the respondents.

The above shows the different views of the respondents on the possible solutions to the constraints they faced with irrigation farming. The provision of security to these farmers will ensure food sufficiency and reduce the rate of unemployment.

Moreover, the findings of the ANOVA test highlight the importance of technology in boosting the productivity of irrigation farming and suggest that transitioning to more advanced methods, such as pump irrigation, could lead to increased income for irrigation farmers along River Jare in Bakori Local Government Area, Katsina State.

CONCLUSION AND RECOMMENDATIONS

One of the best ways to guarantee food security in any nation is to ensure the availability of food year-round. As Nigeria's population continues to grow exponentially, this increasing food demand must be matched with an adequate supply. One major way to achieve this goal is through irrigation farming.

Based on the findings from the study, it can be concluded that irrigation farming along the River Jare is of enormous benefit to these farmers and their respective communities. The reason is that farming remains the major occupation of the inhabitants, and there are viable potentials for irrigation. Undoubtedly, the welfare needs of the farmers are more positively affected by irrigation activities than community development projects.

The problem of changing climates, gully erosion, and conflicts is discouraging the farmers. Pests and diseases, price fluctuations, and the high cost of inputs have greatly impeded irrigation farming, and this often leads to poor harvests. Therefore, the following recommendations are put forward: First and foremost, for the overall increase in productivity from irrigation farming in the study area, workshops and training of the farmers should be prioritised, particularly on how to minimise the effects of climate change through effective adaptation and mitigation strategies. Secondly, soil conservation practices should be encouraged among the irrigation farmers to combat the gully erosion along the river bank that constantly threatens their farmlands. Thirdly, the provision of soft loans to the farmers will supplement their capital sourced from personal savings; making farming inputs, particularly fertiliser, and chemicals, available at subsidised rates will encourage farming and ultimately boost productivity. Finally, the provision of adequate security within rural communities will ensure peace and stability, economic growth, and food sufficiency.

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