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Economic Appraisal of Kano River Irrigation Project (KRIP) Kano State, Nigeria

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ABSTRACT

The Kano River Irrigation (KRIP) is under the Hadejia Jamma'are River Basin Development Authourity (HJRBDA). It covers a total of 62,000.ha of land .The project was established to boost sustainable agricultural productivity of the climo-adaphic environment of the densely populated Kano in northwestern, Nigeria. The area receives a rainfall of less than 700 mm annually, this call's for an alternative means of sustaining the population agriculturally. The general impression of irrigation project experience of Nigeria is that performance of most irrigation projects fall below pre-project expectation. Consequently irrigation project is viewed with circumspection in some quarters. The focus of the paper is to economically appraise growth of KRIP for 30 years from 1984. Modern discounting measures of Net Present Value (NPV) and Benefit Cost Ratio (BCR) were used to assess the project's four major crops: Rice, wheat, maize and tomato cultivated in the rainy and dry seasons. The result of the measures showed high positive values for both single and combined seasons. It was concluded that KRIP is the most economically viable, successful and sustainable project in Nigeria, and West Africa at large. It was recommended that remaining part of the project be completed in order to have full benefit of the project.

Keywords: Economic analysis, KRIP, rainy season, dry season, combine season, NPV, BCR.

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Introduction

Kano River Project (KRP) was conceived in 1965 – 68 after a reconnaissance study of water resources of Chad Basin in Nigeria by United States Bureau of Reclamation (USBR). The KRP was identified with a storage dam at the Tiga Rapids. In 1969, Kano State Government commissioned a Netherlands Engineering Consultant (NEDECO) to carryout feasibility study for the Kano River development which included technical and economic feasibility of construction of the Tiga dam and irrigation of 75,000ha of land [1,2].

The Kano River Irrigation Project (KRIP) is the largest and pioneer irrigation project in the country. Gravity irrigation using basin and furrow methods was adopted for KRIP because of the uniform slope of the land. Hadejia – Jama'are River Basin Development Authority (HJRBDA) manages it. KRIP has a total potential irrigation area of 62,000 ha, divided into two phases KRIP I (Kadawa) and KRIP II (Wudil) comprising 22,000ha and 40,000ha respectively. Fig. 1.The general impression of the irrigation experience of Nigeria is that performances of most irrigation projects fall below pre-project expectation. Consequently irrigation development is viewed with circumspection in some quarters [3]. However, careful examination of the situation would reveal that such conclusion is usually the result of the way in which most early irrigation development took place, rather than the inherent nature of the irrigation. For an irrigation scheme to succeed, it is essential that the components of the scheme be suitably conceived, phased, designed, constructed, operated, maintained and managed. This is true for all sizes of projects, but emphasis differs for large scale from that of small scale [4].

This study attempted to appraise economic growth of KRIP with the aid of historical data of all the crops cultivated for a period of 30 years. Economic analysis of a project aims at assessing the additional income to the nation and the community resulting from the project implementation [5]. Analyzing the economic benefits of irrigation project involves looking at the project at two levels, the farmer and the scheme level. At farmer level, the production, labour requirements and the income "with" and without" the project are look at. At scheme level costs are compared with estimated income from the whole scheme to assess the benefits of investing in irrigation [6]. Generally there are three basic methods that are used in measuring project worthiness; econometric, programming and the economic surplus approaches [7]. In this paper the economic surplus is the major choice because it aims at measuring social and economic benefits, which projected over time. It provides Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratios (BCR) and further conducts sensitivity analysis that is helpful considering the exante nature of the evaluation [8,9,10].

Methodology

Study Area

Location of the Project (KRIP)

It lies within latitudes 11° 45' N - 12° 05' N and longitudes 8° 30'E - 9° 05' E. The elevation of the project lies within 440 metres above sea level, with minimum storage level of Tiga Dam at 506.50 metres, which provides a perfect setting for the gravity irrigation. The project area covers land between Kano and Hadejia Rivers; stretching from Tiga dam (S.E. of Kano) to the landmass on both banks of River Hadejia.

It is bordered to the northeast by river's Hadejia, to east by rivers Garanga, Goriba and Guska river's to the south east and south by villages of Kulluwa, Cirin, Gora, Barnawa and Garu, Babba.. Fig. 1.

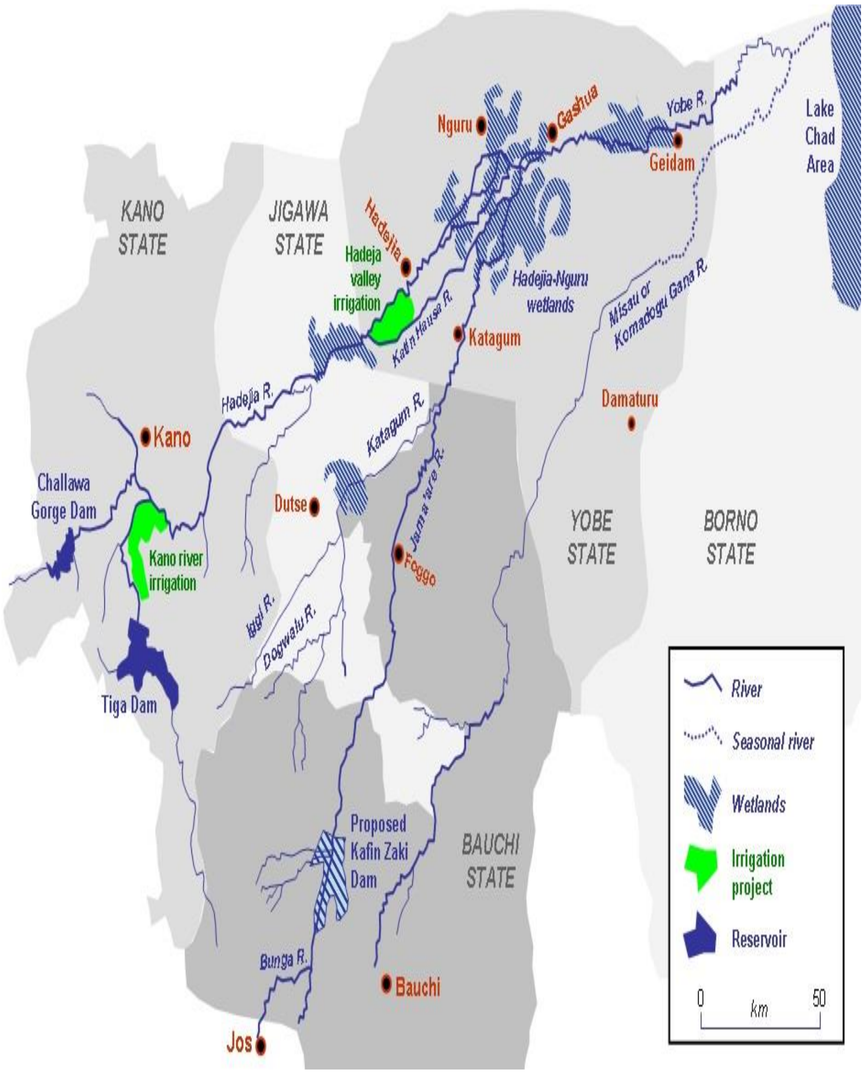

Figure 1. Map of Hadejia-Jammare River Basin Irrigation Projects.

Climate, Vegetation and Drainage

Climatically; there are three distinctive features; Warm rainy season (June to September), cool dry season (October to February) and a hot dry season (March to May). The average annual rainfall is 860 mm [11,12]. The soils belong to Enteric Gumbisol with loam texture of the surface, moderately deep, and well drained with some scatter of iron pans. Vegetation is a typical Sudan savanna consisting of a variety of trees, shrubs, and grassland communities [13].The drainage system is made up of Rivers Hadejia and Kano. The Kano River formation is made up of Hadejia, Katagum and Jama'are rivers that converge to form the River Yobe and drain Kano and Jigawa States into the Lake Chad [12 ,14].

Variety of crops are grown such as millet, sorghum, maize, wheat, groundnut, cassava and vegetable etc., by rainfed farming, while under irrigation crops such as maize, rice, tomato, wheat, melon, cucumber, pepper, onion, garlic and other vegetables through out the year [15].

Structure of the Kano River Irrigation Project (KRIP)

It is unique in its design in that the entire water distribution network operates on gravity. The irrigation water is conveyed from Tiga dam to the Project site through an 18 km long Main Canal (MC), which splits into east and west branches. These are then further broken into lateral canals (LC), field channels (FC) and finally to the farm for irrigating crops [16].

The Project is divided into 29 sectors of varying sizes ranging from 170 to 2,342 ha. A Sector is a single administrative unit, which has water management and operations independent of other sectors. Water is released to each sector through a single Sector Turn Out (STO) which discharges water from the Main Canal into lateral canal. The Night Storage Reservoirs (NSR), which were constructed in different locations throughout the project area, is another unique feature of the project. These reservoirs are built to receive and store the flow in the main and branch canals during the night. This is necessary because the entire project conduct irrigation at the same time during the day. The lateral canals discharging into branches, such as distributor channels, (DC) and finally to the field channels (FC). Each FC serves a single field, ranging from 8.5 to 14.16 ha, with about 7 to 20 or more farmers per field. A group of fields form a block, and one single DC serves each block. The FCs are connected to collector drain at their tail ends, and for each field, there is a shallow drainage channel which carries run-off to the collector drain [17,16]. [16].

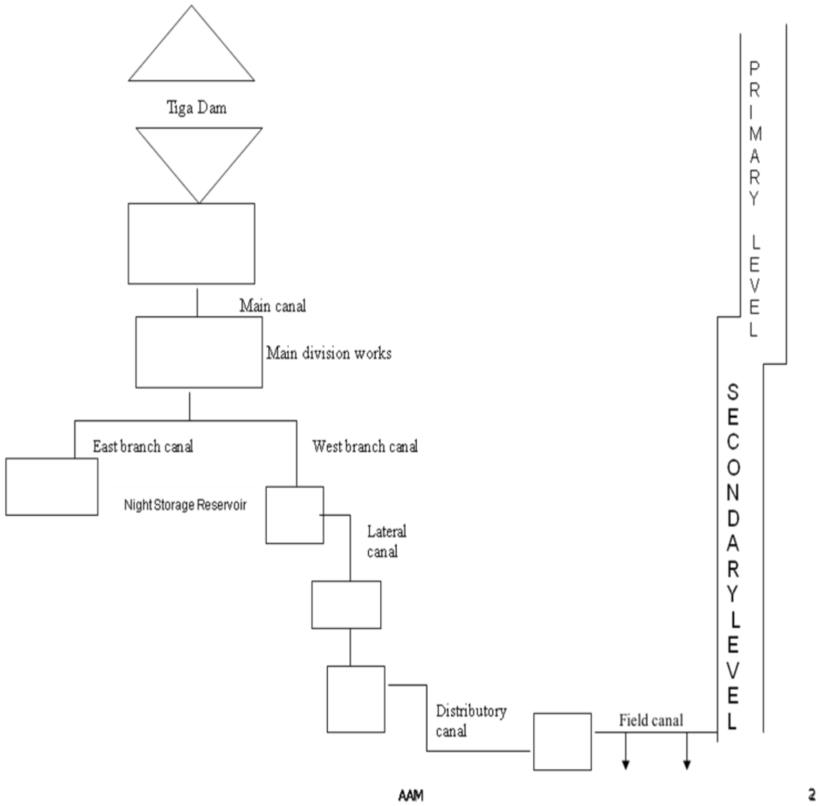

Fig. 2: Schematic Diagram of Kano River Irrigation Project Area. Adapted from Okoh (1999)

Data collection

Historical data from KRIP for 30 years was generated through records on market price of input, output, cost of labour interest rates for respective years from CBN, Operation and Maintenance cost, water charges were imputed for the computation. Three scenario were considered farming in dry (irrigation), rainy (rainfed) and combination of dry/rainy seasons production. The data were analysed with the aid of economic surplus tools and descriptive figures.

Model specification

$$\text{NPV} = \sum_{n=1}^{n}\left[\frac{(B-C)}{(1+r)^n}\right]-1 \qquad (1)$$

Where,

$NPV =$ Net Present Value

$\sum =$ Summation sign

$n =$ Period (number of years)

$B =$ Benefit derived

$C =$ Cost of operation/Expenditure

$I =$ original /initial cost

$r =$ Interest rate

Benefit Cost Ratio

The benefit cost ratio (B/C) is defined as the present value of benefits divided by the present value of costs.

$$\text{B/C} = \sum_{i=1}^{n}\left[\frac{B/(1+r)^i}{C/(1+r)^i}\right] \qquad (2)$$

Where:

$B/C =$ Benefit Cost Ratio

$n =$ number of years

$\sum$ =Summation symbol

$r =$ interest rate

$B =$ Benefit accrued

$C =$ Cost incurred

Result and Discussion

The ultimate purpose of an economic analysis of a project is to ascertain the extent to which the economic resources such as land, labour, capital, and material necessary for a project are more or less effective than would be the case if the project were not undertaken. To achieve this, the discounting techniques such as the Net present value (NPV), and Benefit Cost Ratio (BCR) are used to determine the economic and financial viability of the project.

Net Present Value (NPV)

The Net Present Value relates costs of various operations and benefits of output obtained for the period of 30 years, crops cultivated for the combined seasons (both dry and rainy) for each season in KRIP. Each of these scenarios have varying characteristics of crops cultivated and yield variability from one year to another. Figure 3 shows the NPV for KRIP for the two seasons (i.e. dry and wet seasons and for the seasons combined).

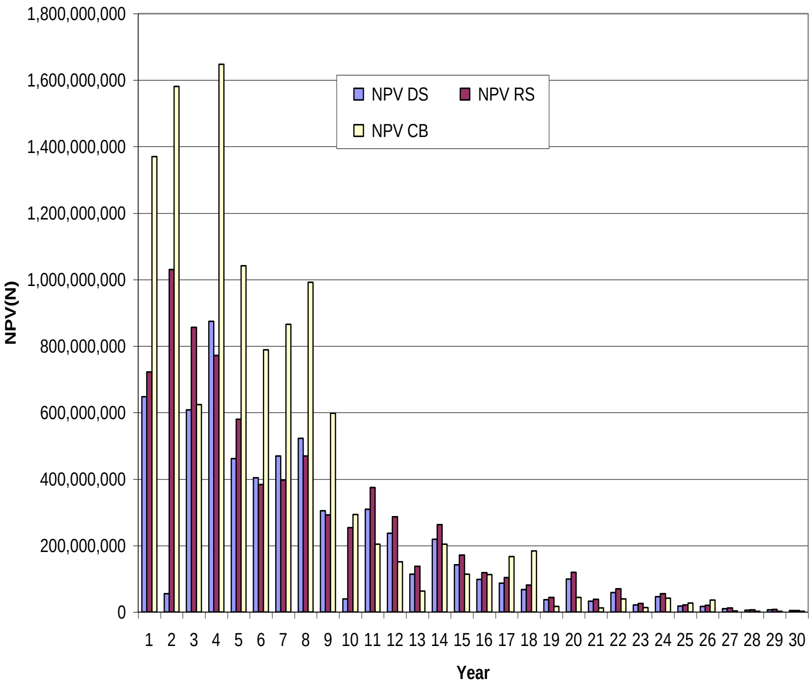

Figure 3: Net present value for KRIP . KEY: DS=Dry season; RS=Rainy Season; CB=Combine Both season

It was observed that the NPV of the three scenarios (combined, dry and rainy season) were positive and the values were high indicating that the investment in KRIP is economically viable. The NPV (N11240) for the combined seasons (dry/ rainy) was higher than when the resources are used for irrigation (dry season) only (N6019 m) or rainfed (N7721m) alone. Also, the rainy season enterprise had higher NPV value than the dry season. This may be attributed to the fact that during the rainy season more land is cultivated for water is not a constraint and there are less maintenance and operation costs. Thus according to the NPV selection criteria the combined season will be selected first. This signifies that having the project in the area is worthwhile. Further more the significance of irrigation can be understood in terms of the additional income to the participating farmers, provision of employment, food security and harnessing the potentials of crops that could not be produced otherwise. Moreover, during the 1973, 1983, and 1994, there were droughts in sub- Saharan region and some parts of Nigeria were affected except for the irrigation projects which mitigated the severity of the drought then. The decline in total amount of rainfall and poor spread over the rainy season were reported by [18,19]. This scenario is only being complicated in these contemporary times by the global warming, and EL-Nino weather phenomena [20]. Irrigation therefore holds the key for sustainable farming practice to meet our food self-sufficiency and security needs particularly in these areas that are vulnerable.

Benefit Cost Ratio (BCR)

The BCR is a means of comparing the benefits derivable, tangible and intangible, with the costs of the project. It also establishes a public project that is a “prima facto” to yield economic benefits. Figure 4 compares the BCR of the rainy season and the dry season over the years.

The analysis revealed that the project has the capacity to recover its investment cost, with time. This was also envisaged by earlier feasibility studies conducted by NEDECO in 1974 before commencing the construction of the project. The benefit-cost ratios for both rainy and dry seasons are greater than unity, which shows that the project is worth undertaking. It was observed from the result

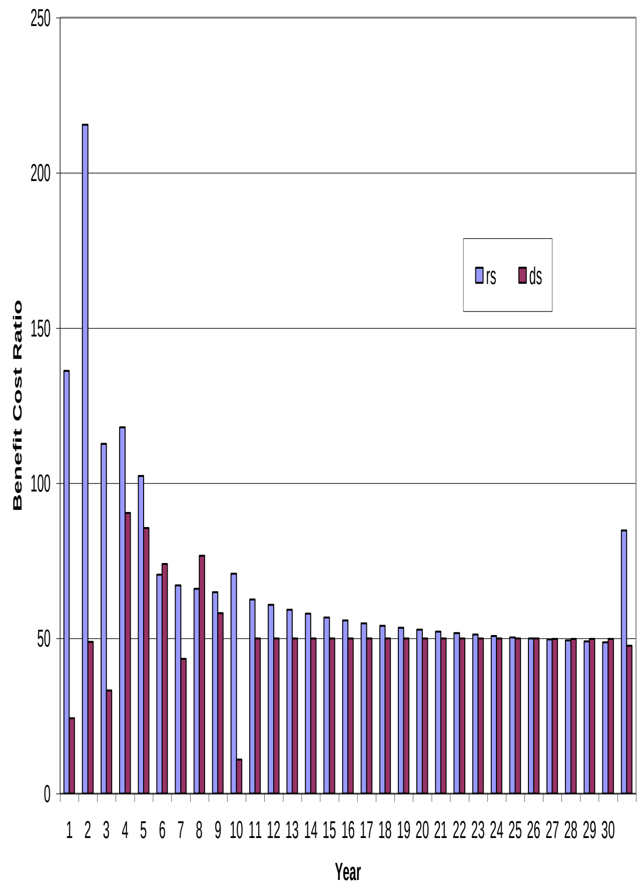

Figure 4: Cost benefit ratio for KRIP KEY: rs = rainy season; ds = dry season

that rainy season production gave the higher total B/C ratio (84), while in some individual years both the rainy and dry seasons were about to exhibit same B/C values which may be attributed to fluctuations in yield and low prices of rainy seasons crop compared to dry seasons crop. This is in agreement with [21] who conducted B/C on wheat crop in KRIP and obtained a B/C ratio of greater than unity. Other tangible benefits derived as a result of the project include access to road network, schools, hospital, agro processing enterprises etc. In addition other intangible benefits of the projects derived in the area include use of the water for domestic, industrial, fishing, livestock watering and transportation purposes. This means that farmers obtained a share benefit of the project facilities to better their livelihood.

Conclusion and Recommendation

It could be concluded that KRIP is a worthwhile undertaken venture economically viable to the community and the farmers as well. This paper recommends that the project should be completed as designed so that full capacity ultilization of the available water and land resource be maximized.

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