TOWARDS REHABILITATION OF PUBLIC IRRIGATION SCHEMES IN THE SUB-SAHELIAN ZONE OF NIGERIA: A Case Study on Bakolori Irrigation Project (BIP).

By

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF POST GRADUATE DIPLOMA IN AGRICULTURAL ENGINEERING (SOIL AND WATER OPTION)

Declaration.

I hereby declare that this project has been conducted solemnly by me, under the effective and fair guidance of Dr. (Engr.) D. Adgidzi of the Department of Agricultural Engineering, Federal University of Technology, Minna, and that I have neither copied someone's work no had someone else done it for me. Writers whose works have been referred to have been dully acknowledged.

M. S. Bala		31 August 2000
Student's Name	*Signature.*	*Date.*

Approval Page.

THIS IS TO CERTIFY THAT THIS PROJECT IS THE ORIGINAL AND APPROVED WORK OF MUHAMMAD SANI BALA PGD/AGRIC/98/99/59 AND HAS BEEN PREPARED IN ACCORDANCE WITH THE REGULATIONS GOVERNING THE PREPARATION AND PRESENTATION OF PROJECTS IN THE FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

15.01.002

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Acknowledgement.

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Profound gratitude is due to my project supervisor, Engr.(Dr.) D. Adgidzi, who has tirelessly guided me until the final production of this project.

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ABSTRACT.

The critical challenge that man cannot afford to ignore is how to make the best use of the natural resources of land, forests, lakes, rivers and seas which constitute his environment, to meet his present needs for food and fibre without jeopardising the well being of the future generation.

This project seeks to contribute to the nation's food basket. It is doing so by examining those factors responsible for the poor performance of the Bakolori Irrigation Project. The project gulped about N600:00 million between 1974 and 1982 for its construction alone and the Federal Government has been responsible for the cost of its operation and maintenance through the Sokoto Rima River Basin Development Authority (SRRBDA) since its inception. To date, the project has not been able to support itself financially. The fact that it still depends on the Federal Government for subvention after 18 years of operation is suggestive of its poor performance.

Some of its problems have been identified and useful suggestions on how to solve the identified problems are provided. These hopefully would lead to the improved performance of at least the rapidly collapsing gravity irrigation section of the project. The sprinkler section of te project has already fallen below 4% utilisation and would need a drastic action to bounce it back to life.

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Chapter One: INTRODUCTION.

1.1 Background.

Rehabilitation exercise for any type of irrigation system is usually informed by the unsatisfactory performance of the scheme soft or hardware or when parts become worn-out or obsolete such that major renovation works, rebuilding, upgrading and/or modernisation becomes necessary.

Poor or inefficient performance of the project managers and/or negligence, ignorance or inability of the users to cope with the project level of technology, or even the incoherent relationship between the managers and the users (as the project software) can stall or result in poor project performance.

Deteriorating water sources, intake structures, distribution facilities, soil conditions and declining quality of irrigation water: particularly from pollution, (constituting the project hardware) would require careful examination of those factors responsible for the deterioration and eventually determine the possible choices for ways and means through which they can be addressed.

In other words, successful rehabilitation exercise for irrigation projects should provide and guarantee well into the future, very simple and economic ways of:

i providing effective technical serviceability of water distribution and other relevant facilities in the scheme;

ii minimizing cumbersome maintenance requirements;

iii recommending appropriate land tenure and cultivation practices such that users can have meaningful sense of belonging on the project;

iv improving soil quality and that of the environment.

v adopting most appropriate levels of technology such that high dependence upon spare parts, excessive fuel or power requirement can be avoided;

v recommending appropriate water charges.

vi establishing firm Water Users' Association for participatory irrigation management (involving the users and the managers of the project).

It is however not really encouraging to note the fact that BIP, barely after 25 years of operation is already asking for general rehabilitation. There are schemes else where in the world, like India for example, where schemes are dating as old as 40/50 years of successful operation without any major rehabilitation exercise.

BIP started with socio-political problems almost at the very beginning, when in 1974/75, the then Federal Military Government awarded the contract for planning and construction of the project to contracting firms that neglected or virtually under estimated principal factors necessary for scheme sustainability, such as the involvement of the community for which the project was intended for, right from the time the project is being contemplated.

Other than the socio-political problems experienced at the beginning of the construction period, there had been no significant problems experienced or reported on the planning, design or construction of the project (which took five years to complete). The project was in the sum of N110,321,157:00 as at June 1975.

As at the time operation started in BIP, all facilities were in good shape and maintenance requirement was minimum, particularly on the area of gravity irrigation. As can be seen from the following chapters, operation and maintenance of facilities have risen to their peaks, but had to declined progressively from 1986 to date. A number of reasons are responsible for this decline, which is being investigated herein, and possible suggestions are being proffered at appropriate places in this report for the overall management, operation and maintenance of this valuable scheme.

1.2. Aims and Objectives of the Project.

As proper planning, implementation and management of irrigation and drainage systems are now becoming more critical, emphasis are now shifting towards minimizing impacts on the environment, optimizing water utilization and economic rate of return. In this regard therefore, the aim of this project is to:

i. Study the extent of deterioration (level) of the Gravity Irrigation area of the BIP.

ii. Determine the level of rehabilitation work on the Gravity Irrigation area of the BIP.

iii Provide useful suggestions/solutions for the effective performance of the Gravity Irrigation area of the BIP.

This way it is hoped, the Gravity Irrigation area of the project could be brought as close as possible to its intended objectives of satisfactory performance in a sustainable manner.

Chapter Two: BRIEF SURVEY OF RELEVANT LITERATURE AND MATERIALS.

2.1 The Nigerian Sahelian Zone

Nigerian sahelian zone is that expanse of land approximately 300 km wide from latitudes 10 to 14 degrees North of the equator and 1060km long from longitudes 4 to 142 degrees East of Greenwich. It encompasses the three northernmost river basin areas of Sokoto-Rima, Hadejia-Jama'are and Chad. This area coincides roughly with the combined areas of Kebbi, Sokoto, Zamfara, Katsina, Kano, Jigawa, Northern part of Bauchi, all of Yobe and Borno States, (see Fig.1), *(Nwa et al, 1999)*

2.2 Potentials for Irrigated Agriculture

Conventional surface irrigation development in this zone is generally favorable especially in view of the key factors necessary for surface irrigation development (i.e. the natural topography and soil type of the area). Its available surface water resources are about 13,685 million cubic meters *(Nwa et al, 1999),* with a sizeable stock of shallow groundwater. The impending problems of desert encroachment and intermittent drought in this area pose both major socio-political, economic and environmental problems for the country as a whole. The zone is about 30% of the area of the country and it is the home for about one quarter of the nation's population (Nwa et al, 1999).

Having appreciated these indicators as a major national security threat, the Federal Government developed deliberate plans aimed at tackling them. The problems fortunately became noticeable at the time the country had some oil

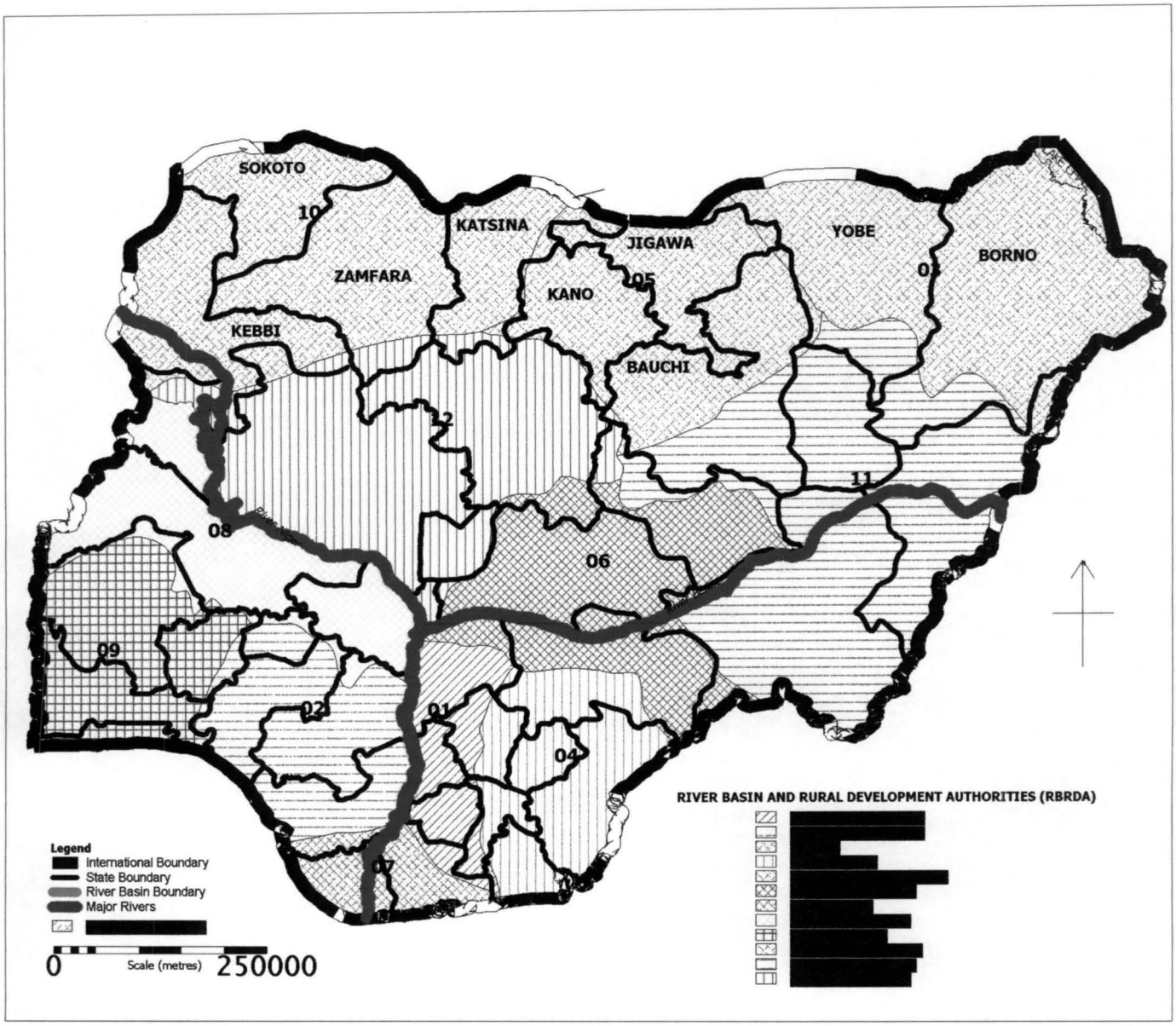

FIG. 1. LOCATION OF RIVER BASINS AND STATES CARRYING THE MAJOR IRRIGATION PROGRAMMES IN NIGERIA

Produced by Afremedev GIS, Abuja.

money available to spend. Contracts were therefore awarded by the Federal Government for the planning, design and construction of irrigation facilities to various contracting firms in the early 1970s all over the country, especially in the desert threatened and drought-ravaged sahelian zone.

2.3 General Status of Irrigation Systems in the Zone.

Nwa et al, (1999) as shown in ***Table 1*** below established fourteen major public irrigation schemes owned by the Federal Government that were operational in the zone. Their analysis revealed that out of the 245,500 hectares planned for irrigation then, only 41,550 hectares were actually irrigated and have been irrigating for the most part of the period since the second half of the 1970s. They have also discovered another 88,500 hectares as been developed but operations have not actually commenced.

Their findings also revealed that four modes of development for the infrastructures were adapted in this zone for the fourteen public irrigation projects, namely:

1). Storage and Gravity Canals (S&GC) involving nine project covering 76,000 ha of land

2). Primary Pumping and Gravity Canals (PP&GC) for 78,000 ha in three projects

3). Diversion and Gravity Canals (D&GC) involving two projects covering 49,500 ha

4). Sprinkler System (SS) on 23,000 ha in one project

Table 1: Federal Government Irrigation Projects in Nigerian Sahelian River Basins (1999)

RIVER Basin and Project	Area Thousand Hectares			Mode of Development
	Planned	Developed	Irrigated	
1. Chad Basin				
i) Alau Dam	8	-	-	S&GC
ii) Baga Polder	0.5	0.5	0.5	PP&GC
iii) Lower Yedseram	37	-	-	D&GC
iv) South Chad	67	49	15	PP&GC
Sub Total	112.5	49.5	15.5	
2. Hadejia-Jama=are Basin				
i) Galala Dam	2.5	-	-	S&GC
ii) Hadejia Valley	12.5	-	-	D&GC
iii) Kafin Zaki	12.5	-	-	S&GC
iv) Kano River Phase I	23	14	14	S&GC
v) Kano River Phase II	30	-	-	S&GC
Sub total 2	80.5	14	14	
3. Sokoto-Rima Basin				
i) Bakolori Dam	23	23	11	S&GC,SS
ii) Goronyo Dam	6.7		-	S&GC
iii) Jibiya Dam	3.5	1	0.5	S&GC
iv) Zauro Polder	11	0.5	0.5	PP&GC
v) Zobe Dam	8.3	0.5	0.05	S&GC
Sub total 3	52.5	25	12.05	
Total Sub-Sahelian River Basins	245.5	88.5	41.55	

* C = Canals; D = Diversion; G = Gravity; PP = Primary Pumping; S = Storage SS = Sprinkler *(Source: E. U. Nwa et al, 1999)*

They concluded that the last mode must have been mistakenly adopted. It has not performed satisfactorily and consequently has been redesigned to convert the scheme from SS to S&GC. The need to ensure satisfactory performance of the redesigned area will be another prime factor for utmost concern to the management of the BIP.

Like the most of the world, Nigeria has been having her own share of imbalance between her rate of population growth and the rate of development and availability of her useable physical resources. The later was certainly not coping with the former. As in every other part of the world, Nigeria turned to irrigation to complement rain-fed agriculture in meeting her additional food and raw material needs.

Recent studies, however, (like the *ACS 1999* report) have indicated that public irrigation projects in Nigeria, like those in many developing countries elsewhere, have not performed according to expectations and have generally failed to achieve their objectives. This is largely because most of the projects were put in place when Nigeria had plenty of oil money to spend and also at a time when it had little experience of both financial and project management. . In the irrigation sub-sector in particular, the problems have been so many (in some cases so serious) and often vary. Notable among these are categorized as follows:

i. Management problems;
ii. Technical Problems;
iii. Environmental Problems;

iv. Financial Problems;

v. Institutional Problems; and

vi. Political Problems.

For the scope of this project, attention will be focussed mainly on the Management, Technical and Institutional problems as being the principal factors responsible for the poor performance of the BIP with a brief examination at the other problems as relevant to BIP.

2.4 The Bakolori Irrigation Project (BIP).

2.41 Background.

Bakolori Irrigation Project was the first phase of the overall development of the Sokoto Rima River Basin in early 1970s as identified by the Food and Agriculture Organization of the United Nations (F.A.O). The FAO recommended it then as one of the most beneficial projects for the socio-economic development of the area. Consequently, the then Federal Military Government in its second National Development Plan (1970 – 1974) decided to create the Chad Basin and Sokoto Rima River Basin Development Authorities by promulgating two decrees, (Decrees Nos. 32 and 33 of 1973) *(FMWR&RD, 1996)* to develop the water resources of the two areas which were worst affected by the droughts that characterized that period.

2.42 Location and Scope.

BIP is located in Talata Mafara town of Zamfara State, about 110km east of Sokoto town. Construction work on the project started on 5th June1975 and was substantially completed and commissioned on 9th April 1983 *(Adamu, 1999).*

The project consists of a multi-purpose dam sitting on River Sokoto. It is 5.5 km long and is capable of storing 450 million cubic meters of water. The reservoir covers 8,000 ha of land, thereby necessitating resettlement scheme of 15 villages of 2,868 households *(Adamu, 1999)*. This marks the beginning of the problems of BIP – the way this resettlement issue was handled.

This amount of water allowed the installation of 2 Kaplan-type hydro-turbines that are capable of generating a continuous power output of 3,000 KW. A diesel power station capable of generating 7,000 KW was also installed and made fully operational in 1982. As at today however, this is also not working.

The irrigation facilities as planned were designed to supply irrigation water to a net area of 23,000 hectares (8,000 ha of surface irrigation and 15,000 ha of sprinkler irrigation) to improve the overall food production output of the nation. Fisheries, livestock development, potable water supply, power generation and recreation were among the principal components of the BIP

The irrigation network includes the following:

A concrete lined supply canal 15km long;

Two main canals 45km long;

Secondary canals of total length of 200 km

Tertiary and field ditches of 300 km and 400 km length;

Buried pipelines 500 km long;

Pumping stations	-	26 Nos.
Lifting stations	-	3 Nos.
Installed pumps	-	160 Nos.
High tension electrical lines	-	150km
Laterite roads	-	400 km.
Asphalt roads	-	55 km.

(Source Adamu, U. 1999)

With these facilities in place, it was intended then, that all the year round farming activities could be achieved. The cultivation of all the 23,000 ha during the dry season period was estimated to produce 30,000 tons of wheat, 20,000 tons of paddy rice, 60,000 tons of tomatoes, 40,000 tons of sugarcane and 30,000 tons of onions. It was also anticipated that all the 23,000 ha would be cultivated during the wet season and up to 50,000 tons of traditional crops such as millet, sorghum, maize, groundnuts and cowpea would be harvested. Another 5,000 tons of fish from the reservoir was also targeted.

Rapid economic revolution for the farming community and considerable savings in foreign exchange for the Federal Government (usually incurred through importation of some of the crops to be grown on the BIP) could almost be guaranteed when the project takes off. In fact the returns on capital investment was put then at 11.8% per annum *(Adamu, U. 1999)*

2.5 Project Performance in the Past.

The first dry season farming started in November 1978 with a modest irrigation area of 277 hectares (Adamu, 999) and has steadily been on the increase up to the year 1985 when cultivation during the dry season farming reached 17,322 ha with supplementary irrigation for crops during drought years in rainy season. Project performance between 1983 and 1986 was high, reaching up to 75% during 1985/86 dry season farming operation (as can be seen from **table 2** below). The system was fully operational at this time and maintenance requirements were relatively at minimum levels.

Table 2: BIP Dry Season Cropping Record from 1978 - 1998

Year	Area Developed (Ha)	Area Cultivated (Ha)	% Utilization
1978	1,250	227	18.2
1979	4,800	1,504	31.3
1980	8,500	2,147	25.3
1981	16,300	6,289	38.6
1982	21,000	8,532	41.0
1983	23,000	13,201	57.4
1984	23,000	14,029	61.0
1985	"	17,332	75.3
1986	"	14,428	63.0
1987	"	11,482	50.0
1988	"	8,687	37.8
1989	"	10,072	43.8

1990	"	8,760	38.1
1991	"	7,877	34.0
1992	"	6,897	30.0
1993	"	7,123	31.0
1994	"	7,160	31.1
1995	"	6,324	27.5
1996	"	5,903	25.7
1997	"	4,977	21.6
1998	"	4,856	21.1

(Source: Adamu, 1999)

Crop yield per hectare during this time tremendously increased with rice been the major crop cultivated during the dry season farming reaching up to 5.0 tons/ha from the previous 2.0 tons/ha. Similarly, the yield of traditional rain-fed crops such as millet and sorghum also increased from 1.2 tons/ha to over 2 tons/ha.

Production however, from the 1986/87 dry season farming as can be seen above has continued to decline year after year and is currently as low as 21.1%.

Chapter Three: METHODOLOGY.

It is intended for the purpose of this project, to prepare at the first instance, a project database, involving the collection of the following information:

3.1 Planning and Design

i. Collection of information on the available water resources of the project (surface run-off, river flows, groundwater and/or reservoir storage)

ii. Collection of available topographical survey/contour maps.

iii. Climatological data (rainfall, sunshine, wind, humidity, and evaporation).

iv. Crop water requirements and irrigation scheduling.

v. Geotechnical data (as designed and constructed) in relation to hydraulic structures used for water distribution and drainage.

3.2 Irrigation/Farming Activities:

i. Type of irrigation in practice and the actual area under such irrigation system.

ii. Irrigation scheduling

iii. Major type of crops cultivated.

iv. Average yield.

v. Number of beneficiaries on the project and their respective farm sizes

vi. Availability of farm inputs such as fertilizer, herbicides etc.

vii. Availability of farm machinery within the project.

viii. Accessibility of agricultural credit facilities to farmers.

ix. Land use and land suitability – in relation to soil suitability for agriculture.

3.3 Water Management.

i. The general situation report and/or physical status of water distribution/drainage facilities.

ii. General Instructions given to farmers by the project staff of the BIP in respect of on-farm water management.

3.4 Operation and Maintenance

a. The general situation report and/or physical status of project infrastructure.

b. Existing command area problems.

c. Operation and maintenance manual of the BIP, and,

d. Current level of farm machinery and their maintenance schedule.

3.5. Possible Environmental Impacts.

a. Water Logging problems

b. Salinity Problems

c. Sedimentation Problems

d. Erosion

e. Aquatic weeds

f. Agricultural pests

g. Any other environmental problems as can be observed.

3.6 Social Aspect of the BIP

a. Reconnaissance survey on available information on social response of farmers to project, i.e. the level of the farmers' acceptability of the project.

b. Land Tenure system/arrangement in the project.

c. Employment opportunity created by the project.

d. Other social services offered by the project to the community.

3.7 Any other relevant information as may be available on the project.

For the purpose of collecting the above information, a visit to the project site for direct inspection of the project and interaction with both the project managers and the farming community is planned. In this regard, structured questionnaires were prepared (as in APPENDIX I and II) for both the farmers and the project managers respectively. These questionnaires will be distributed to the farmers and project managers, and to be retrieved on completion during the proposed visit.

Where farmers (in particular) cannot read and answer the questionnaire in writing, Rapid Rural Appraisal (RRA) approach would be adopted – for it is expected that all project staff will be able to complete the questionnaire.

RRA is that in-formal way of discussing with the rural community (as being interviewed) with a view to extracting the vital information contained in the structured questionnaire.

Other relevant information as can be found in the headquarters of the Sokoto Rima River Basin Development Authority (in Sokoto) would also be sought.

This information will be necessary for effective examination of the management, operation and maintenance, institutional and socio-economic aspects of the project with a view to ensuring that the project is properly rehabilitated and improved performance guaranteed

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Chapter Four: CURRENT SYSTEM PERFORMANCE.

4.1 Organisation and Management.

The Sokoto Rima River Basin Development Authority (SRRBDA) with headquarters in Sokoto manages the BIP through an intern management team headed by a project manager and based in Talata Mafara town, some 110 km east of Sokoto town. The Authority is mandated to operate and maintain the irrigation and to collect fees from the farmers to complement government subventions to project operation and maintenance. It has also provided a Tractor Hire Service (THS) in the past to the participating farmers on the project, though owing to lack of funds for maintaining these tractors, the THS has seized since.

The BIP management also provided extension services during the early years of the project with series of operational difficulties such as transportation. This service was however suspended in 1986 following the rationalisation of the River Basin Development Authorities that disengaged them from direct production.

4.2 Planning, Design and Construction of BIP.

The familiarity visit to BIP also gave me another opportunity to visit a number of other public irrigation schemes within the Zone under study (the Sahelian Zone). The schemes visited include The Kano River Irrigation

Project - Phase I (KRIP) (in Kano State) and the Jibiya Dam and Irrigation Project (in Katsina State).

These visits actually confirmed that some of the existing first generation public irrigation schemes in Nigeria were well designed and well constructed, like the BIP. The major problem hindering satisfactory performances in almost all existing (and currently operational) public irrigation schemes in Nigeria are found to fall either in one, combination or all of the following:

Fig. 2. Part of the project area before development started. (Source: SRRBDA, 1983)

i. Operational Problems.
ii. Maintenance Problems.
iii. Institutional Problems

iv. Problems Associated with Marketing of Farm Produce, and,

v. Problems related to General Management of the Schemes.

Fig. 3. Aerial view of crops growing in the area equipped for surface irrigation. Source: SRRBDA, 1983)

The BIP falls in to the category of schemes that virtually has almost all of the problems listed above, particularly when the sprinkler system area is included.

The specific problems as identified in the area of surface irrigation system of the project are as discussed below.

4.3 Operation of the 8000 hectare Gravity Irrigation System of the BIP.

It would appear that most public irrigation schemes in Nigeria are poorly operated and maintained (ACS, 1999), as evident in the BIP. There were no signs that irrigation scheduling had been carried out in any systematic way, as water is being released most of the times for twenty-four hours, whether there is need for that or not. Furthermore, non of the intake officers (responsible for operating all the secondary canals) who have completed the questionnaire knows how much water his canal is carrying.

Fig 4, Rice growing under good irrigation facilities: (Source. SRRBDA, 1983)

This regime of operation provide farmers the opportunity of having water far in excess of their actual requirements. The results in poor on-farm water management practices and low water use efficiency. These problems

coupled with poor drainage facilities on the project combined together to cause water logging, which has already rendered a substantial part of the gravity irrigation area uncultivable.

Operation of irrigation systems generally is an inter-connected activity on the field. It is related to the management, funding, maintenance, institutional, social and environmental aspect of the project. These areas must be systematically and satisfactorily aligned before successful operation begins. For example, the release of water to the field in the BIP for dry season farming depends on the satisfactory payment of water rates by farmers to the Agency. Unless or otherwise the Authority is satisfied with level of payment, water will not be released for farming activities.

These issues as affect operation of the system are examined and possible suggestions towards effective solutions are proffered at appropriate places. A brief look at operational activities on the area serviced by the sprinkler system is also presented.

4.3.1 Operation Manual of the Project.

Manuals for the satisfactory operation of completed irrigation projects are unavoidable tools for successful scheme performance. As at the time of visit, no manual for operating this project was available either in the offices of the BIP or in the headquarters of the SRRBDA, nor did the any of the staff (that completed the questionnaire) had any. This implies that operation was left to the imagination or judgement of the operators, (who might not have

any technical training), or to the week skills that would have been passed on to the present operators from their fist generation colleagues.

It is strongly recommended that the SRRBDA - as a matter of urgency - ask from the contractor that constructed the scheme to make available these manuals to the Authority. Arrangements should also be made to educate the existing staff on the use of these manuals on delivery. This way, proper operation of this scheme can be relatively guaranteed.

4.3.2 Silt-Build ups.

Although the irrigation and drainage facilities are over twenty (20) years old, all the secondary canals, tertiary and field ditches (of about 900 km long put together) were found to have the problems of silt-build up. Recently, the Federal Government had approved the contract for the maintenance of the concrete lined supply canal (of 15 km) and two main canals (of 45 km). There is therefore no major problem with these canals

The attendant result of this heavily silted up distribution system is reduced carrying capacity, which will again require more discharge from the intake to meet up farm water requirements. This translates to un-economic use of water.

The silted drainage facilities are also not left out in complicating matters. They have rendered a vast portion of the project permanently water logged. The result is that irrigating this water logged areas had become impossible,

thereby reducing the land use efficiency of the project.

4.3.3 Manpower Requirement for Operation.

BIP started with a proficient manpower level and rose to a staff strength of 1,300 as at 1987. This has progressively dropped to a lamentable figure of 216 as at the end of 1999 and the majority are watchmen (Adamu, 1999). Engineering and technical staff required to operate the project are seriously lacking. By the end of 1999 for example, there was not a single engineer among the project staff.

This might also have contributed to the deplorable state of the 15,000 hectare sprinkler irrigation system. Out of the 26 pumping stations that were installed and made operational in 1985, not one can actually operate to its original design capacity at this moment. As a result, the system is currently 3.4% utilised (Adamu, 1999).

4.3.4 Possible Solutions.

The possible solutions to these problems are as recommended for the maintenance section below, for operation and maintenance are interwoven activities.

4.4 Maintenance Problem of the Gravity Irrigation System.

Effective and successful maintenance of any engineering system can only be achieved through the maintenance manual of the system usually provided by the manufacturer of that system. Unfortunately, this is also not available either in the offices of BIP or the headquarters of the SRRBDA. The skeletal maintenance procedure on the project is also left to the wisdom or inferences of the project staff or farmers that might not have any technical training to do so.

The Basin Authority should strive to acquire these maintenance manuals and 'procedure in terms of break down' from the manufacturer of this scheme.

Another problem noticed during the visit is the attitude of the farmers towards maintenance of scheme infrastructures. They hardly do anything to maintain distributry or drainage facilities because they are of the opinion that it is the responsibility of the managers of the scheme. This was however, the impression given to the farmers at the beginning of operations of the project.

Although this impression has changed, the Authorities are not doing anything to change this devastating opinion of the farmers. As result, canals and other service facilities are left with their problems of silt build-ups, growing shrubs on embankments of canals, erosion of canal embankments, faulty gates or turn-outs, faulty drainage facilities, etc.

This problem can easily be solved by re-activating the farmers unions and re-orienting the farmers as regards the use and maintenance of the systems, as has been done in KRIP. Only when effective and successful farmer unions are in place can Participatory Irrigation Management (PIM) excel. PIM aims at transferring irrigation management (particularly operation and maintenance) at tertiary levels from the agency to the farmers. This has already been proven to be possible based on the experience from KRIP.

A the beginning of operation at BIP, the contractor was reported to have left a number of maintenance superintendents for the main canal and one each for the secondary canals. Field channels and drains are suppose to be maintained by the farmers. As at today however, there is not a single superintendent left for this purpose.

The employment of qualified personnel for the proper operation of this project may avert the looming danger of bringing this master piece to a halt.

4.5 Institutional Problems in BIP.

There are a number of government institutions involved in public irrigation development in Nigeria. These include the Federal Ministry of Water Resources (FMWR), the Federal Ministry of Agriculture and Rural Development (FMARD), the similar State Governments level ministries, and the River Basin Development Authorities (RBDAs). The involvement of so many institutions, often acting independently of each other has led to a fragmented approach to management, organisation and development of schemes.

In BIP for example, farmers relay on the state ministry of agriculture on farm inputs such as fertilisers. The state government provide this inputs in accordance with their programs of the year, irrespective of the plans of the management of the BIP.

The same experience prevails in the area of land preparation for agricultural activities. No matter how prepared the operators of the BIP are, farmers have to wait for tractors either from the state government tractor hiring service or from private individuals offering such services, before operation can start.

For holistic approach to problem solving on our irrigation schemes, it is strongly recommended that management of public irrigation schemes - under the present dispensation - can be best conducted by one and the same organisation, and the RBDAs appear most feasible do this. The review of the current regime in which the RBDAs are operating also deserves critical attention, such that they can play effective management role of on these schemes: the execution of those complementary operational activities like land preparation, extension services, etc, in addition to the operation and maintenance of major project facilities.

4.6 Environmental Impact of the BIP.

Although the environmental impact assessment carried out for BIP before inception is not available, the following observations were made:

a. Soil conditions.

Interviews and interaction with the project managers reveal that *no soil* analysis was ever carried out from the last time it was conducted during preliminary surveys for the project. After about 25 years of cultivating almost the same crop on the same land, depletion of soil fertility cannot be completely out of the way, particularly when ertiliser usage is low, as indicated by farmers who completed the ionnaire.

re, vegetation is constantly being cleared for fuel wood environment susceptible to erosion that is visible around

s have already been discussed above.

tation, aquatic weeds and agricultural

ct staff that have completed the

doing nothing about the problems.

facilities (like

a. People are

therefore obliged to urinate or even defecate in the open. Canal embankments are sometimes used for this purpose. These faeces are easily washed in to canals during rainy season, and as canal water is used for drinking, washing and bathing on this project, water related diseases such as diarrhoea, dysentery, cholera, bilharziasis, guinea worm etc are widespread. The farmers also complained of incessant malaria infections

4.7 Socio-Political Problems

Right from the construction stage, a very serious socio-political problem erupted in 1979, which led to Bakolori Crisis, during which many lives were lost (Adamu, 1999). The dam reservoir alone as planned covers 8,000 hectares of land. For it to be in place, 2,868 households had to loose their homes. Other disadvantaged group of people were those who lost their homes and farm plots to other irrigation infrastructure of the project. These groups were the most disadvantaged. Although compensation is always paid to those who loose land, this is only for the loss of crops, economic trees and other improvements, and not for the value of the land itself. This approach has been frequent source of grievance. This grievance is usually carried on for along period of time in the history of irrigation schemes in Nigeria.

For this purpose, the farmers that were expected to pioneer operation on the project did every thing to resist it. Authorities on their part, for the purpose of encouraging and inspiring the farmers to accept and participate in the

activities of the project, had to offer virtually free services to the farmers as incentives. Land preparation, provision of improved seedlings, fertiliser, etc all have been provided for free.

It is for this reason any attempt by the Authority to collect revenue of any kind is met with vehement resistance. The currently charged N2,000:00/hectare/irrigation season is not being responded to adequately.

The solution to this problem once again is an effective and well-oriented farmer organisation.

Chapter Five: CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions.

General.

It has been observed that the development of irrigation and drainage development in Nigeria has proceeded in an ad hoc manner, without clear-cut policy from the government.

Furthermore, most of the RBDAs visited hardly keep any form of manual, either for the operation or for the maintenance of their schemes. Targets and performance indicators for the purposes of evaluating overall scheme performance are also hardly available.

It has also been seen that the SRRBDA and the BIP management in particular lack sufficient and qualified staff to properly manage this edifice.

From the results of the interviews conducted on the BIP, shows a strong indication that the farmers are not properly involved in the scheme operation and maintenance, a very important factor for scheme sustainability. The BIP management is apparently not responsible for the provision of farm inputs or assisting the farmers in the procurement of credit facilities from financial institutions.

Proper marketing procedure for agricultural products is also lacking. Farmers are left to the mercy of market forces that are usually unfavourable to them.

5.2 Recommendations.

Sustainable irrigated agriculture means:

a. Getting policies right. It is strongly recommended that government should decide - as a matter of urgency - the policy it wishes to pursue and device a workable strategy for implementing it. This should reflect strong concerns over social equity and economic efficiency, as well as transparency and accountability.

It should list and describe any legislation that may be required for the policy to be put in practice and place a time frame for this. The legislation might include for example, a new Water Act that includes specific provisions for the legal establishment of Water Users' Associations. Land tenure arrangement in this legislation should, as far as possible, favour the farmer. It should also include the gradual transfer of public irrigation infrastructures to private ownership.

This way it is expected, farmers will begin to see and treat irrigation and drainage facilities as their own property and treat it as such, without depending on government subventions that may never come for one reason or the other.

b. Reducing Land and Water Degradation. The need to restore active productivity and prevent degradation of our agricultural fields cannot be overemphasized. Soil erosion, salinisation, soil and water pollution and loss of soil fertility are critical issues of utmost concern.

c. River Basin Development Authorities - as a matter of urgency - should provide working manuals for the operation, maintenance and even procedure in terms of break down for all their irrigation systems without such manuals. Only in this way can these schemes be properly operated and maintained.

d. Occasional training of project managers and other staff of irrigation schemes on a regular basis cannot be overemphasised. Their managerial skills and technical know-how will be up-dated and new skills or technologies acquired.