Federal Ministry of Water Resources

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

Review of The Public Irrigation Sector In Nigeria

STATUS REPORT

Volume I – Main Report

ENPLAN GROUP

November, 2004

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Report No: 0026/TF/NIR/CPA/27277-2002/TCOT

Table of Contents

CURRENCY EQUIVALENT
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ACRONYMS

ADB	African Development Bank
ADP	Agricultural Development Programme
AIRBDA	Anambra Imo River Basin Development Authority
AMP	Assets Management Plan
APC	Afri-Projects Consortium
APMEU	Agricultural Projects Monitoring and Evaluation Unit
BOT	Build-Operate-Transfer
BPE	Bureau of Public Enterprises
CBDA	Chad Basin Development Authority
CRBDA	Cross River Basin Development Authority
DDRO	Department of Dams and Reservoir Operation
DID	Department of Irrigation and Drainage, same as FDID
EEC	European Economic Community
FAO	Food and Agriculture Organization
FDID	Federal Department of Irrigation and Drainage, same as DID
FEPA	Federal Environmental Protection Agency
FGN	Federal Government of Nigeria
FMA	Fadama Management Agency
FMARD	Federal Ministry of Agriculture and Rural Development
FMEnv	Federal Ministry of Environment
FMWR	Federal Ministry of Water Resources
FUA	Fadama Users Association
HJRBDA	Hadejia Jama'Are River Basin Development Authority
IA	Irrigated Agriculture
IAR	Institute for Agricultural Research
ICT	Information and Communication Technology
I & D	Irrigation and Drainage
IBRD	International Bank for Reconstruction and Development
ICID	International Commission on Irrigation and Drainage
ICMP	Integrated Catchment Management Plan
IEC	International Executive Council
IMA	Irrigation Management Agency
IMT	Irrigation Management Transfer
IUCN	International Union for Conservation of Nature
IWD	Inland Waterways Department
LBRBDA	Lower Benue River Basin Development Authority
LCBC	Lake Chad Basin Commission
LCRI	Lake Chad Research Institute
LNRBDA	Lower Niger River Basin Development Authority
MARD	Ministry of Agriculture and Rural Development
MOH	Ministry of Health
MWR	Ministry of Water Resources
NAERLS	National Agricultural Extension and Research Liaison Services

NAP	National Agricultural Policy
NBA	Niger Basin Authority
NCRI	National Cereals Research Institute
NCWR	National Council on Water Resources
NDBDA	Niger Delta Basin Development Authority
NEPA	National Electric Power Authority
NGO	Non-Government Organization
NIDP	National Irrigation and Drainage Policy
NIHORT	Nigerian Institute for Horticultural and Research (& Training)
NIWA	National Inland Waterways Authority
NNJC	Nigeria/Niger Joint Commission
NTCWR	National Technical Committee on Water Resources
NWRI	National Water Resources Institute
NWRP	National Water Resources Policy
O & M	Operation and Maintenance
OORBDA	Ogun Oshun River Basin Development Authority
PIM	Participatory Irrigation Management
PMO	Project Management Organisation
PPSPIDM	Policy on Private Sector Participation in Irrigation Development and Management
PSAMP	Private Sector Assets Management Partner
PTF	Petroleum Trust Fund
RBDA	River Basin Development Authority
ROPISIN	Review of Public Irrigation Sector in Nigeria
SEPA	State Environmental Protection Agency
SID	State Irrigation Department
SMO	Scheme Management Organisation
SRRBDA	Sokoto Rima River Basin Development Authority
UBRBDA	Upper Benue River Basin Development Authority
UNEP	United Nations Environment Program
UNRBDA	Upper Niger River Basin Development Authority
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WB	World Bank
WUA	Water Users Association

PREFACE

This Status Report of the public irrigation sector was carried out to comprehensively assess the status of selected public irrigation sector schemes covering the whole of Nigeria. The output of this status report review will assist the FAO in the preparation of a review of the Public Irrigation Sector and pave the way for the preparation of the National Irrigation Policy and Strategy.

Some state schemes, private schemes as well as some Fadama (low lying flood plains) schemes were also reviewed taking into consideration the fact that an irrigation and drainage policy will affect these schemes as well.

Much was learnt from the review of the schemes, the most important being the abandonment of many of the schemes where little or no irrigation was going on.

This report is a consolidated report that summarises, the finding of the review of the individual schemes and gives suggestions for improvement where warranted. The individual scheme reports are contained in Volume II to this report.

To give a broader understanding of the public irrigation sector in Nigeria, it was found necessary to carry out some specialist studies. These specialist reviews included Dam Safety Appraisal of dams that are the headworks of irrigation schemes, soil fertility, socio-economic status, environmental impact, farm equipment machinery and plant, land ownership, financial management, irrigation institutions and policy. The output of these specialist reviews are summarised in this report and the individual reports are presented in Volume III to this report.

During the field trips, we were overwhelmed by the help we received from many professional people, organisations especially the RBDAs, farmers and other irrigation stakeholders and are sincerely grateful.

Special thanks to Mr. Tim Stephens for his guidance on the review study right from the onset, to Guy Sneyers despite his busy schedule still creating time to review constraints to the smooth running of the review and solutions to overcome them and to Mr. Jacob Burke for his overall direction.

Our sincere gratitude to the Minister of Water Resources, the Director of Irrigation and Drainage, the Project Coordinator, members of the Department of Irrigation and Drainage and most of all to our colleagues that make up the Peer Group.

Finally, this work is dedicated to the memory of one of our colleagues: Dr. S.A. Ogunwale, Team Leader of the North West Zone who lost his life to armed robbers whilst on this review study.

SUMMARY

Overall Status.

- The public irrigation sector in Nigeria accounts for 13% of the irrigated area and an estimated 0.25% of total agricultural area. Table A shows data for 1991, 1996, 2000 and 2004. The area under irrigation appears to have stabilised but this is still far short of planned areas and only a third of the actually equipped area.
- The overall capital cost of these schemes is estimated at ₦170billion. Maintenance and operational costs to sustain the schemes is estimated at N2.0billion annually.
- The Federal Government's budget allocations to these schemes do not cover this amount. Private contributions are limited to individual farm inputs.
- The agricultural contribution from this irrigated area is estimated at 95,000 tonnes of grains and 105,000 tonnes of vegetables, which represents 0.9% and 2.3% respectively of the total national agricultural production for grains and vegetables.
- The overall state of the 62 public irrigation schemes surveyed in this report is generally poor, although there are some 'bright spots' especially the interest and commitment of the farmers in a few of the schemes.
- The hydraulic infrastructure are dilapidated in most of the schemes with many pumps in need of repair/replacement and conveyance structures damaged or deteriorated, weed infested and silted up.
- The life of some structures especially the larger headworks have been prolonged as a result of the good/over-design and under utilisation.
- Some 3 schemes account for 90% of the irrigated area and many of the smaller schemes in the south of the country are effectively non-operational whilst some of the larger schemes are still active but operating at low level capacities, and low cropping intensities.

Table A: Structure of Nigerian Irrigation

Scheme Grouping	[1]2000 Planned Irrigable Area (ha)	[2]2004 Planned Irrigable Area (ha)	Area Equipped for Irrigation (ha)		Area Actually Under Irrigation (ha)			
			[1]2000	[2]2004	[1]1990-91	[1]1995-96	[1]1999-2000	2003-2004
RBDA Schemes								
Anambra-Imo	11,300	11,450	3,936	3941	3,850	0	15	10
Benin-Owena	7,455	10,380	831	317	0	402	5	0
Chad Basin	106,630	101,900	27,500	26,180	15,500	2,250	1,650	1000
Cross River	717	8,477	717	364	0	72	42	40
Hadejia Jama'Are	83,700	40,500	21,045	18,475	14,000	12,925	16,930	21,000
Lower Benue	10,700	12,215	880	1,310	125	137	30	70
Niger Delta	7,250	6,850	722	187	100	0	53	0
Lower Niger	9,510	16,577	1,615	1,344	400	373	230	115
Upper Niger	3,485	53,895	2,928	3,697	{[5]}	310	345	722
Ogun-Osun	33,679	28,574	6,328	512	140	132	152	110
Sokoto Rima	52,812	62,390	15,445	27,580	11,000	0	6,180	5,290
Upper Benue	58,000	63,200	7,550	8,410	6,150	7,230	3,860	783
Sub Total	397,238	416,408	89,497	92,317	51,265	23,831	29,492	29,140
% Planned		100%	21%	22%	12%	6%	7%	7%
% Developed				100%	53%	24%	30%	30%
State Irrigation Schemes	16,000	16,000	12,200	12,200	6,900	n/a.	6,000 e	6,700e
Private Sector :								
Bacita Sugar	9,000	9,000	5,600	5,600	5,000	7,000	3,000 e	0
Savannah Sugar[3]	(12,000)	(12,000)	(7,000)	(7000)	(6,000)	(5,500)	(3,200)	(500)
Other :								
Fadama[4]	55,000	55,000	55,000	55,000	18,000	30,000	55,000	55,000
Private Small Scale	128,000	128,000	128,000	128,000	128,000	128,000	128,000	128,000
Totals (ha)	**605,238**	**624,408**	**290,297**	**293,117**	**209,165**	**n/a**	**221,492**	**218,840**

Notes:
1, FAO: Irrigation Sub sector Study (Nigeria), September 2000, unless otherwise specified.
2, FMWR 2004 estimates for planned and developed
3, Savannah Sugar Company data included in Upper Benue RBDA
4, Fadama figures from the World Bank Appraisal (Feb 1992) and the later ICR (April 2000) of the National Fadama Development Project – ICR figures not verified in the field and based on number of pumps distributed.
5, Lower and Upper Niger one RBDA in 1991
"e" refers to estimated figures; n/a., information not available and estimate not possible. Recession and moisture retention farming excluded.

The ranking of schemes and the application of criteria.

- 62 public schemes financed by federal funds were surveyed and were ranked according to their level of performance. In addition10 public schemes, 7 state schemes, 2 private schemes and a general review of the World Bank assisted National Fadama Development Programme (NFDPI) in the 11 northern states were included;
- The 62 schemes were ranked according to their potential for quick response to intervention, rice production and capacity to be privatised.
- Criteria to rank the schemes were based on technical, agricultural, socio-economic, location and environmental factors;
- The preliminary ranked list of schemes indicate that 12 schemes with a developed area of 52,581ha (planned area 105,946ha) could respond more quickly to rehabilitation/intervention investment through the repair of the hydraulic structures and facilities, improved water management and institutional development;
- 5 schemes with a developed area of 3,990ha (planned area 82,150ha) could be transferred to the private sector as going concerns;

- 5 schemes with a developed area of 7,380ha (planned area of 17,230ha) have potential to be developed for large scale mechanised rice production;
- 38 schemes are moribund and in poor state of disrepair and are only under rainfed cultivation;
- 4 of the 62 schemes have not been built and are still on the drawing board;
- Most of the schemes that are still active are located in close proximity to urban centres where there are markets for the products of irrigated agriculture;
- The schemes with farmer occupier land tenure system are performing better than those with user allocation land tenure system.

The role of WUAs and extension.

- The Water Users Associations (WUAs) or Farmers' Associations in whatever form rarely exist in most of the schemes and when they do, they are neither not effective nor active. However, it is recognised that there is considerable scope for local communities to be empowered in their economic engagement with the irrigation schemes;
- The ADPs and SIDs thought to provide the necessary extension services to the public irrigation sector are not geared toward large scale irrigation nor setup to accept the additional area of responsibility;
- There is a consultative/communication gap between the beneficiaries and stakeholder communities and developers (FGN and State);
- The ability and participation of the stakeholder communities to operate, manage and sustain public sector irrigation schemes is low;
- It was observed that women are actively involved in post harvest activities, but not much involved in other aspects of the public irrigation sector.

Cost-recovery

- Most of the beneficiaries do not pay for water delivery and water charges are too low to meet the cost of water delivery.
- The inadequate pricing is responsible for the cycle of poor services leading to lack of willingness to pay by the user.

The state of information flows

- The information flow between policy, planning and budgeting for public irrigation is dysfunctional and not effective. Most often policy directives are not matched by corresponding budgetary allocations/releases.
- This review collected a lot of data, however most of the data available is design data; actual as-built information are rarely available.
- Data on operation and maintenance, farm inputs, yields, cost of produce are limited and when available, unreliable;
- There is no central federal repository of updated information on these public investments.

Technology choices

- 84% of the public irrigation schemes use pumps, which are old, unreliable and require a lot of energy;
- The farmers have not been able to adapt to the sprinkler systems which make up 19% of the public sector schemes.

The present role of irrigation institutions (the RBDAs, FMWR, SID, ADP)

- FMWR is the federal ministry responsible for the formulation and implementation of the water resources masterplan for irrigation development amongst others in Nigeria;
- FMARD has the responsibility for crop production, Fadama irrigation and extension services, however there is no clear interface and good cooperation/collaboration between the FMWR and the FMARD;
- The RBDAs are responsible for the comprehensive development of both surface and groundwater resources for irrigation amongst others;
- The SIDs are responsible for the implementation of the irrigation plans and activities of the state and local governments;
- ADPs are responsible for the establishment of farmer owned and managed irrigation mainly in Fadama areas and the provision of extension services;
- SIDs and the SWAs appear to compete with the RBDAs for the control of the water resources and in some States they complement each others efforts;
- Other institutions involved in the public irrigation include NWRI, IITA, IAR, NCRI, LCRI, NSDC, NAERLS etc.

Operation and Maintenance

- The RBDAs have not been able to develop the full potential and maintain the areas originally developed for the schemes due to poor maintenance and water delivery, weak technical and management capacity and technical deficiencies in the infrastructure;
- Most RBDAs even when willing to, have neither the resources nor the capacity to perform the necessary operation, maintenance and management;
- Recent funding constraints have further contributed to the low capacity for operation and management and this has particularly affected the downstream irrigation facilities;
- At the scheme level, there is no clear direction regarding crop production because there is no effective linkage between agriculture (FMARD) and water (FMWR).

Key environmental issues

- It was observed that there was no environmental impact assessment at the onset of most of the schemes and also no effective implementation monitoring and evaluation;

- Some schemes that had environmental impact assessment/studies carried out often do not implement suggested mitigation measure as funds are not budgeted nor provided for such measures;

Legislation

- The legislation for farmers cooperatives as existing is too general for the registration and legal identification of WUAs;
- The 1978 Land Use Decree vests all lands in the State Governments and it is mandatory that ownership of Agricultural Lands is registered with the Local Government and certified by a customary right of occupancy;
- Existing legislation for irrigation, in particular water rights is not currently enforced.

1. INTRODUCTION

1.1 General

This is a Status Report of the public irrigation sector in Nigeria based on the findings of an investigation of 62 public irrigation schemes. These schemes are under the administration of the River Basin Development Authorities (RBDAs), who are supervised and monitored by the Federal Ministry of Water Resources (FMWR).

During the field appraisal, it was found imperative that to make effective recommendations, a general idea of the status of the state owned and private owned schemes as well as the on-going Fadama Project was necessary. Consequently, 8 state schemes, 2 private schemes and a general review of the World Bank assisted National Fadama Development Programme (NFDPI) in the 11 northern states were reviewed.

1.2 Background

The Federal Government of Nigeria (FGN) and various other international donors and bilateral organizations have invested extensively in the Public Irrigation Sector in Nigeria. However, the sector's performance has not had the anticipated impact on national food security, employment opportunities and economic growth.

The FGN is therefore keen to review the performance of the selected schemes in order to determine a course for future investment in the existing asset base. To undertake the review a Unilateral Trust Fund Agreement between the Federal Ministry of Water Resources (FMWR) on behalf of the FGN and the Food and Agriculture Organization of the United Nations (FAO) was established.

The Review of Public Irrigation Sector in Nigeria (ROPISIN) is a national study of the public irrigation schemes across Nigeria. The purpose of the ROPISIN is to assess the current state of irrigation in each of the selected schemes, analyse the reasons for actual performance and offer recommendations for prospects for improved performance under more appropriate technology and management.

1.3 Status Report Objective

The objective of the Status Report is to prepare a comprehensive assessment of the status of Nigeria's public sector irrigation schemes, prepare a ranking of schemes according to their suitability/responsiveness and make recommendations for improved performance.

The activities carried out to achieve this objective included:-

- Review of existing information on each individual scheme, such as files, reports, other documentation (RBDAs were the principal sources);
- Interpretation and ground verification of satellite imagery;
- Field inspection of all major scheme facilities and documentation of findings (e.g. operating conditions of physical infrastructure, offices, workshop facilities, equipment, repair needs etc);
- Review of scheme administration, operation and maintenance with regard to organization, funding, staffing, effectiveness, etc.;
- Interview of farmers-irrigators on crop production, support services as well as social aspects;
- Review of agricultural schemes performance (cropping patterns, yields, irrigation service conditions etc.);
- Review of input supply situation and produce marketing conditions;
- Review of current participatory irrigation management (PIMs);
- Review of current dam safety and management aspects; and
- Review of the environmental impact of existing schemes.

1.4 Work Outputs

The Status Report builds upon previous work “Nigerian Irrigation Sub-sector Study” by the FAO in 2000. The outputs from the fieldwork include:

- An inventory and assessment of physical scheme infrastructure, such as water resource headworks, canals, canal structures, drains, pumping facilities, piping, vehicles and machinery, workshop and office space, etc.;
- An inventory of scheme performance indicators including water use, agricultural production, social factors, staffing and operation and maintenance expenditure, revenues, etc.;
- An assessment of the potential for taking up irrigation crop production in already developed but presently non-irrigated scheme areas;
- An assessment of the feasibility of technology adjustment, by for instance replacing overhead irrigation by surface (gravity) irrigation in schemes where the former is showing significant difficulties in terms of operating efficiency and sustainability;
- A ranking of schemes on the basis of their estimated economic performance, following a proposed set of interventions (physical as well as ‘soft’);
- An assessment of input supplies and costs and an analysis of actual market conditions for the scheme;
- An assessment of dam safety and management practices;
- An assessment of environmental impact.

1.5 Status Report Format

Details of Status Report presented in four volumes as follows:

Volume I	The Main Report
Volume II	The Appendices (Scheme Reports)
Volume III	The Annexure (Specialist Reports)
Volume IV	The Attachments (Sample Questionnaire)

The Appendices are:

Volume IIA	North East Zone - Scheme Reports Revision 1 (Nov.2004)
Volume IIB	North West Zone - Scheme Reports
Volume IIC	Central Zone - Scheme Reports
Volume IID	South West - Scheme Reports
Volume IIE	South East - Scheme Reports

The Annexure are:

Volume IIIA	Soil Fertility Revision 1 (Nov. 2004)
Volume IIIB	Socio-Economic Assessment
Volume IIIC	Mechanical Plant and Equipment
Volume IIID	Environmental Assessment
Volume IIIE	Dam Safety Assessment
Volume IIIF	Irrigation Institutions
Volume IIIG	Policy and Strategy Assessment Revision 1 (Oct. 2004)
Volume IIIH	Financial Assessment of RBDAs
Volume III I	Land Ownership Review

The Attachments are:

Volume IVA	Structured Questionnaire
Volume IVB	Rapid Appraisal Process Worksheets

2. GENERAL REVIEW BACKGROUND

2.1 The Study Area

The Federal Republic of Nigeria lies between Latitudes 4^0 10' and 13^0 50' North and Longitudes 2^0 15' and 14^0 45' East, occupying an area of approximately 923,770 km^2 (see Figure 2.1).

The climate is governed by the seasonal movement of the inter-tropical convergence zone (ITCZ), which results in a humid south where temperatures range from 24^0C to 28^0 C, and a semi arid north with temperatures ranging from 30^0 C to 35^0C. Under the governance of the ITCZ, rainfall occurs between the months of June and September over the more northerly latitudes (12^0-14^0), lengthening to April to November further south. The annual rainfall varies from over 4000mm in the south east to below 250mm in the extreme north east.

The resultant surface runoff estimated at about 250 billion m^3 per year, is drained across the country via a network of river basins. The four principal surface water basins are the Niger and Benue basin, the Lake Chad basin, the Eastern littoral, made up of Cross River and the Imo River, and the Western littoral, which consists of a number of smaller catchments such as Ogun, Oshun, Benin and Owena basins.

An appreciable amount of the runoff recharges local aquifers and is estimated that over 60 billion m^3 per annum of extractable reserves are generated annually.

They include:

- The large scale FGN schemes generally referred to as the River Basin Development Authority schemes, Public Irrigation Sector schemes;
- The medium scale State Government schemes;
- The small scale informal schemes, and
- The small scale formal schemes popularly referred to as Fadama that now constitute large irrigated areas.

2.2 Public Irrigation Sector Schemes

Most large and medium scale schemes in Nigeria are public sector irrigation schemes. Most have large dams and or pumping facilities, extensive network of conveyance facilities, drains, roads, and appropriate housing for the operators of the schemes.

The list of public irrigation sector schemes, reviewed is given in Table 2.1 while Table 2.2 gives the list of Additional Schemes which include state schemes, private schemes and some other public irrigation sector schemes.

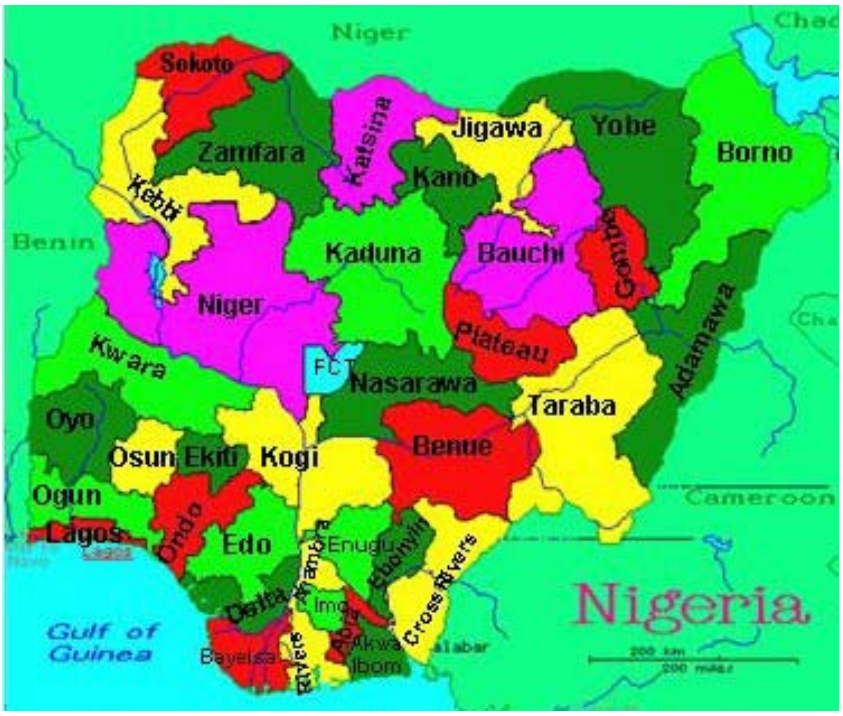


Fig. 2.1 Map of Nigeria

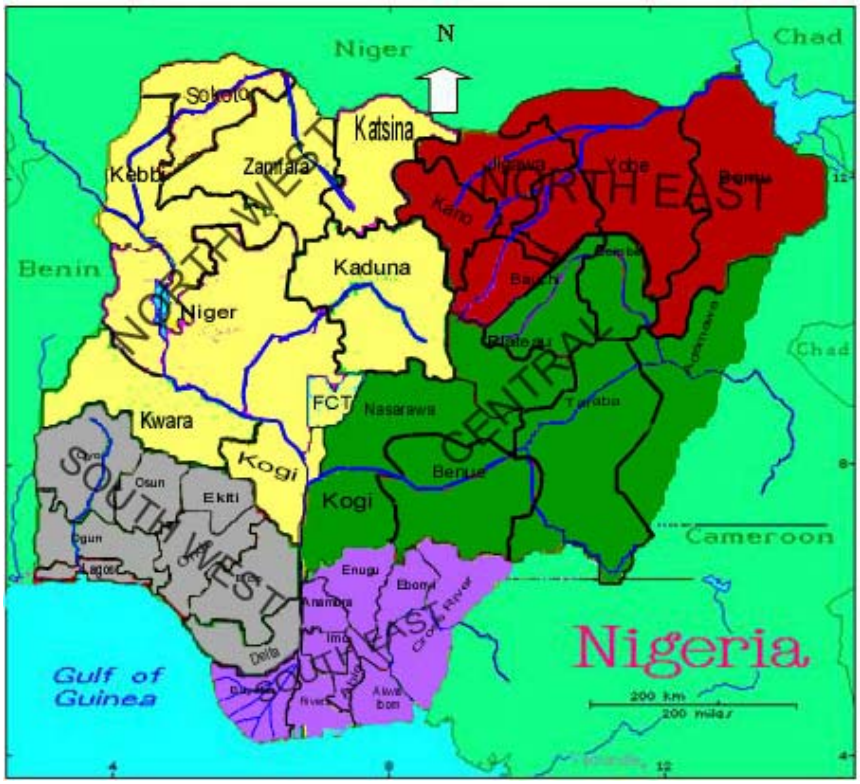


Fig. 2.2 Map of Nigeria showing the ROPISIN Zones

Table 2.1 List of Reviewed Irrigation Schemes

River Basin Authority	Scheme Nos	Name of Scheme
NORTH EAST		
Chad Basin	1	South Chad Irrigation Project (SCIP)
	2	Baga Polder
Hadejia Jama'Are	3	Kano River Irrigation Project Phase I (KRIPI)
	4	Hadejia Valley Project (HVIP)
	5	Jama'Are Valley Project
	6	Kano River Irrigation Project Phase II (KRIPII)
	7	Katagum Irrigation Project
NORTH WEST		
Sokoto Rima	8	Bakolori Irrigation Project (BIP)
	9	Jibiya Irrigation Project
	10	Middle Rima Valley Project (Goronyo)
	11	Zauro Polder Irrigation Project
Lower Niger	12	Kampe Irrigation Project (Omi Dam)
	13	Tada Shonga Irrigation Project
	14	Geriyan Irrigation Project
	15	Erin-Ile/Ajase Irrigation Project
	16	Oke-Oyi Irrigation Project
	17	Kaima Irrigation Project
Upper Niger	18	Swashi Irrigation Project
	19	Tungan Kawo Irrigation Project
	20	Galma Irrigation Project
	21	Suleja (Tafa) Irrigation Project
CENTRAL		
Upper Benue	22	Lake Geriyo Irrigation Project
	23	Dadin Kowa Irrigation Project
	24	Cham Irrigation Project
	25	Waya Irrigation Project
	26	Lower Taraba Irrigation Project
Lower Benue	27	Doma Dam Irrigation Project
	28	Ejule Irrigation Project
	29	Dep River Irrigation Project
	30	Katsina-Ala Irrigation Project
	31	Ofarachi Irrigation Project
	32	Naka Irrigation Project
	33	Bokkos Irrigation Project
	34	Longkat Irrigation Project
	35	Makurdi Irrigation Project
	36	Jato-Aka Irrigation Project
SOUTH WEST		
Ogun Oshun	37	Lower Ogun Irrigation Project (LOIP)
	38	Middle Ogun Irrigation Project (MOIP)
	39	Itoikin Irrigation Project
	40	Ofiki Irrigation Project
	41	Oke Odan Irrigation Project
	42	Sepeterri Irrigation Project
	43	Iwo Irrigation Project
Benin Owena	44	Ukhun-Erha Irrigation Project
	45	Ikere-Ogbese Irrigation Project
	46	Obayantor Irrigation Project
	47	Ilushi-Ega-Otta Irrigation Project
	48	Erusu Irrigation Project
	49	Illah Ebuh Irrigation Project
SOUTH EAST		
Anambra-Imo	50	Lower Anambra Irrigation Project (LAIP)
	51	Imo (Igwu and Ibu) Irrigation Project
	52	Isi Uzo Irrigation Project
Cross River	53	Abak Irrigation Project
	54	Ogoja Irrigation Project
	55	Obudu Irrigation Project
	56	Obubra Irrigation Project
	57	Oniong/Nung Irrigation Project
	58	Ijegu Yala Irrigation Project
Niger Delta	59	Kpong Irrigation Project
	60	Isampou Irrigation Project
	61	Perimabiri Irrigation Project
	62	Kolo Irrigation Project

Table 2.2 List of Additional Irrigation Schemes Reviewed

River Basin Authority	Scheme Nos	Name of Scheme
NORTH EAST		
Hadejia Jama'Are	63	Galala
	64	Watari
	65	Gari
	66	Tomas
NORTH WEST		
Sokoto Rima	67	Warra
	68	Zobe (Garhi)
	69	Sabke
Lower Niger	70	Oloru
Upper Niger	71	Zaria
CENTRAL		
Upper Benue	72	Chouchi
	73	Tallum
	74	Balanga
	75	Savannah Sugar
	76	Savannah Beverages
Lower Benue	77	Oguma
SOUTH WEST		
Benin Owena	78	Ewulu
	79	Ero
SOUTH EAST		
Cross River	80	Itu
Niger Delta	81	Ekporo

2.3 River Basin Development Authorities (RBDAs)

There are currently twelve River Basin Development Authorities (RBDAs). They are responsible for implementing the irrigation development policies of the Federal government. The initial mandate of the RBDAs was rather broad and has since been modified to reflect changing economic realities. Their main functions as outlined in the Federal Government Decree No. 35 of 1987 are as follows:

1. To undertake comprehensive development of both surface and groundwater resources for multipurpose use, with particular emphasis on the provision of irrigation infrastructure, flood and erosion control, and water management;
2. To construct, operate and maintain dams, lakes, polders, wells, irrigation and drainage systems for achievement of the RBDAs functions and to hand over all lands to be cultivated on irrigation schemes to farmers;
3. To supply water from completed storage schemes to all users for a fee to be determined by the RBDA with approval of the Ministry;

4. To construct, operate and maintain infrastructural services such as roads and bridges linking project sites; and
5. To develop and keep up-to-date, a comprehensive water resources masterplan, identifying all water resources requirements, through adequate collection and collation of water resources, water use, socio-economic and environmental data of the River Basins.

2.4 Review Zones

The country was divided into 5 zones: North East, North West, Central, South West and South East which is consistent with the main drainage basins of the country. It also allowed the review to be carried out in time and the zones provided a forum for a greater number of stakeholders to be involved and for the active participation by the farmers. (Figure 2.2 – Map of Nigeria showing the ROPISIN Zones and Figure 2.3 – Map of Nigeria showing locations of the ROPISIN Schemes). Table 2.3 below shows the RBDAs in each of the ROPISIN Zone.

Table 2.3 ROPISIN Zones

Review Zone	RBDA
North East	Chad Basin
	Hadejia Jama'Are
North West	Sokoto Rima
	Upper Niger
	Lower Niger
Central	Upper Benue
	Lower Benue
South West	Ogun Oshun
	Benin Owena
South East	Anambra Imo
	Cross River
	Niger Delta

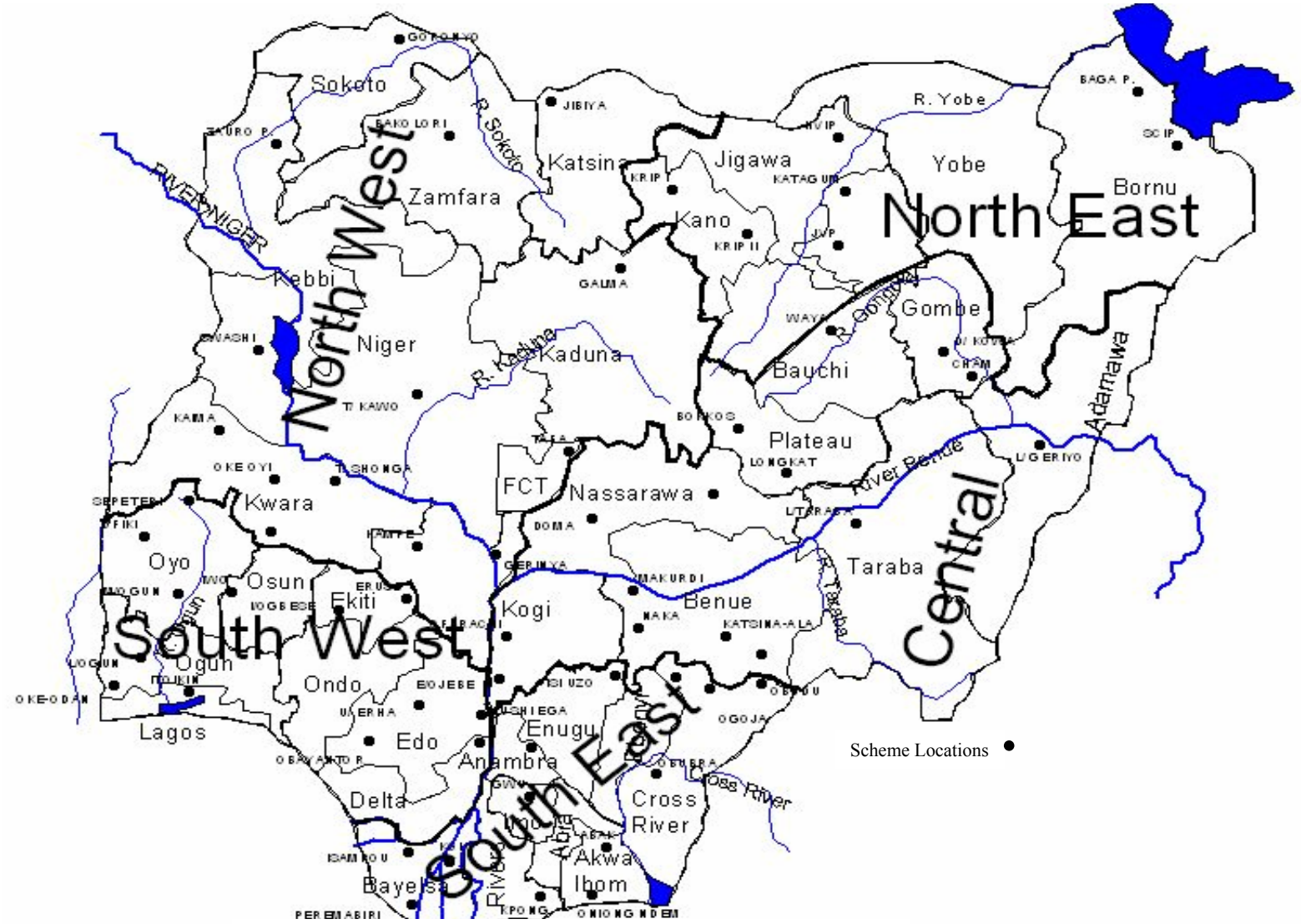


Fig. 3.2 Map of Nigeria showing Scheme Locations

3. METHODOLOGY

3.1 Phasing

The compilation of the Status Report required careful planning in order to correlate the different activities involved. Most of the requirements and activities for the assignments were interdependent and consequently needed careful programming for successful execution.

The review was conducted in phases (Fig. 3.1) and information from both secondary and primary sources were gathered and appraised. Pre-field studies, which commenced with a Pre-inception Workshop, were carried out to familiarize the study team with the scope of ROPISIN.

The rapid appraisal process (RAP) and benchmarking, which allows for a systematic and quick determination of key indicators of an irrigation project was reviewed and accepted by the Resource Persons as the instrument for the assignment.

The first phase of the study was the reconnaissance visit to the study areas, particularly the 12 RBDAs, the Federal Ministry of Water Resources, the Federal Ministry of Agriculture and Rural Development (particularly the PCU), the Federal Ministry of Environment and some selected SIDs and ADPs.

The main purposes of the reconnaissance were to have an idea of the study area, appreciate some of the selected schemes to be studied in the RBDAs, acquire relevant documents and to gather any other information that would enhance the formulation of research instruments and aid the full field investigation. During the reconnaissance study, informal interviews were conducted with officials of the RBDAs, the Federal Ministries and farmers. A list of requirements from the RBDAs was sent out prior to the reconnaissance survey. Some of these materials were made ready by some RBDAs, others brought the materials along to the Inception Workshop. Immediately after the Inception Workshop, the Team Leaders carried out a field test of the RAP at KRIPI.

The second phase of the study was the full field investigation and observations of the selected schemes of the RBDAs. The exercise was comprehensive and was carried out from 1st October 2003 to April 2004. As a precursor to the field investigation, a workshop called the Zonal Workshop in each zone was held. The objective was to sensitize the various stakeholders (including farmers, market traders), enhance their awareness of the ROPISIN and to finalise and present the questionnaire, particularly the RAP, to the stakeholders.

The third phase of the study consisted of the post-field activities and was devoted to the assessment of fieldwork including maps/diagrams, and the drafting of the schemes' status reports.

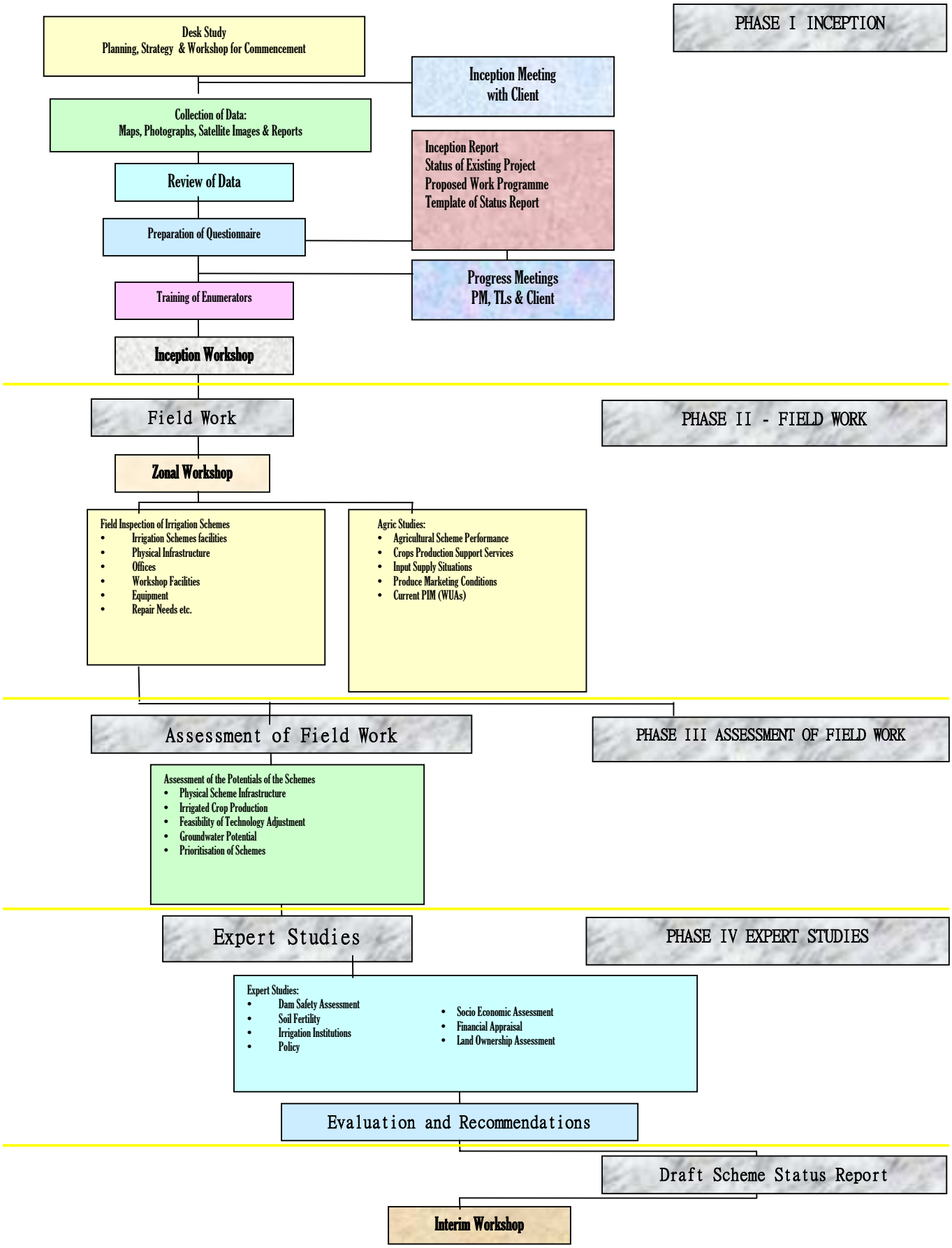


Fig. 3.1 Phases of Status Report Preparation

Agriculture from Project Manager's Perspective

Apart from the background, this had the same content as the farmers' perspective but included a section on the Project Office.

Inventory of plant and equipment of the RBDAs

- Socio-Economic Assessment
- Farm Inputs, Produce and Post Harvest Process
- Participatory Irrigation Management
- Credit facilities
- RBDA Organisation
- RBDA Services

Data Collection (RAP Worksheet) on the Irrigation Schemes

Typical base-line data, such as:

- Total area served
- Climate
- Water supply and source
- Total length of canals, pipelines and drains
- Field sizes
- Crop areas and yields
- Number and size of WUAs
- Budgets

Various institutional constraints

- Methods of collecting water charges
- Existence of WUAs (registration, activeness, effectiveness)
- Availability of labour and cost
- Institutional setup (organisational chart of scheme)

The physical infrastructure for irrigation water delivery

- Designs of associated hydraulic structures
- Canal capabilities
- Flow-rate measurement and control structures
- Communication system
- Density of turnouts

The operation of physical infrastructure

- Frequency of communication
- Promptness of repairs
- Instructions for operating regulating structures
- Water travel time through the system

Service of water delivery at all levels throughout the system, including:

- Service to the main canal from the reservoir or river, or other sources
- Reliability
- Consistency
- Flexibility
- Accuracy
- Main canal service to secondary canals
- Secondary canals service to tertiary canals
- Service to the point where control is turned over to farmers
- Service to individual fields

From the field test of the RAP it was realised that for the RAP to be effective there was need for data to be pre-collected by the relevant agencies. The RBDAs, SIDs and ADPs were sent a list of requirements about 6 weeks prior to the visits to the schemes. The list sent was to form the base-line data required for an effective RAP. During the reconnaissance survey and the Inception Workshop, the RBDAs released some data, however much of the required data were not available and, when available, not in a usable form.

The Zonal Workshop, which preceded the fieldwork, created the forum for clarification of this baseline information. The peer group who were facilitators at the zonal workshops were instrumental in clarifying certain issues.

3.3 Rapid Appraisal Process

Initially the traditional approach – PRA was the tool planned to be used for the review, however, after the field test conducted at KRIP I (HJRBDA) it became obvious that the PRA alone would be intensive and too time consuming. The PRA also tends to examine only portions of the project such as the Water User Associations (WUAs) or the various inputs rather than the project as a whole. Clearly, although time consuming research such as the traditional approach can provide valuable information about irrigation, the period and funding for this review are not extensive enough for this kind of approach.

The appropriateness of the method of assessment cannot be overemphasised because if the various factors in an irrigation project are not understood properly it could lead to wrong conclusions and recommendations being made. For example, Ijir and Burton (1998) noted the central role that management or the lack of it - played in the poor performance of Wurno Irrigation Scheme (State Scheme) in Sokoto State. Similarly, despite all its good intensions, a joint research programme that ran from 1989 to 1992 failed to have any lasting impact as it could not address the issue of poor management by the RBDA.

Therefore it is very important to diagnose the effectiveness of the internal operations to see problems in their true perspective. The evaluation of events according to the level of service provided.

Consequently, there was a need to use a procedure that enables quick decision making whilst being very comprehensive. Hence the RAP was adopted.

The RAP is a process of collection and analysis of data both in the office and on the field. The process examines external inputs and outputs and provides a systemic examination of the hardware and processes used to convey and distribute water internally to all levels within the project. External indicators and internal indicators are developed to provide:

- A baseline of information for comparison against future performance;
- Benchmarking for comparison against other irrigation projects;
- A basis for making specific recommendations for rehabilitation and improvement of water delivery services.

(FAO Rapid Appraisal Process (RAP) and Benchmarking, Explanation and Tools, 2001 http://www.itrc.org/papers/papersindex.html).

4. STATUS OF THE SCHEMES

4.1 General Scheme Conditions

The total planned irrigable area of all the 62 selected review schemes under ROPISIN is 364,592ha out of which 82,205ha are equipped with irrigation facilities. During the review (2003/2004 season) 29,140ha were actually put under irrigation. Of the 29,140ha actually irrigated 73% (21,000 ha) is from the KRIPI and HVIP schemes (Table 4.1 and Fig. 4.1).

The amended decree 35 of 1987 which removed the involvement of the RBDAs in direct agricultural production but restricted their functions to water resource development only has adversely affected the performance of most of the RBDAs on irrigated agriculture as Table A of the summary shows the drastic decline in the actual area cropped from about 52,000ha during the 1990/91 season to about 29,000ha in the 2003/04 season when this review was carried out.

Table 4.1 Irrigation Area (Ha) of the 62 ROPISIN Schemes

RBDAs	*Planned Area (ha)	Developed Area (ha)	Actual Cropped Area (ha) 2003/2004
AIRBDA	5,700	3,941	10
BORBDA	8,795	282	0
CBDA	87,000	24,000	1,000
CRBDA	1212	364	40
HJRBDA	74,860	18,375	**21,000
LBRBDA	11,175	1,170	70
LNRBDA	16,412	1,302	115
NDBDA	6,750	144	0
OORBDA	28,541	485	110
SRRBDA	42,272	27,230	5,290
UBRBDA	50,700	1410	783
UNRBDA	31,175	3,502	722
TOTAL	364,592	**82,205**	**29,140**

* *FMWR, July 2004*

** *The higher values of actual cropped area in HJRBDA is due to the cropping of areas outside the KRIP1 but using irrigation water abstracted from the main canal*

Planned Area – Total potential area commandable by the headworks

Developed Area- Area equipped with irrigation facilities

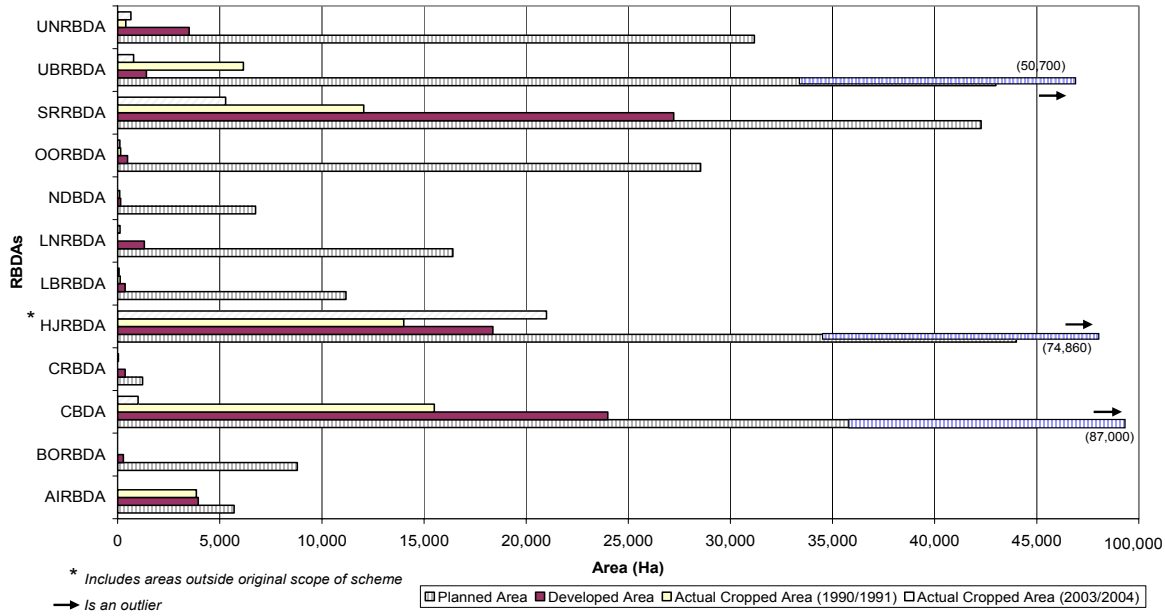
Actual Cropped Area – Area actually cultivated and irrigated

It can be observed that only 23% of the planned area is developed whilst only 8% of the planned area which is 35% of the developed area, was under irrigation during the review period (2003/2004). Taking out the KRIPI and HVIP schemes, which can be considered as outliers, only 2% of the planned area was actually under irrigation during this review. Generally, most of these schemes are old and their infrastructure requires rehabilitation

and in some cases a total replacement of pumping and other equipment. Thus, the RBDAs are a long way from meeting one of their major functions[1].

Most of the schemes reviewed are performing below developed capacity except for the KRIPI and HVIP (HJRBDA). These schemes have recorded actual irrigation being carried out in areas in excess of their developed area. In KRIPI the main canal runs 22km before the project area. Along this section of the main canal an estimated area of about 3,000ha (estimated from satellite imagery) is irrigated on either side of the canal. This area is outside the original scope of the scheme. This situation has also contributed to the inadequate amount of water to the downstream farmers, along with other problems such as siltation/weed infestation leading to the reduction in the conveyance capacity. It should be noted that the capacity of the main canal is for 22,000ha and it is currently providing water for 18,000ha. From the observation of ROPISIN water schedule is not adhered to.

Fig. 4.1 **Irrigation Area (Ha)**



The assessment recommends that:

- *A detailed survey and study be carried out to estimate the area irrigated on either sides of the KRIPI (HJRBDA) main canal before the project area. This area should be incorporated into the scheme formally.*
- *There is a need for proper water management practice for the project taking into account the additional area along the main canal.*

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1 *To undertake comprehensive development of both surface and groundwater resources for multipurpose use, with particular emphasis on the provision of irrigation infrastructure, flood and erosion control, and water management*

4.2 Land and Land Tenure

The land tenure arrangement in the public irrigation sector schemes vary from one RBDA to the other, however there are two distinct systems:

- Farmer Occupier system
- User Allocation system

Farmer occupier tenure system returns the ascertained original farmers holding to the farmer after the development of the scheme less a percentage use for the provision of the basic infrastructural development. In the user allocation system, the RBDA acting on behalf of the FGN acquires the schemes land demarcates the land into irrigable plots or blocks and allocates the plots/blocks to interested farmers usually on seasonal or annual basis for a fixed rate.

The average farm holding varies from zone to zone and within a zone varies from scheme to scheme. In general, most of the schemes have a 0.25ha average farm holding.

In the SE and SW zones land for irrigation is let by the RBDAs per season. Fee for land lease vary from N200/ha/season to N1,200/ha/season. In the SRRBDA schemes of the NW zone, land tenure is the farmer occupier system. In the UNRBDA and LNRBDA of the same zone the land tenure is user allocation except in the Farmer Assisted Schemes[2]. In the Central zone, the UBRBDA land tenure is user allocation and in the LBRBDA the land tenure is farmer occupier except the Doma scheme where the irrigable land has been acquired by the RBDA. In the HJRBDA schemes of the NE zone, the land tenure is farmer occupier whilst in the CBDA the land is user allocation. Table 4.2 below shows the various land tenure systems under each RBDA.

Assessments of field observations have indicated that Government's past involvement with land acquisition has been fraught with difficulties. There have been cases of litigation, (the Kpong integrated Irrigation Farm was abandoned following unrest and court action involving the NDBDA and the community). Some communities have refused to give up their land and compensation disputes have often arisen, as is presently the case at the Abak Irrigation Scheme (CRBDA), and at LAIP (AIBRDA).

Difficulties with re-distribution have also been encountered once the land is developed. Sometimes the original owners become tenants or indeed landless as powerful outside interests are allocated large tracts of farm plots on which they have embarked on medium to large scale production often as absentee farmers. These have created some degree of resentment and mistrust at some schemes where the user allocation system is in practice.

The user allocation system does not encourage the development of the irrigable lands, particularly when the allocation is done on seasonal basis. The farmers have very little

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[2] *Farmer Assisted Schemes are small scale farms where the RBDAs promote double cropping via irrigation through the provision of pumps, land preparation and assistance in obtaining inputs such as seeds and fertilizers*

commitment to the land and the irrigation infrastructure under this arrangement and are often only interested in taking out of the land as much as they can without returning much investment to the soil. This is because they are not sure if they would get any allocation in the following season, and if they do get, they are not sure it would be the same plot. This system operates in most of the schemes and may be a factor leading to the abandonment of the project site whenever conditions are not favourable.

The farmer-occupier system is preferred because it guarantees farmers' investment in the land by keeping the soil productive through effective nutrient improvement and it also encourages operation and maintenance of the schemes' irrigation infrastructure. A farmer sees the land as his under this system and cares for it. However, changes have occurred in the farmer-occupier system. For example, it was discovered that besides the farmer-occupier tenure at KRIPI, hire, loan and inheritance are now common tenure conditions. Of these, the loan system is similar to the user allocation system, except that the loan duration is for a longer period of 3 to 4 years. However what is observed is that the terms of the agreement are often not adhered to by the owner-farmer as the period of the loan is usually for one irrigation season and for a particular crop the tenant farmer is not interested in cultivating. Table 4.2 below shows the various land tenure systems under each RBDA.

Table 4.2 Land Tenure System of the RBDAs

RBDA	Land Tenure System
Chad Basin	User Allocation
Hadejia Jama'Are	Farmer Occupier
Sokoto Rima	Farmer Occupier
Upper Niger	User Allocation
Lower Niger	User Allocation
Upper Benue	User Allocation
*Lower Benue	Farmer Occupier
Ogun Oshun	User Allocation
Benin Owena	User Allocation
Anambra Imo	User Allocation
Cross River	User Allocation
Niger Delta	User Allocation

**Farmer Occupier for all schemes except Doma Irrigation Project*

Clearly, if leases are allocated on an annual or seasonal basis, lessee may find that they are allocated a different plot each year or season, or they may find that they are not allocated a plot at all. This is the present situation on the Lake Geriyo (UBRBDA) and Tomas (Kano State). Even where such an official leasing system is not in operation, informal tenants or sharecroppers face the same insecurity of tenure. Under all these circumstances there is little incentive to invest in the land –for example by applying fertilizer, or by growing nitrogen-fixing crops. Neither is there any incentive for tenants or sharecroppers to become engaged in WUA activities, particularly if it involves the

expenditure of time and labour to maintain canals and the like. Insecurity of land tenure may therefore be an impediment to establishing sustainable WUAs.

The management of the user allocation schemes and also the farmers that loan their farm plots under the farmer occupier system may wish to consider lengthening the allocation/lease period to 5 years or longer (with conditions to ensure proper use) under a firm written agreement.

4.3 Irrigation Infrastructure

4.3.1 General

Of the 62 schemes reviewed, 75% are surface schemes, 19% are sprinkler and the remaining 6% do not have irrigation infrastructure. However, of these schemes with no irrigation infrastructure 50% of them have headworks (dams) in place. Typical scheme characteristics are given in Tables 4.11.1 to 4.11.12. Tables 4.12.1 to 4.12.4 show the positive and negative aspects of some selected schemes. These are representative of all the schemes.

4.3.2 Water Source

35 of the schemes reviewed obtain irrigation water via river abstraction, 20 from reservoir of dams, 5 from lakes and two from boreholes. Conjunctive use does not exist in any of the schemes reviewed. Abstraction is predominantly by pumping using diesel engines with its attendant problems, which include unserviceability of the pumps, lack of spares, high cost of replacement, high-energy consumption and erosion around intake structures.

4.3.3 Surface Scheme

4.3.3.1 Canal System

The total number of surface schemes are 47 out of which 7 are gravity and the rest pumped. The estimated total length of main canals under ROPISIN is 700km of which 70% is lined. Lining is mainly concrete, clay or stone pitching. Most of the concrete linings and stone pitched linings are fairly stable, however, the few schemes that have their main canals lined with clay are severely eroded. 75% of the total lengths of main canals have severely eroded external slopes and need rehabilitation to varying degrees. Siltation of the canals is extensive mostly as a result of canal slope wash out into the system and in some cases banks are destroyed by cattle with the soils often deposited in the canals.

The silt level in the concrete or stone pitched lined canals are generally low and removal of the silt is carried out either by mechanical or manual means. In the unlined canals the silt level is relatively high. Weed infestation in the canal system is highest where there is a full gravity system but in the pumped schemes weed infestation in the canal system is generally low.

Most of the cross regulators in the main canals of the schemes are the manual sluice gate type. Flow into secondary canals can be measured by using rating curves however; measuring gauges to determine water depth for measurement are missing or unreadable where they exist. Thus there are no records of actual flow into the canal systems.

There are 1,200km of secondary/sub canals. Most of the secondary canals are not lined. Their embankments are mostly eroded.

In the larger schemes (>1,000ha) there are tertiary canals and field canals. Most of the smaller schemes do not have tertiary canals but the fields get their water direct from the secondary/sub-canals. The embankments of most of the tertiary canals are also eroded.

Method of water delivery to the fields is predominantly by turnouts usually 4" asbestos or upvc pipes or plastic siphon tubes usually of 3" diameter.

4.3.3.2 Drainage System

Most of the schemes studied under ROPISIN have drainage systems but most of these systems are either silted up or overgrown with weeds. This indicates that both the farmers and operatives pay little attention to the maintenance of the drainage systems. This has led to water logging and salinity in certain schemes notably KRIPI (HJRBDA) and has resulted in low yields recorded or total abandonment of some parts of the schemes notably at Oniong/Nung (CRBDA). Also common was the erosion of the link between the tail ends of the canals and the drainage system.

In Bakolori (SRRBDA) and KRIPI (HJRBDA) schemes a common feature is water logging which is caused by insufficient drainage capacity in addition to improper water management. In these schemes and many others, rehabilitation and new construction of the drainage systems are needed.

All the major drainage channels in the schemes were designed trapezoidal in cross section and were constructed as such, however as result of erosion of the drainage side slopes and the lack of maintenance, they now have virtually irregular shapes, wider channel width and much shallower than originally designed.

In some of the schemes such as the Itoikin and KRIPI farmers use 2" and 3" petrol driven pumps to lift water from some of these drains to irrigate their vegetable farms.

4.3.3.3 Sprinkler System

Twelve of the schemes under ROPISIN are sprinkler irrigation systems of which 2 are combined sprinkler and surface systems (Bakolori and KRIPII).

In the late 1970s and early 80s, the sprinkler systems appeared very attractive for the development of the large scale public irrigation sector schemes due to the fact that they were seen to be partially more efficient, use less labour than surface irrigation and energy costs were low. It also has the advantage of being independent of the variable soil and topography. In some cases the sprinklers where necessitated by the kind of

loans taken for the development of the schemes which required high imports for credit guaranteed loans that had lower interest rates. However, only one (Bakolori) was constructed to completion while others were partially constructed or served as demonstration plots of less than 50ha.

During the operation of these schemes, it became apparent that the technology was not easily adaptable by the farmers involved in these schemes and the equipment were often pilfered and smelted to make household utensils. The electro-mechanical equipment broke down often due to lack of maintenance and needed replacement parts which were not readily available in the country. Spares and replacement costs are high as these items had to be imported into the country and energy prices increased too.

The sprinkler irrigation systems have now been found to be difficult to manage and maintain and these systems are being converted into gravity systems in schemes where this is feasible.

4.4 Major Crops

The major crops put under irrigation in the ROPISIN schemes during the review (2003/2004) include:

- Wheat, rice and tomato in the NE and NW zones;
- Rice in the Central zone;
- Maize in the SW zone and
- Vegetables in the SE zone.

All zones irrigate various vegetables as a second crop.

In the SE zone, 50ha of vegetables was put under cultivation during ROPISIN. The design crop for most of the schemes in the zone is rice which is found appropriate, however, due to non reliability in the irrigation water supply caused by frequent breakdown of the pumping equipment and lack of fuel or its high costs to power the pumps, the farmers have resorted to vegetable cultivation as this requires less water, has shorter growing duration and does well with residual moisture.

In the SW zone, maize and vegetables are the predominant crops with 80ha of maize irrigated and 30ha of vegetables. The design crop for Itoikin (OORBDA) of the SW zone is rice whilst for LOIP (OORBDA) is maize and vegetables. As a result of the reduction in yield at Itoikin (OORBDA) from about 3.5 tonnes/ha to 0.5 tonnes/ha purported to have been caused by change in soil status, the farmers changed crops to maize and vegetable.

In the Central zone, 353ha was cropped with 163 ha to rice, 8ha to Irish potatoes, 62ha to vegetables and 120ha to tomato. The design crop for most of the schemes in the central zone was rice, except Doma (LNRBDA), which was for vegetables. However, due to the uncertainty in irrigation water supply as a result of the high cost of energy and unreliability of the pumps at these schemes, other crops like irish potatoes and vegetables were cultivated. The pumps generally are the hydraflo pumps which are old and have become unserviceable.

In the LNRBDA of the NW zone, 115ha were actually irrigated, with maize 60 ha and vegetables 55ha. The major design crops for the Kampe River irrigation scheme are sugarcane and maize, in Tada Shonga rice and in the farmer assisted schemes vegetables. In the UNRBDA 722ha was cropped, 600ha to rice, 42ha to maize and 80ha to vegetables. The major schemes in this zone are still growing their design crops.

The area cropped was 5,290 ha in the SRRBDA during the review period, of this amount 5,000 ha was grown to rice, 170 ha to wheat whilst 120ha to vegetables.

In the NE zone, 5,856 ha were planted with wheat, 4,760 ha with maize, 5,878 ha with tomato, 2,400ha to onions, 1,566 ha of vegetables with 1,540 ha left to fallow.

The major crops designed for the schemes are appropriate however; the changes that have been observed in major crops planted during ROPISIN are due to:

- Economy: the farmers would rather plant crops that will give them more money;
- Change in soil: reduced yields have caused the farmers to plant other crops;
- Operational problems: long duration crops will involve more water and higher energy cost by the RBDAs;
- Marketability: the farmers want the quickest and easiest means to sell their produce and use the local markets;
- Scarcity: Lack of and high cost of farm inputs for example seeds, fertilizers and chemicals;
- Diseases: some crops are more prone to diseases than others.

Table 4.3 below gives the zonal crop production pattern.

Table 4.3 Zonal Production Pattern for the 2003/2004 Season

Crop / Zone	Wheat (ha)	Rice (ha)	Maize (ha)	Vegetable (ha)	Onion (ha)	Tomato (ha)	Irish Potato (ha)	Sugar Cane (ha)	Fallow (ha)	Total (ha)
North East	5,856	-	4,760	1,566	2,400	5,878	-	-	1,540	22,000
North West	170	5,600	102	255	-	-	-	-	-	6,127
Central	-	163	-	62	-	120	8	*500	-	853
South West	-	-	80	30	-	-	-	-	-	110
South East	-	-	-	50	-	-	-	-	-	50
Total	6,026	5,763	4,942	1,963	2,400	5,998	8	500	1,540	29,140

** Sugar Cane cropped at Savannah Sugar Company Ltd. Adamawa State*

4.4.1 Crop Yields

Typical yields of the major irrigated crops are:

Wheat 2.0 – 2.5 tonnes per ha
Tomato 8.0 – 15.0 tonnes per ha
Rice 4.0 – 7.0 tonnes per ha
Maize 2.5 – 3.0 tonnes per ha
Onion 20.0 – 25.0 tonnes per ha

Table 4.4 is the comparison of average crop yields in Ghana and Nigeria.

Table 4.4 Average Crop Yields in Nigeria and Ghana

Crop	Average Crop Yield in Tonnes/Ha	
	Nigeria	Ghana[3]
Maize	2.75	2.75
Tomato	11.50	9.40
Rice	5.50	4.60
Onions	22.00	11.50

As can be seen from Table 4.4 the average crop yields are very similar between Ghana and Nigeria.

Typical average[4] annual market value of crops per tonne for the 2003/2004[5] season:

Wheat N78,000/tonne
Tomato N55,000/tonne
Rice N27,000/tonne
Maize N30,000/tonne
Onions N60,000/tonne

4.4.2 Cropping Patterns

Sole cropping was prevalent in the Central, SW and SE zones among the farmers in almost all the schemes where irrigation was carried out during this review period. The typical cropping pattern in the NW is wheat 30% and mixed cropping of groundnut/cowpea and maize/tomato or a mixture of both cover the remaining area. About 10% of the area is usually left fallow. In the NE the cropping pattern is estimated at wheat 30%, maize 25%, tomato 20%, 15% mixed vegetables and 10% fallow.

Sole cropping often results from the way irrigation systems are designed (i.e. basin irrigation for rice) and has the disadvantage that, in the event of a disease outbreak or any other natural disaster, such sole crop farms could be severely affected. Furthermore,

[3] *Performance of large and small scale irrigation schemes in Africa, the case of Ghana (1999)*
[4] *Annual average of monthly values obtained from APMEU for the 2003/2004 season*
[5] *Naira/US Dollar exchange rate N138.00/US$1.00*

if there is any marketing problem such as a sudden change in government policy, especially with respect to importation, the farmers could be affected.

Assessment Recommendations:
In the future designs of irrigation schemes, there should be greater interaction and participation of the host communities and harmonisation of designs with government policies especially with respect to crop production.

4.4.3 Seeds

Generally in all the zones, sources of seeds are from the previous harvest, the open market and some NGOs. In the SW zone the Agric Input Supply Company, (a subsidiary of the State ADPs) assist with the supply of seeds. Apron plus and Fermassan D are popularly used for seed dressing in all zones. Crop residues are sold as animal feed or burnt to form compost.

Whilst the yields obtained in the ROPISIN schemes for maize is about 2.5 tonnes/ha on farms of about 0.25ha, large scale commercial farmers of Zimbabwe harvest some of the highest cereal crop yield in the world regularly topping 10 tonnes/ha on farms larger than 1,000ha. One of the reasons that could be adduced for the generally low yields observed is the use of local/previously-harvested seeds rather than the hybrid varieties which give better yields under irrigation. Irrigation also requires greater investment in the management and input for it to be profitable.

4.5 Soil Fertility

The use of fertilizer for nutrient improvement is common in all zones. However, the review could not establish any zones where field tests had been carried out on a continuous basis, on the effect of fertilizers on crop yield. The most common fertilizers used are urea and NPK. The RBDAs and the state government assist farmers to obtain fertilizers at subsidised rates (about ₦1,500/50kg bag) but very often the fertilizers obtained at these rates are not adequate and the farmers have to buy from the open market at higher rates (about ₦3,000), and face the risk of adulteration and scarcity.

The quantity of fertilizer imported is limited and their importation is mostly carried out by the federal and state governments or their agencies. The shortfall in supply of fertilizers is further compounded by the fact the only fertilizer company in the country National Fertilizers Company located in Rivers State is not functional. The little available fertilizers are poorly distributed as consideration for their allocation is often given to political party stalwarts as a form of settlement and compensation.

Assessment Recommendations:
Government strategy on fertilizer supply should be to ensure maximum capacity utilisation in and the expansion of existing plants, to encourage the establishment of new plants, to encourage the use of local raw materials for fertilizer production and to encourage the use of organic fertilizers by farmers.

Government should provide necessary assistance for the importation of fertilizers. The procurement of fertilizers from both local and international markets should be made at the minimum costs possible while the distribution strategy will be directed at developing input transportation, storage and inventory management systems which minimise distribution costs as well as ensure that inputs get to the demand centres in the right quantity and at the right time.

The responsibility for the procurement of fertilizer to farmers should be transferred to the private sector as rapidly as that sector is able to assume the responsibility. Government will however continue to monitor and regulate prices and quality.

The need to study fertilizer application in the public sector schemes is apparent from the crop yields and soil fertility assessment carried out during the ROPISIN. Cultivation of Nigerian soils without applying fertilizers, especially N and P results in low yields because of the low level of nutrients in the soils in their natural state. On the other hand, continued application of acid based fertilizers such as Ammonium Sulphate or Urea, to soils already afflicted by soil acidity problems would only worsen the problem since every crop has its own characteristic response to soil fertilization and every soil to crop-fertilizer interaction.

Before fertilizer requirements are determined for a given crop on a given soil, soil fertility assessments should be carried out as this will help in determining how much fertilizer should be used to give an optimum yield of the crop. The inability to carry out this assessment at the schemes on a continuous basis probably explains why there is a wide disparity between the projected and actual yields of crops from the schemes and consequently their poor economic and financial performances.

It is recommended that a fertilizer strategy be designed to define the crops to be grown, their areas of coverage in each basin, yield targets and fertilizer requirements to achieve the set targets. The difference between the fertilizer status of a soil and the nutrients requirement of a given crop for a given yield target is the quantity of nutrients to be supplied by the farmer. Crop rotation should also be encouraged.

Furthermore, most of the RBDA headquarters are located where there are higher institutions capable of carrying out soil fertility tests and as such the RBDAs should take advantage of this. For larger schemes with areas more than 5,000ha and those >1,000ha but remote from higher institutions/relevant research centres, soil fertility laboratories should be sited at the schemes (with weather observation station and agronomy laboratories). Cost of these should be about N12.5M each.

4.6 Pests and Diseases

The common pests, the crops they attack and the control measures employed are listed below in Table 4.5. Table 4.6 gives details of common diseases and typical control measures.

Table 4.5 Typical Crop Pests

Crop	***Pests***	***Control Measures***
Rice/wheat	Quaila birds	Scaring
Maize/sugar cane	Rodents, stemborer	Rat bait, pesticide
Tomato	Beetles	Pesticide

Table 4.6 Common Diseases

Crop	***Disease***	***Control measures***
Rice/Wheat	Smut	Removal
Maize/Sugar cane	Downy mildew/smut	Uproot
Tomato	Wilting	Antiviral chemical

Generally, herbicides, pesticides and other agro-chemicals are available and at affordable prices to the farmers. Average cost is about N700/litre in all zones.

It was observed however, that the farmers usually wait until their crops are attacked before taking measures. This can be attributed to the lack of adequate extension services.

Assessment Recommendations:
It is recommended that the farmers should be trained to take preventive measures and not to wait for the crops to be attacked before taking such measures. Preventive measures will reduce the spread of any outbreak of diseases and lower the costs to treat such.

4.7 Water and Land Charges

Water charges range from N500 to N2,500/ha. per season except for the Central zone which range from N6,000 to N10,500/ha. per season. This amount does not even cover the energy cost how much more the cost of operation and maintenance, staff salaries and other overheads. For example in one of the schemes, the cost of the diesel to run the pumps for the season over an area of about 93 ha amounted to N3.6M, while the amount realisable from 100% recovery of water charges of N10,500/ha was N0.976M. This translates into N37,710/ha/season for the diesel only.

This gives an overview of the disparity between the water charges and the energy costs. The charges are not based on the type of irrigation (gravity, pumped gravity or sprinkler) system but are fixed arbitrarily by the RBDAs with FMWR/FGN.

Land charges are for leasing of the land from the RBDAs in schemes that have user allocation land tenure system and they vary from N200/ha to N1,200/ha. However, these charges are not defined in some cases as they are lumped with water charges and land preparation charges.

Table 4.7 Disparities between Water Charges and Energy Costs

Scheme	*Cost of Diesel/ha (N)	Water Charges/ha (N)	Difference/ha (N)
Lake Geriyo	38,710	10,500	28,210
LAIP	27100	3,000	24,000
LOIP	27,500	2,500	25,000

** This does not include overheads, such as staff costs or depreciation.*

As can be seen from the Table 4.7 above, the water charges do not cover the cost of the diesel for the pumps, however, it must be appreciated that an attempt to increase water charges to an economic level (charges meeting running and operational costs) would meet opposition and could discourage the farmers.

Policies which favour low water charges and therefore contribute to the inadequacy of operation and maintenance funds may also prove difficult to change. FGN should therefore meet the shortfall in operation and maintenance costs. Table 4.7 provides the example. Table 4.8 gives the average water charges in all the ROPISIN schemes.

Table 4.8 Water Charges for the Schemes Reviewed

River Basin Authority	Scheme Nos	Name of Scheme	Water charges (N)
NORTH EAST			
Chad Basin	1	South Chad Irrigation Project (SCIP)	2,000
	2	Baga Polder	1,800
Hadejia Jama'Are	3	Kano River Irrigation Project Phase I (KRIPI)	2,500
	4	Hadejia Valley Project (HVIP)	3,000
	5	Jama'Are Valley Project	N/A
	6	Kano River Irrigation Project Phase II (KRIPII)	2,500
	7	Katagum Irrigation Project	N/A
NORTH WEST			
Sokoto Rima	8	Bakolori Irrigation Project (BIP)	2,000
	9	Jibiya Irrigation Project	2,000
	10	Middle Rima Valley Project (Goronyo)	3,200
	11	Zauro Polder Irrigation Project	2,500
Lower Niger	12	Kampe Irrigation Project (Omi Dam)	500
	13	Tada Shonga Irrigation Project	500
	14	Geriyan Irrigation Project	500
	15	Erin-Ile/Ajase Irrigation Project	500
	16	Oke-Oyi Irrigation Project	500
	17	Kaima Irrigation Project	N/A
Upper Niger	18	Swashi Irrigation Project	1,250
	19	Tungan Kawo Irrigation Project	1,750
	20	Galma Irrigation Project	N/A
	21	Suleja (Tafa) Irrigation Project	1,000
CENTRAL			
Upper Benue	22	Lake Geriyo Irrigation Project	10,500
	23	Dadin Kowa Irrigation Project	10,500
	24	Cham Irrigation Project	N/A
	25	Waya Irrigation Project	N/A
	26	Lower Taraba Irrigation Project	N/A
Lower Benue	27	Doma Dam Irrigation Project	750
	28	Ejule Irrigation Project	750
	29	Dep River Irrigation Project	1,000
	30	Katsina-Ala Irrigation Project	750
	31	Ofarachi Irrigation Project	N/A
	32	Naka Irrigation Project	1,500
	33	Bokkos Irrigation Project	5,000
	34	Longkat Irrigation Project	N/A
	35	Makurdi Irrigation Project	4,000
	36	Jato-Aka Irrigation Project	N/A
SOUTH WEST			
Ogun Oshun	37	Lower Ogun Irrigation Project (LOIP)	2,500
	38	Middle Ogun Irrigation Project (MOIP)	2,500
	39	Itoikin Irrigation Project	2,500
	40	Ofiki Irrigation Project	N/A
	41	Oke Odan Irrigation Project	N/A
	42	Sepeteri Irrigation Project	N/A
	43	Iwo Irrigation Project	N/A
Benin Owena	44	Ukhun-Erha Irrigation Project	N/A
	45	Ikere-Ogbese Irrigation Project	500
	46	Obayantor Irrigation Project	N/A
	47	Ilushi-Ega-Otta Irrigation Project	500
	48	Erusu Irrigation Project	N/A
	49	Illah Ebu Irrigation Project	N/A
SOUTH EAST			
Anambra-Imo	50	Lower Anambra Irrigation Project (LAIP)	3,000
	51	Imo (Igwu and Ibu) Irrigation Project	N/A
	52	Isi Uzo Irrigation Project	6,400
Cross River	53	Abak Irrigation Project	1,800
	54	Ogoja Irrigation Project	N/A
	55	Obudu Irrigation Project	N/A
	56	Obubra Irrigation Project	N/A
	57	Oniong/Nung Irrigation Project	4,500
	58	Ijegu Yala Irrigation Project	N/A
Niger Delta	59	Kpong Irrigation Project	N/A
	60	Isampou Irrigation Project	N/A
	61	Perimabiri Irrigation Project	N/A
	62	Kolo Irrigation Project	N/A

4.7.1 Mode of Payment and Recovery

The mode of payment is by cash or through the banks in most of the zones and the recovery rates of the water charges vary from zone to zone. In active schemes of the NE, NW, Central and SW zones recovery could be as high as 90% whilst in the SE the recovery is low (about 25%).

The bases for water and land charges are arbitrarily fixed. Initially water and land charges were fixed by the FGN in order to encourage farmers to participate in irrigation at a value of N500/ha/season. With the onset of the partial commercialisation of the RBDAs they have had to increase the cost of water and land, albeit marginally, in order not to discourage the farmers. Even at these low charges the farmers are not willing to pay. This trend has affected the ability of the RBDAs to effectively operate and maintain the schemes.

Cost recovery, with the RBDAs has been an area of intense controversy over the years. The argument for recovery of irrigation cost (capital, operation and maintenance, institutional and support cost) is based on the need for continuity of the development process and for the efficient use of land and water resources. It is generally recognised that the development process shall stop if the on-going projects do not generate enough revenue to pay the cost of new projects. In the majority of the schemes today, there is a reliance on energy and the cost is currently high. There is therefore the need to bring down the energy costs to affordable values that the farmers can pay for. The situation that prevails today with pumped irrigation using expensive imported equipment and fuel/electricity to produce crops sold locally at low prices will make charging for water delivered at the actual cost very difficult.

The most important aspect of cost recovery is the capacity and willingness of the beneficiaries to pay. The capacity of payment for irrigation is influenced by:

i. The value added by irrigation (increase in crop yield, cultivation intensity, insurance against drought, etc.);
ii. The quality of irrigation service;
iii. Other factors like improved farming techniques, availability and cost of inputs, credit and marketing facilities, etc.

The factor responsible for the lack of willingness on the part of the farmers to pay is that they perceive the RBDAs as social service organizations therefore water should be free. The problem is definitely not that of being unable to pay because the crop budget analysis show that they make enough profit to be able to pay the charges currently levied (Table 4.9).

Presently, in most of the RBDAs, the area of land under cultivation is far below the irrigable land. They are operating far below their capacity. Kampe scheme (LNRBDA) has developed for irrigation 1,000ha but only 100ha is presently irrigated. This is similar in all the RBDAs schemes.

Another good source of cost recovery to the RBDAs is the release of raw water to the State Water Agencies. But none of the RBDAs have been able to recover fully the money from the state government. For instance, as of 2003, the Ogun State Government owed the OORBDA ₦8.96 million.

Table 4.9 Estimated Budgets for Major Crops per Hectare at KRIPI (2003-2004)

PRODUCTION COST ESTIMATE PER HECTARE OF MAJOR CROPS (KRIPI)							
S/No.	**OPERATIONS**	**Rice**	**Wheat**	**Maize**	**Tomato**	**Onion**	**Pepper**
1	Land Lease	12,500.00	7,500.00	12,500.00	16,250.00	12,500.00	12,500.00
2	Water Charges	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00
3	Land Preparation						
	Harrowing	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00	2,500.00
	Diking	1,250.00	1,250.00	1,250.00	1,250.00	1,250.00	1,250.00
	Basin Levelling and joining of Dikes	2,600.00	2,600.00			2,600.00	
4	Planting						
	Cost of seeds	2,000.00	7,500.00	5,200.00	4,500.00	20,000.00	4,500.00
	Cost of raising seedlings	3,000.00			3,000.00		3,000.00
	Removal of seedlings	1,000.00			1,000.00		1,000.00
	Transplanting/Broadcasting	4,375.00	750.00	1,250.00	4,370.00	13,125.00	4,370.00
5	Irrigation						
	Pre Irrigation and First Irrigation	1,250.00	1,000.00			1,000.00	
	Subsequent 12 Irrigations	7,500.00	7,500.00	7,500.00	7,500.00	7,500.00	7,500.00
6	Fertilization						
	Cost of NPK @ N2,500/bag	20,000.00	15,000.00	20,000.00	20,000.00	20,000.00	15,000.00
	Cost of Urea @ N2,500/bag	7,500.00	5,000.00	7,500.00	7,500.00	7,500.00	5,000.00
	Cost of Fertilizer Application (2splits)	1,650.00	1,050.00	1,250.00	1,250.00	1,650.00	1,050.00
7	Weeding						
	Pre-emergence herbicide @ N700/liter	7,500.00	1,250.00	7,500.00	7,500.00	15,000.00	7,500.00
	Cost of Spraying	750.00	750.00	750.00	750.00	1,500.00	750.00
	Manual Weeding				3,750.00		3,750.00
8	Pest Management						
	Cost of Insecticide & fungicide @ N700/litre	1,750.00			18,000.00		
	Cost of spraying	750.00			4,500.00		
9	Harvesting						
	Cutting and Threshing/Plucking	12,500.00	8,000.00	7,500.00	10,000.00	12,000.00	8,000.00
	Winnowing	1,250.00	-	-	-	-	-
	Bags/Basket	1,750.00	875.00	1,225.00	2,050.00	6,000.00	2,050.00
	Bagging and sewing	1,000.00	500.00	750.00			
	Loading and Offloading	1,000.00	500.00	750.00		2,400.00	
	Transportation	1,500.00	750.00	1,050.00	4,100.00	7,200.00	1,000.00
10	Contingency	1,987.50	1,335.50	1,619.50	2,445.40	2,724.50	1,664.40
	Total	101,362.50	68,110.50	82,594.50	124,715.40	138,949.50	84,884.40
	ECONOMIC ANALYSIS						
	Yield/Ha.(Tonnes)	5.0	2.5	3.5	12.0	24.0	6.0
	Market Value (Naira/Tonne)[6]	25,000.00	30,000.00	27,500.00	16,500.00	9,000.00	17,000.00
	Gross Income (Naira)	125,000.00	75,000.00	96,250.00	198,000.00	216,000.00	102,000.00
	Net Income (Naira)	23,637.50	6,889.50	13,655.50	73,284.60	77,050.50	17,115.60

Assessment Recommendations:

It is recommended that detailed studies of different methodologies to bring down energy costs should be carried out, including converting to gravity and the use of low-head micro turbines, gas turbines, electricity supply and even solar panels

[6] *The market value used here is the Farmgate price at harvest, which is the lowest price that prevails. Most of the farm produce are disposed of at this time because of the poor storage available to the farmers and the need to have ready cash to meet their immediate needs.*

To enhance the recovery potentials of the RBDAs, they need to improve on their water delivery efficiency by carrying out regular maintenance and ensuring strict water scheduling to the farms. This will encourage more farmers to pay. In addition, the RBDAs would be able to bring more land areas under cultivation.

4.8 Farmers' Organization and Participation

Farmers are organised into some form of cooperatives or other groups in all the zones by many of the RBDAs. In areas close to large water bodies such as the Lake Chad and reservoirs of dams, Fishing and/or Boat transportation groups have been formed.

In all cases, the farmers actively participate in cultivation, but in many schemes play hardly any role in management and maintenance of irrigation structures outside their plots. In a few pilot schemes, such as Kpong (NDBDA) (presently abandoned), farmers were not even involved in cultivation. Farmers' interaction with RBDAs varies widely. In some schemes, farmers are left largely on their own and in others, the farmers toe the line dictated by the agencies that provide them farm inputs and even assist in harvesting.

A lot of post harvest loss was observed as a result of farmers being handicapped to market their produce as a group. This is further compounded by the lack of storage facilities.

In 1995, Centre de Corporation International En Research Agronomique pour le Development (CIRAD), in association with the National Agricultural Extension and Research Liaison Services (NAERLS) of Ahmadu Bello University Zaria and HJRBDA under a research programme to promote Agency Farmer Joint Management established a WUA unit in the HVIP. In spite of the achievements recorded, the programme had a number of constraints such as:

- Inter-village and political differences within the individual associations which led to the retardation of WUA development process;
- Inadequate logistic support for WUA unit for effective programme implementation.

Despite this initiative, it was observed in ROPISIN that in all schemes, no effective WUA exists.

An organizational structure of a typical farmers group or cooperative consists of a Chairman, Vice chairman, Secretary, Public Relations Officer, Financial Secretary and a Treasurer. The groups do not have any formal constitution guiding them however, they are guided by tradition. At the onset of the irrigation season, the farmers cooperative usually have a general meeting where major issues that may affect the smooth running of the scheme are discussed and decisions taken. Subsequent meetings are held as the situation demands.

Assessment Recommendations:
It is recommended that the Proposed National Irrigation and Drainage Policy should include the necessary input for legislation for WUAs registration.

4.9 Extension Services

Most extension services on ROPISIN schemes are meant to provide the following:

- Assisting farmers to cultivate;
- Assist in the procurement of farm inputs and their applications;
- Assist in the preparation of land;
- Assist in transportation and marketing.

The responsibility of providing agricultural extension services presently rests with the ADPs extension staff of the various state ministry of agriculture. However, the ADPs extension services are only provided for the small scale fadama schemes and SID schemes as they were not set up to cater for large scale irrigation schemes.

Findings during the ROPISIN revealed that farmers receive skeletal services from the RBDAs, by untrained operatives who are just offering assistance. Consequently, few farmers on Public Irrigation Schemes receive extension services. This lack of service is a major factor contributing to poor farming practices, poor choice of crops and scheduling the production of such crops. Furthermore, a lack of knowledge of basic irrigation parameters and new innovations also contribute to the poor performance, hence yields are low and farmers' incomes are reduced.

Assessment Recommendations:
It is recommended that the ratios of trained extension officers on irrigation schemes should be about 1:200ha.

4.10 Socio Economic Status

4.10.1 Credit

One of the major problems of the farmers of the various RBDAs is the lack of sufficient funds to carry out farm operations. As a result of this there is a great limitation to the extent the farmers can expand his or her scope of operation. Generally, farmers' sources of funds are from personal savings or loans from friends and family. In all the zones where there are farmers groups, credit is available through such cooperative organisations but at very high interest rates which invariably discourages farmers.

Official sources of credit facilities to farmers include some Commercial Banks and nearly all the Community Banks operating under the Agricultural Credit Guarantee schemes of the Central Bank of Nigeria (CBN) as well as the Nigerian Agricultural Cooperative and Rural Development Bank (NACRDB). However to access the banks' loan facility, prospective farmers, individuals or groups would have to open and operate accounts committed with the banks. Farmers hardly make use of these banks due to the

cumbersome procedures involved in securing the loans. Also very few banks are involved and these are often located far away from the schemes.

Assessment Recommendations:
There is need for a review of the CBN Agricultural Credit Guarantee and the NACRDB schemes for the farmers to receive maximum benefits from them. The commercial banks participating presently are too few considering the large number of farmers they are expected to serve.

4.10.2 Farm Records

In most of the schemes the farmers do not keep farm records. They often resort to memory recall. To retrieve information on the various agriculture activities from these groups of farmers is very difficult and prone to error or even no information at all.

Assessment Recommendations:
Farmers need to be educated on why written records should be kept immediately any operations/activities are carried out.

4.10.3 Marketing

An improved and efficient food marketing system plays an active role in the economic development by reinforcing agricultural expansion. An efficient and effective distribution network will motivate farmers to produce more than their subsistence needs.

Developed market outlets are available for schemes close to the urban centres. Other schemes rely on middlemen for distant markets. For example, some farmers at Itoikin scheme (OORBDA) sell their crops on the farm and the buyers arrange for the harvesting. In some of the schemes, such as Bakolori (SRRBDA), the merchants from the south arrange to buy farm produce in large quantities. At present they no longer visit in the same numbers. Reasons given include the reduction in produce in these schemes and insecurity and as such it was no longer profitable for them to visit schemes with low production and at such risks.

The strong cooperative farmer groups in the past were able to assist members market their produce, but most of these groups have now become weak, the farmers no longer market as a group or enjoy the benefits related to the marketing as a group, such as ensuring good market prices for their products.

4.10.4 Transportation

Transportation is extremely important to agricultural production and marketing. It facilitates the movement of agro-inputs into the farm to aid production and help in the evacuation of produce from the farms to the markets.

In the early days of the RBDAs, they invested in the construction and maintenance of roads in the project areas. Network of roads were built in almost all the schemes in all the RBDAs. These project roads have all fallen into various states of disrepair. Transportation within the schemes and access to and from the schemes have been

seriously hampered. The situation is very critical in some of the RBDAs. For example in LAIP (AIRBDA) the road connecting the project to Onitsha, a major agro-input and rice market, is in extremely bad condition. The project will be cut-off from the rest of the state if the road is not repaired before the next rainy season (2004 rainy season).

A direct effect of these bad roads on the farmers is the high cost of transportation. For example in Bakolori (SRRBDA), schemes in CRBDA and LAIP (AIRBDA), the farmers incur costs of N70/100kg/km, N100/100kg/km, and N200/100kg/km respectively. However, transportation cost is not high in those schemes that are close to trunk roads. The farmers reported they use pick-ups, vans and mini-buses to evacuate their produce. However, in some RBDAs, farmers also use donkeys. Some of the farmers also reported that due to the high cost of transportation and sometimes due to non-availability of vehicles they had to dispose of their produce at the farm-gate. This often puts them at the mercy of merchants and itinerant traders. These traders always take advantage of transportation problems to pay very low prices for the produce.

4.10.5 Storage and Processing

Storage is an important and crucial marketing function that allows the farmers the opportunity to delay the sales of produce, especially when there is a glut, to a later time so as to be able to sell at a higher price. Some of the RBDAs had storage facilities such as cribs and silos, but most of them have deteriorated over time owing to lack of maintenance.

In this review, none of the farmers stored their produce in any storage facility provided by the RBDA. Most farmers have their own storage facilities. Such facilities include *Rumbus*, drums, Jute bags and rooms specially prepared for storing farm produce. However, most of the farmers reported their storage facilities are inadequate and inefficient and they often face the problem of rodents, pest and diseases.

As a result of this development, the farmers are often forced to dispose of their produce in a hurry after harvest due to non-availability of adequate and appropriate storage facilities. A typical example is the rice farmers in LAIP (AIRBDA) who are forced to sell their paddy rice immediately after harvest either to the millers or the merchants due to the problems of storage facilities.

Prices of produce at harvest vary significantly to prices just before the planting season (Table 4.10). For example, onions at KRIPI (HJRBDA) sells at N9,000 per tonne at harvest and just before planting season sells at N160,000 per tonne.

Storage losses vary from scheme to scheme and are due to rodents, insects, micro-organisms such as bacteria and moulds. Other losses are due to the lack of good facilities, handling and biochemical changes.

Rice mills for processing paddy rice exist in or near some of the schemes. Most of these were established by private owners and has given added value to the finished products

for the farmers who could afford it. However, most of these private mills do not have destoners, polishing and packaging machines to further process the rice. In some schemes such as the LAIP (AIRBDA) the RBDA owns the mill, however due to low or non productivity of these schemes the mills are underutilised.

In the Central zone Savannah Beverages own a tomato processing plant and produce tomato paste from tomato cultivated from their own farms and other private farms in close proximity to the plant.

Table 4.10 Monthly Average Market Price Survey (2003-2004)

Crop / Month		Wheat	Rice	Maize	Pepper	Onion	Okra	Tomato
Mar 2003	U	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	R	30.00	34.16	21.85	77.85	38.64	190.39	16.42
Apr 2003	U	51.85	42.71	22.69	20.00	9.38	n/a	45.83
	R	n/a	48.59	23.87	n/a	26.07	66.67	8.82
May 2003	U	48.40	66.67	24.25	94.10	55.44	48.72	49.08
	R	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Jun 2003	U	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	R	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Jul 2003	U	52.00	33.90	20.30	32.14	68.71	381.25	n/a
	R	n/a	n/a	n/a	119.12	n/a	n/a	159.67
Aug 2003	U	n/a	n/a	n/a	78.59	n/a	n/a	97.64
	R	n/a	40.63	25.05	121.61	34.74	256.25	29.95
Sep 2003	U	27.07	32.01	16.51	58.57	43.81	77.70	23.11
	R	28.76	37.75	17.25	37.08	26.07	43.12	49.17
Oct 2003	U	37.71	35.71	17.95	57.78	23.47	39.15	20.24
	R	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Nov 2003	U	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	R	42.31	24.27	18.27	63.89	51.78	156.48	56.62
Dec 2003	U	194.64	36.06	18.53	n/a	158.34	n/a	133.33
	R	n/a	39.0 7	19.99	485.12	88.65	153.13	81.91
Jan 2004	U	48.00	41.67	20.00	16.67	41.67	n/a	40.00
	R	n/a	28.34	19.68	129.17	n/a	152.50	112.91
Feb 2004	U	52.00	33.90	20.30	138.18	68.71	381.25	40.95
	R	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Source: APMEU: U – Urban: R - Rural

4.10.6 Micro-Economic Impact

ROPISIN examined the impact of the schemes on the farmers and communities in which they were located.

Variables examined include, the farmers income, the farm size, the standard of living as represented by the types of house they live in, the kind of food they eat, their mode of transportation, the kind of household items they possess. Variables examined for the impact on communities included, development of schools, health centres, mosques and churches, potable water and other social amenities.

The communities in which the schemes are located have benefited a lot in different ways. These included the development of schools, health centres and in some cases hospitals, mosques, churches and potable water supply.

From the field survey, most of the farmers reported that the operation of the schemes has had a positive influence on their life. Some of the farmers claimed that they were able to build houses as a result of proceeds from their irrigated farms. Some farmers in Sepeteri (OORBDA) reported they bought motorcycles, from the income generated from the irrigated farms, which was a sign of improved standard of living.

Some of the farmers in SRRBDA also claimed that they were able to perform the holy pilgrimage to Mecca because of the increase in their income as a result of irrigation farming.

Unfortunately, some of the farmers claimed their standard of living had declined badly since the RBDA divested from agriculture. For example, some of the farmers that purchased motorcycles at Sepeteri Irrigation Scheme (OORBDA) have lost the motorcycles because they could not maintain the machine any longer due to the down-turn on their income as a result of the non-operation of the scheme.

Farmers in almost all the schemes reported similar situations in different forms. Those in Bakolori (SRRBDA) reported they have lost the patronage of big time merchants that used to come from the south. This has created great challenges to them in the marketing of their produce.

The farmers were made to appreciate the high cost of putting a scheme in place and that of operation and maintenance. They were then informed of the need for them to participate in operation and maintenance of the schemes for their own benefit. While some of the farmers were of the opinion that the FGN should continue to fund the RBDAs some welcomed the idea of the farmers getting involved in the operation and maintenance of the schemes.

4.11 Operation

It has become a matter of increasing concern in recent years that the performances of the public irrigation schemes have fallen short of expectations. Developed areas of ROPISIN schemes is 82,205ha in 2003-2004 season and actually cultivated area was

29,140ha. This is due to a number of factors but the lack of proper operation and maintenance is one overriding cause for the malfunctioning of the schemes.

There are five fundamental causes for the poor operation of the ROPISIN schemes:

i. Insufficient funds to support optimum operation as a result of the low water charges;
ii. Poor water management and lack of effective monitoring of the system;
iii. Weak technical capacity and monitoring of scheme operatives;
iv. Poor man-management and inadequate farmer participation;
v. Technical deficiencies in the physical system.

During the ROPISIN the study team observed that in the larger schemes, there was usually over-irrigation at the head of the systems whilst irrigation water was insufficient at the tail end. An example is the KRIPI (HJRBDA) where opportunist farmers irrigate the lands adjacent to the main canal. The uncertainties as to the timing and amount of water supplies have also affected the choice of crop grown in many schemes. At DEP Irrigation Scheme (LBRBDA) the design crop was rice however at present the major crop at DEP is vegetables as the water requirement and time of growth is less and shorter respectively than the design crop.

As proper operation of irrigation systems involves the timely delivery of the irrigation water necessary to satisfy crop water requirements the farmers have had no choice but to cultivate crops that have less risks in case of operational lapses in water delivery. It is observed that generally there are two scenarios of water and demand at the schemes reviewed:

- Water supply equal or greater than demand;
- Water supply less than demand.

4.11.1 Pumped Schemes

In all the pumped command schemes the water source is adequate whilst there is deficit in the supply only due to the high cost of energy. Where proper water management is carried out high returns could be obtainable despite the deficit.

Therefore, there is a need for improved planning and scheduling of water delivery. The implementation of such improved plan and the monitoring of the water delivery must be in line with crop requirement otherwise yields will be low and the capacity of the system will not be met.

The ROPISIN observed that the water schedule is done arbitrarily if it is done at all. In most schemes though the basic water schedule is known and can be computed by the project operatives at the beginning of the season, however, for many reasons including high-energy costs these schedules are neither computed nor implemented.

Although, the object of water schedule is to match supply with demand as closely as possible, the ROPISIN observed that in the pumped schemes the schedule could not be based on demand but on the budget for energy costs. Lake Geriyo for instance had developed 183ha however due to high energy cost the area cultivated is limited to 93ha.

In some schemes farmers have had to grow low duration crops instead of the most optimum crop for that location. At Ikere Ogbese (BORBDA) the farmers have had to change crops from water-melon to okro. Implying that the farmers could not cultivate what they really want.

In the past 3 seasons, most of the pumped schemes have not been operational due to lack of budgetary allocation. Furthermore, the pumps are old with high consumption of fuel and frequent breakdowns.

There is a need to carry out detailed reassessment of the pumped schemes with a review of different methodologies with the aim of bringing down energy costs.

It is noted that where water schedules are discussed between the RBDAs operatives and the farmers it is more instructional than participatory. Whilst this interaction is good and should be encouraged, farmers should be given more participatory roles in the water management and crop selection.

4.11.2 Gravity Schemes

In the gravity schemes there is adequate water however, due to poor water management such as leakages, seepage, aquatic weeds and siltation of the canals, the water hardly reaches the tail ends of the canals. A general operation scenario on the ROPISIN schemes is as follows:

> Water is released into the main canal continuously. From the main canal it is distributed into the secondary canals through manual sluice gates operated by staff of the RBDAs, from the secondary canals into the tertiary canals via sluice gates also operated by the RBDA staff. The water in the tertiary canals is released to the fields by means of siphon tubes or turnouts by the farmers.

There is the need for reorientation from management through the ranks to the operatives by institutional development and capacity building.

The rehabilitation programme recommended for some schemes as an outcome of ROPISIN would be useful as a tool for capacity building by the secondment of relevant staff who will likely take over the schemes from the Contractor. Running maintenance should also form part of such a rehabilitation programme to enable participation and appreciation of the mechanism of the operation of the schemes by seconded staff and also WUAs.

From the observation of ROPISIN there is need therefore for increased efforts to achieve more efficient productive and sustainable irrigation practices by using appropriate cropping patterns, improved water distribution practices and adequate but realistic water charges.

Furthermore, the drains are not cleaned and desilted regularly resulting in salination, backwater and water logging causing damage to the adjacent farmland. An example is some parts of KRIPI (HJRBDA) where some farmlands have been lost to salination.

4.11.3 Operation Staff (Irrigation Operatives)

4.11.3.1 Staffing

The numbers of staff on each of the project vary from scheme to scheme. Basic staffing requirement consist of these categories of staff.

- Water Guards;
- Tractor Operators and drivers;
- Operators of large structures;
- Pump set operators;
- Water supervisors;
- Extension officers;
- Project Manager.

The number of each of these categories of staff also varies from scheme to scheme.

Generally, we note that the schemes are overstaffed with low to middle level staff even on schemes that have been non operational for some years.

4.11.4 Monitoring and Evaluation of Operation

This important activity is hardly carried out in any of the schemes and if carried out not documented adequately. The main purpose for the monitoring of the operation of the scheme is to gather data to assist in comparing the actual and the expected as well as reasons for the difference. It also provides information on water supply requirements and performance for future planning purposes. The RBDAs monitoring and evaluation (M&E) units no longer exist. Many records are not well kept or interpreted for later use. Without adequate M & E and record keeping the performance of the individual schemes and of the RBDAs cannot be assessed.

The lack of M & E in recent years and poor records has proved a major constraint to ROPISIN.

The establishment of agro-meteorological stations within the area of an irrigation scheme is most advisable in medium or large schemes to provide data for sound calculation of crop water requirements and water balance studies.

4.11.5 Maintenance

One of the major reasons, the schemes have not operated to design capacity is due to poor maintenance. Silt deposition, weed infestation and malfunctioning of pumps and hydraulic structures have had an adverse effect on the irrigation systems.

The review established that the reasons for poor maintenance of the schemes examined include:

- Insufficient funds made available or mobilised by the RBDAs;
- Inability to mobilise the farmers to participate or collaborate in the maintenance work;
- Poor organization of the maintenance work.

The farmers believe that the maintenance of the scheme is not their responsibility and that the water charges paid should cover the maintenance.

The inspection during the ROPISIN showed that concrete lined canals need minimum maintenance and that the unlined canals are often characterised by weed infestation, siltation, eroded and collapsed canal slopes.

4.11.6 Equipment Maintenance

The ROPISIN observed that the equipment in use at the schemes fall into two main categories namely:

(i) Water delivery equipment and
(ii) Agricultural equipment and machinery

The water delivery equipment comprise pumps of various capacities used for water abstraction at the water source. These include both diesel engine and electric motor driven pumps. Most of the surface pumps are hydraflo pumps manufactured by M&W Pump Corporation of USA. These pumps were acquired by the FMWR and distributed to the RBDAs in the early 1980s. Another set is the Maritza pumps from Bulgaria and some others whose manufacturers could not be ascertained during the review.

The available agricultural machinery varies according to usage and extent of coverage of each RBDA. The machinery includes Komatsu Bulldozers, Komatsu Swamp dozers, CAT Tractors, CAT graders, Payloaders, Excavators, Scrapers, Lister Generators, Fiat combined rice harvesters, rice threshers, boom sprayer, maize planter, maize shellers, grain dryer, rice mill, arc welding machine, air compressor, rome plough, drilling machine, lathe (Universal), bending machines and standing grinders.

About 90% of the equipment and machinery are not being operated. Most of the pumps were purchased during the 1980s without spare parts for maintenance. These spares are now no longer available in Nigeria as the pumps are obsolete. Most of the agricultural machinery, which were purchased over 20 years ago no longer function.

There were very few maintenance personnel presently working on schemes and in some cases did not exist at all. Workshops at all RBDAs were run down, and poorly equipped

and staffed. Spare parts were rarely stocked and records not kept. Most workshops also did not have adequate manuals for the equipment they were expected to maintain.

It was observed during the review that some equipment had no nameplates, and no information or data about the equipment could be ascertained.

In order to ensure sustainability and continuity, each scheme should maintain good record on all equipment, agricultural machinery, and other appliances in use.

Equipment and machinery procurement should be standardised and obtainable from only two approved manufacturers, so that spares are standardised and stock levels maintained. Procurement should be based on the World Bank guidelines and comply with a standard technical specification for equipment and machinery.

Procurement packages should include maintenance management and training as well as the provision of spares for at least two years running maintenance. Procurement of such equipment and machinery should be through manufacturers with local well-established assembly plants in Nigeria.

4.12 Project Management

The management of the schemes is of paramount importance to the success of irrigation. Management must be able to make decisions at the appropriate time. Such timely decisions include water distribution, maintenance and assistance to the farmers.

In order to make good management decisions there should be accurate feedback from the field especially through the collection and processing of operation data. The Project Managers (PMs) on most of the schemes of ROPISIN are not collecting data and when collected not processed.

It appears that the major problem in all cases is the lack of funds to assist in the proper management of these schemes. In a few of the schemes such as Obudu Irrigation Scheme (CRBDA) and Isi Uzo Irrigation Scheme (AIRBDA) the PMs have used their initiative and taken appropriate measure to ensure the delivery of water to the farms.

The PMs and their assistants are primarily responsible for the day-to-day running of the schemes. In most of the schemes, it was generally observed that the PMs and their assistants are usually educated up to tertiary degree level. However, there were some PMs that did not have the requisite qualifications and skills. PMs should be qualified and be familiar with agricultural matters and farmers' social and economic conditions as well as with irrigation engineering and management.

The Heads of the Divisions (HOD) who assist the PMs also have Higher National Diploma certificate while the other technical staff (operatives) are mostly with Ordinary National Diploma certificates with little skills.

The irrigation operatives are responsible for the water operators (water guards) who operate the canal gates and the gates of the night storage reservoirs. The operatives

also inspect the canal networks for breaches, damages or people tampering with the canal structures.

The project management structure of the schemes differs from RBDA to RBDA and from scheme to scheme. A typical one for the LAIP (AIRBDA) and KRIPI (HJRBDA) are given in Fig. 4.4 and Fig. 4.5. These project management structures have been modified from the designed structure (in the project design report) to suit the current status, level of staff available and the different project constraints such as finance.

ROPISIN could not establish if the project operatives and managers had specific job description, the staff all seem to know what they are to do but were not specific on their job descriptions. This caused some confusion as some of the project staff do not do things because they believe another staff member would have done it.

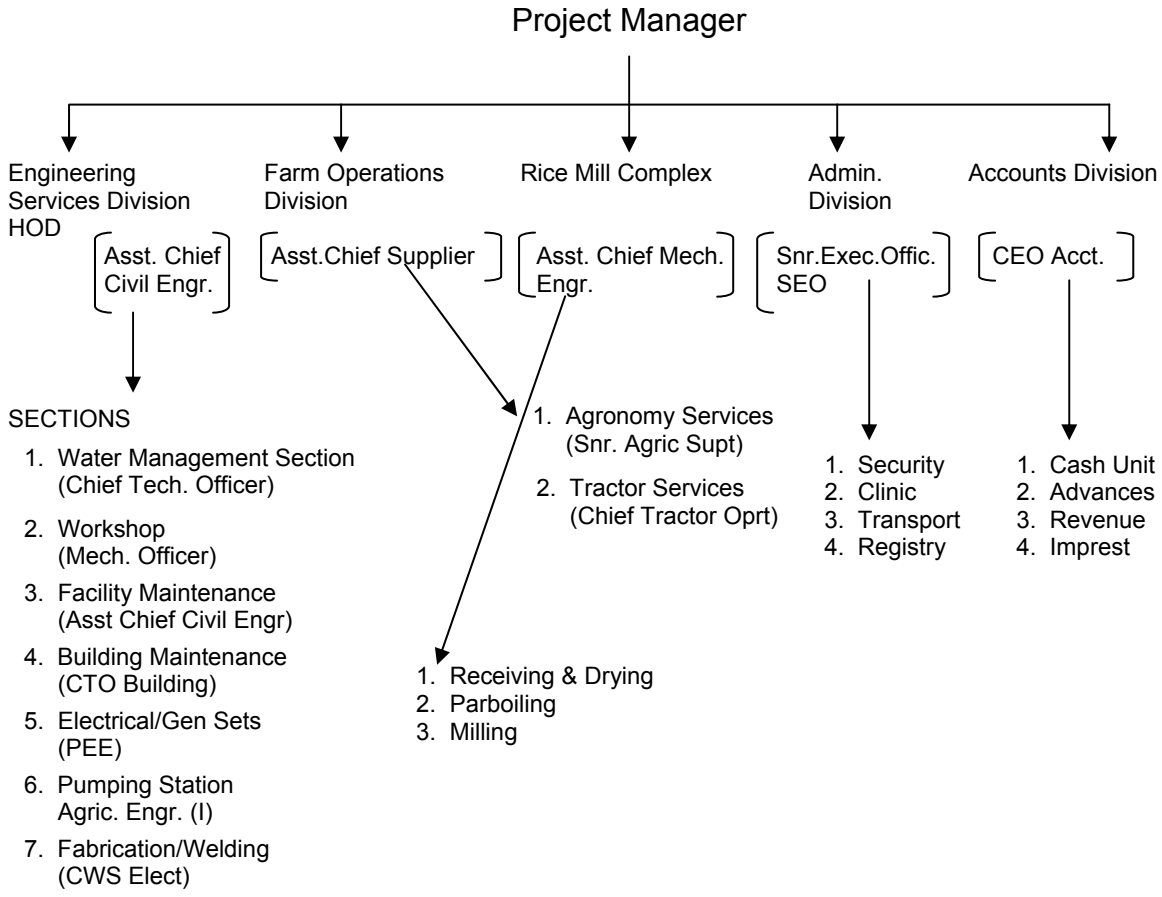


Fig. 4.4 Organizational Chart at Lower Anambra Irrigation Project

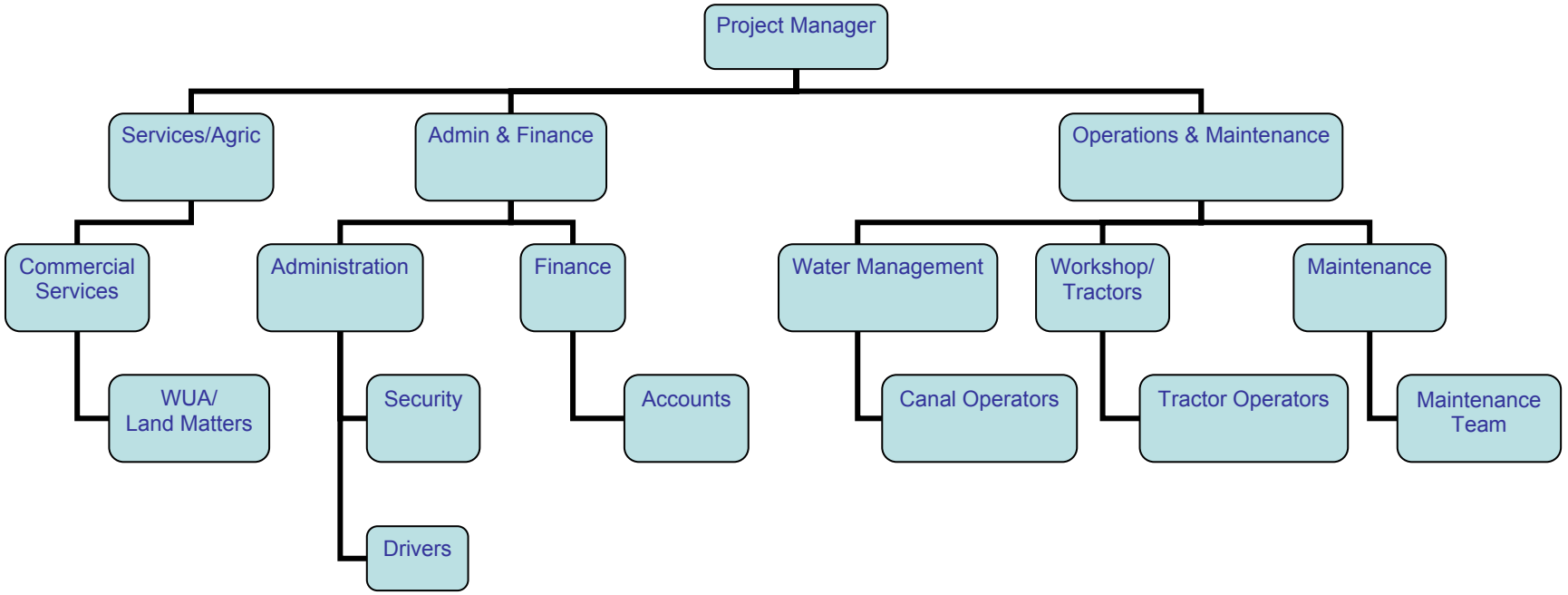


Fig. 4.5 Organizational Chart at Kano River Irrigation Project

4.12.1 Participatory Irrigation Management (PIM)

The PIM concept had been introduced in some schemes like KRIPI (HJRBDA), and LAIP (AIRBDA) sometimes in the early 1990s; however, it was only in 1998 at the sitting of the NCWR that all irrigation agencies were mandated to adopt the PIM concept in all their schemes.

Field investigations indicate that the PIM concept so far is understood and implemented by some of the RBDAs, through the establishment of WUAs and their involvement in the maintenance of the tertiary canals and drainage network. They have been active in the collection of water charges. Apparently they have not been assigned any management responsibilities and still operate as farmers cooperatives.

There are few schemes with a semblance of a functional WUA. Notable are the Watari Irrigation Project owned by the Kano State ADP, and the HVIP (HJRBDA). In the other schemes where WUA were introduced, established, and registered - i.e. the KRIPI (HJRBDA); the LAIP (AIRBDA); Wurno Scheme (Sokoto State) and Bakolori (SRRBDA); they have become mere paper associations and very ineffective and some, such as the LAIP (AIRBDA) have since been dissolved.

It was observed that even in the schemes that have attempted and introduced PIM, there is little information as to the impact of PIM on agricultural performance of irrigation systems. In fact the impact is not noticeable in terms of agricultural performance, since there are no detectable upward changes in irrigated area, cropping patterns and or intensity, or yields.

Farmers indicated during ROPISIN that they would support WUA development if the benefits outweigh the membership demands – in terms of their time, materials, cash, and interpersonal transactions. It might be difficult to get farmers in the existing schemes to be fully committed to WUA especially if in the past, they had received most of the services WUA is expected to undertake free. They are also suspicious of Government officials, particularly when various study groups on new schemes must have made the farmers believe that the project will be implemented soon. The case of the Peremabiri and Isampou Rice Irrigation Schemes (NDBDA) comes to mind, where after over 20 years that the schemes were identified, investigated, recommended for implementation, and contracts awarded, the farmers still have no hectare under irrigation.

Assessment Recommendations:
PIM can be a success if the RBDAs can be reoriented to service provision and become accountable to participating farmers, commence the establishment of WUA at the time the project is conceived, and provide for appropriate training and aftercare that should extend for several years after the formation of the WUA. Responsible WUA development cannot occur without transferring appropriate management roles to the WUA and on to the farmers.

Rehabilitation and modernisation of irrigation schemes in Nigeria should have PIM as a major influence in design and implementation. Large, complex, awkward schemes with sophisticated pumping technology are not conducive to PIM. Equally grouping subsistence farmers together and providing them with irrigation equipment without capacity building or extension services is just as bad. A compromise suited to the Nigerian situation is required. Many public schemes will never be able to be managed at 100% by the beneficiaries and the Government will always have some role. New schemes however can be designed more appropriately and be more amenable to farmers' operation and management.

4.12.2 Scheme Governance

Field investigations indicate that there is essentially no farmers' participation in decision–making associated with any of the schemes' planning, development, and management. It is surprising that the top-down approach is still the norm.

In essentially all the schemes, particularly the gravity flow schemes, there are three operational management levels that coincide with the canal network hierarchy – the primary, secondary and tertiary levels.

In the schemes where WUA had been introduced and established such as the HVIP, KRIPI (HJRBDA), the Watari Scheme (Kano State), the LAIP (AIRBDA) the WUA were assigned maintenance responsibilities on the tertiary level only. The main decision making activity the WUA are involved in is that of conflict resolution amongst themselves -the farmers and or with other resource users.

The RBDAs perception of user participation is that Users' should maintain tertiary and some secondary level canals and collect water charges for and on behalf of the RBDAs. There is no suggestion whatsoever of sharing management responsibilities with WUA or any other user group.

Assessment Recommendations:
It is suggested that the Proposed National Irrigation and Drainage Policy should provide for user participation in decision making on issues of land, conflict resolution, operations and maintenance as it relates to the administration of the scheme.

4.13 Appraisal and Data Analysis

The ROPISIN has developed a new framework for the quick assessment of irrigation schemes given the sparse database that exist. The framework incorporates the RAP in the form of Scheme's Key Characteristics (Tables 4.11.1 to 4.11.12) and a comprehensive set of indicators (Ranking Criterion Section 4.14) which when examined as a whole indicates how and where improvement should be targeted. The framework also includes a GIS model which gives a representation of the schemes locations and their spatial interrelationship. It also gives the spatial relationship of the schemes' characteristics. This model can be used as a decision support tool and can

be updated as necessary. A summary of the status of the schemes in each zone is given in Section 11 of this status report whilst the output of the RAP for KRIPI (HJRBDA) and LAIP (AIRBDA) are presented in Volume IV of the this status report.

4.14 Ranking of Schemes

The schemes have been ranked [7] using the following criteria and weighted percentages:

Technical	40%
Agriculture	20%
Socio-economic	15%
Location	15%
Environmental	10%

Technical criteria include the layout, water source, delivery mechanism, water delivery efficiency including drainage, pumped or gravity and amount of rehabilitation required.

Agriculture includes interest of the farmers, the number of farmers available, crop type, farm inputs, mechanisation availability and soil workability, soil fertility, crop water requirements and supplementary benefits.

Socio-economic criteria include pastoralists/farmer conflicts, WUA, private sector potential, cost of delivery and recovery, land ownership and potential for good governance.

Location which is split into physical involving accessibility and distance to markets and to input suppliers and climate including rainfall and flood risks.

Environmental includes salinity, water logging, pests and diseases, weeds, erosion and effects on public health.

The ranking at this stage is preliminary and purely technical and does not take into account discreet variables which could influence the prioritisation of the schemes in any future rehabilitation/expansion programme.

[7] *This ranking is to be further refined using discreet variables to present a more comprehensive status*

Table 4.11.1 Key Scheme Characteristics

CHAD BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	SCIP	BPP
Planned Irrigable Area (ha.)	67,000	20,000
Developed Irrigable Area (ha)	22,000	2,000
Actual Area Cropped in 2003/04 (ha.)	None	1,000
Current Year Crop Intensity	1	1
Average Farm Holding (ha.) Land Ownership - (Farmer Occupier (F) or User Allocation (U)	F	0.5 F
Cost of Leasing Land (Naira/ha.)	N/A	N/A
Major Crop	Wheat	Tomato
Major Crop Yield (Tonnes/ ha)	2	18
Second Major Crop	Rice	Maize
Second Major Crop Yield (Tonnes/ ha)	2.5	2.5
IRRIGATION WATER		
Water Source	Lake Chad	Lake Chad
Abstraction Method	Pumping	Pumping
Average Annual Rainfall; (mm)	500	500
Water Charges (Naira/ha)	share cropping	2,500
MAIN CANALS (MC)		
Total Length of Main Canals (km)	38	17
% of Lining of Main Canal	10	5
Silt Level in Canals (10 = high; 1 = low)	10	4
Weed in Canal (10 = high; 1= Low)	1	none
Total Length of Main Pipeline (km)	N/A	N/A
SUB-MAIN/SECONDARY CANALS		
Total Length of Sub Main Canals (km)	N/A	10
% lining of Submain Canals	N/A	0
Silt Level in SMC (10 = high; 1 = low)	10	8
TERTIARY /FIELD CHANNELS		
Final Distribution to Farm (lined/unlined)	unlined	unlined
Water Distribution Schedule to Farmer	N/A	N/A
Final distribution of water – Farmer/Farmer Group/WUA	farmer	farmer
Method of Water Delivery to Fields	pipe	pipe
No of Farmers Involved in the Scheme.	500	350
Existence of WUA (Yes or No)	No	No
Existence of other Farmer's Group (Yes/No)	Yes	Yes
WUA effectiveness (High = 10; Low = 1)	N/A	N/A
DRAINAGE SYSTEM		
Length of Principal Drains (km)	25	20
Silt Level in Drains(10 high; 1 = low)	10	5
Weed in Drain (10 = high; 1= Low)	2	5
Remarks Note: N/A = Not Applicable or Not Available		

Table 4.11.2 Key Scheme Characteristics

HADEJIA JAMA'ARE RIVER BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	KRIP1	HVIP	JVP	KRIP11	KATAGUM
Planned Irrigable Area (ha.)	22,000	12,500	80	48,580	700
Developed Irrigable Area (ha)	15,000	3,000	20	80	100
Actual Area Cropped in 2003/04 (ha.)	18,000	3,000	N/A	N/A	N/A
Current Year Crop Intensity	2	2	1.0	1.0	1.0
Average Farm Holding (ha.)	0.5	0.5	0.25	N/A	0.5
Land Ownership - (Farmer Occupier(F) or User Allocation (U)	F	F	U	U	F
Cost of Leasing Land (Naira/ha.)	N/A	N/A	N/A	1,750	N/A
Major Crop	Wheat	Wheat	Vegetables	Vegetables	Vegetables
Major Crop Yield (Tonnes/ha)	2.4	2.5	N/A	N/A	N/A
Second Major Crop	Tomato	Tomato	N/A	Cowpea	N/A
Second Major Crop Yield (Tonnes/ha)	15	15	N/A	N/A	N/A
IRRIGATION WATER					
Water Source	Tiga Dam	Tiga/Challawa	Sawe Lake	Tiga Dam	Jamaare River
Abstraction Method	Gravity	Gravity	Pumping	Pumping	Pumping
Average Annual Rainfall; (mm)	750	700	750	750	700
Water Charges (Naira/ha)	2,500	2,500	N/A	N/A	N/A
MAIN CANALS (MC)					
Total Length of Main Canals (km)	74	30	N/A	N/A	N/A
% of Lining of Main Canal	80	5	N/A	N/A	N/A
Silt Level in Canals (10 = high; 1 = low)	6	6	N/A	N/A	N/A
Weed in Canal (10 = high; 1= Low)	6	5	N/A	N/A	N/A
Total Length of Main Pipeline (km)	N/A	N/A	N/A	N/A	N/A
SUB-MAIN/SECONDARY CANALS					
Total Length of Sub Main Canals (km)	320	65	N/A	0.4	0.85
% Lining of Submain Canals	25	10	N/A	5	N/A
Silt Level in SMC (10 = high; 1 = low)	6	5	N/A	10	N/A
TERTIARY /FIELD CHANNELS					
Final Distribution to Farm (lined/unlined)	unlined	unlined	unlined	unlined	unlined
Water Distribution Schedule to Farmers	rotation	rotation	N/A	rotation	rotation
Final distribution of water – Farmers/ Farmer Group/WUA	farmers	farmers	N/A	farmers	farmers
Method of water delivery to the field	syphon	syphon	N/A	syphon	syphon
No. of Farmers Involved in the scheme	500	350	N/A	20	50
Existence of WUA (Yes or No)	yes	yes	No	No	No
Existence of other Farmer's Group (Yes/No)	N/A	N/A	N/A	N/A	N/A
WUA effectiveness (High = 10; Low = 1)	4	4	N/A	N/A	N/A
DRAINAGE SYSTEM					
Length of Principal Drains (km)	815	165	N/A	3	2
Silt Level in Drains (10 = high; 1 = low)	6	7	N/A	7	8
Weed in Drain (10 = high; 1= Low)	6	7	N/A	7	6
Remarks					
Note: N/A = Not Applicable or Not Available					

Table 4.11.3 Key Scheme Characteristics

SOKOTO RIMA RIVER BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	Bakolori	Jibiya	Goronyo	Zauro
Planned Irrigable Area (ha.)	23,000	3,500	5200	10,572
Developed Irrigable Area (ha)	23,000	3,400	250	580
Actual Area Cropped in 2003/04 (ha.)	5,000	170	120	N/A
Current Year Crop Intensity(2003)	1.5	1.2	1.5	1.0
Average Farm Holding (ha.)	1.5	1.2	2.5	N/A
Land Ownership - (Farmer Occupier (F) or User Allocation (U)	F	F	F	F
Cost of Leasing Land (Naira/ha.)	N/A	N/A	N/A	N/A
Major Crop	Rice	Wheat	Pepper	Rice
Major Crop Yield (Tonnes/ha)	7.2	4	14.2	5.1
Second Major Crop	S. Potato	Cowpea	Onion	Maize
Second Major Crop Yield (Tonnes/ha)	15.1	2	21.2	1.4
IRRIGATION WATER				
Water Source	Reservoir	Reservoir	Reservoir	River
Abstraction Method	Gravity/Pumping	Gravity/Pumping	Gravity	Pump
Average Annual Rainfall; (mm)	790	716	650	700
Water Charges (Naira/ha)	2,000	2,000	3,200	N/A
MAIN CANALS (MC)				
Total Length of Main Canals (km)	200	192	5.88	0.75
% of Lining of Main Canal	100	100	100	N/A
Silt Level in Canals (10 = high; 1 = low)	4	1	1	N/A
Weed in Canal (10 = high; 1= Low)	5	1	4	N/A
Total Length of Main Pipeline (km)	N/A	N/A	N/A	N/A
SUB-MAIN/SECONDARY CANALS				
Total Length of Sub Main Canals (km) % lining of Sub-main Canals	300 N/A	N/A N/A	1.895 N/A	5.26 N/A
Silt Level in SMC (10 = high; 1 = low)	4	N/A	1	N/A
TERTIARY / FIELD CHANNELS				
Final Distribution to Farm (lined/unlined)	Unlined	N/A	Unlined	Unlined
Water Distribution Schedule to Farmer	Arranged	N/A	N/A	Arranged
Final distribution of water-Farmer/Farmer's Group	Farmers	Farmers	Farmers	Farmer
Method of Water Delivery to Fields	siphon	siphon	siphon	N/A
No. of Farmers Involved in the scheme	3,000	100	70	N/A
Existence of WUA (Yes or No)	Yes	No	Yes	N/o
Existence of other Farmer's Group (Yes or No)	No	No	No	No
WUA Effectiveness (High = 10 ; Low = 1)	4	N/A	4	N/A
DRAINAGE SYSTEM				
Length of Principal Drains (km)	N/A	114	N/A	N/A
Silt Level in Drains(10 high; 1 = low)	10	2	N/A	4.7
Weed in Drain (10 = high; 1= Low)	5	5	N/A	N/A
Remarks Note: N/A = Not Applicable or Not Available				

Table 4.11.4 Key Scheme Characteristics

LOWER NIGER RIVER BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	KAMPE	TADA SHONGA	OKE_OYI	GERINYA
Planned Irrigable Area (ha.)	11,000	3,200	200	2,000
Developed Irrigable Area (ha)	1,000	100	100	100
Actual Area Cropped in 2003/04 (ha.)	100	0	10	5
Current Year Crop Intensity (2003)	1.5	0	1.2	1.2
Average Farm Holding (ha.)	1.0.	N/A	0.5	0.5
Land Ownership - (Farmer Occupier (F) or User Allocation (U)	U	U	F	F
Cost of Leasing Land (Naira/ha.)	N/A	N/A	N/A	N/A
Major Crop	Tomatoes	Rice	Tomatoes	Sugar Cane
Major Crop Yield(Tonnes/ha)	12	2.5	4.0.	N/A
Second Major Crop	Maize	N/A	Okro	Okro
Second Major Crop Yield(Tonnes per ha)	2.5	N/A	3.0.	2.5
IRRIGATION WATER				
Water Source	Reservoir	River	River, Weir	River
Abstraction Method	Gravity	Pumping	Pumping	Pumping
Average Annual Rainfall; (mm)	1100	1000	1100	1200
Water Charges (Naira/ha)	500	500	500	500
MAIN CANALS (MC)				
Total Length of Main Canals (km)	39	N/A	N/A	N/A
% of Lining of Main Canal	0	N/A	N/A	N/A
Silt Level in Canals (10 = high; 1 = low)	4	N/A	N/A	N/A
Weed in Canal (10 = high; 1= Low)	1	N/A	N/A	N/A
Total Length Of Main Pipeline (km)	N/A	N/A	0.2	0.25
SUB-MAIN/SECONDARY CANALS				
Total Length of Sub Main Canals (km)	150	N/A	N/A	N/A
% lining of Sub-main Canals	0	N/A	N/A	N/A
Silt Level in SMC (10 = high; 1 = low)	5	N/A	N/A	N/A
TERTIARY/FIELD CHANNELS				
Final Distribution to Farm (lined/unlined)	Unlined	N/A	N/A	N/A
Water Distribution Schedule to Farm	Continuous	N/A	N/A	N/A
Final distribution of water- (Farmer/Farmer's Group/WUA)	Farmer	N/A	Farmer	Farmer
Method of Water Delivery To Fields	Breaking of bunds	N/A	N/A	N/A
No. of Farmers Involved in the scheme	150	N/A	20	10
Existence of WUA (Yes or No)	Yes	No	No	No
Existence of other Farmer's Group (Yes or No)	Yes	No	No	No
WUA Effectiveness (High 10; Low 1)	6	N/A	N/A	N/A
DRAINAGE SYSTEM				
Length of Principal Drains (km)	150	N/A	N/A	N/A
Silt Level in Drains(10 high; 1 = low)	7	N/A	N/A	N/A
Weed in Drain (10 = high; 1= Low)	5	N/A	N/A	N/A
Remarks		Project Abandoned	Farmer Assisted	Farmer Assisted

Table 4.11.5 Key Scheme Characteristics

UPPER NIGER RIVER BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	TUNGA KAWO	SWASHI	TAFA	GALMA
Planned Irrigable Area (ha.)	880	3,150	145	27,000
Developed Irrigable Area (ha)	880	2,500	42	80
Actual Area Cropped in 2003/04 (ha.)	400	200	42	80
Current Year Crop Intensity	2	1.2	1.0	1.0
Average Farm Holding (ha.)	4	0.8	2.5	N/A
Land Ownership - (Farmer Occupier (F) or User Allocation (U)	U	U	F	F
Cost of Leasing Land (Naira/ha.)	N/A	N/A	N/A	N/A
Major Crop	Rice	Rice	Maize	N/A
Major Crop Yield (Tonnes/ha)	4.7	3.4	3.8	N/A
Second Major Crop	None	Tomatoes	Garden Egg	N/A
Second Major Crop Yield (Tonnes/ha)	N/A	8	11.8	N/A
IRRIGATION WATER				
Water Source	Reservoir	Reservoir	River	River
Abstraction Method	Gravity	Gravity	Pumping	Pumping
Average Annual Rainfall; (mm)	1080	1,000	1,000	950
Water Charges (Naira/ha)	2,000	1,250	1,000	N/A
MAIN CANALS (MC)				
Total Length of Main Canals (km)	0.72	15	N/A	N/A
% of Lining of Main Canal	100	N/A	N/A	N/A
Silt Level in Canals (10 = high; 1 = low)	10	10	N/A	N/A
Weed in Canal (10 = high; 1= Low)	10	10	N/A	N/A
Total Length Of Main Pipeline (km)	N/A	N/A	N/A	N/A
SUB-MAIN/SECONDARY CANALS				
Total Length of Sub Main Canals (km) % lining of Sub-main Canals	10.64 N/A	35 N/A	N/A N/A	N/A
Silt Level in SMC (10 = high; 1 = low)	10	10	N/A	N/A
TERTIARY /FIELD CHANNELS				
Final Distribution to Farm (lined/unlined)	Unlined	Unlined	N/A	N/A
Water Distribution Schedule to Farmer	Arranged	Arranged	N/A	N/A
Final distribution of water - Farmer/Farmer's Group/WUA	Farmers	Farmers	N/A	N/A
Method of Water Delivery To Fields	Gravity	Gravity	N/A	N/A
No. of Farmers Involved in the Scheme	100	120	N/A	N/A
Existence of WUA (Yes or No)	Yes	Yes	No	No
Existence of other Farmer's Group (Yes/No)	No	No	No	No
WUA Effectiveness (High 10; Low 1)	5	3	N/A	N/A
DRAINAGE SYSTEM				
Length of Principal Drains (km)	3.24	N/A	N/A	N/A
Silt Level in Drains (10 high; 1 = low)	10	10	N/A	N/A
Weed in Drain (10 = high; 1= Low)	N/A	N/A	N/A	N/A
Remarks				

Table 4.11.6 Key Scheme Characteristics

UPPER BENUE RIVER BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	LAKE GERIYO	DADIN KOWA	CHAM	WAYA	LOWER TARABA
Planned Irrigable Area (ha.)	1200	44,000	500	2000	3,000
Developed Irrigable Area (ha)	550	250	250	10	350
Actual Area Cropped in 2003/04 (ha.)	*[1]213	70	0	0	0
Current Year Crop Intensity	1	2	1	0	1
Average Farm Holding (ha.)	0.25	0.1	0.25	N/A	0.25
Land Ownership: Farmer Occupier (F) or User Allocation (U)	U	U	U	U	U
Cost of Leasing Land (Naira/ha.)	1,200	1,200	N/A	N/A	N/A
Major Crop	Rice	Rice	Rice	N/A	Rice
Major Crop Yield (Tonnes/ha)	6	6	5	N/A	5
Second Major Crop	*[2]Vegetables	N/A	N/A	N/A	Sugar cane
Second Major Crop Yield (Tonnes/ha)	12	N/A	N/A	N/A	*[1]100
IRRIGATION WATER					
Water Source	River & Lake	*[1]River	*[1]Reservoir	Reservoir	River
Abstraction Method	Pumping	Pumping	Gravity flow	Gravity flow	Pumping
Average Annual Rainfall; (mm)	1,100	900	850	895	1,000
Water Charges (Naira/ha.)	10,800	10,800	N/A	N/A	3,000
MAIN CANALS (MC)					
Total Length of Main Canals (km)	4.7	*[2]11	0.7	N/A	1.4
% of Lining of Main Canal	100	N/A	0	N/A	0
Silt Level in Canals (10 = high; 1 = low)	1	N/A	5	N/A	6
Weed in Canal (10 = high; 1= Low)	1	N/A	1	N/A	3
Total Length of Main Pipeline (km)	1	3	0.25	N/A	N/A
SUB-MAIN/SECONDARY CANALS					
Total Length of Sub Main Canals (km)	11.05	8.3	4.5	N/A	4.8
% lining of Sub-main Canals	0	13	0	N/A	0
Silt Level in SMC (10 = high; 1 = low)	2	3	3	N/A	5
TERTIARY/FIELD CHANNELS					
Final Distribution to Farm (lined/unlined)	Unlined	Unlined	Unlined	N/A	Unlined
Water Distribution Schedule to Farmer	Known Rotation	Known Rotation	Known Rotation	N/A	Known Rotation
Final distribution of water: (Farmer or Farmer Group/WUA)	Farmer	Farmer	Farmer	N/A	Farmer
Method of water delivery to the fields	4"/6" AC pipes	4" PVC pipe	Breaking of bunds	N/A	Breaking of bunds
No. of Farmers Involved in the Scheme	768	650	455	Nil	550
Existence of WUA (Yes or No)	Yes	Yes	Yes	No	Yes
Existence of other Farmers Group (Yes or No)	No	No	No	No	No
WUA Effectiveness (10 = high; 1 = low)	3	2	1	N/A	2
DRAINAGE SYSTEM					
Length of Principal Drains (km)	3.1	0.65	0.7	N/A	8.3
Silt Level in Drains(10 high; 1 = low)	3	3	2	N/A	5
Weed in Drain (10 = high; 1= Low)	4	2	2	N/A	3
Remarks	*1-120ha fadama type irrigation inclusive. *2- include okro & tomatoes	*1-Canal from Dam to irrigation project not completed *2- only 3,3km was constructed.	*1 - Reservoir now empty after collapse- se of Dam	No down-stream irrigation infrastructure	*1 - Estimated Yield

Table 4.11.7 Key Scheme Characteristics

LOWER BENUE RIVER BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	DOMA	EJULE-OJEBE	DEP RIVER	KATSINA-ALA	OFARACHI
Planned Irrigable Area (ha.)	2,000	2,000	1,585	1,000	1,000
Developed Irrigable Area (ha)	250	25	500	150	10
Actual Area Cropped in 2003/04 (ha.)	*[1]10	0	*[1]50	0	0
Current Year Crop Intensity	1.04	1	1.17	1	1
Average Farm Holding (ha.)	1	0.5	0.8	0.5	
Land Ownership: Farmer Occupier (F) or User Allocation (U)	U	F	F	F	F
Cost of Leasing Land (Naira/ha.)	N/A	N/A	200	200	200
Major Crop	Melon	Rice	Hot pepper	Rice	Maize
Major Crop Yield (Tonnes/ha)	0.7	2.5	1.9	2	1.2
Second Major Crop	Okro	Maize	Okro	Maize	Spinach
Second Major Crop Yield (Tonnes/ha)	4.5	3	3.5	2.5	
IRRIGATION WATER					
Water Source	Reservoir	Lake Ota	River	River	River
Abstraction Method	Pumping	Pumping	Pumping	Pumping	Pumping
Average Annual Rainfall; (mm)	915	1,215	1,000	2,000	1,215
Water Charges (Naira/ha.)	600	750	1,000	2,000	
MAIN CANALS (MC)					
Total Length of Main Canals (km)	N/A	N/A	10	1.6	N/A
% of Lining of Main Canal	N/A	N/A	0	0	N/A
Silt Level in Canals (10 = high; 1 = low)	N/A	N/A	3	4	N/A
Weed in Canal (10 = high; 1= Low)	N/A	N/A	3	5	N/A
Total Length of Main Pipeline (km)	N/A	N/A	N/A	N/A	N/A
SUB-MAIN/SECONDARY CANALS					
Total Length of Sub Main Canals (km)	N/A	1.25	12	1.2	N/A
% lining of Sub-main Canals	N/A	0	0	0	N/A
Silt Level in SMC (10 = high; 1 = low)	N/A	7	4	5	N/A
TERTIARY/FIELD CHANNELS					
Final Distribution to Farm (lined/unlined)	N/A	N/A	N/A	N/A	N/A
Water Distribution Schedule to Farmer	N/A	Known Rotation	Known Rotation	Known Rotation	N/A
Final distribution of water: (Farmer or Farmer Group/WUA)	N/A	Farmer	Farmer	Farmer	N/A
Method of water delivery to the fields	Sprinkler	Breaking of bunds	Breaking bunds	4"/3" AC pipes	Sprinkler
No. of Farmers Involved in the Scheme	50	20	*[2]31	200	50
Existence of WUA (Yes or No)	Yes	Yes	Yes	Yes	Yes
Existence of other Farmers Group (Yes or No)	No	No	No	No	No
WUA Effectiveness (1 = low; 10 = high)	2	0	2	1	1
DRAINAGE SYSTEM					
Length of Principal Drains (km)	Not constructed	0	10	Not so defined	N/A
Silt Level in Drains(10 high; 1 = low)	N/A	N/A	4	10	N/A
Weed in Drain (10 = high; 1= Low)	N/A	N/A	5	2	N/A
Remarks	*1- Under National Fadama Dev. Program. *2- Irrigation System is sprinkler	Irrigation last carried out in 1985.	*1- 30ha under - private farmer inclusive. *2- 6 private farmers	Irrigation last carried out in 1995.	Irrigation System is Sprinkler

Table 4.11.7 (Contd.) Key Scheme Characteristics

LOWER BENUE RIVER BASIN DEVELOPMENT AUTHORITY (Contd.)

CHARACTERISTICS/SCHEME	NAKA	BOKKOS	LONGKAT	MAKURDI	JATO-AKA
Planned Irrigable Area (ha.)	100	30	2,000	1,000	1,000
Developed Irrigable Area (ha)	10	5	100	100	20
Actual Area Cropped in 2003/04 (ha.)	2	8	0	0	0
Current Year Crop Intensity	2	2	1	1	1
Average Farm Holding (ha.)	0.1	0.25	1	1.25	1
Land Ownership: Farmer Occupier (F) or User Allocation (U)	F	F	F	F	F
Cost of Leasing Land (Naira/ha.)	200	200	0	0	0
Farm Labour Cost (Naira/day)	350	400	400	450	300
Major Crop	Okro	Irish potatoes	Rice	Rice	Rice
Major Crop Yield (Tonnes/ha)	0.8	7.5	3.5	2	2
Second Major Crop	Spinach	N/A	N/A	Maize	Maize
Second Major Crop Yield (Tonnes/ha)	0.4	N/A	N/A	2.5	2.5
IRRIGATION WATER					
Water Source	River	Reservoir	River	River	River
Abstraction Method	Pumping	Pumping	Pumping	Pumping	Pumping
Average Annual Rainfall; (mm)	1,125	860	823	1,125	2,000
Water Charges (Naira/ha.)	1,500	6,000	0		0
MAIN CANALS (MC)					
Total Length of Main Canals (km)	N/A	0.2	2	2.4	0.25
% of Lining of Main Canal	N/A	0	0	0	0
Silt Level in Canals (10 = high; 1 = low)	N/A	3	4	7	5
Weed in Canal (10 = High; 1= Low)	N/A	2	3	5	4
Total Length of Main Pipeline (km)	N/A	0.3	0.6	0	0
SUB-MAIN/SECONDARY CANALS					
Total Length of Sub Main Canals (km)	N/A	N/A	4.5	1.8	2
% lining of Sub-main Canals	N/A	N/A	0	0	0
Silt Level in SMC (10 = high; 1 = low)	N/A	N/A	4	8	6
TERTIARY/FIELD CHANNELS					
Final Distribution to Farm (lined/unlined)	N/A	Unlined	N/A	N/A	N/A
Water Distribution Schedule to Farmer	N/A	Known rotation	Known rotation	Known rotation	Known rotation
Final distribution of water: (Farmer or Farmer Group/WUA)	N/A	Farmer	Farmer	Farmer	Farmer
Method of water delivery to the fields	Sprinkler	With bowls	siphons	3"/4" AC pipes	Breaking bunds
No. of Farmers Involved in the Scheme	20	20	105	75	20
Existence of WUA	Yes	Yes	Yes	Yes	Yes
Existence of other Farmers Group (Yes or No)	No	No	No	No	No
WUA Effectiveness (1 = low; 10 = high)	1	1	1	1	1
DRAINAGE SYSTEM					
Length of Principal Drains (km)	1.5	0	2.1	0	0
Silt Level in Drains (10 high; 1 = low)	4	N/A	7	N/A	N/A
Weed in Drain (10 = high; 1= Low)	3	N/A	6	N/A	N/A
Remarks	Irrigation system de-signed for surface but the 2ha available is sprinkler.				

Table 4.11.8 Key Scheme Characteristics

OGUN-OSHUN RIVER BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	ITOIKIN	LOWER OGUN	MIDDLE OGUN	SEPETERI	OFIKI	OKE-ODAN
Planned Irrigable Area (ha.)	141	12000	12000	2000	2000	400
Developed Irrigable Area (ha)	141	200	40	80	12	12
Actual Area Cropped in 2003/04 (ha.)	70	40	0	0	0	0
Current Year Crop Intensity	1.5	1.2	1	1	1	1
Average Farm Holding (ha.)	4	1.0.	N/A	N/A	N/A	N/A
Land Ownership - (Farmer Occupier (F) or User Allocation (U)	U	U	U	U	U	U
Cost of Leasing Land (Naira/ha.)	800	800	N/A	N/A	N/A	N/A
Major Crop	Maize	Maize	N/A	N/A	N/A	N/A
Major Crop Yield (Tonnes/ha)	3.5	N/A	N/A	N/A	N/A	N/A
Second Major Crop	Vegetables	Vegetables	N/A	N/A	N/A	N/A
Second Major Crop Yield (Tonnes/ha)	1.8	N/A	N/A	N/A	N/A	N/A
IRRIGATION WATER						
Water Source	River	Reservoir	Reservoir	Reservoir	Reservoir	Reservoir
Abstraction Method	Pumping	Pumping	Pumping	Pumping	Pumping	Pumping
Average Annual Rainfall; (mm)	1,350	1,300	1,250	1,150	1,150	1,300
Water Charges (Naira/ha)	2,500	2,500	N/A	N/A	N/A	N/A
MAIN CANALS (MC)						
Total Length of Main Canals (km)	5	N/A	N/A	N/A	N/A	N/A
% of Lining of Main Canal	20%	5	N/A	N/A	N/A	N/A
Silt Level in Canals (10 = high; 1 = low)	1	2	N/A	N/A	N/A	N/A
Weed in Canal (10 = high; 1= Low)	2	1	N/A	N/A	N/A	N/A
Total Length of Main Pipeline (km)	N/A	1.8	N/A	N/A	N/A	N/A
SUB-MAIN/SECONDARY CANALS						
Total Length of Sub Main Canals (km)	140	N/A	N/A	N/A	N/A	N/A
% lining of Submain Canals	0	N/A	N/A	N/A	N/A	N/A
Silt Level in SMC (10 = high; 1 = low)	3	N/A	N/A	N/A	N/A	N/A
TERTIARY SYSTEM/FIELD CHANNELS						
Final Distribution to Farm (lined/unlined)	Unlined	N/A	N/A	N/A	N/A	N/A
Water Distribution Schedule to Farmer	Arranged	Arranged	N/A	N/A	N/A	N/A
Final distribution of water-Farmer/Farmer's Group/WUA	Farmer	Farmer	N/A	N/A	N/A	N/A
Method of Water Delivery To Fields	Arranged	Sprinkler	Sprinkler	Sprinkler	Sprinkler	N/A
No. of Farmers Involved in the Scheme	22	40	N/A	N/A	N/A	N/A
Existence of WUA (Yes or No)	Yes	Yes	No	No	No	No
Existence of other Farmer's Group (Yes or No)	Yes	Yes	No	No	No	No
WUA Effectiveness (High 10 ;Low 1)	5	3	N/A	N/A	N/A	N/A
DRAINAGE SYSTEM						
Length of Principal Drains (km)	120	N/A	N/A	N/A	N/A	N/A
Silt Level in Drains(10 high; 1 = low)	8	N/A	N/A	N/A	N/A	N/A
Weed in Drain (10 = high; 1= Low)	4	N/A	N/A	N/A	N/A	N/A
Remarks		first irrigation season	No irrigation yet	2 Small Dams Completed) 400ha Designed)	2 Small Dams (Completed)	1 Small Dam (Completed) 400ha designed & Contract awarded

Table 4.11.9 Key Scheme Characteristics

BENIN OWENA RIVER BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	ILLUSHI EGA	OBAYANTOR	UKHUN ERHA	ERUSU	IKERE OGBESE
Planned Irrigable Area (ha.)	5000	250	250	250	45
Developed Irrigable Area (ha)	50	100	0	0	32
Actual Area Cropped in 2003/04 (ha.)	0	0	0	0	0
Current Year Crop Intensity	1	1	1	0	1
Average Farm Holding (ha.)	N/A	N/A	N/A	N/A	1
Land Ownership - (Farmer Occupier (F) or User Allocation (U)	U	U	N/A	N/A	U
Cost of Leasing Land (Naira/ha.)	N/A	1,000	N/A	N/A	1,000
Farm Labour Cost (Naira/day)	800	800	800	800	800
Major Crop	Rice	Vegetables	N/A	N/A	Maize
Major Crop Yield (Tonnes/ha)	1	1.5	N/A	N/A	2.0
Second Major Crop	N/A	N/A	N/A	N/A	Okro
Second Major Crop Yield (Tonnes/ha)	N/A	N/A	N/A	N/A	N/A
IRRIGATION WATER					
Water Source	River	Borehole	Reservoir	Reservoir	River
Abstraction Method	Pumping	Pumping	Pumping	Gravity	Pumping
Average Annual Rainfall; (mm)	2250	2250	1700	1400	1300
Water Charges (Naira/ha)	N/A	N/A	N/A	N/A	500
MAIN CANALS (MC)					
Total Length of Main Canals (km)	0.4	N/A	N/A	N/A	N/A
% of Lining of Main Canal	100	N/A	N/A	N/A	N/A
Silt Level in Canals (10 = high; 1 = low)	N/A	N/A	N/A	N/A	N/A
Weed in Canal (10 = high; 1= Low)	N/A	N/A	N/A	N/A	N/A
Total Length of Main Pipeline (km)	N/A	N/A	2.5	N/A	0.3
SUB-MAIN/SECONDARY CANALS					
Total Length of Sub Main Canals (km)	0.8	N/A	N/A	N/A	N/A
% Lining of Submain Canals	0	N/A	N/A	N/A	N/A
Silt Level in SMC (10 = high; 1 = low)	N/A	N/A	N/A	N/A	N/A
TERTIARY / FIELD CHANNELS					
Final Distribution to Farm (lined/unlined)	Unlined	N/A	N/A	N/A	N/A
Water Distribution Schedule to Farmer	N/A	N/A	N/A	N/A	Arranged
Final distribution of water- Farmer / Farmer's Group/WUA	N/A	N/A	N/A	N/A	Farmer
Method of Water Delivery to Fields	N/A	N/A	N/A	N/A	Sprinkler
No. of Farmers Involved in the Scheme	N/A	N/A	N/A	N/A	22
Existence of WUA (Yes or No)	No	No	No	No	Yes
Existence of other Farmer's Group (Yes or No)	No	No	No	No	No
WUA Effectiveness (High 10; Low 1)	N/A	N/A	N/A	N/A	5
DRAINAGE SYSTEM					
Length of Principal Drains (km)	N/A	N/A	N/A	N/A	N/A
Silt Level in Drains (10 high; 1 = low)	N/A	N/A	N/A	N/A	N/A
Weed in Drain (10 = high; 1= Low)	N/A	N/A	N/A	N/A	N/A
Remarks	50ha Pilot Scheme badly constructed. 5,000ha designed	Project Abandoned (Sprinkler)	Dam completed but has problems	Dam under construction	Sprinkler but farmer assisted

Table 4.11.10 Key Scheme Characteristics

ANAMBRA-IMO RIVER BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	LAIP Omor 1	Igwu 2	Isi Uzo 3
Planned Irrigable Area (ha.)	5,000	400	300
Developed Irrigable Area (ha)	3,850	71	20
Actual Area Cropped in 2003/04 (ha.)	Nil	Nil	10
Current Year Crop Intensity	1	1	1.5
Average Farm Holding (ha.)	0.5	0.25	0.25
Land Ownership - (Farmer Occupier (F) or User Allocation (U)	U	U	U
Cost of Leasing Land (Naira/ha.)	N/A	N/A	N/A
Major Crop	Rice	Rice	Vegetables
Major Crop Yield (Tonnes/ha)	3.5	2.5	3
Second Major Crop	N/A	N/A	Rice
Second Major Crop Yield (Tonnes/ha))	N/A	N/A	2.5
IRRIGATION WATER			
Water Source	River	River	River
Abstraction Method	Pumping	Pumping	Pumping
Average Annual Rainfall; (mm)	1650	1750	1600
Water Charges (Naira/ha.)	3,000	N/A	6,400
MAIN CANALS (MC)			
Total Length of Main Canals (km)	40	3.5	N/A
% of Lining of Main Canal	2	100	N/A
Silt Level in Canals (10 = high; 1 = low)	6	N/A	N/A
Weed in Canal (10 = high; 1= Low)	6	10	N/A
Total Length of Main Pipeline (km)	N/A	N/A	N/A
SUB-MAIN/SECONDARY CANALS			
Total Length of Sub Main Canals (km)	12	N/A	N/A
% Lining of Sub main Canals	N/A	N/A	N/A
Silt Level in SMC (10 = high; 1 = low)	5	N/A	N/A
TERTIARY /FIELD CHANNELS			
Final Distribution to Farm (lined/unlined)	Unlined	Unlined	Sprinkler
Water Distribution Schedule to Farmer	Weekly	N/A	Weekly
Final distribution of water – Farmer/Farmer Group/WUA	Farmer	N/A	Operatives
No. of Farmers Involved in the Scheme.	25	N/A	N/A
Existence of WUA (Yes or No)	Yes	No	No
Existence of other Farmer's Group (Yes/No)	No	No	No
WUA Effectiveness (High = 10; Low = 1)	1	N/A	N/A
DRAINAGE SYSTEM			
Length of Principal Drains (km)	225	0.75	N/A
Silt Level in Drains (10 high; 1 = low)	4	6	N/A
Weed in Drain (10 = high; 1= Low)	6	5	N/A
Remarks 4. Still on the drawing board.			

Table 4.11.11 Key Scheme Characteristics

CROSS RIVER BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	ABAK	IJEGU-YALA	OBUBRA	OBUDU	OGOJA	ONIONG N. NDEM
	1	2	3	4	5	6
Planned Irrigable Area (ha.)	62	2,200	500	120	125	405
Developed Irrigable Area (ha)	62	0	17	20	125	140
Actual Area Cropped in 2003/04 (ha.)	0	0	0	10	0	30
Current Year Crop Intensity	1	1	1	1.5	1	1.2
Average Farm Holding (ha.)	0.04	N/A	N/A	0.25	0.25	0.04
Land Ownership - (Farmer Occupier (F) or User Allocation (U)	U	N/A	U	U	U	U
Cost of Leasing Land (Naira/ha.)	N/A	N/A	N/A	N/A	N/A	N/A
Major Crop	Vegetables	N/A	Vegetables	Vegetables	Vegetables	Vegetables
Major Crop Yield (Tonnes/ha)	2.5	N/A	N/A	2	2	2.5
Second Major Crop	Maize	N/A	N/A	N/A	Rice	Maize
Second Major Crop Yield (Tonnes/ha)	1	N/A	N/A	N/A	N/A	N/A
IRRIGATION WATER						
Water Source	River	N/A	River	River	River	Groundwater
Abstraction Method	Pumping	N/A	Pumping	Pumping	Pumping	Pumping
Average Annual Rainfall; (mm)	1800	N/A	1200	1000	1000	2500
Water Charges (Naira/ha.)	3,000	N/A	2,000	N/A	3,000	3,500
MAIN CANALS (MC)						
Total Length of Main Canals (km)	1.7	N/A	N/A	1.4	5.6	0.9
% of Lining of Main Canal	100	N/A	N/A	100	100	100
Silt Level in Canals (10 = high; 1 = low)	3	N/A	N/A	1	1	1
Weed in Canal (10 = high; 1= Low)	6	N/A	N/A	3	3	2
Total Length of Main Pipeline	N/A	N/A	N/A	N/A	N/A	N/A
SUB-MAIN/ SECONDARY CANALS						
Total Length of Sub Main Canals (km)	Sprinklers	N/A	N/A	1.1	N/A	N/A
% Lining of Sub-main Canals	N/A	N/A	N/A	N/A	N/A	N/A
Silt Level in SMC (10 = high; 1 = low)	N/A	N/A	N/A	N/A	N/A	N/A
TERTIARY /FIELD CHANNELS						
Final Distribution to Farm (lined/unlined)	N/A	N/A	N/A	N/A	N/A	N/A
Water Distribution Schedule to Farmer	N/A	N/A	N/A	N/A	N/A	N/A
Final distribution of water- Farmer/Farmer Group/WUA	Farmer	N/A	N/A	Farmer	Farmer	Farmer
Method of Water delivery to the Fields	Sprinklers	N/A	N/A	Breaking bunds	Breaking bunds	Breaking bunds
No. of Farmers Involved in the Scheme	N/A	N/A	N/A	35	N/A	50
Existence of WUA (Yes or No)	No	No	No	No	No	No
Existence of other Farmers Group WUA (Yes/No)	No	No	No	No	No	No
WUA effectiveness (High = 10; Low = 1)	N/A	N/A	N/A	N/A	N/A	N/A
DRAINAGE SYSTEM						
Length of Principal Drains (km)	N/A	N/A	N/A	N/A	1.5	0.5
Silt Level in Drains (10 high; 1 = low)	N/A	N/A	N/A	N/A	4	4
Weed in Drain (10 = high; 1= Low)	N/A	N/A	N/A	N/A	6	5

Remarks

1. No Irrigation practise since 2001 due to break down of facilities and compensation problems.
2. Still on the drawing board.
3. Still on the drawing board.
4. Still on the drawing board.
5. Due to lack of funding there was no Irrigation practise in the 2003/2004 dry season
6. Functional and 2003/2004 Dry season practised was based on residual moisture rather than the established source of water supply

Table 4.11.12 Key Scheme Characteristics

NIGER DELTA BASIN DEVELOPMENT AUTHORITY

CHARACTERISTICS/SCHEME	KPONG 1	ISAMPOU 2	PEREMABIRI 3	KOLO 4
Planned Irrigable Area (ha.)	150	4,000	2,500	100
Developed Irrigable Area (ha)	30	50	34	30
Actual Area Cropped in 2003/04 (ha.)	0	0	0	0
Current Year Crop Intensity	1	1	1	1
Average Farm Holding (ha.)	N/A	N/A	N/A	N/A
Land Ownership - (Farmer Occupier (F) or User Allocation (U)	U	U	U	U
Cost of Leasing Land (Naira/ha.)	N/A	N/A	N/A	N/A
Major Crop	Vegetables	Rice	Rice	Rice
Major Crop Yield (Tonnes/ha)	N/A	N/A	N/A	N/A
Second Major Crop	N/A	N/A	N/A	N/A
Second Major Crop Yield (Tonnes/ha)	Tree Crops	N/A	N/A	N/A
IRRIGATION WATER				
Water Source	River	River	River	River
Abstraction Method	Pumping	Pumping	Pumping	Pumping
Average Annual Rainfall; (mm)	2450	2900	2900	2650
Water Charges (Naira/ha.)	N/A	N/A	N/A	N/A
MAIN CANALS (MC)				
Total Length of Main Canals (km)	N/A	N/A	N/A	N/A
% of Lining of Main Canal	N/A	N/A	N/A	N/A
Silt Level in Canals (10 = high; 1 = low)	N/A	N/A	N/A	N/A
Weed in Canal (10 = high; 1= Low)	N/A	N/A	N/A	N/A
Total Length of Main Pipeline (km)	N/A	N/A	N/A	N/A
SUB-MAIN/ SECONDARY CANALS				
Total Length of Sub Main Canals (km)	N/A	N/A	N/A	N/A
% lining of Sub-main Canals	N/A	N/A	N/A	N/A
Silt Level in SMC (10 = high; 1 = low)	N/A	N/A	N/A	N/A
TERTIARY SYSTEM/FIELD CHANNELS				
Final Distribution to Farm (lined/unlined)	N/A	N/A	N/A	N/A
Water Distribution Schedule to Farmer	N/A	N/A	N/A	N/A
Final distribution of water- Farmer/Farmer Group/WUA	N/A	N/A	N/A	N/A
Method of Water Delivery to the Fields	N/A	N/A	N/A	N/A
No. of Farmers Involved in the Scheme	N/A	N/A	N/A	N/A
Existence of WUA (Yes or No)	No	No	No	No
Existence of other farmer's Group (Yes or No)	No	No	No	No
WUA effectiveness (High = 10; Low = 1)	N/A	N/A	N/A	N/A
DRAINAGE SYSTEM				
Length of Principal Drains (km)	N/A	N/A	N/A	N/A
Silt Level in Drains (10 high; 1 = low)	N/A	N/A	N/A	N/A
Weed in Drain (10 = high; 1= Low)	N/A	N/A	N/A	N/A

Remarks

1. Scheme was abandoned since 1986.
2. Scheme still on drawing board
3. Scheme still on drawing board
4. Scheme still on drawing board

Table 4.12.1 Positive and Negative Aspects of Selected Schemes

SCHEME	POSITIVE ASPECTS	NEGATIVE ASPECTS
LAIP OMOR (AIRBDA)	Simple design and construction work quality is satisfactory. Farmers are really interested and are willing to contribute towards effective O&M.	Utilizes large and bulky pumps that involve high energy cost. The unlined 40km primary canals (head race & main canals) requires an appropriate lining. Irrigation is practised at night, which is difficult and ineffective. Present land ownership and re-distribution system are hindrance to sustainable O & M.
Oniong Nung Ndem (CRBDA)	Source of water supply (groundwater) is renewable in view of ready recharge from the Kwa Iboe river system and should support additional tube wells if scheme is expanded. Assured marketing outlet in view of scheme's proximity to an urban centre. Gender friendly with about 80% women farmers.	Scheme lies in heavily forested region where land clearing and levelling constitutes about 40% of total developmental cost. Involves pumping with resultant high energy costs. Certain portions of the scheme are prone to flooding from the Kwa Iboe river. Risk of salt water intrusion is high.
Abak (CRBDA)	Located on the outskirts of a semi-urban community, access to the scheme is good and farm produce have a ready market.	Involves high energy cost as a result of pumping. The nozzles of the sprinkler device are readily blocked by sediment in the irrigation water from the river. Land compensation issues are major hindrance to community participation on affairs of the scheme. Soil erosion is another potential hazard.
Ogoja (CRBDA)	Gender Friendly with about 75% women farmers.	Poor quality of constructed works, particularly the land levelling aspects and the small hydraulic structures that regulate and control flow. High energy cost involving pumping, which could be reduced by exploitation of the gravity supply potentials of the scheme.
Isampou (NDBDA)	Provides employment for restive rural youths. Has potential to be converted to farmer owned scheme where small petrol driven pumps are used in association with shallow tube wells.	Risk of flooding is very high. Requires pumps for both irrigation and drainage operation during high flood period, with resultant high fuel cost. Accessibility is difficult as area is in the swamps of the Niger Delta.

Table 4.12.2 Positive and Negative Aspects of Selected Schemes

Ogun-Oshun River Basin Development Authority

PROJECT	POSITIVE ASPECTS	NEGATIVE ASPECTS
Itoikin	-Farmers interested in joint management of project -Good access roads to project site and favourable market outlets -Rehabilitation of irrigation facilities on-going but slow due to lack of funds -Farmers pay agreed water charges -Access to credit facilities -Project connected to National Grid for electricity supply, with a standby transformer. -Water delivery provided on arranged demand basis	-Lack adequate machineries for agricultural activities -Project originally supporting rice production. Now changed to maize and some other crops like okra and vegetables due to change in soil status. -Intake pumps and generator are very old -Needs increase in % of canal lining -Water quality being affected by sea intrusion -Project relies heavily on fertilizer -Seepages and blocked drains are common
Lower-Ogun	-First irrigation practice on 40ha land -Got attraction from private firm for rice seedlings production. -Project has good access roads. -Water source, the Oyan Dam has been completed	-Project is heavily dependent on electro-mechanical components -Project is based on sprinkler system, which is difficult to manage -Project pumping station is yet to be connected to the National Grid -Contract for development has been going on for 14years. -Training required for farmers as irrigation is still new
Middle-Ogun	-Efforts are being made to put one out of the five irrigation sectors into operation -Water source, the Ikere Gorge Dam has been completed -Project has good access roads	-Project is large, complicated and complex -Project contract has been on since 1990, and no irrigation has ever taken place on the project despite the high investment committed. -Project is based on sprinkler system which is difficult to manage -Training required for farmers as irrigation is still new
Sepeteri	-Two dams have already been completed -Design for the development of 400ha irrigable land completed -Pilot scheme developed initially to encourage farmers	-Dams have not been fully utilised since completion over 12 years ago -Necessary to ascertain stability of embankments -Necessary to review irrigation design for possibility of converting from sprinkler to gravity.
Ofiki	-Two dams have already been completed. -Pilot scheme developed to encourage the farmers	-No irrigation design yet. -Dams have not been fully utilised since completion over 12 years ago -Necessary to ascertain stability of embankments
Oke Odan	-One dam already completed -Design of 400ha irrigable land completed	Dam have not been fully utilised since completion about 10 years ago. Necessary to ascertain stability of embankment.

Table 4.12.3 Positive and Negative Aspects of Selected Schemes

Lower Niger River Basin Development Authority

PROJECTS	POSITIVE ASPECTS	NEGATIVE ASPECTS
Kampe	-Water source, Omi dam has been completed -30% of irrigable land has been completed -Project has good access road -Adequate farm machinery available -Scheme is fully by gravity	-Lack of accommodation for migrant farmers -Inadequate maintenance of existing structures. -Lack of interest by local communities in participating in irrigation activities -Possible conflicts with cattle rearers and fishermen
Tada Shonga	-Comprehensive design of 3,200ha ready for tendering	-Lack of close market outlets for disposal of products -Project area is prone to flooding during the rainy season -Lack of credit facilities -Lack of farmers
Oke-Oyi	-Good market outlets	-Lack of residential accommodation for migrant farmers -Lack of proper canals and drains, except make shift ridges and furrows. -Limitation to land availability -Reduction of weir reservoir capacity due to siltation -Pumps are old and need replacement -Some areas are sloping and not suitable for gravity system
Gerinya	-Attracted private firm for sugarcane production	Lack of proper canals and drains except make shift ridges and furrows

Table 4.12.4 Positive and Negative Aspects of Selected Schemes

Benin-Owena River Basin Development Authority

PROJECTS	POSITIVE ASPECTS	NEGATIVE ASPECTS
Illushi-Ega	-50ha pilot scheme completed -Design of 5000ha irrigation component completed	-Pilot scheme failed due to poor construction and wrong hydraulic structures -Access road to project site is poor -RBDA have shown little presence on site -Will need a dyke along the river bank -Problems with intake pumps and recession of water at river bank
Obayantor	-Existing 32ha oil palm field belonging to the RBDA -Project located within RBDA headquarters -Seedlings for oil palm, dwarf coconut and ducanut currently being produced.	-Source of water is borehole, which requires pump and electricity supply -Project is sprinkler irrigation method and difficult to maintain -No power supply to borehole site since 1993.
Ukhun Erha	-Farmers already participating in rainfed agriculture -Dam component already completed -Design of 250ha for irrigation completed -Regulating reservoir completed -Construction work for 500m main canal on-going -Project has good access roads and favourable market outlets	-Embankment failure on dam upstream slope -Irrigation facilities yet to be fully completed -Project temporarily abandoned due to lack of fund
Erusu	-Dam component under construction and about 45% completed	-Project site has limitations for irrigation activities -Farmers availability doubtful -Lack of fund to complete project
Ikere Ogbese	-Interested farmers available -Existing pilot scheme of 12ha	-Available pumps are old -Available sprinkler pipes could only cover limited area -Project area has limitation of land to only 35ha -Farmers are reluctant to pay water charges

5. ENVIRONMENTAL ASSESSMENT

5.1 Scope and Methods of the Study

The headquarters of all the RBDAs were visited while at least one scheme under each RBDA was reviewed. At the headquarters of the RBDA, besides browsing through the library and retrieving available relevant documents, interviews were held with key officials based on a checklist designed to capture the required information. At these schemes, farmers were interviewed on one-on-one basis to gather data relating to their perception on the management and performance of the project as well as on the contributions of the project to their well-being and the community at large. Observations were also made to record the physical condition and environmental implications of the scheme.

5.2 Agricultural Development and Operation

More than 85% of the schemes are designed for surface irrigation through gravity, but in quite a few, water has to be pumped into main supply canals thereby requiring hydro-lift devices. Indeed, at the South Chad Irrigation Scheme (SCIP) water is literally being pumped to flow up slope to the irrigated fields from the lower-lying Lake Chad. The few schemes anchored on sprinkler irrigation have failed. The largest of these is the Bakolori Irrigation Project (BIP) under the SRRBDA.

There are large areas suitable for irrigation under the command of the RBDAs that have not been developed. What is actually under irrigation is hardly more than 10% of planned area. Kano River Irrigation Project, Phase I (KRIPI) is the most successful and the only exception to the low level development of irrigable areas. About 68.2% of the 22,000 ha designed has been prepared and irrigated except for the land already left in fallow because of waterlogging or other site problems.

The most popular crops under dry season irrigation are vegetables such as tomato, onion, garlic eggplant, pepper, wheat, maize and cowpea. Wheat is restricted to the drier areas during the cool Harmattan period, particularly in the HJRBDA command. Rice is the most popular wet season crop grown under supplementary irrigation. Paddy rice is very popular in the southern zones. Maize is widely grown under rainfed cultivation; so are some of the local staples. However, it is noted that sorghum and millet are reacting negatively to the high water table in irrigated areas, particularly at KRIPI.

An apparent decline in irrigated area in recent years is noticeable in many of the schemes. Indeed, quite a few have folded up and are waiting for rehabilitation. Some of the reasons advanced for this declining fortune of irrigation agriculture include reliance on obsolete irrigation facilities and machines, blockage of canals by weeds thereby impeding reliable delivery of irrigation water, frequent power outages, expensive cost of fuel and the confusion created by the 1987 Decree, among others.

5.3 Environmental Situations

It is clear that soil problems related to flooding of farms, waterlogging, weed invasion, salt water intrusion (coastal areas), gradual build up of salt and lowering of pH values are already manifesting themselves in some of the schemes. Specifically, researches have shown that there are serious waterlogging and other complaints at the Kano River Irrigation Project, Phase 1, particularly at the Kore sector and at SCIP since the 1980s. Also, certain changes have occurred in the physio-chemical properties of the soil, including salt accumulation, in all the irrigation areas, particularly KRIPI (HJRBDA), SCIP 1 (CBDA) and Bakolori (SRRBDA).

A study in 1991 indicated that the soil at the Kadawa Sector of the KRP1 (HJRBDA) changed from sandy loam pre-irrigation to loamy sand postdam, the sand fraction increased at the expense of the silt and clay fractions. The cation exchange capacity increased 21.43% from 7.0 me/100g to 8.5 me/100g and exchangeable potassium increased 575% from 0.08 me/100g to 0.54 me/100g. Among the salts, only the available potassium decreased by 23.88% from 49 ppm to 37.3 ppm.

However, the researchers were quick to add that the accumulation of these salts had not reached critical levels at the time of their studies. It is believed that more recent results would still show this trend. This must be so because most of the projects started with excellent soil and water conditions as exemplified by the physical and chemical qualities of soil and water under the Uhkun/Erha Irrigation Project under the BORBDA. All the parameters indicate very good to excellent qualities for irrigation.

Salt-water intrusion has affected the scheme at Itoikin under the OORBDA. Flooding out of farmlands with associated escalated soil erosion, arising from overbankfull flow of rivers, is common in the more humid areas, generally south of latitude 9^{o}N, particularly in schemes under LBRBDA, NDBDA and CRBDA.

Some of the weeds include the striga, typha, reed, elephant grass, Eleusine indica (L.) and species of Gaertu and Chloris. Water hyacinth is also noticed in coastal areas. Certain crop diseases and pests have also emerged since the inception of many of the schemes. Common diseases include leaf rot, downy mildew (maize), blast and streak (cereals). Pests include stem borers, Quaila birds, beetles, rodents and armyworms. The environmental implications of the herbicides and pesticides used to control these diseases and pests are not being researched at present.

Some researches have attributed an increase in human diseases to the establishment of these irrigations projects. Referring extensively to the SCIP (CBDA) and the KRIPI (HJRBDA), a study in 2000 listed the human diseases that have increased in occurrences to include schistosomiasis, malaria, typhoid, river blindness, skin diseases, cholera, hepatitis and dysentery. These occurrences were attributed to the presence of pathogenic organisms in the irrigation water.

5.4 Recommendations

Certain mitigating measures thought appropriate to combat observed existing threats to the environment and socioeconomic variables to projects in the various RBDAs are presented as recommendations. Observed environmental problems to be mitigated include: the misuse of Agro-chemicals affecting soil and water quality in terms of salt accumulation, which affects all schemes. For example, white crusts on ground surface have been reported in parts of KRIPI. There is also over irrigation that has led to waterlogging problems and abandonment of parts of irrigated areas such as at KRIPI, SCIP, Bakolori (gravity area). Mono cropping of large areas for long periods has led to new strains of pests and weeds. An example is rice production at KRIPI. There have also been cases of soil nutrient depletion due to prolonged cultivation and crop up take leading to declining productivity as has been noticed by rice farmers at KRIPI. Other observed environmental problems include flooding of farmlands and erosion of canals owing to overbankfull flow or release of water from reservoirs as has happened at some LBRBDA schemes and the LAIP (AIRBDA). There are also cases of blocked or collapsed canals and water ways, which are common to all schemes on surface gravity system such as KRIPI, Hadejia Valley Scheme, SCIP, among others. Another problem is the intrusion of sea water particularly at the Itoikin scheme of OORBDA Finally the lack of proper environmental impact assessment at the onset of most of the programmes, and the absence of post-implementation monitoring and evaluation have led to a number of environmental mismanagement impacts in all schemes and no auditing too, e.g. KRIPI. Appropriate mitigation measures are suggested for all of the observed environmental problems.

It is also argued that if the gains of the RBDAs to date are to be retained, and even surpassed in a new dispensation, certain environmental variables should be subjected to routine monitoring through measurements and accurate record keeping. The key variables include soil and water physical and chemical properties, productivity, vegetation and erosion hazards. The records should also be subjected to periodic evaluation or assessment in order to determine whether the project is safely on course, or not. The paucity of relevant environmental data in the archives of many of the RBDA headquarters gives room for concern. Monitoring is expensive and the analysis of samples even more expensive. However, one RBDA may require not less than N5 million to effectively monitor soil and water annually. The question as to who to pay for the monitoring or where to find the money should not arise since without monitoring and evaluation the projects cannot be sustainable. The RBDAs or financiers must find the funds to undertake the monitoring, or face project failure.

Also, continuous mono cropping of certain crops on the same parcel of land for many years should be avoided – indeed, stopped – since this practice encourages the emergence of new strains of pests and plant diseases as well as bringing about soil nutrient depletion. A system of crop rotation should be worked out for each irrigation

scheme. The most demanding crop seems to be rice and some soils are already deteriorating under it. Yet, it is the most popular.

There should be well-equipped soil and water laboratories to cater for the needs of the RBDA. Such laboratories are needed to enhance the RBDA's environmental monitoring and auditing, which are necessary for sustainable irrigation agriculture. It may be too expensive for each RBDA to have its own laboratory. Indeed, such duplication may not lead to the establishment of a standard laboratory. Rather, there should be a standard laboratory in each of the geo-political zones of Nigeria. Luckily, these zones also reflect particular ecological zones to some extent. Samples of water and soil from the RBDAs in a particular zone would be sent for analysis in the relevant laboratory.

There should be an establishment of linkage and collaboration of RBDAs and Zonal offices of FMEnv for Post- implementation monitoring and evaluation of projects. This arrangement will encourage compliance to environmental standards.

6. IRRIGATION INSTITUTIONS

6.1 Introduction

There are a lot of institutions involved in irrigation development, management and control in the public irrigation sector in Nigeria. The roles of the various institutions are ill-defined, sometimes resulting in duplication of functions, conflict of interest, confusion and counter-productivity. The bureaucracy of the public institutions amongst them can be excessive; the key ones are overstaffed in respect of support staff while the professional/technical cadre are in most cases understaffed. These key institutions are under-funded; and most of them were established without well defined goals, purpose or output targets.

The staff of the key institutions are often underpaid and unmotivated, lacking visible incentives to render productive services. Under these circumstances their levels of accountability and transparency are low and so is their management efficiency resulting at best in marginal financial and economic returns on irrigation investments.

6.2 Existing Irrigation Institutions

6.2.1 List of Institutions

The following institutions listed in Table 6.1, are or have been involved in water resources, and by extension, in irrigation development, management and control. They either do influence or are influenced by the course of irrigation development in Nigeria. Table 6.1 distinguishes between public and private institutions and Federal and State/Local Government institutions. It also shows the main water–and/or irrigation-related responsibilities of each institution as well as the supervising authority it reports to.

Of the listed institutions those directly involved in public irrigation development include the FMWR, RBDAs, FMEnv, NWRI, IAR and NAERLS the latter two being of Ahmadu Bello University, LCRI, NCRI, Nigerian Institute for Horticultural Research, NSDC and SIDs.

Table 6.1 List of Institutions involved in Irrigation in Nigeria

Category	Organization	Main water-and/or irrigation-related Responsibilities
Public Sector/ Federal	Federal Ministry of Water Resources (FMWR)	Responsible for policy formulation and coordination of activities relating to irrigation and drainage, conservation, quality and quantity control of inland water bodies
	Federal Ministry of Environment (FMEnv.)	Responsible for policy formulation and coordination of activities related to environmental conservation & quality control of land and water utilization, soil erosion and flood control, forestry and watershed management of inland waterways.
	Federal Ministry of Power and Steel	Functional responsibilities for development, and management of hydro-power generation in the country.
	Federal Ministry of Transport	Functional responsibilities for supervision of activities related to navigation on the inland waterways.
	Federal Ministry of Agric. And Rural Development (FMARD)	Has responsibilities for some aspects of fisheries, fadama irrigation.
	Federal Ministry of Works	Functional responsibilities for coastal and flood defence and some aspects of coastal water quality.
	Federal Ministry of Health	Functional responsibilities for ensuring quality control of potable water supplies and water borne diseases.
	Federal Ministry of Science Technology	Functional responsibilities for research into aspects of water resources quality and quantity.
	Agricultural Research Institutes	Functional responsibilities for irrigation research.
	River Basin and Rural Development Authorities	Public parastatals with accountability to FMWR; Responsibilities include water pollution, Water resources management, flood control, irrigation, rural water supply, bulk water retail, and conservation.
	National Water Resources Institute	Reports to FMWR; Responsible for applied research, and training of a middle level manpower requirement in the water resources sector.
	National Inland Waterways Authority	Transport Responsible for navigation on the inland watways.

Category	Organization	Main water-and/or irrigation-related Responsibilities
Public Sector/ Federal Continued		
	National Electric Power Authority	Reports to Federal Ministry of Power and Steel; Responsible for development and management of hydro-power installation on the inland waterways.
	Nigerian Sugar Development Council	Reports to Federal Ministry of Industry; Responsible for development of sugar cane and beets to meet the growing domestic sugar needs.
	North East Arid Zone Development Programme[8]	A joint public (Federal, Borno and Yobe State Governments) institution that was funded by EEC on rural development programme
Public Sector/	State Ministry of Water Resources	Responsible for water resources, planning and development in the states.
	State Ministry of Works	Most States that have no Ministry of Water resources have Minstry of Works responsible for water resources development.
	State Ministry of Agriculture	Has functional responsibilities for supervision of ADP engaged in Fadama development and generally houses the State Irrigation Department.
	State Water Agency	Responsible for potable water supply and sanitation.
Educational	Polytechnics & Universities	Training and Research in water resources.
Private/Non-Government Organisations	The Hadejia Nguru Wetlands Conservation Project;NCF	An NGO that is managed by the IUCN (The World Conservation Union).
Financial	Banks WB, ADB	Funding Fadama Projects
Regional Org.	NBA, LCBC, NNJC	Solving transboundary water problems.
UN Org.	FAO, IWMI	Undertake studies. Provide tech. advice
Others	WUAs & Farmers	The Beneficiaries

FMWR has the statutory responsibility for policy formulation and coordination for water resources and public sector irrigation development and management throughout the federation. The ministry formulates policy through the NCWR which is chaired by the FMWR and has as its members, all the State commissioners responsible for water resources development as well as representatives of the other federal agencies which are also concerned with water use, such as the NEPA, the IWD and the FMARD.

[8] No longer funded by EEC and Borno State has no stake in it any more

6.2.2 Functions of the Federal Ministry of Water Resources

The functions of the FMWR are listed in Table 6.2. The NTCWR provides technical advice on policy issues. Chaired by the Permanent Secretary of the FMWR, its membership includes: the departmental directors of FMWR (including the director of NWRI), the Managing Directors of the RBDAs, NEPA, the State government water boards, the Directors of the State ministry responsible for water resources, the Directors of NIWA, the Department of Meteorology, representatives of: Universities, Nigerian Society of Engineers, Consultants and Contractors in the water resources sector. The NTCWR which meets twice a year has five specialist sub-committees: dams, water supply, irrigation & drainage, hydrology & hydrogeology, and manpower. However, it now meets once a year due to fund constraints.

The Department of Irrigation and Drainage (DID) is one of the seven departments of the FMWR. The DID is charged with the responsibility of promoting the development of irrigated agriculture through the RBDAs, and to provide guidance and technical support to the RBDAs and facilitating irrigation development masterplans.

6.2.3 River Basin Development Authorities (RBDA)

There are currently twelve RBDAs and are responsible for implementing the irrigation development policies of the Federal Government. The initial mandate of the RBDAs was rather broad[9] and has since been modified by the Federal Government Decree No. 35 of 1987. Their main functions now are as follows:

- To undertake comprehensive development of both surface and groundwater resources for multipurpose use, with particular emphasis on the provision of irrigation infrastructure and control of flood and erosion, and for watershed management;

- To construct, operate and maintain dams, lakes, polders, wells, irrigation and drainage systems for achievement of the authorities' functions and to hand over all lands to be cultivated on irrigation schemes to farmers;

- To supply water from completed storage schemes to all users for a fee to be determined by the authority with approval of the ministry;

- To construct, operate and maintain infrastructural services such as roads and bridges linking project sites, provided that such services are included and form an integral part of the list of approved projects; and

- To develop and keep up-to-date, a comprehensive water resources masterplan, identifying all water resources requirements in the authorities' areas of operation, through adequate collection and collation of water resources, water use, socio-economic and environmental data of the River Basin.

[9] In Nigeria, RBDAs essentially cover area based on hydrological boundaries with some few medications that were based on administrative or political boundaries convenience.

Table 6.2 Functions of the Federal Ministry of Water Resources

No	Definition/Description of function
1	Formulate and implement a Water Resources Master Plan for irrigation development;
2	Develop and support irrigated agriculture;
3	Promote and sustain national food security by minimizing unexpected and undesirable shortfalls in domestic food production and agro-based raw materials caused by the vagaries of weather;
4	Collect, store, analyse and disseminate hydro meteorological and hydrological data;
5	Support, monitor and evaluate the programmes and performances of theRBDAs and the NWRI;
6	Explore and develop surface and underground water resources;
7	Co-ordinate the development and utilization of water resources for irrigation and water supply;
8	Liaise with all relevant national and International Agencies on all matters relating to water resources development;
9	Support studies and research on the nation's underground and surface water resources potentials;
10	Undertake hydrological and hydro-geological investigations;
11	Formulate and implement national irrigation policy that is consistent and complementary to the national agriculture policy;
12	Formulate and review from time to time the National Water Legislation;
13	Develop programmes and policy towards surface water storage schemes;
14	Develop guiding principles for dam construction nation-wide;

The RBDAs are funded directly by the FGN and are expected to recover operation and maintenance costs from the beneficiaries of their schemes. The RBDAs have been categorized into A, B & C, on the basis of the level and value of their assets, and development of their projects as shown in Table 6.3.

The organogram of each RBDA Category A, B or C is shown in Figure 6.1. Beyond the statutory limits placed by the FGN on the Board sizes, the actual organograms suggests that each Board is free to create as many positions as its funds can support. Some of the positions are of questionable relevance to irrigation and drainage development, management and control.

Table 6.3 Board Composition of River Basin Development Authorities (RBDAs) in Nigeria by Categories

	Categories of the R.B.D.A		
Board Membership	A	B	C
Chairman, Part-Time	1	1	1
FMWR Representative Part-time	1	1	1
Managing Director Full-Time	1	1	-
General Manager Full-Time	-	-	1
Executive Director, Full-Time			
Exec. Director, Operations	1	1	-
Exec. Director, Services	1	1	-
Exec. Director Finance & Admin.	1	-	-
Part-Time Directors	3	2	2
Total Board Membership	9	7	5
Name of RBDA	CHAD,HJ,SR	AI,OO,LB, UB,LN,UN	BO,Cross, ND
No. of RBDAs	3	6	3

6.2.4 NIWA, NEPA and other Federal Government Institutions

The FMT through its parastatal, the NIWA and the FMPS through its own parastatal, NEPA are concerned with only the flow regimes and capacities of rivers Niger, Benue, Kaduna and their tributaries.

They do not withdraw or extract water from these sources for consumptive use. However their activities require that some measure of regulation be imposed on the rivers to achieve the objectives of these institutions. For example, navigation locks have to be opened and closed to allow the passage of vessels and water levels must be raised and lowered at the dams in the course of generating hydroelectric power. These regulations affect the amount of water available to irrigation projects downstream or upstream of such operations, and the influence of these institutions on irrigation activities should be taken into consideration.

Other relevant Federal Government Institutions are as follows:

(a) The FMEnv is now charged with the responsibility of managing and protecting the Nation's environment. Its main relevance to public irrigation projects is in the form the enforcement of Environmental Impact Assessment (EIA) studies of water resources projects. Unfortunately the priority rating of EIA has been falling since the advent of the present civilian administration in 1999. For example, most of the EIA components of the 2002 FMWR budget proposal were not supported by the National Assembly Appropriation Committee on Water Resources, and so could not be funded. As to the recommendations in the EIA conducted so far, the construction of the projects to which they refer has either slowed down or stopped completely because of lack of funds. For the same reason, the recommended mitigation measures in the EIA reports could not be implemented. Thus the recommendations of EIA studies are rarely followed because most of the projects concerned, such as the Kampe (LNRBDA).

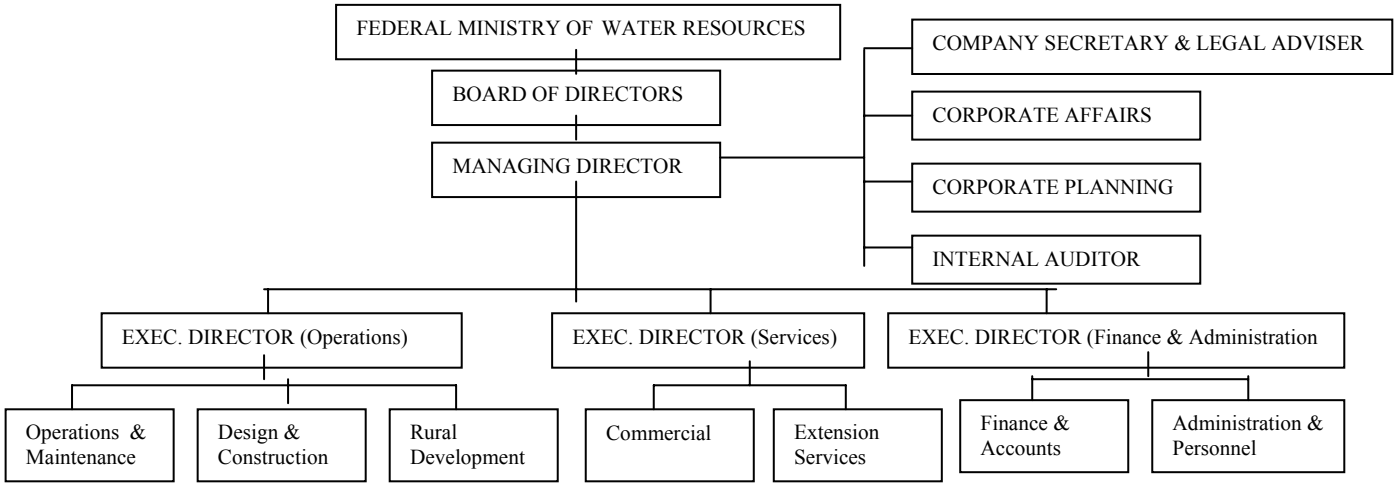
(b) The NWRI was established in 1979 as an agency of FMWR to provide diploma and higher diploma level training in water resources engineering technology. It also organizes short training courses for post graduate personnel, and undertakes modest engineering research, related to water resources development activities including irrigation, water supply and flood control. A key function of the NWRI is to establish and maintain a water resources library and documentation centre which it has done to the extent that available funds permit. It is also to promote the establishment of a uniform national data collection system for surface and underground water resources. According to the December 2003 draft of the National Water Resources Policy (p.2), NWRI had trained 805 officers of State Water Agencies and has been running a Data Bank with data from eight hydrological areas and 222 meteorological stations nationwide. Other tertiary institutions also offer training in water resources/irrigation engineering.

(c) Basic agricultural research, including irrigated agriculture research, is carried out mainly by the IAR, LCRI, the NCRI and the NIHR.

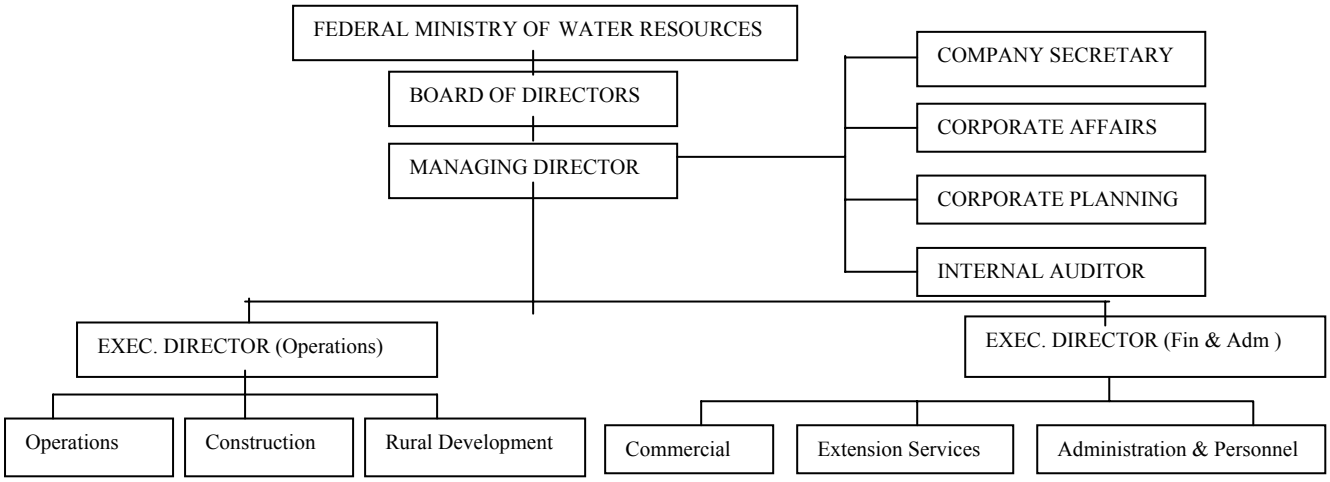
(d) The NSDC reports to the FMI and participates in irrigation through the development of infrastructure necessary for the cultivation of sugarcane for sugar production.

(e) The FMARD through the ADPs, carries out fadama irrigation activities, with a total potential of 2.04 million hectares out of which 120,000 hectares were targeted in 2001 to be financed by the World Bank.. FMARD houses the Department of Agriculture, Fisheries and Rural Development, and it is the custodian of the nation's agricultural extension and other input services. It renders no significant irrigation extension services to the irrigation projects under the FMWR at present. This is surprising as the fisheries and rural development supervisory functions of the RBDAs were transferred to the FMARDs from FMWR.

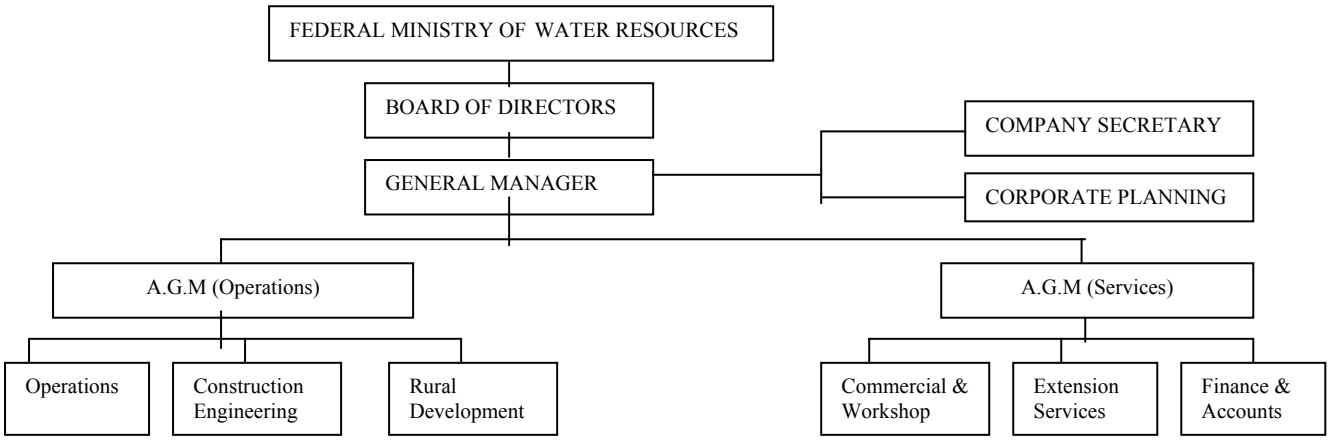
Figure 6.1 Organogram for R.B.D.A in Nigeria



(a) Category “A”



(b) Category “B” : B and C have only 2 Exec. Directors/AGMs not 3



(c) Category "C": GM not MD; has less administration

6.2.6 Other Institutions

The other institutions include the regional and the United Nations institutions.

(a) Regional Institutions

Most of Nigeria's water resources either originate from or flow through territories outside its borders. That makes them share resources covered by international and bilateral agreements and protocols. Nigeria is currently a member of three regional bodies with common water resources interests, all of which impact on the water management of the basins concerned and the irrigation activities therein. These are the Niger Basin Authority (NBA), the Lake Chad Basin Commission (LCBC) and the Nigeria/Niger Joint Commission (NNJC).

(b) United Nations Institutions

The Food and Agriculture Organization (FAO) of the United Nations, and the International Water Management Institute (IWMI) have been involved in irrigation management in Nigeria in one form or another. FAO had carried out (i) studies in the early 1960s, as a result of which three pilot public irrigation schemes at Bakolori (SRRBDA), KRIP (HJRBDA) and SCIP (CBDA), were developed; (ii) a scientific assessment in 1987 of Africa's land carrying capacity, resulting in a document titled "Need and Justification of Irrigation Development"; (iii) the irrigation subsector review for Nigeria in 1992 and later reviewed in 2000. IWMI, (formerly IIMI) facilitated the HJRBDA with the formation and operation of its WUAs at the KRIPI (HJRBDA) from 1990 to 1992.

6.2.7 Institutional Changes in Irrigation

A number of institutional changes have occurred in water resources and irrigation in Nigeria through the past 45 years. These are highlighted in Table 6.4.

Table 6.4 Institutional Changes and Developments in Water Resources and Irrigation Sector

Period	Development
1959	Creation of the Inland Waterways Division of the Federal Ministry of Communications based in Lokoja with responsibility for monitoring levels in the Niger/Benue system.
1960-66	Formation of Hydrological Unit under the First Republic
1960s	Creation of Water Resources Division in the Ministry of Agriculture and Formation of the Geological Survey Department of the Federal Ministry of Mines and Power.
1970s	Creation of State Water Agencies.
1970s	Creation of Kainji Lake Development Commission and the CBDA and SRRBDA in the Second National Development Plan.
1975	Creation of the FMWR.
1976	A further nine (9) RBDAs were established (3rd National Development Plan)
1977	FMWR was merged with Federal Ministry of Agriculture.
1979	Re-creation of the FMWR and the establishment of NWRI.
1984	FMWR merged with the FMA&NR to form Federal Ministry of Agriculture, Water Resources and Rural Development.
1984	Creation of 18 RBDAs, with one for each State except Ogun and Lagos that shared one.
1988	Mergers of 18 RBDAs to the former 11 with reduction of functions to only provision of water for multipurpose usage.
1989	Re-creation of FMWR and the expansion of the departments from one to eight.
1990	Partial Commercialization of RBDAs by Technical Committee on Privatisation and Commercialisation (now Bureau of Public Enterprises (BPE).
1992	Re-merger of FMWR with FMARD 1ST Review of Irrigation Subsector by the FAO.
1994	Re-creation FMWR which was merged with Directorate of Food Road and Rural Infrastructure (DFFRI) thus renamed FMWR&RD. Lower and Upper Niger RBDA were recreated out of the Niger RDBA and the creation of some states' ministry of water resources.
1995	Change of the name from River Basin Develop Authorities to River Basin and Rural Development Authorities.
1999	The Department of Rural development was transferred to FMANR and renamed FMARD and FMWR.
2001	Promotion to Participatory Irrigation Management Campaign by FMWR/DID.
2002	Promotion of Private Sector Participation in Irrigation by the FMWR/DID.
2003	FGN/FAO Review of Public Irrigation Sector commences

6.3 RBDA in Nigeria's Irrigation Management

6.3.1 Organizational Structure of a Typical RBDA

The RBDAs are the key Federal Government agencies for implementing its irrigation development policies. The detailed arrangements for achieving the objectives of the RBDAs may vary from one to the other, but a general structure is discernible as shown in Figure 6.1. Each RBDA, apart from the board and advisory committee described earlier is managed on a day-to-day basis by an executive committee comprising a Managing Director,[10] and an Executive Director for each of the departments[11] (Administration and Finance, Operations, and Services). Under the Managing Director's office are the corporate planning, audit, corporate affairs and legal affairs units with unit heads. Area offices (usually headed by area managers), or liaison offices (headed by liaison officers) are also under the Managing Director's office. The Administration and Finance department is further divided into two divisions: administration & personnel, and finance & accounts. The operations department has two divisions: operation & maintenance, and design & construction. The services department includes the commercial and the extension services divisions. In case where there are only two departments the extension services division falls under the operations department while the commercial division comes under the finance and administration department.

6.3.2 A Typical Irrigation Project

The organizational structure at a typical irrigation scheme reflects the structure at the RBDA headquarters. This is to allow easy flow of information and management.

(i) Mandated Responsibilities

The management of the schemes are charged with the main responsibility of improving farm incomes through increase agricultural productivity and production resulting from the establishment and popularization of irrigated agriculture. This overall objective is translated into three activities.

(a) the operation and maintenance of irrigation infrastructure
(b) conducting trials, seed multiplication and demonstration of new farming techniques,
(c) running a Basic Training Centre where farmers and workers are trained on new irrigation management and agronomic practices

[10] The Managing Director should ordinarily be a very senior and experienced irrigation, civil or agricultural engineer or an agriculturalist with vast exposure to irrigation management. In a few cases appointment of MDs has been more of political patronage than professional competence cum personal integrity.

[11] The number of departments and by implication the number of executive directors in each case depends on the category under which the RBDA falls.

(ii) Structure and Staffing

Figure 6.2 is the organizational structure of a typical public Irrigation Project, in Nigeria. For example in LAIP (AIRBDA) the scheme's management is headed by a PM, who has tertiary level educational qualification (reports to the MD). In the Project's office are the Internal Audit and the Community Relations Units. There are four divisions in all, namely, administration, finance, engineering and farm operations. Each division is overseen by an officer of a specified level but in practice they are headed by the most senior officer. The administration division is subdivided into the security, medicare, transport and personnel/legal matters sections, each overseen by a sectional head. The finance division has the revenue, expenditure and stores sections. The farm operations division is made up of the operations, co-operative, experimental farm and the extension and training sections. The engineering division in this example is the largest with four main sections, namely, facility maintenance, water management, workshop and rice mill. The facility maintenance section is subdivided into roads, irrigation facilities, building maintenance and electrical maintenance units. The water management section is made up of the water management and pumping station units[12]. The workshop section consists of the agro-mechanical repair and maintenance, and the vehicles unit. The level of staffing by division was 51 senior and 106 junior staff15[13]. This is not only at LAIP (AIRBDA) but peculiar with most of the schemes.

6.3.3 Funding Trend

The RBDAs were initially fully funded by the FGN through the FMWR. However, the FGN in 1986 introduced the Structural Adjustment Programme (SAP), (a macro economic reform package) which among other measures devalued the Naira (Nigerian currency), commercialized or privatized some public enterprises, gradually removed certain categories of subsidy, and reduced the annual recurrent appropriation in many sub-sectors, including irrigation. The removal of subsidy adversely affected the projects operation and maintenance management, as the RBDAs were expected to recover the operation and maintenance costs from the users, a task that they had not been trained to perform. Also, the partial commercialization of RBDAs was interpreted to mean that the government would continue to provide funds for the development of new irrigation infrastructure but all completed projects would be managed by the RBDAs without any recurrent subvention from the government after a transition period of between three and five years[14]. Arising from these changes, the functions of the RBDAs were curtailed to exclude any involvement in the supply of agricultural inputs to farmers, produce, marketing, agricultural extension services and direct agricultural production. They remained responsible for O & M of the public irrigation systems under their jurisdiction but were planned to generate revenue in the form of water charges to

[12] This is a pumped gravity system.

[13] All staff between salary grade levels 7 to 14 are considered senior, while those above GL 14 are management staff. All staff below GL.7 are junior staff. There was no management staff in this project at the time of visit.

[14] Musa, I.K. 1994. Irrigation Management Transfer in Nigeria: A case of financial sustainability for operation, maintenance and management; A paper presented at the International Conference on Irrigation Management Transfer, Wuhan, China, 20-24 Sept., 1994.

cover cost for O & M. However, the current water charges are very low to cover this cost[15].

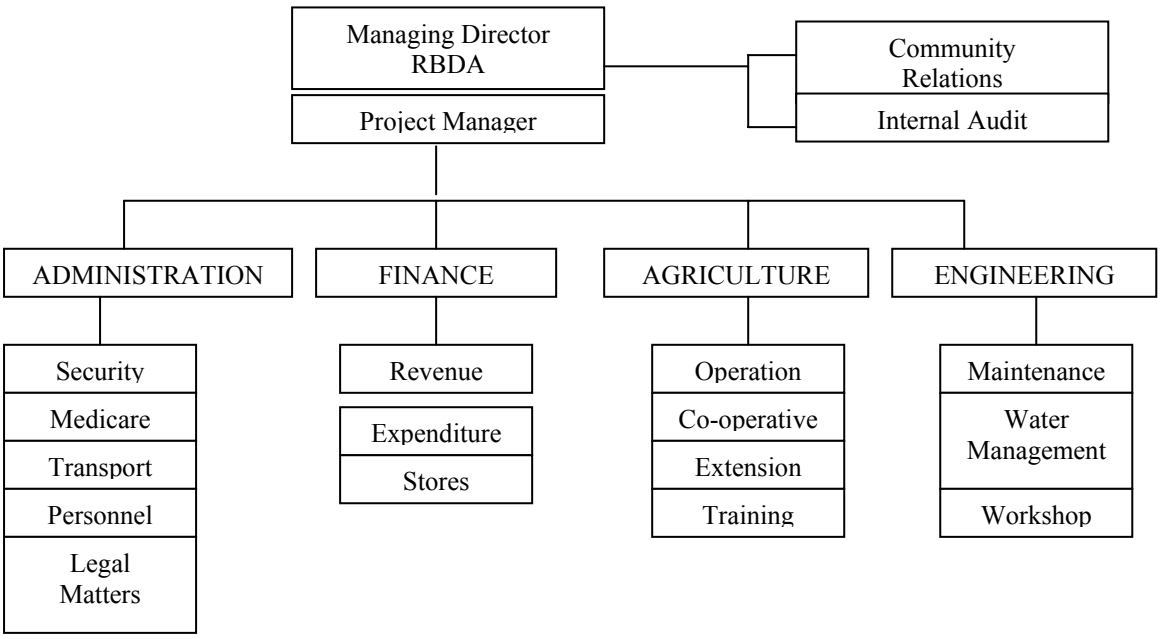


Figure 6.2 Typical RBDA Irrigation Project Organization

Note: The number of departments in each project and the distribution and functions of the section will vary between projects.

6.3.4 RBDA Performance

The performance of RBDAs is below expectation: prior to the micro economic reforms of 1986, the RBDAs grew to be very large institutions with extensive portfolios of activities – in addition to irrigation – few of which were either financially or economically sound. Even in the core task of monitoring water resources and planning their development the RBDAs have achieved no discernible success. While the reforms of 1986 forced the RBDAs to rationalize their non-water resources functions and staff, what remains in terms of numbers of staff, offices and housing is much more than required except for the professional/technical staff. Furthermore, the remaining staff are in many cases inadequately trained and/or inexperienced to perform useful functions.

[15] Water used was never measured so they were simply charges for using the infrastructure.

6.4 Observations and Findings

6.4.1 Institutional Arrangements

6.4.1.1 Public Sector Institutions

Numerous government institutions as listed in Table 6.1 are still involved in the public irrigation sector. The large number of these institutions in this sector, and the existence of so many layers of government bureaucracy, much of it overlapping, has not been conducive to satisfactory performance of public irrigation schemes.

6.4.1.2 Private Sector Institutions

The main private sector institutions involved in public irrigation development are contractors & consultants, the World Bank and the African Development Bank; the involvement of commercial banks is small, as most irrigation farmers are ineligible for commercial credit due to lack of collateral.

In some schemes it was observed that inappropriate designs must have contributed to high capital cost, non-viability and unsustainability of the schemes in Nigeria example Bakolori (SRRBDA) where the original sprinkler design is now being converted to a gravity system.

The assessment recommends:
The appointment of engineering companies whether national or international should be much more selective whereby only those consulting companies who are able to demonstrate high standards of professional competence should be appointed. The corollary is that there is need to improve project implementation and management skills within the government institutions concerned to assure the quality of services being provided by consultants.

6.4.2 Project Management by RBDA

Given their present state it is obvious that RBDAs have not carried out their mandate for management of Nigeria's public irrigation schemes very well. The reason generally is a shortage of operating funds: without government subventions projects must rely on farmers paying the 'water' charge. But as already mentioned, farmers are not prepared to pay for a service that is not rendered, at a price that is not transparent, particularly when they suspect that charges collected are used for purposes other than scheme operation and maintenance. RBDAs can never be transformed into commercial entities unless they provide value for money, maintain up-to-date books of accounts that are open to the public and are accountable to their customers. RBDAs in their present form could never achieve this condition. For one thing, they employ too many staff who are paid at rates that provide no incentive to perform, that is to provide value for money, and therefore, they are far from being

accountable. It is not forgotten however that RBDAs were created not only for irrigation but also for other components of catchment management.

The assessment recommends:
While RBDAs retain their regulatory functions, a service oriented irrigation agency should be established by government (see Section 6.5.1.5).

6.4.3 Agricultural Extension Services

The responsibility for agricultural extension services on RBDAs managed irrigation schemes presently rests with State Ministry of Agriculture extension staff of the various ADPs since the RBDAs were no longer mandated to provide extension services. However, ADP extension staff are not geared to the provision of extension services on public schemes, and consequently a gap exists in the provision of services to farmers on most public irrigation schemes.

The suggestion was made in one of the NCWR meetings in 2000 that it would be appropriate to restore responsibility for extension services to the RBDAs. The response to this has been if the RBDAs could not manage to provide such services in the past, how could they be expected to do so in the future under increasingly stringent fiscal constraints? The lesson is that neither the RBDAs nor the ADPs in their present forms will be in a position to provide such services and an alternative solution must be found.

The assessment recommends:
A total reform of the ADPs and PCU with redefined and expanded mandates to include rendering full scale irrigation extension services to all irrigation projects at cost to be borne ultimately by such projects. The cost of services to private projects will be borne 100% by their owners right from the start while the beneficiary farmers on public projects will initially be sharing the cost with the three tiers of government namely, Federal, State and Local government stage-wise, using a suitable sharing formula such as that suggested in Table 6.5.

Table 6.5 Irrigation Maintenance Cost-Sharing Chart (% of Cost)

Year	**1**	**2**	**3**	**4**
FGN	30	20	10	0
State Government (s)	20	10	0	0
Local Government (s)	10	0	0	0
Beneficiary Farmers	40	70	90	100
Total	**100**	**100**	**100**	**100**

6.4.4 WUAs

6.4.4.1 WUA Sustainability

Field visits and secondary sources of information indicate that there are less than six public irrigation projects at both Federal and State levels with partially functional WUAs. Watari (Kano State) and HVIP (HJRBDA) are well known projects which had WUAs that were at least partially functional, but even in these cases there is no certainty that they will continue to be sustained. Attempts to establish WUAs elsewhere – such as at KRIPI (HJRBDA), Wurno (Sokoto State), LAIP (AIRBDA) and Bakolori (SRRBDA) – brought little success: they have either dissolved or live on without performing any useful function. The non effectiveness of the WUAs could be attributed to the constraints faced by the RBDAs and as such there are no incentives for WUAs to succeed. .

A study in 1998 for example noted the central role that management – or the lack of it – played in the poor performance of Wurno (Sokoto State). Similarly, despite all its good intensions the IIMI-HJRBDA Joint Research Programme that ran from 1989 to 1992 failed to have any lasting impact: it could not address the issue of poor management. Indeed it appears that throughout the duration of the programme the HJRBDA carried on as it always had, failing to provide adequate O&M service. The RBDAs perception of the role of WUAs was that the latter should (a) maintain tertiary and preferably secondary canals and (b) collect water charges for on behalf of the RBDAs. There was never any suggestion of sharing management responsibility.

Experience suggests that for farmers to support a WUA the benefits must outweigh the costs – in terms of their time, materials, cash and interpersonal transactions – that membership involves. Obliging WUAs to perform functions (a) and (b) above may not have any direct effect on meeting this condition. Moreover, attempts to form WUAs appear to have come too late, and the time allocated for the process has been inadequate, as interface consultants were only engaged for the duration of the construction period.

The RBDAs can be reoriented to service provision and become accountable to users then WUAs can be expected to respond positively and be sustained. There is also a need for training and follow up action that would extend for several years beyond formation of the WUA.

The assessment recommends:
That user participation which WUAs are intended to be the vehicle for should commence at the time that projects are conceived, and not as an afterthought.

6.4.4.2 Legislation for WUAs

Attempts to register WUAs under the existing regulations for cooperatives have been difficult. Even where RBDAs have tried to facilitate registration, these attempts have in the main been frustrated by apathy on the part of farmers' groups, the local authorities and banks, probably for one good reason: these institutions cannot see any advantage to be gained. Consequently WUAs at HVIP and KRIPI (HJRBDA) have remained loose associations without legal personality, and any past agreements made with the HJRBDA have never been legally binding on either party.

The legislation for cooperatives is too general for the registration and legal identification of WUAs, since for example it does not necessarily make provision for those who are leasing land or sharecropping. It does not, for another example, make provision for recognizing the special relationship between the RBDAs and the users. The requirement for WUAs to operate a bank account before they can be registered at the State level is a major problem because banks will not open accounts for unregistered organizations.

6.4.4.3 Land Tenure and WUAs

Although the limited numbers of WUAs in public irrigation schemes in Nigeria are only weakly developed so far, some are weaker than others. The weakest are those at schemes on which all users are tenants rather than holders of the land, such as at Tomas (Kano State), LAIP (AIRBDA) and Wurno (Sokoto State). The present land tenure legislation has evolved from customary usufructuary rights that were administered by traditional authorities, to one in which all land is vested in the State Government and occupied for use by individuals. Legal right of use is gained by obtaining a 'Certificate' of Occupancy' under the Land Use Decree. This entitles the user to remain on the land for 50 or 99 years, depending on the level of government that issues the Certificate[16], or until such time as the State Government may require the land for other purposes – such as to construct a dam or an irrigation project. Land users are then offered compensation for developments on land to be given up, or any economic trees or crops thereon.

The majority of small farmers continue in the belief that their tenure of the land is secured by customary rights. However while government still recognizes these, if there is ever a dispute over ownership in which there are two claimants to a piece of land and one of them holds a Certificate of Occupancy, it is the latter who succeeds over the former. The system for obtaining a Certificate of Occupancy is open to abuse, and it is believed that there have been many instances of small farmers being swindled out of their land by unscrupulous influential people. It is further believed that this often happens when land is being acquired for public irrigation development and compensation money is known to be available. Thus it happens that the original users of the land become tenants on the same land and are subsequently obliged to pay rent or to sharecrop in return for the use of the irrigated land.

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[16] *Federal, State or Local Government*.

Clearly, if leases are allocated on an annual or seasonal basis lessees may find that they are allocated a different plot each year or season, or they may find that they are not allocated a plot at all. This is the present situation at Lake Geriyo (UBRBDA) and Tomas (Kano State). Even where such an official leasing system is not in operation, informal tenants or sharecroppers face the same insecurity of tenure. Under all these circumstances there is little incentive to invest in the land –for example by applying fertilizer, or by growing nitrogen-fixing crops. Neither is there any incentive for tenants or sharecroppers to become engaged in WUA activities, particularly if it involves the expenditure of time and labour to maintain canals and the like. Insecurity of land tenure may therefore be an impediment to establishing sustainable WUAs. The management of those schemes may wish to consider lengthening the lease period to 5 years or longer (with conditions to ensure proper use) under a firm written agreement.

6.4.5 Stakeholder's Participation

It is obvious, from the history of public irrigation development in Nigeria, that there has been little if any participation by the users in decision-making associated with project planning and development to date. What is surprising is that, despite the lessons of history, top-down approaches are apparently continued, even where 'interface' consultants are employed. The 1981 uprising of one of the communities in the Bakolori (SRRBDA) area and the objections raised at the LAIP (AIRBDA), LOIP and MOIP (OORBDA) may have been averted if the bottom-up approach to the development of these schemes had been considered. Instead the top-down option was adopted, communities were not adequately consulted; their land was taken up for development and those who were not interested in irrigation were displaced. For example at the Bakolori (SRRBDA), some communities that were not satisfied by the relocation and compensation arrangements engaged the SRRBDA in a fierce confrontation that resulted in some loss of lives. The status there today is "algorean" where a weaker party "does not agree but accepts" the situation. The events at the LAIP (AIRBDA), LOIP and MOIP (OORBDA) were only a shade milder than that at Bakolori (SRRBDA). In the end, the project sizes were reduced to avert confrontations at these schemes.

Successful development requires participation in planning and implementation by all stakeholders, in order to create a sense of ownership and consequent commitment to the project. This requires that the project planning process should allow time for the users to participate in and contribute to the planning process and for any potential losers to have an influence on decisions that affect their future. It is never too early to start participation but it can sometimes be too late – for example after land acquisition and reallocation has taken place. Ownership and commitment by the users are unlikely to be achieved unless they consider that the project would meet their own felt needs and unless they have a stake in the equity – either in the form of land or by sharing in the costs. This is achieved in some other countries by requiring the prospective users to contribute an advance payment of a small proportion of the capital costs in cash or kind.

However, farmers may not be interested in participation, especially if in the past they had received free, though possibly unreliable irrigation services and are suddenly expected to meet more of the costs. They may be suspicious of government officials, particularly if they have been the losers as a result of incompetent or corrupt practices. In these circumstances, it is often difficult for the RBDAs to initiate and sustain participation – particularly when there is no incentive for the RBDAs staff to perform. *In this case the assessment recommends that an impartial third party, such as an NGO, be mandated to facilitate stakeholder's participation*.

6.5 Conclusion

It is apparent from the findings and observations of the field investigations that some painstaking management and institutional reforms are inevitable in the public irrigation sector. Such reforms, targeting IMT through the PIM process, will include the restructuring of existing RBDAs, and re-orientating the restructured agencies towards being more effective and more productive as service providers than they are at present. The reform will also include measures that will facilitate changes in public irrigation policies and changes of attitudes. Both project users and service providers will have to be made to operate towards a common goal of transforming public sector irrigation schemes into positively sustainable enterprises.

6.6 Recommendations

This assessment recommends that:

1) FGN should enact legislation specific to (WUA and FUA) establishment rather than using the legislation on Co-operatives.
2) The appointment of consulting engineering companies – whether national or international, should be much more selective. Specifically, only those consulting companies, who are able to demonstrate high standards of professional competence, should be appointed.
3) FMWR should intensify its efforts through professional staff training and retraining to improve project implementation and management skills within the government institutions concerned to assure the quality of services provided by consultants.
4) Irrigation agencies should be reoriented to service provision and become accountable to users, so that WUAs can respond positively and be sustained. Even when the conditions for sustainability exist there would always be a need for training and follow-up action that would extend for several years beyond formation of the WUA.
5) An impartial third party, such as an NGO, should be mandated to facilitate WUA formation and development.
6) There should be social equity and for investment decisions and project designs resulting from initiatives that come from below, driven by farmers through participation, rather than from above.

7) The water charges must be affordable by the users and leave sufficiently attractive net farm incomes.
8) Irrigation agencies must provide value for money, maintain up-to-date books of accounts and be accountable to their customers.
9) Irrigation agencies must be adequately remunerated before one can expect them to be committed and the cost of operations and maintenance should be shared among the 3 tiers of government and the beneficiary farmers' stage wise for the first 3 years until the project stabilizes when only the beneficiaries pay the cost 100%.
10) International technical and financial support should be sought for designing and implementing a programme for transforming existing public irrigation schemes into self-sustaining units that are eventually controlled by the users, operating through legally established WUAs.
11) Meanwhile government should commission a land tenure study and a water pricing study.
12) There should be no investment in new public irrigation projects for the time being until existing projects have been made to be optimally utilized and self-sustaining.

7. POLICY AND STRATEGY ASSESSMENT

7.1 Introduction

7.1.1 Definition and Status

The proposed National Irrigation and Drainage Policy (NIDP), as a document, is currently a diverse package of statements of intentions, desires, wishes or aspirations, positions, governing principles or courses of action of the FGN on irrigation and drainage development, management and control. A policy is not a law *per se* but requires a legislation to back it up. It needs a body of laws and regulations to implement it in order to translate the spirit behind its letters into concrete action. Appropriate laws should be identified if they already exist or new ones enacted where necessary, to enable the policy to realize its goals and objectives. This has to be so because the strategy for achieving each of these must necessarily operate within the confines of the Constitution and the Law of the land.

The Federal Government has been in the process of formulating a NIDP since 1993. That year a draft framework of the NIDP was prepared by the DID after a consultative process within the Department.[17] It took two years to secure a NCWR resolution authorizing that a more articulate policy document be prepared to guide irrigation and drainage development and management in Nigeria. The first official draft of the NIDP came into circulation about five years ago, and its second draft is currently being circulated. Each component of the draft carries with it, the strategy for implementing it.

There are also currently in circulation two other FMWR draft documents: (i) “Policy on Private Sector Participation in Irrigation Development and Management” (PPSPIDM), and (ii) National Water Resources Policy (NWRP). The former PPSPIDM presents the rationale and opportunities for private sector participation in irrigated agriculture in Nigeria, the policy objective, scope and strategies as well as the follow-up action for making private sector participation sustainable. NWRP contains in its section 2.5 a summary of the draft NIDP. There is no official irrigation and drainage policy in operation yet in Nigeria. However, it is understood that this ongoing review, when concluded will accelerate the completion of the **Final Draft** NIDP (a) addressing both private and public sector participations in, and (b) reconciling and harmonizing the positions of both FMWR, and the FMARD on irrigated agriculture in Nigeria.

The current National Agricultural Policy (NAP) is essentially a synthesis of the action plans which were drawn to tackle poverty and under-development in Nigeria. In particular, the plans were designed to: achieve self-sufficiency in food production, attain food security and provide raw materials for the nation’s agro-industry. They were also intended to earn foreign exchange from exports of surplus agricultural

[17] Second Draft of “Guidelines, National Irrigation and Drainage Policy (NIDP): Nigeria”.

produce (raw or processed), generate employment, provide economic diversification and enhance socio-economic development of the rural areas.[18]

The latest draft of the NIDP sums up the goals and objectives towards providing guidance on ways to manage the nation's land and water resources sustainably. It seeks to: optimize crop production per hectare of land cultivated and per litre of water utilized in the system; slow down, halt or even reverse the overall rate of environmental degradation of the system; ensure the long term sustainability of the productive capacity of the system and maintain the beneficial use of these resources. It also proposes the framework for future development and sustainable financial management of irrigation and drainage schemes in Nigeria.

To supplement the latest draft NIDP's goals and objectives are those of the draft PPSPIDM. The overall goal of the latter is to provide strategies for promoting private sector participation in irrigation and drainage for poverty alleviation, food security and socio-economic growth of Nigeria.

The NAP and the draft versions of NIDP and PPSPIDM have one common goal – to increase agricultural production. They also have in common three expectations – attain food security, alleviate poverty and enhance socio-economic development of the country. Yet NAP makes only a passing reference to irrigation. Indeed, a 279-page FMARD "From Vision to Action" document says nothing about the importance of irrigation in the production of maize, rice and vegetables in Nigeria. Although the document reported a high 1990 production of 554,000 tonnes of wheat at 2.3 tonnes per hectare, it was silent on the role of irrigation as a principal input in that achievement. It does acknowledge however that limited irrigation facility is one of the constraints to continued wheat production in Nigeria. It also listed (1) expansion of fadama irrigation and (2) RBDAs support of irrigated wheat farmers (by providing timely services in land preparation and irrigation water delivery) as two important implementation strategies to accelerate wheat production in the country

The NAP of FMARD and the NIDP with PPSPIDM of the FMWR need to be carefully worked out, reconciled and harmonized as complementary rather than competing and mutually undermining documents. Each should recognize and keep to its limitations.

7.2 The Draft National I&D Policy

7.2.1 The NIDP Setting

A review of Nigeria's public sector irrigation experience of the last three decades and a projection of the role irrigation is likely to play in the nation's socio-economic future together constitute the basis of the current draft NIDP. The goals and objectives of NIDP have already been introduced in Section 7.1 above. A summary of the analysis of that projection includes, among other things:

(i) Identification of major constraints limiting the development of improved irrigated agricultural production in Nigeria;

[18] FMARD (2000) – Nigeria: Agricultural and Rural Transformation Programme from Vision to Action, Main Report, Abuja, September 2000

(ii) Proposing strategies by which the public sector irrigation and drainage programme can systematically address those constraints and difficulties over time;

(iii) Presentation of detailed guidance on development and management approaches and priorities which civil servants, consultants, researchers and other collaborating agencies can use in assessing specific opportunities in the sub-sector;

(iv) Assisting Nigerian agriculture in adjusting to trends in long-term water-centred strategy in farming where improved water management could be embraced by all for increased food and fibre production using high yielding varieties and improved cultural practices; and

(v) Contribution to deepening and enriching the on-going debate on (a) agricultural issues, (b) more detailed irrigation and drainage development programming and (c) the identification, design and execution of more effective investments in the irrigation sub-sector.

The summary also mentions the wide spatial variability and diversity of irrigated agricultural potentials and constraints not only between but also within catchments or RBDAs in Nigeria. Therefore in putting the NIDP into use, care should be taken to recognize this spatial diversity in identifying priorities on location-by-location basis.

7.2.2 The Principles Underlying the Strategies

The strategies being developed for actualizing the various ramifications of the proposed policy are based on a number of principles, the most important of which are outlined hereunder.

- Irrigation and drainage (I&D) have an important role to play in agricultural production in Nigeria; as it is a viable means of stabilizing agricultural production in more than two-thirds of the nation where droughts are prevalent because of its scanty and erratic rainfalls. It is therefore in the national interest to accord I&D the importance it deserves in the agricultural economy of Nigeria.

- I&D can be a suitable instrument for achieving the need to become self-sufficient in food production and increasing food security; poverty alleviation, increased foreign exchange earning, creating additional opportunity for dry season employment, rural development and jobs for women whose spouses might otherwise be forced to be working at locations far away from their homes; rehabilitating drought victims and the landless; and conserving dry-farmed areas.

- Irrigated and rain-fed agricultures are complementary activities and the balanced development of which must be ascertained in national agricultural production plans. Raising input levels in both rain-fed and irrigated cultures tend to meet and are confronted with similar constraints, therefore both cultures need to find a common ground on how to deal with and remove these

constraints so as to achieve the desired increases in agricultural production by both irrigated and rainfed farming.

- The adoption of the "bottom-up" approach, which encourages the participation of all stakeholders' right from the planning stages. Farmers, the RBDAs and other I&D stakeholders must be involved in all stages of I&D development and management. For example devolution of management responsibilities to farmers through the establishment of viable and functional water users associations (WUAs) is indispensable for achieving sustainable development. The ultimate target of every scheme should be total irrigation management transfer (IMT) from government agencies to the beneficiaries through their WUAs, by way of stepwise participatory irrigation management (PIM).

Government needs to adopt policies which provide appropriate incentives to motivate irrigation beneficiaries to increase production and ensure greater water and land use efficiencies within the existing social, physical and ecological constraints.

7.2.3 Future of I & D Development in Nigeria

The future of Nigeria's irrigation and drainage development should hinge primarily on past experience. Its success will, however, depend largely on both the existence of a realistic I&D policy and a judicious application of workable strategies for implementing it. The proposed policy should have an in-built understanding:

(a) of the uniqueness and peculiar demands of irrigated agriculture (IA);
(b) that IA requires a coordinated management of land and water resources for sustainable crop production, each of which in turn needs special skills and institutional arrangements to yield the desired results;
(c) that IA cannot succeed without (i) substantial initial capital investment per unit area, the benefits of which may not usually manifest as fast as investments in other businesses and (ii) appreciable and deliberate farmer commitment of his time as well as financial and physical resources which may affect his life significantly; and
(d) that each irrigation and drainage scheme has the potentials to have profound effects on the indigenous farming system and its environment.

Nevertheless, an I&D policy will not be realistic nor its associated strategies workable if they do not factor into their formulation the effects of global macro-economic forces; the reliance on availability and price of imported capital, technology and material goods; foreign exchange earnings by exports; and adaptability of the imported technology [19] to the bio-physical and socio-cultural settings of the Nigerian environment. Thus the NIDP must seek to minimize reliance on imported inputs and maximize the use of available and known indigenous skills, technologies, motivation and social structure. The advantage of this approach is that the innovations engendered by IA can be contained within the absorptive capacity of the community

[19] This includes skills, development plans, engineering designs, machinery and equipment

so that the confidence in the process of change can be maintained at each successive step of development. I&D development is influenced by such dynamic factors as level and nature of food demand, rainfall variability and droughts, the economic climate and policies of financial institutions.

The level and nature of food demand, responding to population growth, urbanization, occurrence of droughts (unpredictable in the short run) and to changes in eating habits tend to increase the pressure to expand and encourage irrigation development. For instance, preference for rice and wheat over other traditional staples, obviously calls for expansion of irrigation and drainage development to produce more of these grains locally. Other factors, such as unfavourable trade balance and reduction in external assistance (both multi-and bi-lateral), tend, on the other hand, to discourage I & D development, especially in the absence of a strategic plan acceptable to external funding institutions. In this context the draft NIDP notes that large-scale I&D development must proceed cautiously "in the absence of adequate resource data" required for planning. It stresses the importance of careful planning and the need to learn from the farmer-owned and operated small-scale schemes before opening new areas for large-scale projects.

7.2.4 Operation and Maintenance Management (OMM) Strategies

Operation and maintenance constitute the heart of any scheme. A sustainable scheme is one that has adequate and properly managed funds and personnel to operate and maintain it profitably in such a way that its infrastructure can be replaced conveniently after its normal economic life. Under this condition, the level of service provided to the farmers and other stakeholders conforms to and are in consonance with the strategic plan of the scheme. At any given time in the life of the project, the institutions funding it (external agencies, the FGN through the RBDAs, State/Local governments, farmers etc.) expect a given level of service from the service provider according to the projects' strategic plan. When this expectation is not fulfilled, continued financial support is discouraged, cash flow slows down and may even stop completely.

In formulating the proposed NIDP, answers to the following questions which are paramount to the sustainability of I&D schemes needs to be addressed:

(1) Has there been a realistic strategic plan in place, which took a proper account of its O&M requirements to start with?
(2) If such a plan exists, was the optimum level of irrigation and drainage services, mutually agreed upon to be provided by the scheme management organizations (SMO) to the benefiting farmers, properly determined and defined?
(3) Was the SMO properly identified, constituted and oriented to provide the required irrigation and drainage services at the required level and at the required time as defined in the management contract, if any?

(4) Has the funding policy of the Federal Government (with a particular reference to the scheduling and level of funding of irrigation and drainage development, management and control) been consistent with the optimum level of service defined in the scheme's strategic plan? In other words, has the FGN contribution to O&M funding been adequate as defined in the strategic plan?
(5) Have the FGN and the concerned RBDA been releasing funds available from the government and other sources to the SMO as defined in the management contract and in consonance with the scheme's strategic plan?
(6) Have the funding policies of the FGN and the RBDA been encouraging "input driven" or "output driven" budgetary models?

During this review exercise, field information suggests answers in the negative to questions (1) to (5). They should be in the positive. As to the last question, the budgetary model has been more of "input driven" than "output driven". Under a condition of dwindling subvention from government the implication of an input driven budget is that every component activity of the scheme receives too little allocation, which is inadequate for any worthwhile output. The alternative is to allocate all the available funds to some of the component activities to produce tangible outputs at the expense of the others receiving nothing and producing nothing. Either way, the scheme will continue to sink deeper in its ailment. The budget should be output driven.

On strategic planning, none of the existing schemes in Nigeria can really boast of a "realistic strategic plan". There are too few reliable data with which to draw up one conveniently at the moment; therefore NIDP will have to give I&D data collection, generation, acquisition and management the prominence they deserve in the scheme of things.

The issue of identifying and constituting the right SMO has for long remained a political problem. It is even more problematic in giving the management the right orientation to provide services to the scheme's clients and beneficiaries. Such a move often arouses suspicion as the schemes' personnel see it as leading to retrenchment of some of them. The proposed NIDP should have inbuilt mechanisms for selecting the right personnel for the right job so that they can deliver the appropriate service that will give the expected results.

On scheme funding, it is unlikely that the low level and irregular schedule of fund releases by the FGN for I&D programmes will change significantly in the foreseeable future. It is necessary therefore to explore other alternative O&M funding strategies. The draft NIDP outlines one new approach based on strategic investment planning that requires the preparation of asset management plans. To execute the strategy, the I&D data issues mentioned above will have to be addressed first. Next to be tackled will be the problems of: its general acceptability; the need for certain institutional reforms including land tenure and water rights; the institutional instrument of its execution, promotion and even enforcement, of transparent accountability into the socio-economic, financial and political system, without which the strategy will not

work. If these pre-requisites are met and the strategy is adopted and executed faithfully, the probability is high that it will solve most of the country's RBDA-managed public schemes O & M problems.

7.2.5 Omission in the "New Approach" Outline

The outline of the new approach is silent on what is perhaps the most crucial element of this strategy: the institutional instrument of its execution. For example the following are not explicitly defined;

- Assets management partners were not identified.
- Type of agreement not specified
- What role the existing management structure would play

It seems logical that the "new approach" should for any I&D scheme, have provisions in the following sequence, to:

(1) decide on what management philosophy the scheme wishes to follow – either keep its management entirely in the hands of the government and its agencies or share it with a private sector management partner?;

(2) identify, recognize, sensitize and mobilize the scheme's stakeholders – governments and their agencies, sponsors, the community farmers and their organizations, other beneficiaries – getting them involved, using a bottom-up approach early in the life of the intended transformation to incorporate their inputs into the process;

(3) mutually define and allocate through consultative processes, the roles, entitlements and rights, obligations and responsibilities of each category of stakeholders;

(4) specify which management option it wishes to adopt – ranging from the civil service type through service contract, management contract, lease, concession, build-operate-transfer, up to even outright divestiture;

(5) search for, establish or institute the appropriate asset management partner to provide the necessary I&D services;

(6) undertake transparently with all essential stakeholders participating, a dispassionate and rigorous inventory of all the scheme's assets and liabilities to ascertain the level of serviceability of the assets and, the effects of the liabilities on the O&M contracts;

(7) commit the government to complete the major rehabilitation of the scheme before turning it over to the "new approach";

(8) with specified scenarios, propose potential but realizable targets and the associated capital and recurrent inputs to achieve the set targets;

(9) mutually establish the "capacity to pay" profile, reconciling the equity issue with the "user pays principle" to finalize the level and cost of service to be provided;

(10) ensure financial autonomy for the scheme within the limits of the nation's financial and fiscal regulations;

(11) reach mutual understanding with the government on the level of subsidies it may be required to provide for capital expansion or modernization of the scheme's assets; and

(12) limit the RBDA under which the scheme is located to its enabling and regulatory functions only – such as allocating water to the schemes, representing government in negotiating or adjusting tariff levels and structure, and in determining investment requirements.

7.2.6 Institutional Instrument of Execution

The prevailing economic realities of Nigeria no longer favour a situation in which public irrigation and drainage scheme management is entirely in the hands of the government and its agencies. It is better shared with efficient private sector management partner. Table 7.1 shows the relative stands of each of the six options mentioned in (7.2.4) above.

Service contract is only slightly better than the typical civil service brand of administration. It has defects of lower efficiency, shorter duration, higher susceptibility to corruption and poor accountability. Build-Operate-Transfer (BOT) and divestiture do not, in this context, seem to have an immediate appeal in Nigeria and to Nigerians especially. The socio-economic and security climates in the country need to improve much more to attract outsiders coming to take commercial risks of such magnitudes. Nigerians are not known for long-term high-risk investments of this kind.

Table 7.1 Execution Options and Allocation of Responsibilities

Execution Option	Asset Ownership	O & M	Capital Investment	Commercial Risk	Duration Years	Potential Benefits
Service Contract	Public	Shared	Public	Public	2 – 5	Increasing
Management Contract	Public	Private	Public	Public	5 - 10	
Lease	Public	Private	Public	Shared	10 – 25	
Concession	Public	Private	Private	Private	25 – 50	
Build-Operate-Transfer	Private	Private	Private	Private	25 – 50	
Divestiture	Private	Private	Private	Private	Indefinite	

Modified after: Cowen (1999).[20]

Government needs a detailed legislation to back up its intention to gradually hand over O&M responsibilities to WUAs. The existing SMOs are government agencies operating under the existing civil service rules and there are no incentives for the SMOs at present to encourage irrigation farmers under their respective projects to form viable, functional and effective WUAs.

[20] Penelope J. Brook Cowen. The Private Sector in Water and Sanitation – How to get started in "The Private Sector in Water, Competition and Regulation, IBRD, World Bank, Pp.21-24

Private sector management partnership like an NGO on O&M should be considered in order to realise a successful government-WUA hand over of O&M responsibilities.

7.3 Conclusion and Recommendations

7.3.1 Conclusion

An NIDP is not yet in place but there are indications that the FGN is intensifying its efforts to complete not just the NIDP but also a PPSPIDM. The two documents should be harmonized and merged into one policy document. The PIM and IMT will be natural derivatives of the finalised policy.

It was observed that the lack of regular inter-ministerial consultations between the FMWR and FMARD has been a contributing constraint to the sustainability of irrigated agriculture. The NIDP needs to provide a forum for such consultation and cooperation. This co-operation for instance should start from a “bottom-up” project proposal development to project implementation. In particular, provision of production inputs and outputs services is crucial to irrigated agriculture O&M management. Mutual co-operation rather than antagonism is indispensable for a smooth and productive flow of these services.

7.3.2 Summary of Recommendations

The assessment recommendations are summarized hereunder.

(1) The NAP of FMARD and the NIDP with PPSPIDM of FMWR need to be carefully worked out, reconciled and harmonized as complementary rather than competing and mutually undermining documents.

(2) Large-scale I&D development must proceed cautiously in the absence of adequate resource data required for planning, learning from the experience of the farmer-owned and operated small-scale schemes before opening new areas for large-scale projects.

(3) Every scheme should have a realistic strategic plan in place, which takes a proper account of its O&M requirements and should be run under some management contract agreement legally binding on both the service receivers and the service providers.

(4) The SMO should be properly identified, constituted and oriented to provide the required irrigation and drainage services mutually agreed upon at the required level and at the required time as defined in the management contract.

(5) A well-equipped observation and information collection, collation and research centres to obtain process and sell/disseminate data should be setup as top priority; Some tertiary institutions including the NWRI, the RBDAs

should be one of the many agencies to ensure that the centres are well run. It should be well funded by FGN and other bilateral organizations.

(6) Public irrigation and drainage scheme management is better shared with an efficient private sector management partner. Therefore the “new approach” should consider ***management contract, lease and concession***, starting with the first of these three in the short term and gradually moving on to concession in the long term.

(7) Government intention to gradually hand over O&M responsibilities to water users associations (WUAs), is easier implemented through private sector management partners such as NGOs than through the existing SMOs which are government agencies operating under the existing civil service rules.

(8) All public irrigated agriculture projects in Nigeria should be conjointly planned and implemented by the beneficiaries, the FMWR, and the FMARD using their relevant departments, agencies, parastatals, divisions and units as appropriate.

(9) There should be regular inter-ministerial consultations between the FMWR and FMARD.

8. DAM SAFETY APPRAISAL

8.1 Introduction

The review study carried out a dam safety assessment of 20 large and medium dams of which 18 of them form the headworks of some of the Public Irrigation Sector Schemes and the other two dams are the NEPA Dams of Kainji and Jebba located on the Niger River. The list of the dams are spread over the five zones of the review and the list is as given below:

List of Dams Appraised under the Review

North West

- Bakolori
- Goronyo
- Jibiya
- Tugan Kawo
- Swashi
- Kubli
- Zobe

North East

- Tiga
- Ruwan Kanya
- Hadejia Barrage
- Challawa Gorge

Central

- Cham
- Dadin Kowa
- Kiri

South East

- Obudu

South West

- Ikere Gorge
- Oyan

NEPA Dams

- Kainji
- Jebba

Desk Studies

- Omi
- Ikere Gorge
- Oyan

8.2 Current Status of the Dams

Many of the dams are over 20 years old and underutilized. The dams are not being monitored and very little information exist about the status of the dams. Records of dams' instrumentation readings hardly existed and where existed were not in a usable form, thus it was not possible to:

- Determine the phreatic surface of seepage through dam embankments;
- Assess any settlement of horizontal movement of dam structures;
- Observe any unusual hydrostatic pressures particularly at the toes of the embankments that threaten the integrity of the dam;
- Assess the functioning of the internal drainage system.

Consequently, only the physical inspection and physical safety assessment were carried out.

Due to the age of the dams, it is necessary that continuous periodic monitoring is carried out. Most of the instrumentation consisting mainly of piezometers and monuments are in bad states and should be rehabilitated as soon as possible.

The ROPISIN observed based on physical assessment that there is a need for the immediate rehabilitation of the Obudu Dam spillway structure, the Cham Dam, the downstream slope and toe drains of Ruwan Kanya Dam and the upstream slopes of the Hadejia Barrage end of the spillway channel of the Jebba Dam.

Table 8.1 gives the basic characteristics of each of the dams and summarizes the observations including cost of rehabilitation of each dam. Ranking based on the need for immediate intervention is given. The costs given are as at June 2004.

8.3 Recommendations for Dams Assessed under ROPISIN

8.3.1 Hadejia Barrage

The Hadejia Barrage needs major rehabilitation works to be carried out on the embankments and upstream slopes. The 24km dyke along the reservoir also needs to be restored urgently to avoid any breach. Furthermore, the town of Hadejia is immediately downstream and therefore prone to flooding in the event of a collapse of the barrage. The total estimated budget for these works is **₦393,035,875.00** (2004).

8.3.2 Tiga Dam

Recommendations for Tiga Dam include:

(a) Routine maintenance on the embankment slopes and crest should be continued especially on the right flank of the dam.

(b) Monitoring of the large number of instruments installed is important. None of the records were made available when the dam was inspected in January 2004.

(c) The preferred spilling area, which is the auxiliary exposed weathered rock area needs a formal concrete sill in order to maintain the present tail water level, even though of no safety consequence. The establishment of this narrow concrete sill about 200m in length and 0.5m wide and about 1.0m deep will cost only about ₦7,500,000.00.

(d) It is important to establish an annual budget for the monitoring of the instruments and general maintenance of the access roads and side slopes of the dam.

8.3.3 Ruwan Kanya Dam

The Ruwan Kanya Dam is rated poor as it needs some significant rehabilitation works. The recommendations include:

(a) All the trees, shrubs and plant growth along the crest and the upstream slopes should be removed and a regular maintenance be scheduled to keep these areas free of vegetation growth and trees.

(b) The downstream slope of the dam should be improved to a flatter slope of about 1 vertical to 2.5 horizontal as detailed in Enplan Group Report of 1995.

(c) A toe drain as indicated in Fig. 8.1 should be provided along the downstream toe to collect seepage water and empty into a well defined ditch which will drain into the old river channel.

(d) An estimates for the above works is ₦109,366,000.00.

8.3.4 Challawa Gorge Dam

There is a 4m drop between the end sill of the stilling basin structure and the spillway channel. This has caused significant erosion to the ford structure downstream linking the village of Turewa on the right flank of the spillway. It is proposed that the end sill be redesigned as a drop structure with an adequate energy dissipating structure. The estimated cost for this work is ₦154,460,000.00. (Fig. 8.2 shows the proposed structure).

The RBDA has made a commendable effort to collect instrumentation data. However, these data have to be analysed in order to assess and monitor the performance of the dam. All instrumentation that have been stolen, broken or not functioning should be replaced or rehabilitated and the pneumatic read out units and survey levelling instruments should be replaced.

8.3.5 Jibiya Dam

Jibiya Dam is in good condition, therefore, no need for immediate intervention. However, the dam performance monitoring has been ignored. It is necessary that the monitoring staff at the site are trained on how to record and interpret the large number of instruments installed on this dam.

8.3.6 Zobe Dam

Although this dam appears stable, it experienced some seepage problems in the past. The dam should be closely monitored and the long term solution recommended by Enplan Group in 1988 should be adopted to effectively intercept the foundation seepage. (See Fig. 8.3).

8.3.7 Goronyo Dam

The rehabilitation works to this dam has recently been completed and the dam is classified as being in good condition. The current development of irrigation areas is a step in the right direction as this large reservoir of 940 million cubic meters of water has not been used for over 20 years.

8.3.8 Bakolori Dam

There is a need to fund routine maintenance, to keep vegetation growth from the crest and downstream slope of the dam embankment.

Table 8.1 **SUMMARY OF DAM SAFETY APPRAISAL OVERALL ASSESSMENT**

Dam no	Dam name	Ownership	Date of construction	Maximum height	Length of Dam	Type of Dam	Reservoir Capacity	Type of Spillway + Capacity	Rating	Remarks and Observations	Rank
1	Hadejia Barrage	H-JRBDA HQ Kano	1994	9.25m	1,000	Earthfill	11.4 x 10^6m^3	Gated 150m^3/sec	Poor	Require significant works to restore and protect embankment slopes including 24km dykes. Cost estimate N393,035,875.00	V
2	Tiga Dam	H-JRBDA HQ Kano	1974	48m	6,000m	Earthfill	1,874 x 10^6m^3	Concrete ogee + rock channel 6,330m^3/sec	Good	Emergency rock channel spillway at 527.30. Needs formal narrow control sill. Cost estimate of concrete sill is N7,500,000.00	XII
3	Ruwan Kanya	H-JRBDA HQ Kano	1978?	21.95	3,000m?	Earthfill	33.0 x 10^6m^3	Concrete ogee	Poor	O + M repairs, D/S slope repair and toe drain to be provided. Cost estimate N109,366,000.00	III
4	Challawa Gorge Dam	H-JRBDA HQ Kano	1992	42m	7,804m	Earthfill	930 x 10^6m^3	Concrete ogee 3,850m^3/sec	Good	Ford crossing to Turawa village in distress; needs repairs. Cost estimate N178,401,300.00	VII
5	Jibiya Dam	SRRBDA HQ SOKOTO	1991	21.5m	3,680m	Eolic sand fill with synthetic material protection	142.7 x 10^6m^3	Concrete ogee 2,200m^3/sec	Good	But no instrument readings since 1994. Operators are to be instructed on how to read and interpret the large number of instruments installed.	XV
6	Zobe Dam	SRRBDA HQ SOKOTO	1983	19m	2,760m	Earthfill	177.0 x 10^6m^3	2,083m^3/sec (estimated)	Good	Require permanent solution to the toe drain as recommended	XIV
7	Goronyo Dam	SRRBDA HQ SOKOTO	1984	20m	5,285m	Earthfill	942 x 10^6m^3	Gated 1,540m^3/sec	Good	Emergency spillway is Asphalt ogee crested with length 2,000m. capacity about 7,5336m^3/s estimated	XVI
8	Bakolori Dam	SRRBDA HQ SOKOTO		48	5,135m and concrete 356m	Earthfill and concrete control section	450 x 10^6m^3	Concrete ogee with 10m gated 3,750m^3/sec	Good	Repair and installation of the two turbines to generate 3.0MW electricity	IX
9	Tugan Kawo	UNRBDA HQ MINNA	1988	11.75	3,300m	Earthfill	22 x 10^6m^3	Concrete ogee 85m^3/sec	Good	Urgent repairs to Intake Lift gate support beam	VIII

Table 8.1 (Cont.)

Dam no	Dam name	Ownership	Date of construction	Maximum height	Length of Dam	Type of Dam	Reservoir Capacity	Type of Spillway + Capacity	Rating	Remarks and Observations	Rank
10	Swashi Dam	UNRBDA HQ MINNA	1992	9.0?	600m	Earthfill	5 x 10^6m^3	Concrete ogee 375m^3/sec	Good	13km Access road needs urgent repairs. Cost estimate N78,000,000.00	X
11	Kubli Dam	UNRBDA HQ MINNA	1992	17m	109m (measured)	Concrete	70 x 10^6m^3	Concrete ogee 407m^3/sec	Good	14.5km Access Road needs urgent repairs. Cost estimate N87,000,000.00	XI
12	Obudu Dam	CRBDA	1998?	15m	425m	Earthfill	4.2 x 10^6m^3	Open channel stone-pitched 173.94m^3/sec	Cause for concern	Immediate works required to restore failed spillway. Estimate for new spillway is N272,000,000	I
13	Kainji Dam	National Electric Power Authority (NEPA)	1968	78.7m	7,200m	Concrete, rockfill and earthfill	15,000 x 10^6m^3	Gated 8,800m^3/sec	Good	Dam is well instrumented and operation and maintenance done regularly and any repairs done on time	XVII
14	Jebba Dam	National Electric Power Authority (NEPA)	1984	40.0m	2,060m	Concrete, rockfill and earthfill	3,600 x 10^6m^3	Gated 13,600m^3/sec	Adequate	Urgent rehabilitation of spillway channel must be carried out to maintain the downstream permanent works. Estimated cost N1,015,436,896.00	II
15	Kiri Dam	UBRBDA HQ YOLA	1982	20.0m	1,300m	Earthfill	615 x 10^6m^3	Gated 4,000m^3/sec	Good	Important to repair the 12km Access Road, pave the crest road with 0.10m Asphalt concrete and restore all the stand pipes. Estimated cost N117,600,000.00	XII
16	Cham Dam	UBRBDA HQ YOLA	1992	15.0m	1,400m	Rockfill	6,135 x 10^6m^3	200m^3/sec	Cause for concern	Dam was over-topped in 1998. Though was redesigned, tendered and awarded in 2001. No work has been started	IV
17	Dadin Kowa Dam	UBRBDA HQ YOLA	1987	42.0m	520m	Rockfill	2,800 x 10^6m^3	Gated over-flow 1,110m^3/sec	Good but un-utilised	a) Power units of 34MW to be installed b) Irrigation canals to be constructed c) Land leveling of irrigation areas must be developed	VI

8.3.9 Tugan Kawo Dam

This dam requires urgent repairs to the intake lift gate support beam, as it is possible that the gate might be stuck in an open position thereby emptying the reservoir. We also noted that the baffled Ogee-Crested concrete spillway needs some attention, Weep holes about (150mm diameter) may be required to drain the standing water in the stilling basin, when not in use; repairs to the broken baffle blocks should be effected.

8.3.10 Swashi Dam

The major problem of this dam is its accessibility. Therefore, the 13.5km access road to the dam site needs to be rehabilitated at a cost of about ₦78,800,000.00. Also the right bank irrigation lift sluice gates need repairs to the uplift mechanism.

8.3.11 Kubli Dam

This dam also has the problem of accessibility from Swashi Diversion Dam. The 14.5km access road needs to be rehabilitated at an estimated cost of about ₦87,000,000.00. It was also observed that the rip-rap boulders are being removed by the discharge flow and a crater is developing immediately downstream of the concrete spillway flip-bucket. To arrest the situation, it is proposed that mass concrete be used to fill up the crater and avoid further erosion. This repair is estimated at ₦37,500,000.00.

8.3.12 Obudu Dam

This dam needs urgent rehabilitation to restore the failed spillway. A concrete lined inclined drop structure in the form of a chute ending in a stilling basin about 20m in length has been proposed to replace the old spillway. In addition, an auxiliary spillway should be considered a little further to the right of the existing one. This will serve in the event of a flood exceeding 240m^3/sec.

8.3.13 Kainji Hydro-Electric Dam

This is a well instrumented dam. The records of instrument readings are kept and interpretations and plots regularly done. Regular maintenance is carried out and repairs needed are attended to.

8.3.14 Jebba Hydro-Electric Dam

There is need for urgent rehabilitation of the main spillway channel, to forestall the possible breach of the access road leading to the permanent coffer dam which is an integral part of the downstream permanent works. The cost estimate of the rehabilitation works is about ₦1,000,000,000.00.

8.3.15 Kiri Dam

The dam is in good condition, however, it is recommended that since the Hydraulic piezometers (29 No.) installed are no longer functioning (10 years now), all the 16No. Stand pipe piezometers should be rehabilitated and monitored regularly. A high volume of traffic uses the crest of the dam and this has led to some deterioration and pot holes on the crest road. A permanent surface for the road is recommended using 7mm thick asphaltic concrete surface and limiting traffic to smaller vehicles. In addition the main access road to the site about 12km should be rehabilitated. The estimated cost for these works is about ₦117,600,000.00.

8.3.16 Cham Dam

This dam was overtopped in 1998 leading to a breach of the dam. Despite a re-design and tender which was opened on the 30th of May 2001, and the contract for re-construction being awarded, no work has commenced. Our visit on the 9th of March 2004 indicated that the Contactor awarded the contract has not even mobilized to the site. It is a cause for concern as the irrigation systems could deteriorate.

8.3.17 Dadin Kowa Dam

This dam which is in very good condition has not been utilized much. The reservoir volume of some 2.8 billion cubic meters with live storage of 1.77 billion is lying idle. Currently to keep the reservoir level low, the spillway gates are in permanent open position, which is not good for the operation of the gates. The irrigation intake gate is also permanently open to discharge water back to the downstream channel. It is recommended that:

(a) The power generating units of 34MW should be installed and the generated power sold. Water requirements for the generating plants will use about 65m^3/s from the stored reservoirs almost 2,021,760,000m^3 in a year.

(b) The irrigation canals be completed up to irrigable areas of at least 10,000 hectares, requiring about 10m^3/sec.

(c) The Gombe State Water Board is constructing a treatment plant with a capacity of 86.4 x 10^6 litres per day. This will take up about 1.0m^3/sec (31,104,000m^3/year).

8.4 Prioritization of Remedial Works

The dams have been prioritized in accordance to their safety requirement as follows:

I. **OBUDU DAM**:- Cause for concern. A new spillway to be constructed immediately to replace the failed existing spillway. Cost estimate ₦272,000,000.00.

II. **JEBBA-HDROELECTRIC DAM**:- Urgent rehabilitation of the main gated spillway channel that has been designed to pass floods of some 13,600m^3/sec. NEPA needs to be alerted on the importance, so as to avert a possible breach that will cut-off part of the downstream permanent works. The cost estimated is about ₦1,000,000,000.00.

III. **RUWAN KANYA DAM**:- The downstream slope is rather steep and is being subjected to finger gulley erosion. No toe drain has been provided causing the downstream toe area to be wet at all times. There is a need to properly intercept the seepage through the dam and carry it safely to the old river channel; Cost Estimate is ₦109,366,000.00.

IV. **CHAM DAM**:- This breached dam should be rehabilitated. It has already been re-designed and tendered for and awarded; Cost estimate ₦850,000,000.00.

V. **HADEJIA BARRAGE**:- This dam is in a poor state. The barrage needs its side slopes to be properly protected and its 24km dykes restored. The cost estimate for this work is about ₦393,035,875.00.

VI. **DADIN KOWA DAM**:- In good condition but there is a threat to its safety on account of non utilization of the impounded reservoir. It is important that the Power Generating Unit of 34MW be installed to fully utilize the storage.

VII. **CHALLAWA GORGE DAM**:- The ford crossing the spillway discharge channel is in distress and needs restoration to allow access to Turawa Village. Aside from this, the possibility of the erosion extending towards the spillway exists, as there is a 4.0m potential drop at the ford crossing.

VIII. **TUGAN KAWO DAM**:- Urgent repairs to the intake lift gate support beam. If not properly supported, it might come to a stage where the irrigation gate, when opened can not be closed, thus emptying the reservoir. No cost estimate has been provided because the work involved is so small.

IX. **BAKOLORI DAM**:- It is important to repair and install the 2No, 1.7MW turbines in order to generate Electricity to serve both the dam and its environs of their electricity needs.

X. **SWASHI DAM**:- It is almost impossible to access this dam from the main untarred road Swashi-Agara road. It is important to rehabilitate this 13.5 km road as gullies cut-off operatives getting to the scheme for operation and maintenance purposes. At time of visit only two guards were on site who alternate between Swashi and Kubli Dams. Cost estimate ₦78,000,000.00.

XI. **KUBLI DAM**:- Has same access road problem as Swashi. Cost estimate to re-habilitate the 14.5 km is about ₦87,000,000.00.

9. FINANCIAL ASSESSMENT OF RBDAS

9.1 Introduction

9.1.1 General

The financial assessment of the Review of the Public Sector Irrigation in Nigeria was carried out at the RBDA headquarters as a component of the financial and socio-economic assessment. This section gives an overview.

9.1.2 Methodology of Review

Methodology included identification of the relevant laws that established the powers of the laws and the implications of the statutory requirements. Through interviews and discussion with the officials of the RBDAs, the mechanism of the Corporate Planning and Budgeting system was gained. Draft and Audited accounts that were available from various RBDA for various years were collected, analysed and reviewed from which the structure and trend in sources of revenue, expenditure for operations and personnel emoluments were deduced. The Accounting Standards and the Standard of Audit reports were reviewed and recommendations made based on the findings.

9.2 Findings

9.2.1 Financial Implications of statutory Requirements

The RBDAs have not been able to operate as commercial ventures. This is because they are incapacitated by the Law and also tied to the Civil Service remuneration system. They always require approval from the Honourable Minister of Water Resources to change their Revenue rates.

9.2.2 Corporate Planning and Budgeting

All the RBDAs produce three year rolling plans which were reviewed yearly from formats provided by Ministry of National Planning. The plans are summarised in financial terms with appropriate subsidiaries (Revenues and Operating Expenditures, Capital Expenditures etc.).

The RBDAs are responsible for preparing the plan which is approved by the FMWR, thereafter presented to the Federal Ministry of National Planning. A Review System is in place annually for changes in prices and mechanism for such changes provided it is within the ambit of the law. Capital expenditure is also reviewed annually. The Managing Directors/General Managers are responsible for implementation and review.

The RBDAs are also responsible for preparing the annual budgets with input from all departmental heads. Formats and guidelines are provided by the Federal Ministry of Finance. Approval is obtained from FMWR before going to the Federal Ministry of Finance. The Budget has to be defended at the National Assembly after which it will receive the President's approval. Release of capital allocations to the RBDAs has to pass through the Due Process Guideline/Procedure under the Budget Monitoring and Price Intelligence Unit (BMPIU). Competitive bidding and proper evaluation of bids have given the system a lot of credibility.

9.2.3 Flow of Funds

The structure of Grants, Revenue and Expenses of the RBDAs have been analysed from the audited accounts (Figures 9.1 and 9.2).

9.2.4 Federal Government Grants

Funds are provided through Grants from the Federal Government which constitute between 72% and 99% of the total annual income of the RBDAs and in absolute terms the range is between 72 million and 170 million Naira.

9.2.5 Personnel Grant

Personnel Grant is responsible for the Major part of the Grant from the Federal Government. In 2002 it was between 78 and 89% of the Total Income of the RBDAs. In absolute terms it was between ₦ 95 million and ₦168 million.

9.2.6 Internally Generated Revenue

There are two major sources of internally generated revenue. Revenue from the main activities of the RBDAs such as irrigation water charges, land preparation costs, hiring of plant, tractors and equipment, drilling of bore-holes, fisheries and revenue from other sources which include registration/tender fees, house rent. The general trend is that operating revenue accounts for 2 - 5% of the total income whilst average personnel and overhead grant is about 95%.

9.2.7 General Operating Expenses

General operating expenses consists mainly of staff cost, operating costs and maintenance costs. It is a lot higher than all the sources of RBDA revenue out of which staff cost alone accounts for almost 80% followed by maintenance cost.

9.2.8 Financial Performance of Irrigation Schemes

The financial systems in place in all the RBDAs are not designed to report performance of the irrigation schemes. It is therefore recommended that a Uniform Standard Practice Instruction should be developed in all the RBDA, bearing the following in mind:

(i) The accounting system should be fully integrated, whenever possible, with all other financial management systems (budget, treasury) to assure that it provides a single, common database for financial information.

(ii) There should be linkage between the cost categories used by the accounting system and the inputs needed to carry out the project. Cost groupings should be logical and key inputs apparent. More important costs should be tracked at a less aggregated level. The correspondence between actual cost and budget, as determined should be clear.

(iii) Project related costs and revenues should be grouped together so that the sources and uses of project funds can be readily matched.

(iv) Recurrent and capital costs should be distinguished by establishing separate sub-categories.

(v) Periodic financial reports produced from the accounting system should compare actual to projected/budgeted costs for the current period and the total project to date.

(vi) The financial data produced by the system should be capable of providing some measurement of performance when linked with the outputs of the project.

(vii) The accounting system should follow clearly documented accounting standards.

Figure 9.1

RIVER BASIN DEVELOPMENT AUTHORITY

STRUCTURE OF GRANT, REVENUE & EXPENSES FOR 2001

	SOKOTO RIMA		UPPER NIGER		LOWER NIGER		LOWER BENUE		CHAD BASIN		UPPER BENUE		CROSS RIVER		ANAMBRA/ IMO		BENIN OWENA		OGUN/ OSUN		NIGER/ DELTA	
	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%
GRANT FROM FGN:																						
Personnel	-	-	-	-	95,324	67	81,826	81	159,956	86	83,161	77	72,568	65	-	-	-	-	134,041	81	-	0
Overhead	-	-	85,246	85	7,620	5	-	-	6,928	4	7,024	6	6,854	6	124,202	72	100,226	7	8,377	5	-	0
Special Capital Grant	-	-	-	-	11,508	8	-	-	-	-	-	-	-	-	-	-	1,280,351	91	-	-	-	0
Capital Grant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
Sub Total	-	-	85,246	85	114,452	81	81,826	81	166,884	90	90,185	83	79,422	72	124,202	72	1,380,577	99	142,418	86	-	0
OPERATING REVENUE																						
Capital Project	-	-	-	-	-	-	-	-	2,813	2	17,893	17	-	-	-	-	-	-	613	0	-	0
Water Charges	-	-	2,724	3	-	-	-	-	226	0	-	-	123	0	-	-	-	-	-	-	-	0
Land Preparation	-	-	828	1	685	0	-	-	-	-	-	-	39	0	-	-	72	0	-	-	-	0
Sale of Fertilizer	-	-	-	-	458	0	-	-	-	-	-	-	-	-	-	-	-	-	18	0	-	0
Sale of Agric Produce	3,631	11	29	0	1,014	1	-	-	-	-	-	-	72	0	63	0	4,822	0	-	-	-	0
Fishing Right/Sale of Fish	68	0	20	0	34	0	-	-	-	-	-	-	-	-	-	-	-	-	730	0	-	0
Hire of Equipment/Plant	5,045	16	233	0	1,374	1	2,229	2	618	0	-	-	42	0	2,962	2	306	0	8,103	5	-	0
Rent	4,084	13	561	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14,319	9	-	0
Sub Total	12,828	40	4,395	4	3,565	3	2,229	2	3,657	2	17,893	17	276	0	3,025	2	5,200	0	23,783	14	-	0
OTHER INCOME:																						
Registration/Tender Fees	3,288	10	684	1	8,219	6	-	-	5,135	3	-	-	20,029	18	32,899	19	4,580	0	-	-	-	0
House Rent Recoveries	-	-	-	-	-	-	-	-	8,712	5	-	-	1,339	1	2,517	1	-	-	-	-	-	0
CBDA Investment Dividend	11,040	35	-	-	-	-	-	-	755	0	-	-	-	-	9,111	5	-	-	-	-	-	0
Pension and Gratuity Funds	-	-	-	-	7,200	5	-	-	-	-	-	-	5,200	5	-	-	-	-	-	-	-	0
Miscellaneous	4,699	15	10,417	10	8,391	6	17,077	17	561	0	-	-	4,602	4	115	0	10,523	1	33,486	20	-	0
Sub Total	19,027	60	11,101	11	23,810	17	17,077	17	15,163	8	-	-	31,170	28	44,642	26	15,103	1	-	-	-	0
Oper. Revenue/Other Income	31,855	100	15,496	15	27,375	19	19,306	19	18,820	10	17,893	17	31,446	28	47,667	28	20,303	1	23,783	14	-	0
Grand Total	**31,855**	100	**100,742**	100	**141,827**	100	**101,132**	100	**185,704**	100	**108,078**	100	**110,868**	100	**171,869**	100	**1,400,880**	100	**166,201**	100	**-**	**0**
OPERATING EXPENSES																						
Staff Costs	138,009	33	77,275	59	121,043	79	87,181	56	155,318	71	98,040	63	70,857	72	114,449	41	83,407	55	170,880	56	-	0
Operating Expenses	35,944	9	10,729	8	17,603	11	9,045	6	38,378	17	11,660	7	3,288	3	53,099	19	49,279	32	80,266	26	-	0
Maintenance	166,950	40	11,555	9	4,907	3	31,629	20	17,897	8	37,565	24	995	1	87,221	31	18,142	12	-	-	-	0
Others	74,995	18	31,181	24	9,601	6	28,989	18	8,139	4	9,469	6	23,351	24	22,858	8	1,353	1	56,244	18	-	0
Total	**415,898**	100	**130,740**	100	**153,154**	100	**156,844**	100	**219,732**	100	**156,734**	100	**98,491**	**100**	**277,627**	100	**152,181**	100	**307,390**	100	**-**	**0**

Source: Audited Accounts from RBDAs

Figure 9.2

RIVER BASIN DEVELOPMENT AUTHORITY

STRUCTURE OF GRANT, REVENUE & EXPENSES FOR 2002

	SOKOTO RIMA		UPPER NIGER		LOWER NIGER		LOWER BENUE		CHAD BASIN		UPPER BENUE		CROSS RIVER		ANAMBRA/IMO		BENIN OWENA		OGUN/ OSUN		NIGER/ DELTA	
	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%	₦,000	%
GRANT FROM FGN:																						
Personnel	-	0		-	109,463	81	-	0	168,516	89	95,016	78	-	0	-	0	-	-	-	0	-	0
Overhead	-	0	75,609	62	2,406	2	-	0	2,005	1	2,053	2	-	0	-	0	84,820	72	-	0	-	0
Special Capital Grant	-	0		-	-	0		0	-	-	-	-	-	0	-	0	-	-	-	0	-	0
Capital Grant	-	0		-	-	0		0	-	-		-	-	0	-	0	-	-	-	0	-	0
Sub Total	-	0	75,609	62	111,869	83	-	0	170,521	90	97,069	80	-	0	-	0	84,820	72	-	0	-	0
OPERATING REVENUE																						
Capital Project	-	0	-	-	-	0	-	0	3,734	2	24,142	20	-	0	-	0	-	-	-	0	-	0
Water Charges	-	0	2,432	2	-	0	-	0	433	0	-	-	-	0	-	0	-	-	-	0	-	0
Land Preparation	-	0	484	0	2,683	2	-	0	-	-	-	-	-	0	-	0	26	0	-	0	-	0
Sale of Fertilizer	-	0	493	0	180	0	-	0	-	-	-	-	-	0	-	0	-	-	-	0	-	0
Sale of Agric Produce	-	0	936	1	1,865	1	-	0	5,352	3	-	-	-	0	-	0	5,280	4	-	0	-	0
Fishing Right/Sale of Fish	-	0	-	-	5	0	-	0	-	-	-	-	-	0	-	0	-	-	-	0	-	0
Hire of Equipment/Plant	-	0	408	0	-	0	-	0	408	0	-	-	-	0	-	0	493	0	-	0	-	0
Rent	-	0	30,823	25	-	0	-	0	-	-	-	-	-	0	-	0	-	-	-	0	-	0
				-		0				-		-						-				
Sub Total	-	0	35,576	29	4,733	4	-	-	9,927	5	24,142	20	-	-	-	-	5,799	5	-	-	-	-
OTHER INCOME:																						
Registration/Tender Fees	-	0	684	1	3,115	2	-	0	-	-	-	-	-	0	-	0	68	0	-	0	-	0
House Rent Recoveries	-	0	-	-	-	0	-	0	2,078	1	-	-	-	0	-	0	-	-	-	0	-	0
CBDA Investment Dividend	-	0	-	-	-	0	-	0	6,196	3	-	-	-	0	-	0	-	-	-	0	-	0
Pension and Gratuity Funds	-	0	-	-	11,300	8	-	0	968	1	-	-	-	0	-	0	-	-	-	0	-	0
Miscellaneous	-	0	9,894	8	3,507	3	-	0	18	0	-	-	-	0	-	0	26,676	23	-	0	-	0
				-		0				-		-						-				
Sub Total	-	0	10,578	9	17,922	13	-	0	9,260	5	-	-	-	0	-	0	26,744	23	-	0	-	0
				-		0				-		-						-				
Oper Rev / Other Income	-	-	46,154	38	22,655	17	-	-	19,187	10	24,142	20	-	-	-	-	32,543	28	-	-	-	-
				-		0				-		-						-				
Grand Total	**-**	**0**	**121,763**	100	**134,524**	100	**-**	**0**	**189,708**	100	**121,211**	100	**-**	**0**	**-**	**0**	**117,363**	100	**-**	**0**	**-**	**0**
OPERATING EXPENSES																						
Staff Costs	-	0	74,306	50	126,235	77	-	0	167,172	69	101,705	41	-	0	-	0	92,843	49	-	0	-	0
Operating Expenses	-	0	5,200	3	27,321	17	-	0	43,694	18	11,461	5	-	0	-	0	49,199	26	-	0	-	0
Maintenance	-	0	39,451	26	4,398	3	-	0	13,499	6	44,962	18	-	0	-	0	47,590	25	-	0	-	0
Others	-	0	29,964	20	6,234	4	-	0	18,004	7	90,337	36	-	0	-	0	1,196	1	-	0	-	0
Total	**-**	**0**	**148,921**	100	**164,188**	100	**-**	**0**	**242,369**	100	**248,465**	100	**-**	**0**	**-**	**0**	**190,828**	100	**-**	**0**	**-**	**0**

Source: Audited Accounts from RBDAs

9.2.9 Accounting Standards

An integral part of financial reporting is the accounting standard on which it is based. The RBDAs and their auditors follow internationally recognized accounting standards and the provisions of the Nigerian accounting standards board.

9.2.10 Review of Audited Accounts

The audited accounts did not disclose any fundamental basis on which to recommend rejection of any of the auditors, we are however of the opinion that lapses in auditing need to be drawn to their attention.

9.3 Recommendations

9.3.1 Financial Management System

The accounts of all the RBDAs should be computerized through the assistance of a Financial Management Consultant who will develop a financial management system (FMS) with budgetary, internal controls, accounting and reporting capabilities. A standardized system in the form of “Standard Practice Instruction” (SPI) or Financial Procedure Manual (FPM) should be adopted by all RBDAs. The FMS should be flexible and adaptable to suit the size and scope of each RBDA and capable of generating reports as required by the FMWR.

9.3.2 Financial Procedures Manual (FPM)

The main output of the FMS would be two volumes of Financial Procedures Manual (FPM) for the RBDAs, i.e. Volume 1 should be for the headquarters of each RBDA and Volume 2 for each of the Irrigation Schemes. The FPM for the irrigation schemes shall be developed to enable monitoring of the performance of each scheme.

The FPM would comprehensively document the procedure for the operations of the FMS and would serve as a reference document for the RBDAs.

The FPM shall include the following internal components:

(i) Flow of funds;
(ii) Financial and accounting policies;
(iii) Accounting system (including maintenance of accounts charts, format of books and records, accounting and financial procedures);
(iv) Budgeting system;
(v) Financial forecasting system;
(vi) Procurement and contract administration monitoring system;
(vii) Financial reporting (including formats of reports and linkages with Chart of Accounts).

9.3.3 Computerization of Financial Systems

There is an urgent need for the RBDAs to computerize their accounting system. So they can monitor adequately the performance of each scheme and the RBDA in general. Components of the computerization should include:

a. General IT strategy and requirements;
b. Communication Network: LAN and WAN;
c. Hardware / Software Specification and Selection;
d. Software Implementation;
e. Irrigation Scheme Supervision and Monitoring;
f. Training;
g. Human Resources Staffing Requirements.

9.3.4 Internal Audit Transformation

The present manual audit system will undergo transformation to Information Systems Audit. This will involve staff training in the use of Computer Audit Tools (CAATS).

9.3.5 Development of IT Manuals

The following manuals are recommended.
a. IT Security Policy Manual
b. Disaster Recovery Manual
c. End User Computer Policy Manual
d. Data Management policy Manual

9.3.6 Staff Audit

Given the high personnel cost incurred by all the RBDAs compared to the operating revenue, a staff audit will be necessary to justify the optimal manning level for each RBDA.

10. RECOMMENDATIONS

10.1 Status of Schemes

10.1.1 General Scheme Conditions

It was observed during the ROPISIN that in the KRIPI (HJRBDA), some additional areas were put under irrigation outside the original scope of the scheme. It is therefore recommended that:

- A detailed survey and study be carried out to estimate the area irrigated on either sides of the KRIPI (HJRBDA) main canal before the project area. This area should be incorporated into the scheme formally.

- There is a need for proper water management practice for the project taking into account the additional area along the main canal.

10.1.2 Land and Land Tenure

It is apparent that the user allocation system does not encourage the development of the irrigable lands, particularly when the allocation is done on seasonal basis. The farmer-occupier system is preferred because it guarantees farmers' investment in the land by keeping the soil productive through effective nutrient improvement and it also encourages operation and maintenance of the schemes' irrigation infrastructure. Under the present insecurity of land tenure for existing leasing system, it is recommended that:

- The management of the user allocation schemes and also the farmers that loan their farm plots under the farmer occupier system may wish to consider lengthening the allocation/lease period to 5 years or longer (with conditions to ensure proper use) under a firm written agreement.

10.1.3 Irrigation Infrastructure

Most of the schemes studied under ROPISIN have adequate irrigation infrastructure such as canals, drainage systems and structures. However, most of these facilities are in a poor state with canals and drains either silted up or overgrown with weeds. This assessment recommends that:

- Immediate rehabilitation/intervention investment through the repair of the hydraulic structures and facilities, improved water management and institutional development should be carried out in the identified 12 schemes.

10.1.4 Major Crops

Sole cropping was prevalent among the farmers in almost all the schemes where irrigation was carried out during this review period. This cropping pattern often results from the way irrigation systems are designed and has the disadvantage that, in the event of a disease outbreak or any other natural disaster, such sole crop farms could be severely affected. Furthermore, if there is any marketing problem such as a sudden change in government policy, especially with respect to importation, the farmers could be affected. It is therefore recommended that:

- In the future designs of irrigation schemes, there should be greater interaction and participation of the host communities and harmonisation of designs with government policies especially with respect to crop production.

10.1.5 Soil Fertility

The use of fertilizer for nutrient improvement is common in all zones. However, the review could not establish any zones where field tests had been carried out on a continuous basis, on the effect of fertilizers on crop yield. It was also observed that the quantity of fertilizers available is limited and they are poorly distributed. It is recommended that:

- Government strategy on fertilizer supply should be to ensure maximum capacity utilisation in and the expansion of existing plants, to encourage the establishment of new plants, to encourage the use of local raw materials for fertilizer production and to encourage the use of organic fertilizers by farmers.

- Government should provide necessary assistance for the importation of fertilizers. The procurement of fertilizers from both local and international markets should be made at the minimum costs possible while the distribution strategy will be directed at developing input transportation, storage and inventory management systems which minimise distribution costs as well as ensure that inputs get to the demand centres in the right quantity and at the right time.

- The responsibility for the procurement of fertilizer to farmers should be transferred to the private sector as rapidly as that sector is able to assume the responsibility. Government will however continue to monitor and regulate prices and quality.

- Before fertilizer requirements are determined for a given crop on a given soil, soil fertility assessments should be carried out as this will help in determining how much fertilizer should be used to give an optimum yield of the crop. The inability to carry out this assessment at

the schemes on a continuous basis probably explains why there is a wide disparity between the projected and actual yields of crops from the schemes and consequently their poor economic and financial performances.

- A fertilizer strategy should be designed to define the crops to be grown, their areas of coverage in each basin, yield targets and fertilizer requirements to achieve the set targets. The difference between the fertilizer status of a soil and the nutrients requirement of a given crop for a given yield target is the quantity of nutrients to be supplied by the farmer. Crop rotation should also be encouraged.

- Since most of the RBDA headquarters are located where there are higher institutions capable of carrying out soil fertility tests, the RBDAs should therefore take advantage of this. For larger schemes with areas more than 5,000ha and those >1,000ha but remote from higher institutions/relevant research centres, soil fertility laboratories should be sited at the schemes (with weather observation station and agronomy laboratories). Cost of these should be about N12.5M each.

10.1.6 Pests and Diseases

It was observed that farmers usually wait until their crops are attacked by pests and diseases before taking measures. This can be attributed to the lack of adequate extension services. It is thus recommended that:

- The farmers should be trained to take preventive measures and not to wait for the crops to be attacked before taking such measures. Preventive measures will reduce the spread of any outbreak of diseases and lower the costs to treat such.

10.1.7 Water and Land Charges

The bases for water and land charges are arbitrarily fixed and are very low. Even at these low charges the farmers are not willing to pay and this has affected the ability of the RBDAs to effectively operate and maintain the schemes. It is recommended that:

- Detailed studies of different methodologies to bring down energy costs should be carried out, including converting to gravity and the use of low-head micro turbines, gas turbines, electricity supply and even solar panels.

- To enhance the recovery potentials of the RBDAs, they need to improve on their water delivery efficiency by carrying out regular maintenance and ensuring strict water scheduling to the farms. This will encourage more farmers to pay. In addition, the RBDAs would be able to bring more land areas under cultivation.

10.1.8 Farmers' Organization and Participation

It was observed in ROPISIN that in all schemes, no effective WUA exists. It is recommended that:

- The Proposed National Irrigation and Drainage Policy should include the necessary input for legislation for WUAs registration.

10.1.9 Extension Services

Findings during the ROPISIN revealed that few farmers receive skeletal services from the RBDAs, by untrained operatives who are just offering assistance thus contributing to poor farming practices, poor choice of crops and scheduling the production of such crops. It is recommended that:

- The ratios of trained extension officers on irrigation schemes should be about 1:200ha.

10.1.10 Socio Economic Status

Very few commercial banks are involved in making credits available to farmers. The procedures involved in securing the loans are cumbersome and very often the banks are located far away from the schemes. In most of the schemes the farmers do not keep farm records and often resort to memory recall. The following are therefore recommended:

- There is need for a review of the CBN Agricultural Credit Guarantee and the NACRDB schemes for the farmers to receive maximum benefits from them. The commercial banks participating presently should be increased to meet the demands of the large number of farmers they are expected to serve.

- Farmers need to be educated on why written records should be kept immediately any operations/activities are carried out.

10.1.11 Operation

The performances of the public irrigation schemes have fallen short of expectations. This is due to a number of factors but the lack of proper operation and maintenance is one overriding cause for the malfunctioning of the schemes. Amongst the recommendations for better performance of the schemes are:

- Improved planning and scheduling of water delivery.

- Carry out detailed reassessment of the pumped schemes with a review of different methodologies with the aim of bringing down energy costs.

- Reorientation of the management through the ranks to the operatives by institutional development and capacity building.

- Increased efforts to achieve more efficient productive and sustainable irrigation practices by using appropriate cropping patterns, improved water distribution practices and adequate but realistic water charges.

- The establishment of agro-meteorological stations within the area of an irrigation scheme is most advisable in medium or large schemes to provide data for sound calculation of crop water requirements and water balance studies.

- Each scheme should maintain good record on all equipment, agricultural machinery, and other appliances in use in order to ensure sustainability and continuity.

- Equipment and machinery procurement should be standardised and obtainable from only two approved manufacturers, so that spares are standardised and stock levels maintained. Procurement should be based on the World Bank guidelines and comply with a standard technical specification for equipment and machinery

- Procurement packages should include maintenance management and training as well as the provision of spares for at least two years running maintenance. Procurement of such equipment and machinery should be through manufacturers with local well-established assembly plants in Nigeria

10.1.12 Project Management

Field investigations indicate that the PIM concept so far is understood and implemented by some of the RBDAs, through the establishment of WUAs however the impact is not noticeable in terms of agricultural performance, since there are no detectable upward changes in irrigated area, cropping patterns and or intensity, or yields. Furthermore they have not been assigned any management responsibilities and still operate as farmers cooperatives. This assessment is of the view that:

- PIM can be a success if the RBDAs can be reoriented to service provision and become accountable to participating farmers, commence the establishment of WUA at the time the project is conceived, and provide for appropriate training and aftercare that should extend for several years after the formation of the WUA. Responsible WUA development cannot occur without transferring appropriate management roles to the WUA and on to the farmers.

- Rehabilitation and modernisation of irrigation schemes in Nigeria should have PIM as a major influence in design and implementation. Large, complex, awkward schemes with sophisticated pumping technology are not conducive to PIM. Equally grouping subsistence farmers together and providing them with irrigation equipment without capacity building or extension services is just as bad. A compromise suited to the Nigerian situation is required. Many public schemes will never be able to be managed at 100% by the beneficiaries and the Government will always have some role. New schemes however can be designed more appropriately and be more amenable to farmers' operation and management.

- The Proposed National Irrigation and Drainage Policy should provide for user participation in decision making on issues of land, conflict resolution, operations and maintenance as it relates to the administration of the scheme.

10.2 Environmental Assessment

The review highlighted the following environmental problems; the misapplication of agro-chemicals affecting soil and water quality; over irrigation that has led to water-logging problems and abandonment of parts of irrigated areas; extensive mono cropping of large areas for long periods resulting in soil nutrient depletion; salt water intrusion particularly at the Itoikin scheme of Ogun-Oshun RBDA. This assessment therefore recommends that:

- There is a need for proper environmental impact assessment at the onset of most of the programmes.

- There is a pressing need for environmental post-implementation monitoring and evaluation be carried out periodically on all public sector schemes.

- Where mitigative measures are recommended either at the onset of the project or post implementation these should be funded

- A system of crop rotation should be worked out for each irrigation scheme.

- FMEnv zonal offices to work in collaboration with irrigation officers and RBDAs at the States, to ensure compliance to environmental guidelines.

- State Environmental Protection Agencies to equip their laboratories in order to assist RBDAs in post implementation environmental monitoring and evaluation.

10.3 Irrigation Institutions

10.3.1 Future role for RBDAs

The RBDAs as currently structured have been unable to operate and manage their respective irrigation schemes in an economic and sustainable way. It is recommended that:

- A total reorientation of the RBDAs towards business management including restructuring, institutional development and capacity building.

- The RBDAs should be transformed into catchment management agencies or authorities for the overall water resource management in Nigeria, by ensuring that river basin operations are rationalised to conform to the basic principle of integrated catchment management or Irrigation Management Boards.

- Another option is to convert the RBDAs into Irrigation Management Boards (IMB) responsible for the overall management of the downstream irrigation infrastructure and completely independent of government involvement or participation. For this to be successful there is a need for total business structure with a cost recovery orientation.

- The RBDAs could relinquish functions of direct service delivery and be granted the mandate to establish partnership, make bulk sale of the allocated water from their reservoirs and to co-ordinate the actions of all public agencies and developers in their catchment thereby ensuring that there is strict adherence to the Water Resources Policy and the NIDP.

- Private entrepreneurs should be encouraged to set up agro allied businesses (including import and export) in close proximity to the irrigation schemes by giving tax, custom duties and land incentives in line with government's policy.

10.3.2 Institutional Enhancements

Most of the public institutions are overstaffed in respect of support staff while the professional/technical cadre are in most cases understaffed. These key institutions are under-funded; and most of them were established without well defined goals,

purpose or output targets. Furthermore the staff of these institutions are often underpaid, untrained and unmotivated, lacking visible incentives to render productive services. It is therefore recommended that:

- FMWR should intensify its efforts through professional staff training and retraining to improve project implementation and management skills within the government institutions concerned to assure the quality of services provided by consultants.

- The appointment of consulting engineering companies – whether national or international, should be much more selective. Specifically, only those consulting companies, who are able to demonstrate high standards of professional competence, should be appointed.

- Irrigation agencies must be adequately remunerated before one can expect them to be committed and the cost of operations and maintenance should be shared among the 3 tiers of government and the beneficiary farmers' stage wise for the first 3 years until the project stabilizes when only the beneficiaries pay the cost 100%.

- International technical and financial support should be sought for designing and implementing a programme for transforming existing public irrigation schemes into self-sustaining units that are eventually controlled by the users, operating through legally established WUAs.

- There should be no investment in new public irrigation projects for the time being until existing projects have been made to be optimally utilized and self-sustaining.

- A well-equipped observation and information collection, collation and research centres to obtain process and sell/disseminate data should be setup as top priority; some tertiary institutions including the NWRI, the RBDAs should be one of the many agencies to ensure that the centres are well run. It should be well funded by FGN and other bilateral organizations.

10.4 Policy and Strategy Assessment

The FGN and its agencies (FMWR, NCWR, NTCWR, and RBDAs) should expedite the processes of producing an acceptable irrigation policy with a workable strategy for implementing it. Although a policy is not a law, it is an essential element in

achieving sustainable development, management and control of irrigation and drainage. Once a policy is approved by Government, steps are taken to list and describe all the relevant legislation needed for its implementation. Institutional, technical and other reforms can proceed without any hindrance, targets of achievement set and time frames placed on them in consonance with the policy and the enabling legislation. In line with the above the following recommendations are made:

- The NAP of FMARD and the NIDP with PPSPIDM of FMWR need to be carefully worked out, reconciled and harmonized as complementary rather than competing and mutually undermining documents.

- Large-scale I&D development must proceed cautiously in the absence of adequate resource data required for planning, learning from the experience of the farmer-owned and operated small-scale schemes before opening new areas for large-scale projects.

- Every scheme should have a realistic strategic plan in place, which takes a proper account of its O&M requirements and should be run under some management contract agreement legally binding on both the service receivers and the service providers.

- The SMO should be properly identified, constituted and oriented to provide the required irrigation and drainage services mutually agreed upon at the required level and at the required time as defined in the management contract.

- Public irrigation and drainage scheme management is better shared with an efficient private sector management partner. Therefore the “new approach” should consider ***management contract, lease and concession***, starting with the first of these three in the short term and gradually moving on to concession in the long term.

- Government intention to gradually hand over O&M responsibilities to water users associations (WUAs), is easier implemented through private sector management partners such as NGOs than through the existing SMOs which are government agencies operating under the existing civil service rules.
- All public irrigated agriculture projects in Nigeria should be conjointly planned and implemented by the beneficiaries, the FMWR, and the FMARD using their relevant

departments, agencies, parastatals, divisions and units as appropriate.

- There should be regular inter-ministerial consultations between the FMWR and FMARD.

10.5 Dam Safety Appraisal

Many of the dams assessed during this review are over 20 years old and underutilized. The dams are not being monitored and very little information exist about the status of the dams. Records of dams' instrumentation readings hardly existed and where existed were not in a usable form. Due to the age of the dams, it is recommended that:

- Continuous periodic monitoring is carried out.
- Most of the instrumentation consisting mainly of piezometers and monuments are in bad states and should be rehabilitated as soon as possible.

Specific recommendations and cost of rehabilitation of each dam is as presented in Section 8.3 of this report.

10.6 Financial Assessment of RBDAs

The RBDAs have not been able to operate as commercial ventures. This is because they are incapacitated by the Law and also tied to the Civil Service remuneration system. They always require approval from the Honourable Minister of Water Resources to change their Revenue rates. It is therefore recommended that:

- The accounts of all the RBDAs should be computerized through the assistance of a Financial Management Consultant who will develop a financial management system (FMS) with budgetary, internal controls, accounting and reporting capabilities.
- The present manual audit system will undergo transformation to Information Systems Audit. This will involve staff training in the use of Computer Audit Tools (CAATS).
- A staff audit will be necessary to justify the optimal manning level for each RBDA, given the high personnel cost incurred by all the RBDAs compared to the operating revenue.

11. EXECUTIVE SUMMARY OF THE ZONAL SCHEME'S REPORTS

11.1 Constraints of the Schemes

- Initial planning design and construction of irrigation schemes are implemented without the farmers' participation. Some schemes rely on migrant labour or farmers to produce crops.
- Some systems are planned using sprinkler systems which the operatives and farmers cannot manage due mainly to lack of technical knowledge and the high O&M costs of the equipment. Other projects stopped due to problems in supply of spare parts, theft and damage. No supplier or manufacturer of such equipment exists in Nigeria making spares and repairs expensive and difficult,
- Old pumps predominate and these require large amounts of diesel and perform badly – some no longer operate. M&W pumps cannot be serviced or repaired as no agent exists for them in Nigeria and spares have to be imported from the USA,
- Many dams were designed to have hydro-electric power (HEP) facilities (some to power the irrigation pumps) but these were not installed or do not operate,
- Lack of effective O&M at all schemes over many years and subsequent deterioration of facilities,
- The limited funds collected as water and other charges from the farmers are not sufficient to fund O&M needed and often are perceived to have been used by the RBDA's for other purposes,
- Flooding is a problem at schemes close to bigger rivers such as the Niger and Benue. At some sites dykes have been designed to reduce flooding but have not been completed or are inadequate,
- Inadequate and timely supply of inputs,
- Lack of extension services,
- No effective WUA's,

11.2 Consolidated Zonal Recommendations

- Ensure effective and efficient utilization of the limited resources for the O&M of the projects and facilities,
- Larger schemes such as KRIP I should have autonomous management on site with a high degree of financial independence,
- Complete HEP installations at those dams where power can be used for pumping OR connect diesel powered pumps to NEPA,
- Discard schemes where flooding and other problems are too costly to rectify,
- Encourage the growing of cash crops such as sugar, cotton and rice,
- Improve existing irrigation and drainage systems by focusing on projects that have designs and facilities appropriate for farmer management and that have potential for such management transfer,
- Improve irrigated crop output by strengthening extension services, credit facilities, input supplies and WUA's and other farmer groups,
- Collect realistic water charges and use these funds for improving infrastructure and providing services to the irrigation farmers.

Table 11.1 Summary of Irrigation Schemes in the North East Zone

Table 11.1.1 Chad Basin Development Authority (CBDA) North East Zone					
Scheme	**Infrastructure**	**Agronomy**	**Socio-economic**	**Water Supply**	**Other**
South Chad (SCIP) 67000ha planned, 22000ha developed and no irrigation 2003.	Pumped, surface, gravity scheme from Lake Chad via 38kms intake. Main intake and 5 pumping stations powered by generators. Breakdowns and high costs typical.	Wheat, cotton, groundnuts & rice were main crops. Low rainfall area (500-600mm) and short season (Jun-Sep). Heavy soils.	Traders from Maiduguri (120kms) main buyers of crops. Many farmers were migrants from nearby states. No significant irrigation since 1984.	Lake Chad receded 15kms soon after scheme constructed (1979).	Field infrastructure requires complete rehabilitation. Pumps and gensets more than 25 years' old and no use for many years. Power lines vandalised.
Baga Polder 20000ha planned, 2000ha developed, 1000ha irrigated 2003.	1975-76 scheme with dyke around polder and intake to Lake Chad. Initially 500ha sprinkler scheme but costs and spares problem. Pumping surface scheme of 1500ha developed around intake channel.	Wheat was main crop. As Lake receded and water supply dried up by March, crops changed to potatoes and cowpeas. Low rainfall area. Light soils.	Many farmers were migrants from nearby states. Good road access to Maiduguri.	Temporary pumps stations lift water from main intake channel.	Drainage and irrigation system in poor condition. Main intake choked with weeds.

Table 11.1.2 Hadejia Jamaare River Basin Development Authority (SORBDA) North East Zone

Scheme	Infrastructure	Agronomy	Socio-economic	Water Supply	Other
Kano River I 22000ha planned, 15000ha developed and 18000ha irrigated 2003.	1977-81 surface, gravity scheme from Tiga Dam via 74kms canal. 3000ha being irrigated from canal informally and 7000ha extension being contracted. East (13000ha) and west (7000ha) sectors.	Rice, wheat, maize, veges & melons are main crops. Wheat yields 3t/ha). Light well drained soils. Salinity and waterlogging problems in some areas.	Good markets locally and Kano. Limited WUA's established based on canals – good potential to develop them for PIM. Project managed from RBDA HQ.	Tiga Dam supplies water to KRIP I &II and to Kano City. 1845mcm. Extensive canal and drainage system.	Local management using income from scheme would e beneficial. Scope to increase farmer management. Most important scheme in Nigeria. No schools or clinics on scheme.
Hadejia Valley 12500ha planned, 3000ha developed, and irrigated 2003.	1980's surface, gravity scheme sourcing water from Tiga + Challawa dams. Barrage with main canal (27kms) on Hadejia River. Work stopped 1984 but resumed 1992.	Wheat, maize, tomatoes and onions main crops. Low rainfall (400-600mm with 50% July-Aug) area. Light soils.	Good road access. Traders buy crops. 9 WUA's with limited activities.	Gravity canal from storage pond. North Main Canal, night storage reservoirs and drains have weed problems.	3000ha developed since 1992. Some wind erosion of light soils. Flooding of fadama area every rainy season.
Jama'are Valley 50ha planned, 20ha developed.	1960's demonstration farm. Pumped, gravity from Sawe Lake on Jama'are river.	Vegetables were main crop. Rainfed farming only.	RBDA allocated plots annually.	Dams on river to improve dry season flows not constructed.	Intake, pumps and canals flooded 1998. No irrigation since.
Kano River II 48580ha planned 80ha developed.	1980's 200ha Wudil Pilot Project to trial surface gravity and overhead pumped irrigation.	Wheat and vegetables were main crops. Rainfall 860mm.	Kano 25kms away. RBDA leased project to private company 1995 for 3 years.	Barrage on Hadejia river collects water from Tiga Dam. Pumps+pipeline.	No irrigation since 1999. Meant to be Phase II of KRIP.
Katagum	I994 scheme for 150ha. 50ha developed. Pumps on ox bow lake.	Rice project.	Regular flooding problems – canals damaged and no irrigation.		

Table 11.1.3 Summary of Physical Characteristics of the Schemes of the North East Zone

RBDA and HQ	States	*Project*	Size of Area (ha)			Head works	Type of Irrigation	Types of Crops	Water Charges N/ha	Average Price N/Ton	Average Harvest Tons/Ha	Remarks
			Plan'd	Develp'd	Cultivat'd (Operational)							
HJRBDA Kano	Kano	KRIP I KRIP II	22,000 48,580	15,000 since 1983 80	18,000 0	Dam 1845mcm Dam 1845mcm	Gravity	Wheat Maize Rice Vegetables N/A	N2,500 N/A	N40,000 N35,000 N35,000	2.4	KRIPI is operational. Some constraints in the delivery system.
	Jigawa	HVIP	12,500	3,000	3,000	Barrage	Gravity	Wheat Maize Vegetables Rice	N2,500	N40,000 N35,000 Variable N35,000	2.5	The project is operational - weeds and erosion are problems in water delivery
	Bauchi	Jama'are Valley Project	80	20	0	Sawe Lake	Gravity Pump	N/A	N/A	N/A	N/A	
	Bauchi	Katagum Irrigation Project	700	100	0	River	Gravity Pump	N/A	N/A	N/A	N/A	The project was designed and constructed by direct labour, rainfall washed away all the canals.
CBDA Maiduguri	Borno	SCIP I Baga Polder	67,000 20,000	22,000 2,000	0 1,000	Lake Chad Lake Chad	Pump Gravity Pump Gravity	Wheat Rice Tomato Maize	2,000 1,800	N/A	2.0 2.5 18 2.5	The project has not been operated since 1983/84.

Table 11.2 Summary of Irrigation Schemes in the North West Zone

Table 11.2.1 Sokoto Rima River Basin Development Authority (SORBDA)					North West Zone
Scheme	**Infrastructure**	**Agronomy**	**Socio-economic**	**Water Supply**	**Other**
Bakolori 23000ha planned and developed and 5000ha irrigated 2003.	Surface and sprinkler scheme from multi-purpose dam. No sprinkler irrigation (15000ha) since 1997 and only surface irrigation of 5000ha undertaken (2000 farmers).	Rice, wheat and vegetables grown. Low rainfall area (500mm). Rainy season is May to October.	Talata Mafara market developed to sell produce from scheme. Finding spare parts, theft and damage to pipes+sprinklers were problems in past.	Dam (450mcm) on Sokoto river completed 1976. Pumped water conveyed 15kms by canal to project. HEP turbines not working.	Sprinkler area proposed to convert (where possible) to gravity surface irrigation. Field infrastructure requires rehabilitation.
Goronyo 5200ha planned, 250ha developed, 120ha irrigated 2003.	Also called Middle Rima. Scheme still under construction – 120ha of 817ha block completed 2003.	Rainfed rice and irrigated wheat, maize, cowpea and vegetables main crops grown. Pepper yields are 14t/ha.	Local market at Goronyo town. Farmers own their plots. Subsistence crops grown with surpluses sold.	Dam (942mcm) on Rima river completed 1983. All gravity irrigation and water supply downstream.	Need to intensify cropping and commercialise activities.
Jibiya 3500ha planned with 3400ha developed and 170ha irrigated 2003.	Surface scheme – 206ha (1 block) irrigated by gravity, 3266ha (5 blocks) by pumping. Concrete canals due to permeable soils.	Wheat, onions, tomatoes and groundnuts main crops. Low rainfall area-long dry season.	Main market Jibiya town. Katsina 43kms away. Farmers own their plots. Katsina ADP provides extension.	Dam (121mcm) on Gada river completed 1991.	Pumps broken down – hence no irrigation on 3266ha. Some canals broken. Some lands since lost to urbanisation.
Zauro Polder 10572ha planned, 580ha developed but no irrigation 2003.	Surface pumped/gravity scheme using water from river and Goronyo dam (210kms away). Proposal to develop tubewell irrigation now. 100ha pilot underway.	Rice scheme. Low rainfall area-long dry season. Quelea birds reduce rice yields.	Annual plot allocation by RBDA. Birnin Kebbi town main market – close by.	Polder on floodplain of Rima river. Barrage and dyke for flood protection and water supply. Pumped to canal.	WUA involved in land allocation. Erratic power supply requires genset backup. Some flooding problems.

Table 11.2.1.1 Summary of Physical Characteristics of the Schemes of the SRBDA

S/N	Name of Project	Planned area (ha)	Developed (ha)	Actual cultivated area (ha)	Gravity/pump	Type of crops	Average Harvest per Ha (tons)	Average Price at Harvest 2004(N/ton)	Water Charge per Ha (N)	General Remarks
1	Bakolori (BIP)	23,000	15,000 (sprinkler) 8,000 (surface)	5,000	Gravity	Rice Potato Pepper Onions	7.2 15.1 15.6 20		2000:00	Sprinkler area abandoned due to maintenance problems.
2.	Goronyo (GIP)	5,200	250	120	Gravity	Pepper Onions Maize Cassava	14.2 21.2 1.8 18		3200:00	On-going new Project.
3.	Jibiya (JIP)	3,500	3,400	170	Gravity/ Pumping	Wheat Onions Tomato Cowpea Grdnut Maize	3.7 18 40 1.1 2.3 1.8		2000:00	Area put under pumping is no more functional due to faulty pumps.
4.	Zauro Polder (ZIP) (Pilot Scheme)	10,572	580	0	Pump from river Rima	Rice Maize Tomato Potato	5.1 1.4 7.3 7.2			Limited water availability on project.
	TOTAL	42,272	27,230	5,290						

Table 11.2.2 Lower Niger River Basin Development Authority (LNRBDA)					North West Zone
Scheme	**Infrastructure**	**Agronomy**	**Socio-economic**	**Water Supply**	**Other**
Kampe 11000ha planned, 1000ha developed and 100ha irrigated 2003.	Omi dam and phase I (23 out of 44 blocks) (1000ha) completed 1999 after 16 years. Contractor still on site. Surface gravity scheme with 290ha requiring pumping.	Maize, guinea corn, groundnuts and vegetables grown. Rainfall 1250mm. Rainy season is April to October. Potential rice scheme.	Local farmers not interested in project – RBDA arranged for migrant farmers but only 150 on site 2003. Seasonal plot allocation by RBDA.	Dam (220mcm) on Oyi river is also used for completed 1976. 16kms of 39kms main canal completed.	Some erosion of structures. Local people rely on fishing/livestock and not interested in irrigation.
Tada Shonga 3200ha planned, 100ha developed but no irrigation 2003.	Pumped gravity surface scheme on banks of River Niger. Flood protection works required. Delays to implementation-only 30ha (using small pumps) ever irrigated. No irrigation since 2000.	Rice project but mainly rainfed rice grown. Rainfall 1086mm. Rainy season is April to October.	Ilorin is 120kms from site. On site infrastructure dilapidated/abandoned. Present farming system low tech and farmers may not be interested in irrigation.	Flooding is major issue. Old intake severely damaged. Some floods caused by releases from NEPA dams upstream.	Flood protection dykes do not function or are incomplete. Most infrastructure damaged by many floods.
Farmer Assisted Schemes: Gerinyan Erin-Ile/Ajasse Ipo Oke-Oyi Oluru	Improved traditional schemes of 1980's. Weirs and pumps provided on rivers. Max area irrigated was 30ha at any site. Now less than 15ha total irrigated.	Okra, vegetables, sugarcane and rice main crops.	Old pumps have not been replaced or repaired. Diesel costs were not covered by fees.	Pumped water from tributaries of River Niger.	M&W pumps broken down.
Kaima	At design stage.				

Table 11.2.2.1 Summary of Physical Characteristics of the Schemes of the LNBDA

S/N	Name of Project	Planned area (ha)	Developed (ha)	Actual cultivated area (ha)	Gravity/pump	Type of crops	Average Harvest Per ha (Tons)	Water Charge Per Ha (N)	General Remarks
1.	Kampe	11,000	1000	100	Gravity	Maize Okra Tomatoes Garden egg Pepper	2.5 5 4 7 5	500:00	Limited farmers available to cultivate developed area.
2.	Gerinya	2000	100	5	Pump	Sugarcane Okra		500:00	Farmer assisted.
3.	Oke-Oyi	200	100	10	Pump	Okra Tomatoes Vegetables Onions	3 4 2.6 2.8	500:00	Farmer assisted.
4.	Erin-Ile/Ajasse	0	0	0	Pump				Drawing board.
5.	T/Shonga	3,200	100	0	Pump	Rice Maize Sorghum Groundnut Cassava Yam	2 2 2 13.2 7.2 6	500:00	Detail design for the development of 3,200ha ready.
6.	Kaima	0	0	0	Pump				Drawing board.
	TOTAL	16,400	1,305	115					

Table 11.2.3 Upper Niger River Basin Development Authority (UNRBDA)					North West Zone
Scheme	Infrastructure	Agronomy	Socio-economic	Water Supply	Other
Tungan Kawo 880ha planned and developed and 400ha irrigated 2003.	Surface, gravity scheme from Tungan Kawo dam. 100 farmers	Rice is monocropped. Yields are 4.7t/ha.	Land is allocated to villages annually by RBDA. Quelea birds problem affects yields. Traders from nearby Wushishi buy rice.	Dam (22mcm) on River Ubandawaki completed in 1978. Delays common in commencing irrigation thus reducing yields.	7 WUa's based on villages. Sedimentation of dam and canals major problem. Field infrastructure requires rehabilitation.
Swashi 3150ha planned, 2500ha developed, 200ha irrigated 2003.	Scheme still under construction after many delays – pumps to irrigate 577ha installed and left bank canal constructed (but later failed). Right bank canal poorly constructed and never used. Only 200ha can be irrigated.	Rice and vegetables main crops grown. Low yields are common.	Land is allocated annually by RBDA. Poor road access. Marketing issues.	Kubli dam (57mcm) and Swashi diversion structure (5mcm) supply water to scheme by gravity. Main canal problems led RBDA to install pumps to supply 200ha.	Drainage and irrigation system in poor condition. Remote site – 210kms from Mokwa and 110kms from New Bussa.
Galma 27000ha planned.	Scheme at planning stage except for small, pumped pilot area.				
Tafa 145ha planned, 42ha (55 farmers) developed and irrigated 2003.	Pilot pumped/gravity scheme using water from river Tafa. Jere scheme nearby (10ha – 8 farmers - irrigated 2003) but no records available from RBDA.	Okra, aubergine, peppers and tomatoes grown.	Low yields due to limited water supplies pre-harvest time. FCT Abuja is nearby as market. Annual allocation of land by RBDA.	Pump proved too large for small river flow so farmers use small petrol pumps to obtain water.	SG2000 and IFAD demonstrate technologies for farmers.

Table 11.2.3.1 Summary of Physical Characteristics of the Schemes of the UNRBDA

S/N	Name of Project	Planned area (ha)	Developed (Ha)	Actual cultivated area (ha)	Gravity/pump	Type of crops	Average Harvest per Ha (Tons)	Average Price at Harvest 2004 (N/Ton)	Water Charge Per Ha (N)	General Remark
1	Tunga-Kawo	880	880	400	Gravity	Rice	4.7	45,000:00	2,000:00	About 400ha not irrigated due to faulty construction works.
2.	Swashi	3,150	2500	200	Gravity	Rice Okra Roselle Tomato Spinach	3.0-4.0 1.6 1.7 8 1.5		1,250:00	Most irrigation structures have undergone deterioration.
3.	Galma (Pilot)	27,000	80	80	Pump					Project at planning stage.
4.	Suleja (Tafa)	145	42	42	Pump	Maize Gardegg Okra	3.8 11.8 2.2	30000:00		Farmers using private pumps
	TOTAL	31,175	3,502	722						

Table 11.3 Summary of Irrigation Schemes in the Central Zone

Table 11.3.1 Upper Benue River Basin Development Authority (UBRBDA)					**Central Zone**
Scheme	Infrastructure	Agronomy	Socio-economic	Water Supply	Other
Lake Geriyo Pumped gravity (1,200ha) scheme with 213ha irrigated 2003/2004.	Sprinkler phase (24ha) started 1979. 40ha by 1980 & centre-pivot (58ha) 1981. Rain gun replaced some sprinklers 1986. Surface replaced overhead due to high cost of O&M. Expansion in 1990's led to183ha under irrigation.	Vegetables main crop in 1980-90's. Rice introduced in 1990's. Yields are 1.75tons paddy per 0.25ha & 6 tons vegetables per 0.5ha plot.	Jimeta & Yola markets close by. Nearest rice mill is at Numan (60kms).	Water pumped from R Benue or L Geriyo. Flooding in rainy season a problem.	Present pumping costs very high (diesel gensets – old pumps) – estimated at N40,000/ha for diesel alone for the area irrigated 2003.
Dadin Kowa Sprinkler (44,000ha) scheme with 70ha irrigated 2003/2004.	Dam completed 1988 but no turbines installed and release structure unusable for irrigation. 250ha (700 farmers) pilot project started but sprinkler section (150ha) abandoned. Of 100ha surface area only 70ha used now.	Topography more suited to sprinkler. Vertisols in area near dam and loams downstream. Rice main crop on pilot farm with 6tons/ha yield. Some veges and tree crops.	650 farmers on 70ha at present. Small processing facilities for tomatoes & fruits nearby. *Nearest markets/input suppliers?*	Dadin Kowa dam designed to release 130m3/sec – enough water to irrigate (by gravity) 34,000ha. HEP (34mW) turbines not installed. Canal for irrigation incomplete – pumps used now from river.	Infrastructure on the pilot area is deteriorating. Pumping costs are high.
Cham Dam	1992 dam washed away 1998. Major rehabilitation now required.	Rice was main crop with yields of 5tons/ha.			
Waya Dam	Dam not complete.	No irrigation.			
Lower Taraba	Old project – not operating since 1996.	Rice grown on pilot area in 1990's.	Rice & sugar cane possible.	R Taraba with planned barrage.	Barrage not started. Flooding problems.

Table 11.3.1.1 Summary of Physical Characteristics of the Schemes of the UBRBDA

Name of Scheme	Area (ha)			Major Crops Grown	Gravity/ Pump	Average Harvest Per Ha (Tons)	Water Charge (N)	General Remark
	Planned	Developed	Actual (2003/04)					
Lake Geriyo	1,200	550	*213	Rice	Pumping	6.0	10,800	
Dadin Kowa Dam	44,000	250	70	Rice	Pumping	6.0	10,800	
Cham Dam	500	250	0	Rice	Gravity	5.0		
Waya Dam	2,000	10	0	N/A	Gravity			
Lower Taraba	3,000	350	0	Rice	Pumping	5.0	3,000	

Table 11.3.2 Lower Benue River Basin Development Authority (LBRBDA) Central Zone

Scheme	Infrastructure	Agronomy	Socio-economic	Water Supply	Other
Doma 2,037ha with 250ha developed but 10ha irrigated 2003/2004.	Sprinkler scheme from multi-purpose dam. 250ha pilot scheme constructed but only 20ha used. Pipelines for 1,600ha installed.	Melon & okra are main crops. Well drained soils unsuitable for surface irrigation.	Markets at Doma & Lafia. Melon processing locally. Theft & damage to sprinklers & pipes a problem.	Pump house at dam lift water for sprinklers.	4 diesel gensets on site but NEPA being considered for pumping.
Ejule Ojebe 2,500ha with 25ha developed.	1983 scheme but only 25ha used – no irrigation since 1985.	Rainfed farming for rice & other crops.		Ota Lake main source of water.	Linked with Ofarachi scheme. Scheme much deteriorated.
Dep 1,585ha with 500ha developed but 20ha irrigated 2003/2004.	1972 scheme taken over by RBDA 1979. RBDA has not been involved on O&M for 5 years. 25 farmers manage pumps now.	Hot pepper grown with yields of 19 bags/ha. Okra also grown.	54km from Lafia. Some private farmers use own pumps to irrigate on scheme area.	Water pumped from Dep River to scheme. Flooding is a problem.	Farmer effectively manage this project.
Katsina Ala No irrigation since 1995.	Scheme needs complete rehabilitation.	Rainfed rice, maize, sugar cane & veges.	Katsina Ala town is nearby.	Katsina Ala river is a major tributary of the Benue River.	Flooding is a problem.
Ofarachi	1981 scheme but only 12ha used until abandoned 1985.			Pumped gravity from tributary of Niger.	Sprinklers introduced 1996 for 10ha but discontinued 1998.
Naka	2ha pilot project to demonstrate sprinkler irrigation.	Okra & spinach grown	20 farmers with 0.1 ha plot each. Farmers purchase diesel.	Naka dam nearby. Water pumped direct to sprinklers.	Road access poor.
Bokkos	5ha pilot project using water from Bokkos dam.	Potatoes main crop.	Jos is 70kms away.	Water pumped direct to plots via canal.	Good road access.
Other sites	No irrigation at all.	Much deteriorated infrastructure at all sites.			Flooding problems

Table 11.3.2.1 Summary of Physical Characteristics of the Schemes of the LBRBDA

Name of Scheme	Area (ha)			Major Crops Grown	Gravity/ Pump	Average Harvest Per Ha (Tons)	Water Charge (N)	General Remark
	Planned	Developed	Actual (2003/04)					
Doma	2,000	250	10	Melon	Pumping	0.7	600	
Ejule-Ojebe	2,000	25	0	Rice	Pumping	2.5	750	
Dep River	1,585	500	50	Hot pepper	Pumping	1.9	1,000	
Katsina-Ala	1,000	150	0	Rice	Pumping	2.0	2,000	
Ofarachi	1,000	10	0	Maize	Pumping	1.2		
Naka	100	10	2	Okro	Pumping	0.8	1,500	
Bokkos	30	5	8	Irish potatoes	Pumping	7.5	6,000	
Longkat	2,000	100	0	Rice	Pumping	3.5	0	
Makurdi	1,000	100	0	Rice	Pumping	2.0		
Jato-Aka	1,000	20		Rice	Pumping	2.0	0	

Table 11.4 Summary of Irrigation Schemes in the South West Zone

Table 11.4.1 Ogun Osun River Basin Development Authority (OORBDA)					**South West Zone**
Scheme	Infrastructure	Agronomy	Socio-economic	Water Supply	Other
Lower Ogun Sprinkler (12000ha) scheme with 40ha irrigated 2003/2004.	Phase 1 (3000ha) started 1990. Weir and water main 56% complete, canal 52% complete, pipelines 8% complete, pumps & other works 12-18% complete. Overall scheme 45% complete.	*Maize, Water Melon, Garden Egg, Cucum-Ber & Pineapple*	*Good access road to project site.* *Markets at Owode and Abeokuta.*	Oyan dam (270mcm) completed 1983. HEP component (9mW) not fully installed. Supplies water to Lagos & Abeokuta + 3000ha LOIP.	NEPA required for pumping. Present pumping costs very high (diesel gensets)– estimated at N40,000/ha for 40ha irrigated 2003.
Middle Ogun Sprinkler (12626ha) scheme with no irrigation 2003.	Phase 1 (3080ha) started 1990. Much work completed but on-going problems with finance & the contract have prevented final completion. 536ha ready to irrigate.	Thin top-soils, topography & drainage constraints led designer to recommend sprinkler for cassava, maize, yam, tomatoes & cowpeas.	Rainfed farming going on at present. Farmers not familiar with sprinkler irrigation. *Good access road to project site, Markets at Iseyin and Oyo.*	Ikere Gorge dam (565mcm) completed 1985. HEP (6mW) component not fully installed. Access road poor condition. Supplies water to 3 towns & Lagos.	Sums owed to contractor & works to complete estimated at $40 mill. (12000ha). Water charges are likely to be high: N40,000/ha power cost alone.
Itoikin	1976 Chinese rice project. Pumped (from river) gravity scheme with 141ha developed of potential 315ha. Only 3 of 5 pumps now working but old. Major rehabilitation now required.	Rice no longer grown (change in soil pH). Maize, water melon, pineapple & veges now grown. Some salinity due to closeness to sea.	Lagos is 50km away. 15 farmers on site with plots 4-12ha each. ADP assists with land preparation. Traders from Lagos buy crops.	Water pumped from perennial R. Aye by electric pumps (old) powered by NEPA & old diesel genset.	Originally developed to train Lagos State farmers in irrigated rice production. WUA & Co-op exist. Farmers pay N2500/ha for water but real cost is N36750/ha.

Table 11.4.1.1 Summary of Physical Characteristics of the Schemes of the OORBDA

RBDA & HQ	States included	Irrigation Projects	IRRIGATION AREA(ha)			Headworks	Type of Irrigation	Type of Crop	Average Harvest per Ha (tons)	Average price as at harvest (₦) 2004	Water charge per Ha (₦)	Input Cost (N)	General remark
			Planned	Dev'ped	Actual cultivated								
Ogun-Oshun (OORBDA) Abeokuta	Ogun Oyo Oshun Lagos	Lower Ogun Middle Ogun Itoikin Sepeteri Ofiki Oke-Odan Iwo	12000 12000 141 2000 2000 400 -	40 200 141 80 12 12 -	40[1] - 60 - - - -	Dam 270mcm) Dam (565mcm) River Aye Dam (4.5 mcm) Dam (1.9 mcm) Dam (5.6 mcm) -	Sprinkler Sprinkler Gravity Sprinkler Gravity Gravity -	- - Maize - - - -	- - 3.0 - - - -	- - 2500/100kg bag - - - -	- - 2500:00 - - - -	30,000	On-going project On-going project Need rehabilitation No irrigation Component No irrigation Component No irrigation Component Drawing Board

1. First Irrigation Season-No Harvest Yet
2. Production of Rice Seedlings for SPFSS
3. Harvest not disclosed, but Project Manager estimated 2.0t/ha for maize.
4. Private Farm of RBDA

Priority Ranking Column 1`(RBDA) Column 2 (Zonal

Table 11.4.2 Benin Owena River Basin Development Authority (BORBDA)					South West Zone
Scheme	Infrastructure	Agronomy	Socio-economic	Water Supply	Other
Illushi Ega	Pumped irrigation scheme using water from R Niger. Pilot scheme (50ha) constructed 1994. It has never operated as designed due to faulty construction.	Rice seedlings being grown on 8ha by RBDA for the SPFS.	Market prospects low – poor road access & low yields. Rice growers co-op in area.	Original intake moved following river meander.	Farmers are traditional rice growers planting crops on flood recession areas. Enplan propose 5000ha scheme here.
Ukhun Erha	Dam completed 1993. Now in poor condition with leakages. Pump station, main pipe, pumps & reservoir completed 1998. Main canal/field works yet to start thus no irrigation. 250ha designed, 150ha cleared.	Rainfed farming for subsistence crops (maize, yam& cassava). Low level of technology on small plots typical.	90km from Benin City.	Earth dam (1 million mcm) releases water to pump station downstream. Water would be pumped to balancing reservoir & then via gravity canal to fields.	Farmers view 8 month rainy season as sufficient for their needs re food and small amounts of cash crops. Farmers have opposed RBDA in developing works on site.
Ikere Ogbese	Small scale sprinkler project developed by RBDA in 2000 without feasibility study. Only 11ha irrigated 2000-2002. No irrigation since due to funding shortage for pumps.	Maize & okro grown.	Farmers co-op assisted by RBDA. Farmers object to paying water fees & moving lateral pipes.	Water pumped from Ogbese River to 32ha scheme via reservoirs & secondary pumps.	Farmer assisted irrigation project developed by RBDA to use donated M&W pumps in 1980's.

Table 11.4.2.1 Summary of Physical Characteristics of the Schemes of the BORBDA

RBDA & HQ	States included	Irrigation Projects	IRRIGATION AREA(ha)			Headworks	Type of Irrigation	Type of Crop	Average Harvest per Ha (tons)	Average price as at harvest (₦) 2004	Water charge per Ha (₦)	Input Cost (N)	General remark
			Planned	Dev'ped	Actual cultivated								
Benin-Owena (BORBDA) Benin	Edo Delta Ondo Ekiti	Illushi Ega Ukhun Erha Ikere Ogbese Obayantor Ewulu Illah ebuh Erusu	5000 250 45 250 30 3000 250	50 - 32 100 10 100 -	8[2] - 11[3] - 7[4] - -	River Niger Dam (1.0 mcm) River Ogbese Borehole River Umomi River Niger Dam(1.29 mcm)	Gravity Gravity Sprinkler Sprinkler Sprinkler Gravity Gravity	Rice Maize/Rice Okro/Maize Maize Pineapple Rice Okro/Maize	- - 2.0 - - - -	- - 2500/100kg bag - - - -	- - 500:00 - - - -	30,000	Badly constructed pilot scheme On-going No irrigation since 2001 Abandoned 1993 Drawing board 100ha Design available Dam under construction

1. First Irrigation Season-No Harvest Yet
2. Production of Rice Seedlings for SPFSS
3. Harvest not disclosed, but Project Manager estimated 2.0t/ha for maize.
5. Private Farm of RBDA

Priority Ranking Column 1`(RBDA) Column 2 (Zonal

Table 11.5 Summary of Irrigation Schemes in the South East Zone

Table 11.5.1 Anambra Imo River Basin Development Authority (AIRBDA)					**South East Zone**
Scheme	Infrastructure	Agronomy	Socio-economic	Water Supply	Other
Lower Anambra (LAIP) Pumped gravity (3,850ha) scheme with no irrigation 2003.	Irrigation started 1984 with 35ha rising to 3,049ha in 1993. No irrigation since 1999. Long main canal (16.7km). 4 zones.	Rice was double cropped. Yields of 4tons/ha achieved.	Rice mill on site but not used since 1999. 7,500 farm plots (0.5ha). Rice sold to traders from Onitsha, Enugu and Nsukka.	Water pumped from R Anambra via main and field canals. Lift of 32m by 4 diesel powered pumps	Pumping costs were high (diesel gensets – old Japanese pumps). Main canals still in good condition but all facilities need rehabilitation.
Imo No irrigation.	1992 dam and irrigation project. 71 ha developed at Igwu but no longer operates. Re-designed mid 1990's. Only one site (of 4) now (250ha) being constructed.	Rice project. Farmers grow rainfed rice locally. High rainfall area (2500mm).		Weir site on Imo River will be used. Pumping to fields proposed on 71ha pilot area.	Weir partly completed. No irrigation facilities.
Isu-Uzo 10ha pilot area.	100ha designed. 10ha sprinkler system 2003. Pumped gravity proposed though.	Rainfed rice with vegetables in dry season today. Double cropped rice proposed.		The perennial Ebonyi river is used.	

Table 11.5.2 Cross River Basin Development Authority (CRBDA) South East Zone					
Scheme	Infrastructure	Agronomy	Socio-economic	Water Supply	Other
Abak 62ha developed but no irrigation 2003. Pumped scheme.	1992 sprinkler scheme from River Abak. Pumping to reservoir + further pumping to sprinklers. No irrigation since 2000.	High rainfall (2000mm) area. Vegetables and maize crops grown under irrigation.	Abak market nearby and Uyo only 30kms away. Seasonal land allocation. Expensive scheme to operate.	Pump house at river lifts water to reservoir and second pump sprinklers.	Erosion around intake a problem. Proposed to use NEPA for pumping. Old pumps now.
Ogoja 40ha developed but no irrigation 2003.	No signs that irrigation was ever practised. Pump house and pipeline/canals constructed	High rainfall area (1700mm). Rainfed cropping only. Rice, vegetables and maize proposed.		Aya River source of water.	
Obudu 15ha developed and irrigated 2003.	Ad hoc development of pumped gravity irrigation 7kms downstream from dam. Multipurpose dam.	High rainfall area (1800mm). Vegetables grown under irrigation.	Private farmers use own pumps to irrigate their own plots. Obudu town market is nearby.	Obudu dam (4.2mcm) constructed 1990's. Spillway severely eroded 2003 and a risk to the dam now.	Farmers effectively manage this project.
Katsina Ala No irrigation since 1995.	Scheme needs complete rehabilitation.	Rainfed rice, maize, sugar cane & veges.	Katsina Ala town is nearby.	Katsina Ala river is a major tributary of the Benue River.	Flooding is a problem.
Onion Nung Ndem 30ha developed and irrigated 2003.	Temporary scheme developed using borehole close to RBDA HQ. 750 small plots irrigated from canal by siphons.	High rainfall area (2500mm).	Eket town market is close. Uyo is accessible via good road.	Design is for pumped gravity scheme from Qua Iboe river.	Pumping costs are high.
Other sites	No irrigation at all.	All projects at design stage.			

Table 11.5.3 Niger Delta Basin Development Authority (NDBDA)				South East Zone	
Scheme	Infrastructure	Agronomy	Socio-economic	Water Supply	Other
Kpong 89ha developed but no irrigation 2003.	1984 scheme using portable sprinklers. Abandoned 1986.	Rainfed cassava and yam farming now. High rainfall area (2680mm). Short dry season.	Integrated project originally.	Andoni river was source of water.	Local discontent with RBDA and scheme proposed.
Isampou 20ha developed but no irrigation 2003.	1960's rice pilot project. Studies in 1990's proposed 1280ha scheme but only 20ha developed.	High rainfall area (2500-3000mm). Short dry season.	Small rice mill on site but broken down.	Pumping from Bomadi Creek proposed. Then by gravity via canals.	Project essentially at design stage. No irrigation ever occurred. Located in area of unrest.
Peremabiri 20ha developed but no irrigation 2003.	Studies in 1990's proposed 1280ha rice scheme based around 1960's 26ha pilot project. No development to date.	High rainfall area (2500mm).	Access to area is only by boat.	Pumping from nearby creek and Nun River proposed.	As Isampou.
Kolo	Scheme at design stage.				

Table 11.5 Summary of Physical Characteristics of the Schemes of the South East Zone

SCHEME	PLANNED AREA (HA)	DEVELOPED AREA (HA)	ACTUAL AREA (HA) CULTIVATED IN 2003	GRAVITY/ PUMP	TYPE OF CROPS	AVERAGE HARVEST PER HA (TONS)	AVERAGE PRICE AT HARVEST 2004(N/Ton)	WATER CHARGE PER HA (N)	INPUT COST (N)
Igwu Irrigation Project	400	71	10	Pumping	Rice	2.5		N/A	
Imo Irrigation Development Project	1,200	Nil	Nil						
Isu-Uzo Irrigation Project	100	10	10	Pumping	Vegetables	3.0		6,400	
Lower Anambra Irrigation Project	5,000	3,850	Nil	Pumping	Rice	3.5		3,000	
Abak Irrigation Scheme	62	62	Nil	Pumping	Vegetables	2.5		3,000	
Ijegu-Yala Irrigation Project	2,2 00	Nil	Nil	N/A	N/A	N/A	N/A	N/A	N/A
Obubra-Owakande Irrigation Project	500	17	Nil	Pumping	Vegetables			2,000	
Obudu Irrigation Project	120	20	10	Pumping	Vegetables	2.0			
Ogoja Irrigation Project	125	125	Nil	Pumping	Vegetables	2.0		3,000	
Oniong Nung Ndem Irrigation Project	405	140	30	Pumping	Vegetables	2.0		3,500	
Itu Irrigation Project	1,265	Nil	Nil						
Isampou Irrigation Project	4,000	50	Nil	Pumping	Rice				
Kolo Rice Irrigation Project	100	30	Nil	Pumping	Rice				
Kpong Integrated Irrigation Project	150	30	Nil	Pumping	Vegetables				
Peremabiri Rice Irrigation Project	2,500	34	Nil	Pumping	Rice				