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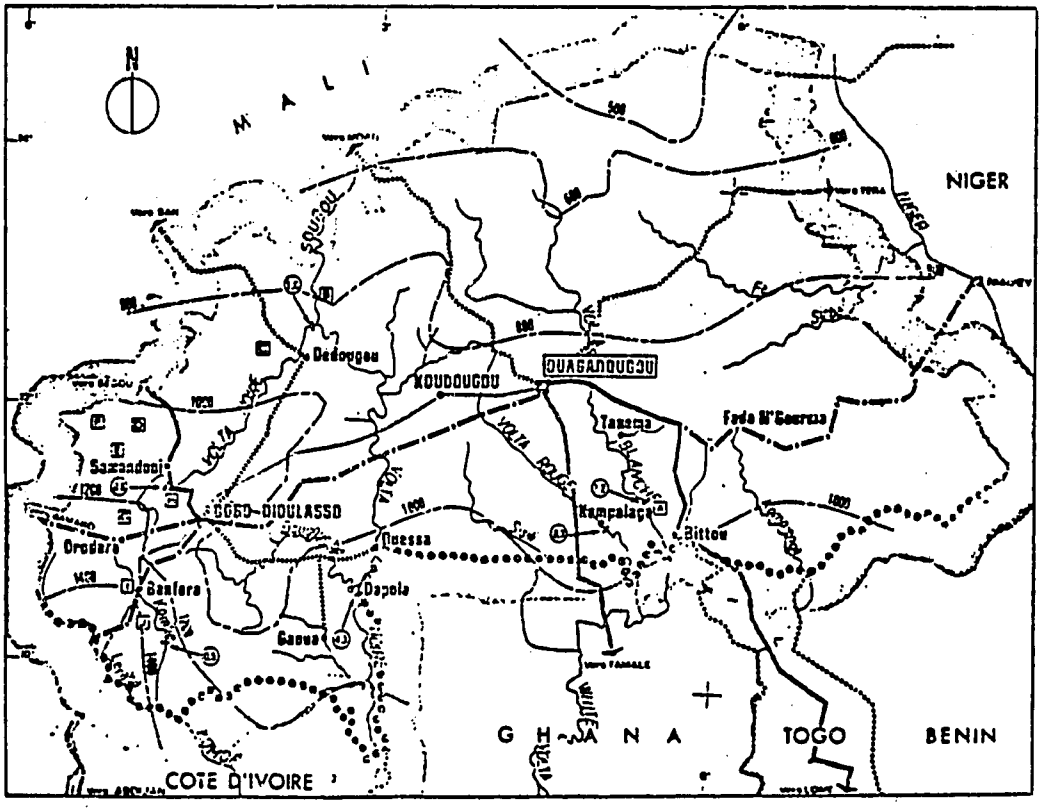
DEVELOPMENT OF IRRIGATED AGRICULTURE IN UPPER VOLTA

PROPOSALS FOR A SECOND PROGRAMME 1980-1985



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Two years ago, CILSS adopted the first generation programme in the field of irrigated farming. It was decided during the most recent meeting of the specialized irrigation team of the Club du Sahel and CILSS to review activities undertaken, to examine the difficulties encountered for the expansion of irrigation and to develop, in the light of the information supplied by Sahel States, a second programme of projects to be put forward for consideration by the International Community.

A study mission organized by the Club du Sahel and CILSS went to Upper Volta from 1st to 15th May, 1979 in order to examine conditions in the irrigated farming sector with the competent authorities, review the status of programmes and their implementation and discuss operations contemplated for the coming years.

This report was prepared by Mr. Pierre Ponsy, Engineer in Rural Engineering, Waterworks and Forestry, consultant to the Club du Sahel. It is essentially composed of information provided by Voltaic officials he met during the mission.

The conclusions and recommendations are intended for the Club du Sahel and CILSS irrigation team for consideration and discussion.

EXPANDING IRRIGATED AGRICULTURE IN UPPER VOLTA

PROPOSALS FOR A SECOND GENERATION DEVELOPMENT PROGRAMME 1980 - 1985

INTRODUCTION

Within its overall policy to insure national food self-sufficiency, the Government of Upper Volta intends to pursue three series of complementary activities :

- intensify dry land farming systems, particularly in new lands areas;
- regulate pricing and marketing of agricultural products;
- promote irrigated agriculture.

Irrigated agriculture is still modest in Upper Volta.

Developed areas under total water control cover only 4,600 hectares which is barely 4% of Upper Volta's potential estimated at 125,000 hectares.

Thus, the development of this potential has barely begun. Nevertheless, the limited development possibilities for dry land agriculture and the important increase in demand for crops requiring irrigation such as wheat and rice in particular, leave no doubt as to irrigated agriculture's crucial future role.

However, a certain number of difficulties limit irrigation's rapid expansion : high development costs, limited actual capacity of administrative services to insure promotion and control of irrigation projects, insufficient technical know-how of farmers as compared with the high productivity rate implied by the success of irrigated perimeters.

On the basis of recent information gathered in Upper Volta, the purpose of this report is to :

- present the status of the CILSS first generation programme adopted in 1977;
- examine the means for dealing with the main constraints described above;
- present an outline of a second generation programme to be presented to donors and implemented during the coming years.

I. CURRENT STATUS OF IRRIGATED AGRICULTURE PRODUCTION

1.1 Current production - needs for the medium term :

Current internal demand and production to cover cereals and sugar needs are estimated at :

	Estimated production (1)	Estimated needs (in thousands of tons)	
	in 1978 (in tons '000s) (Popul.: 5,9 mil.)	in 1978	in 1990 (Popul.: 7,5)
Traditional cereals	1 125	1 250	1 650
Paddy rice	35/40	50	85/90
Wheat	p.m.	30	50
Sugar	22	24	30/35

(1) Source : Ministry of Rural Development

(2) FAO study (long term development prospects for Upper Volta 1976)

This table shows the importance of the effort that Upper Volta must undertake to insure its food dependence. This would mean, according to certain recent FAO studies, dry land farming of 900,000 new hectares over a period of 25 years as well as compensating the loss of land of the over-developed MOSSI plateau representing 235,000 hectares on one hand, and on the other a decline in soil fertility of traditionally farmed areas equalling 700,000 hectares.

A total of almost 2,000,000 additional hectares must be developed to meet the country's food needs. Thus it seems that without a radical change in production techniques and methods, UPPER VOLTA is on its way to chronic food shortages.

These conclusions indicate all the importance which irrigated agriculture should take in the future.

Currently the share of irrigated production in national consumption is modest :

- rice : represents only 3%-4% of all cereals consumed. However, this production is already deficient. Due to change in food habits particularly in urban zones, demand should grow rapidly to reach 80 to 90,000 tons around 1990. It should also be noted that 3/4 of rice production is obtained through traditional farming (rainfed rice and lowlands production).

- sugar :
  National sugar production (SOSUHV complex at Banfora) at 22,000 tons currently balances demand which should increase at the same rythm as demography and reach 30 to 35,000 tons in 1990. The current price on the national market is high (2.5 times more than world market prices) and does not foster the development of new projects.

- wheat :
  Wheat is at present imported (25 to 30,000 tons) and national needs should equal around 50,000 tons in 1990. Local production appears to be possible according to results of agronomic research and should be done through irrigation in the upper valley areas of the Black Volta and the Sourou.

- truck farming and fruit production :
  Since 1970 a relatively dynamic truck farming sector developed in Upper Volta with a view to supplying urban centers and exporting fresh out of season produce to Europe. Currently, several centers controlled by the Voltaic agricultural and truck farming cooperative union (U.V.O.C.A.M.) cover nearly 600 ha.

  Recently fruit production essentially destined towards supplying urban centers has developed. Two centers - one near Bobo (in the Kou valley) and the other near Bazera (80km from Ouagadougou) operate on approximately 40 ha each.

1.2 Existing operations :

The surface developed for irrigation currently represents approximately 7,800 hectares of which 4,600 are under total water control. This can be broken as follows according to type of development :

type of development	surface	production and yield norms
I. SUBMERSION		
. development of lowlands	3,200(1)	Rice at 1,5 T/ha (approx. 4,800 T.)
II. IRRIGATION		
. downstream development of small dams	900(2)	Rice at 2 to 3 T/ha (approx. 2,400 T.) + market gardening on 15% S.A.U.
. development with total water control :		
- KOU valley	940(3)	Rice : 2 harvests at 3.5 T/ha (approx. 6,600 T)
- BANFORA sugar complex	2,200	Sugar (approx. 22 to 24,000 T)
- truck farming and fruit	580 approx.	
- BANZO perimeter	p.m.	Rice : 2 harvests
TOTAL II	4,620	

(1) of which 2,200 developed since 1972

(2) of which 300 developed between 1977 and 1980

(3) 940 under production out of 1,260 equipped

(4) perimeter being developed (400 hectares planned)

1.2.1 Development of lowlands

Their purpose is to use hydromorphic soils favorable to rice farming and generally not developed.

This type of development is old in Upper Volta but it expanded since 1972 within the framework of activities financed by the Regional Development Fund (IDA/IBRD financing).

Since 1972, 2,200 hectares have been developed. Current IDA and EDF programmes for the Banfora region should permit an increase of approximately 2,000 hectares during the next three years.

- Development principles (see Annex 1)

These developments consist in equipping small clay depressions (usually around 10 hectares) located mostly along temporary backwaters. The construction of bunds along contour lines, transversal banks and watercourses foster the retainment and better use of rainwater or excess water with a view to improving rice farming.

These operations are most fruitful in the Center and North regions where hydroagricultural development possibilities are low and conditions for improving agricultural productivity are particularly difficult.

Activities are carried out with an important participation of local inhabitants (filling up and transporting equipment) with the support of the ORDs and the HER.

Improved lowlands :

In certain cases (at the head of watersheds, area of river overflow) the availability of water permits an intensification of rice farming. Additional development is then undertaken to insure certain control over the flow of flood waters through lamination and eventually partial storage (concrete sills, surplus irrigation water, central drains, and eventually inlet channels).

This type of development which also requires the participation of interested farmers was carried out over approximately 100 hectares.

The average production of these developments is 1.5 tons/hectare and 2.5 tons/hectare after protection and improvement.

Development activities are completed by improved farming (fertilizer, sowing in drills, ploughing).

The investment costs of these operations on the basis of achievements of the first programme of the Regional Development Fund are :

- lowlands.....45,000 FCFA/hectare
- "improved lowlands"....200,000 to 250,000 FCFA/hectare

Each lowland averages 10 hectares. Land is distributed through the initiative of the community organization to families who participated in development activities, each one receiving a parcel of 0.2 hectares.

The net value of additional production is estimated at 9,800 FCFA on the basis of each hectare yielding 1.5 ton and the price of rice at 35 FCFA/kg. This represents 445 FCFA net income for a day's work, while for developed lowland it would be 668 FCFA.

Maintenance expenses are born by the farmers (approximately 20 working days).

Net profit per hectare is thus almost equal to the initial investment cost (50,000 FCFA).

These operations are conducted under the responsibility of the ORDs and controlled by the Hydraulics and Rural Equipment Directorate (H.E.R.).

The role of the ORDs is vital in carrying out these operations :

- they identify and program projects on the basis of technical criteria and motivation of the population concerned;
- they carry out development studies under the control of the HER;
- they organize and carry out actions;
- they assure supplies (seeds, fertilizers..) and the extention of farming techniques and must monitor the maintenance of developments.

An almost permanent contact must be maintained with the beneficiary community which means numerous extension personnel trained accordingly.

The main difficulties encountered on developed lowlands are due to the principle of developments themselves which assure only partial water control. Thus rice farming is dependent on rainfall distribution and on the other hand, at sowing time, on the competition of traditional farming which remains the main and priority concern of farmers.

These developments also imply manual maintenance activities to be borne by those concerned.

The advantage of these small hydraulics operations is their integration into a set of activities carried out on the level of the beneficiary village (soil restoration, village equipments, development of farming habits, etc..) based mostly on the quality of extension the ORDs provide and farmer motivation.

Nevertheless, the general evaluation remains positive. According to the government's objectives, current programmes should permit continuation of these developments at a pace of 500-600 hectares per year while improving technical implementation conditions and extension activities.

In order to prepare subsequent development, it would be desirable to proceed with a systematic inventory of all possible developments depending on existing natural conditions as well as technical experience and perfection attained during the past several years.

1.2.2 Small earthen dams and downstream development

In Upper Volta there are numerous small earthen dams (approximately 240) which form potentially irrigable land estimated at 4000-5000 hectares.

These dams, located mostly in densely populated areas with low hydraulic resources, represent an important investment whose development should be a priority where economic conditions and the necessary extension permit.

The building of these dams[1] was not always carried out with a sufficient knowledge of technical conditions (hydrology and pedology) and a precise determination of their purpose.

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(1) See FAO report No. AT.2429 : Critical Study of Small Earthen Dams; 1967.

It appears that the role of these dams in supplying water to villages is almost abandoned due to extremely defective sanitation. Thus their purpose is essentially agricultural and secondly for watering cattle.

Agricultural development of the dams currently covers a net irrigated area of 800-900 hectares during the rainy season (rice farming) of which only 10-20% can be irrigated during the dry season (mostly truck farming).

Since the National Dams and Irrigation Office (O.N.B.I.) was created, 11 sites have been equipped totalling approximately 250 hectares (areas ranging between 15 and 75 hectares) out of a programme of 300 hectares due to be terminated in 1980 (EDF funding).

At the same time O.N.B.I. pursued the implementation of five new dams (with Dutch assistance). The goal is to build three dams per year.

At the time it seems that the construction of small dams is carried out as projects separate from downstream irrigation perimeters and that the same errors of the past continue to be made. The purpose of the new constructions is not better defined than in the past.

We insist on the fact that it appears very desirable that such construction should have a mostly agricultural purpose and priority should be given to sites only if they include the following : guaranteed water resources, favorable downstream soils and a motivated population.

The problems encountered by the implementation and planning of these developments are numerous :

a) high investment costs :

- dyke reservoir : between 50 to 80 million FCFA (not including cost of O.N.B.I. staff) for the latest with a capacity of 5 and 9 million cubic meters;
- perimeters : 1 million FCFA/hectare;

b) frequently defective filling up :

due to lack of knowledge of the hydrological conditions of small watersheds;

c) Constraints and operating expenses :

These are particularly heavy for dikes whose geographical distribution does not facilitate the organization of activities. Royalties to be paid by the farmer

(15,000 FCFA per hectare per year when these are collected[1]) are enough to cover the perimeter's maintenance costs but is not enough to maintain dikes. This is to be covered by the national budget. By estimating annual maintenance charges to be 1% of the initial investment, these would represent approximately 1 million per action per year;

d) perimeter staffing :

Staffing and agricultural extension is entrusted to the ORDs. It should include qualified and sufficient personnel.

It definitely seems that this type of low profitability development should be carried out when technical and socio-economic conditions permit. In densely populated areas where hydro-agricultural development possibilities are few, such projects could contribute towards partially settling families doomed to emigrate and costly resettling expenses[2]. Estimated agricultural harvests (3 to 4 tons of rice per hectare) are important in areas where traditional cereals do not yield more than 600-700 kg/hectare.

Pursuing the development of agricultural micro-dams implies a technical organization adapted to insure that studies, implementation, maintenance and development are taken care of. Its mostly on the latter two that O.N.B.I. should concentrate. It appears desirable that activities carried out by O.N.B.I. be devoted first of all to the maintenance and valorization of existing resources.

1.2.3 The KOU Valley

This project of about 1,200 hectares is located on the left bank of the Kou, an affluent of the Black Volta, 30 km northwest of Bobo-Dioulasso. A small diversion dam and a canal, 11 km long, irrigate and drain by gravity over an area of about 1,270 hectares. About 1,200 hectares are for rice farming and 70 hectares for truck farming and fruit plantations.

1/ This cost is acceptable to a farmer who has a parcel of about 0.2 hectares and whose net income after deducting royalties and farming expenses is 20,500 F for an intensification of 1.2 (20% in case of double harvest). This represents 662 FCFA per working day.

2/ Estimates concerning relocation costs borne by the A.V.V. vary. However none is below 2,000,000 FCFA.

The project was implemented in 1970-74 with Chinese technical assistance (Taiwan and then by the People's Republic) which provided technical staff for the perimeter until 1974.

Results achieved equal 9 tons per hectare of paddy through double cropping in 1973 on the first 930 developed hectares.

Currently production is at 6,500 tons i.e. 7 tons/hectare on an area of 940 hectares. This is less than in 1973 and due mainly to problems of drainage and maintaining soil fertility.

A project to rehabilitate the perimeter (drainage, fertility and development of a rice mill) associated with a livestock fattening project to develop animal traction and natural fertilizer was presented for external financing (see Infra).

The KOU project has enabled the settling of almost 1,000 families of migrants from different backgrounds, each one receiving between 1 and 1.5 hectares (0.25 hectares per U.T.H.) depending on the amount of working units. Each development is guided by specifications defining farming operations to be carried out, maintenance costs and yearly repayments (farming loans)to be made. This totals 12,000 FCFA per hectare per year.

Farmers are organized into a cooperative which is the spokesman of the perimeter's management committee which answers to the BOBO ORD. It is composed of the following :

Director of the perimeter	1	ORD staff
Production Head	1	
Sub-sector Head	2	
Technical staff (1 per village)	12	
Water Foreman	8	Staff assigned to the cooperative
Drivers	3	
Clerk	1	
Secretary	1	
Warehousemen	3	
Guards	2	
Unskilled workers (temporary)	5	

Harvest marketing was a very big problem in 1978, because the ORD and national marketing organizations (OFNACER and SOVOCOM) were not able to market the cooperative's production. The relatively high price set by the State - 63 FCFA per kilo of paddy - was not honored.

Since national production was not protected, it competed with low priced imports and thus the national market quickly reached the saturation point and many Voltaic rice farmers were not able to sell their harvest.

1.2.4 The Banfora Sugar Perimeter

This project covers approximately 2,600 hectares of sugar cane plantations of which 2,200 are being farmed.

This project managed by the Upper Volta Sugar Society (SOSUHV) provided about 28,000 tons of sugar in 1978-79 (85 to 90 tons of sugar cane per hectare with 12.67% of sugar). It directly supervises the plantations and the refinery and employs approximately 1,500 agricultural employés.

The refining unit can currently absorb 1,500 tons of cane per day during the harvests' 130 days.

Water is currently supplied by two diversion dams on the COMOE and YANNON rivers which use the available water flow 2 m^3/s at low water level which limits plantations to their current acreage). Pumping energy is provided by the falls at Banfora. This enables irrigation with portable sprinklers.

The cost of hydro-agricultural development was 1,400,000 FCFA per hectare (1974 prices).

The existing sugar complex considerably reduced the availability of water to the riperian population known for its successful rice farming. A water development guideline prepared in 1975 recommends the construction of a regulating dam on the Comoe river. This inter-annual reserve would meet all the needs of the area. The 1975 study was carried out on the assumption that sugar cane plantations will be expanded and should be revised to take into account the abandonment of this project and examine different possible alternatives to benefit local farmers.

1.2.5 Truck gardening and fruit farming

Upper Volta developed an interesting truck gardening sector based on farmer production. Approximately 500 hectares are currently planted providing about 90,000 tons of produce per year of which 30,000 tons are marketed.

The truck sector is guided by a national cooperative union - UVOCAM - which includes 4 regional unions and 3 cooperatives totalling 2,300 farmers.

The purpose of UVOCAM is to :

"carry out all production, storage and marketing operations of produce from corporate members,

insure the supply of inputs (equipment and products) required for their development."

The ORDs support cooperative activities by providing the necessary technical or management personnel.

The main production centers are :

- LANFIERA perimeters (Sourou Valley) 150 hectares
- BAM Lake (Kaya region) 170 hectares
- BOBO region (Kou Valley et al) 70 hectares.

These perimeters are irrigated by pumping. Depending on the availability of water, a second crop (corn) is farmed.

Two fruit units of 20 hectares each at Bazega and Bobo-Dioulasso were created near truck gardening perimeters. Their production is destined for urban centers.

The fruit and truck sector will continue to develop if marketing negotiations already begun, particularly with Europe (French beans) and West African coastal states succeed.

The objective would be to extend truck farming to an area of 2,000 hectares in 4 years and fruit perimeters to 150-200 hectares. Part of this production could be used for processing.

This expansion would require support for maintenance structures within the UVOCAM and the creation of new organizations better adapted to the market's trading constraints.

II. MAIN CONSTRAINTS TO THE DEVELOPMENT OF IRRIGATED AGRICULTURE

We refer here to documents already published by the Club du Sahel's irrigated agriculture team and to the note in Annex 2 of this document[1/].

We will recall here the main constraints appearing at different stages :

1/ Elements for programming hydro-agricultural development in Upper Volta (March 1977) - Synthesis Report of the irrigated agriculture team (May 1977).

a) Irrigated perimeter :

2.1 Investment cost and rate of return

Irrigation projects require high investment costs of about 1.5 to 2 million FCFA per developed hectare (not including eventual regulating reservoirs). Both their economic and financial profitability requires high productivity in the developed areas.

2.2 Project management

An irrigated perimeter under total water control requires strict management of a set of technical, economic and administrative activities to insure that :

- the installations are maintained in good condition;
- productivity objectives and agricultural income are maintained (this includes carrying out different farming and marketing duties).

Management structures must be adapted to the type and size of projects. It would be desirable to take into account that as soon as projects reach sufficient proportions (1000 - 2000 hectares) they should be transformed into an autonomous management unit whose purpose would be to promote farmer organization on the perimeter and progressively assume various agricultural production and equipment maintenance tasks.

b) Irrigated development :

2.3 In the most common case i.e. farmer type development, the constraints are due mostly to features of irrigated perimeters and type of installations. They should take into account :

- the family's available time for work
- possible per capita incomes

c) On the national level :

It is at this stage that the conception and organization of necessary means for promoting irrigated agriculture should take place.

The elaboration and implementation of a real policy implies that Upper Volta stress its efforts in the following fields :

2.4 Planning and programming of installations

- Objectives and production policy of irrigated agriculture (rice, sugar, truck, fruits, cereals);
- Potentialities and water development of the major basins, feasibility studies and choice of priority projects;
- Fixing the rythm of installations compatible with national resources (both human and financial).

This planning effort not only supposes the implementation of a large number of specific activities (study of natural and socio economic potentialities, of a guideline and feasibility of a development project, market surveys, organizational studies, ..) but also a coordination and synthesis qualification which is currently not available.

2.5 Training of cadres

Irrigation projects require the participation of numerous cadres at different stages of project preparation, implementation and management.

It is estimated that the development of 3000 hectares of irrigated agriculture under total water control (see following diagram) would require the following staff besides extension agents :

	Start-up Phase	Operating Phase
Engineer (A level)	2/3	2
Engineer (B level)	4	3
Technical Associate	6 to 7	5
Technical Officer and irrigated agriculture Advisor	25	8/10
Extension Agents	30	15
	70	35

The training effort to be undertaken is considerable[1/]. It is a key element in fixing the rythm of "manageable" projects in addition to the requirement for foreign technical assistance (see annex 3 - number of Voltaics in training).

In a preliminary analysis it appears that for the moment the development rythm cannot exceed 2,000 hectares per year.

2.6 Marketing structure and regulation

This structure is currently very precarious in the field of cereals and particularly rice. In 1978, a certain inconsistency was noted (a high theoretical incentive price of 63 FCFA/kg of rice without protection of the national market) which seriously penalised producers who were not capable of marketing their production in adequate conditions[2/].

1/ Particularly in training advisors for irrigated farming which must be organized (see PID in Annex 4).

2/ The substitution price in Ouagadougou and Bobo was 55 F/kg.

PRODUCTION UNIT (3000 hectares)

PROJECT DIRECTOR

Experienced I.T.A. associate

- Production Department (+ start-up advisor)
  - Pilot farm seeds
  - Cooperatives extension agents
    - Area head
      - 1 Area head/ waterman for every 800 ha (4)
      - Extension Agent
      - 1 for 2/3 groups or 150 ha
  - Supply storage marketing
  - Agricultural activities

I.T.R. associate

- Farming Department (+ start-up advisor)
  - Operation and maintenance of network
  - Management & repair of car park

Administrative

- Management Department (+ start-up advisor)
  - Budget & Finance management
  - personnel management

Personnel	Start-up phase	Cruising phase
Senior cadres	3	2
Cadres	12	8
Technicians	30	20
Extension Agents	30	5
Labor	25	25
TOTAL :	100	100
Estimated cost	85 million FCFA	55 million FCFA

It is urgent to implement this organization. It is a prerequisite to the creation of new projects.

2.7 Irrigation support structures

Three ministries are directly concerned by hydro-agricultural developments :

- the Ministry of Plan by its trusteeship of the A.V.V. which is in charge of the Volta Valley Basin Development;
- the Ministry of Rural Development, and more specifically
  - . the Hydraulics and Rural Development Division responsible for major irrigation projects;
  - . the National Dams and Irrigation Bureau, a public establishment of commercial and industrial nature which is also responsible for the studies and implementation of small dams projects and irrigated perimeters;
  - . the ORDs which carry out certain small hydraulic development and provide technical advisors for most irrigation projects;
- the Ministry of Public Works and the VOLTELEC, responsible for major multi-purpose dams (hydroelectricity and irrigation).

The number of organizations involved currently harms coherent programming of agricultural hydraulics projects.

It appears very desirable that Upper Volta, on the threshold of starting major developments, should seek a better distribution and coordination of study and implementation functions as well as efficient formulas for managing programmed perimeters based on previously acquired experience.

III. STATUS OF THE CLUB DU SAHEL/CILSS FIRST GENERATION PROGRAMME AS OF MAY 1, 1979

3.1 The first programme presented by Upper Volta to CILSS in 1977 (see annexed table) can be considered as a preparatory programme to the development of irrigated farming.

Achievements remain modest. They mostly consist of pursuing small hydraulics programmes (Development of lowlands and downstream from the dams) as well as creating small truck and fruit farming projects over a total developed area of about 100 hectares.

In reality, the first CILSS programme covers the start-up of different development studies most of which are either already completed or about to be.

The status of the programme's eight operations in April 1979 is the following :

A. STUDY OF A DEVELOPMENT GUIDELINE OR PROJECT FEASIBILITY STUDY

3.1.1 Development of the Niena-Dionkele plain

The feasibility study for the project was finished in 1978 . The project foresees the development of 3,500 hectares of lowland farming (rice farming under water control) and 5,000 hectares of associated rainfed farming.

IBRD, after financing the study, is ready to finance the implementation of a first tranche of installations covering 400 hectares. Discussions are currently under way to begin this first phase whose financing is secured. (the evaluation mission has been carried out). This operation is of a pilot type particularly as concerns :

- defining farming associations (pilot farm)
- creating an autonomous project management agency
- establishing a marketing agency to assure :
  - the price of rice at the production stage,
  - import control,
  - collection of rice and payment to the producers.

The government's commitment on the last point is the condition for a definite financing agreement.

The implementation of this first tranche will be over a 3 year period (1980-1982) and concern 800 families. The remaining part of the project (3,100 hectares) will spread from 1982 to 1990.

3.1.2 Development of the Kamadena plain

The pre-feasibility study carried out in 1976 shows the possibility of developing 4,000 hectares of lowland.

However, the technical aspects of the development require further hydrological studies. This additional study component was funded by IBRD and entrusted to ORSTOM. The conclusions should be available for analysis in 1979.

The project's feasibility dossier on the basis of available elements should be prepared during 1980 by the Voltaic authorities.

3.1.3 The Loumana plain

The preparation of the project dossier for this development covering 1,600 hectares of land also requires additional hydrological elements which are covered by Germany.

The project's feasibility study should be ready during 1980. Germany has indicated a preliminary interest in this project which should take shape at the end of studies presently underway.

3.1.4 Development of the Sourou valley

The study of a plan for the whole valley is underway. Studies lasting from January 1979 to June 1980 are being funded by FAC (200 million FCFA).

The valley has an important potential of 30,000 irrigable hectares, water will be provided by the Black Volta and stored in the Sourou valley itself. This could be an important natural reserve after building a dam where the Sourou flows into the Volta.

This development should permit the settling of 15,000 to 20,000 families and the farming of industrial cash crops (wheat, sugar, cane, truck,....) in association with traditional food crops and bovine farming.

The quality of soil and possibilities for settling migrants make it one of the most interesting projects in Upper Volta. Its implementation should take approximately 10 to 15 years and could be undertaken as of 1981.

3.1.5/3.1.6 Master Plan for the development of the VOLTA and COMOE Basins

VOLTA Basins

This vast planning study has begun in part. Development possibilities are located mostly in the Black Volta valley (particularly in the basin upstream from Sourou) and the White Volta (where most areas suitable for development are controlled by the Bagre dam; see infra) and their affluents. The start-up of the Sourou valley study encouraged Voltaic authorities to examine in priority development possibilities upstream from the Sourou, in order to assure the harmonious use of water resources which represent a limiting factor depending on the various agricultural development possibilities.

The purpose of the study which is financed jointly by IBRD and FAC is :

- to complete the basic data on the upper valley of the Black Volta which is necessary for evaluating the valley's potentiality (pedology, hydrology, topography, socio-economy);
- to establish a master plan for the development of land and water consistent with that of Sourou;
- to identify and carry out feasibility studies for a first series of development projects covering about 3,000 hectares.

The duration of the study will be 18 to 20 months. Project studies should be finished by mid-1980.

The COMOE Basin - BADADOUGOU dam

A study request presented within the CILSS first generation programme concerned carrying out a PID for the Badadougou Dam (capacity : 150 million cubic meters) which is the centerpiece of the hydraulic development of the Banfora region and the high basin of the Comoe and Yanon rivers where besides extending sugar cane farming, 10,000 hectares could de developed.

The preparation of the development master plan for this region, carried out in 1975, must be updated to take into account both the abandonment of the project to extend the sugar perimeter in this area (4,000 hectares) and changes which could influence the size of construction works and their purpose.

The updating and programming of the hydraulic developments in the Comoe-Yanon area according to new agricultural directions should be carried out in priority due to the region's many potentialities. Costs should not exceed 20 million FCFA.

B. CAPITAL PROJECT

3.1.7 Rehabilitation of the KOU project

A financing request was presented in 1977 for the development of the Kou valley perimeter (see part 1.2.3) with a view to improving the perimeter's functioning which, as a whole, is satisfactory.

This rehabilitation project contains three components :

- improve the draining and sanitation of the perimeter's lowlands (controlling the water plan of the Bama pond) whose deficient functioning spoiled 120 developed hectares;

- research for improving soil fertilization techniques (particularly in certain areas poor in clay and sensitive to leaching) through the use of organic fertilizers (compost, manure, etc...);

- develop bovine fattening to expand animal traction, manure and meat production.

The Dutch Government has practically agreed to finance the project (400 million FCFA). IBRD is also interested in the bovine fattening project. However, no definite agreement has been made as of April 1979.

3.1.8 Creating an irrigated agriculture training center for supervisors

This project deals with training technical personnel for irrigated perimeters who in turn will directly supervise farmers carrying out irrigations. The Dutch Government expressed an interest in this project. Nevertheless, the project is still at a very early stage. A detailed study is to be undertaken, based on an agreement to be worked out with Voltaic authorities - should it be an autonomous center or associated with an already existing one - location - hiring level - staff number (see Annex 4).

3.2 Other committed projects (apart from the CILSS programme)

3.2.1 Operations controlled by the A.V.V.

The BAGRE development :

- the feasibility study of this important project has recently been completed under the control of the AVV;
- the project would consist in constructing a reservoir dam on the White Volta with a capacity of 1.6 billion cubic meters allowing energy production at the rate of 40 GWH/year and the irrigation of 30,000 hectares.

The development of 30,000 hectares of irrigable land would permit the creation of :

- 8,000 hectares of rice paddy,
- 2,000 hectares of fruit and truck farming,
- 20,000 hectares of mixed farming (cereals and cotton).

The cost of the project is estimated at 75 billion FCFA (1977 prices) and can be broken down as follows :

- dyke (earthen of 3 million cubic meters with constructive works in concrete) 19 billion FCFA
- power station 4.25 " "
- pumping station 3 " "
- canals and development 48.4 " "

The programme will take 17 years and will begin in 1982.

- The first development stage will cover :

  constructing the power station's dam and developing 5,000 hectares. Its cost is estimated at 37 billion FCFA.

BAGRE pilot farm

The AVV has included the development of a small preliminary plot of 80 hectares to experiment with agricultural development techniques and settling 25 families. The project, estimated at 900 million FCFA, includes the construction of a reservoir with a capacity of 3 million cubic meters, hydro-agricultural installations, and technical assistance over 3 years. Thsi project is being financed by CCCE and FAC and should begin in 1979.

The BOUGOURIBA pilot development

IBRD is ready to finance this small pilot development on the Black Volta affluent covering 30 hectares irrigated through pumping. The project's objectives are the same as those of the Bagre farm i.e. test methods for the development of irrigated systems. This project should prefigure the development of the whole valley whose study remains to be undertaken.

3.2.2 Activities controlled by O.N.B.I. and H.E.R.

1. Development of the Douna plain

The EDF has just agreed to finance a feasibility study for the Douna plain (Leraba valley west of Banfora). This project recommendsthe development of 2,000 hectares of valley under uncontrolled flooding of the Leraba (an affluent of the Comoe).

This project should begin in 1979 and take 18 months.

2. Development of lowlands and downstream of the dam

The IBRD, through the Rural Development Fund, continues to support the lowland and D.R.S. development programme in addition to rural development operations entrusted to the ORDs.

The programme currently underway (2,600 hectares) is financed until 1980. Its continuation appears to be conditioned by an inventory study which should allow the programming of this type of operation using experience already acquired.

The EDF agreed to finance the development of 1,000 hectares of lowlands in the region of the Banfora ORD.

The equipping of irrigation installations downstream of the small dams carried out by ONBI is financed by the EDF (a 300 hectare programme through 1981), the Netherlands (takeover of the Louda plain project) and IBRD should permit the development of 250 hectares within the framework of the second Rural Development Fund.

The Netherlands also assist ONBI in the development of new micro-dams.

3. Rice farming at Banzo

The People's Republic of China is carrying out a rice farming project in the Banzo area (Upper Valley of the Black Volta). It covers 600 hectares of which 180 are currently being developed.

3.2.3 Other projects

1. Truck farming (UVOCAM) and fruit projects

The CCCE and FAC have agreed to finance an extension of the Lanfiera perimeter in the Sourou (150 new hectares) and the establishment of an experimental irrigation station. Implementation of the project currently under study should begin by 1979.

The CCCE agreed in principle to finance various truck farming projects, particularly in the Sourou valley. It also wishes to assist in developing fruit farming - to create 5 production centers (20 to 40 hectares) to supply the main urban centers.

REPUBLIC OF UPPER VOLTA

STATUS OF MAJOR IRRIGATION PROJECTS

	STATUS OF STUDIES ON MAY 1, 1979					SUBSEQUENT STUDY PHASES			IMPLEMENTATION PHASE				
	Financing	Contractor	Purpose of Study	Status on May 1,79	Expected completion	Financing	Type and expected completion	Remarks	Financing	Project area	Contractor	Duration	Remarks
Main projects identified as of May 1,1979													
- Banzo									People's Republic of China	600	ONBI/ORD	1978-80	Underway
- Niena Zionkeld	IBRD	ONBI	Financing dossier (feasibility)	completed	-	-	-	-	IBRD/AID	3,100 ha	ONBI	1980-82	Loan under discussion for the 1st phase 400 ha
- Kamadena	IBRD	ONBI	Hydrology	underway	1980	IBRD ?	Feasibility 1981	Terms of reference to be defined in 1980	open	2-4,000 ha		?	
- Loumana	West Germany	ONBI	Hydrology	underway	1980	West Germ. ?	Feasibility 1981	Terms of reference to be defined in 1980	open	1,600		?	
- Kou rehabilitation	-	-	-	-	-	-	-	-	Netherlands		ONBI/ORD	1980-81	Financing under discussion
- Sourou plain	FAC	AVV	Master plan (20,000 ha)	underway	1980	FAC ?	Dossier - 1st phase (3 to 5,000 ha) 1981	Terms of reference to be defined in 1980	open	3-5,000 ha	to be determined	2-3 years	Managing agency to be determined
- Upper Valley of Black Volta	FAC/IBRD	MER/AVV	Master plan	underway	1980	IBRD ?	Dossier - 1st phase (3 to 5,000 ha) 1981	Terms of reference to be defined in 1980	open	2-3,000 ha	-	2-3 years	
- Comoe Basin	(Water development master plan - 1975)					open	Updated, financing 1st phase 1981	Terms of reference to be defined in 1979	open	dam + 2-3,000 ha	?	?	
- Bagre	FAC	AVV	Feasibility (dam and 30,000 ha)	completed					open	dam	to be determined	1982-85	Cost : 37 billion
- Bougouriba	(AVV Surveying Study - 1976)					open	Master plan	Terms of reference to be defined in 1979	IBRD	30 ha	AVV	?	Pilot project 80 ha financed by CCCE Pilot farm
- Douna plain	EDF	MER/ORD	Feasibility study		1981	EDF ?	Study for possible dam	Terms of reference to be defined in 1981	open	2,000 ha	?	1982-84	
- Kompienga	(Feasibility study for hydroelectric dam, 1976)					open CIDA?	Master plan study	Terms of reference to be defined in 1980	EDF/IBRD	Programme to de... 2,000 ha	ONBI/ORD	1981-85	
- Developed lowlands	(IBRD/EDF development programmes committed until 1980-81)					open	Inventory and programme projects	Terms of reference to be defined in 1979					
- Sourou truck farming	(Study linked with Sourou Master plan) Expansion of Bandiora perimeter decided C.C.C.E.				1980	CCCE ?	Feasibility project 1,000 ha	Terms of reference to be defined in 1980	CCCE	1,000 ha	UVOCAM ?	1981-83	Managing agency to be determined

2. Projects studied by the Ministry of Public Works

Only hydro-electric dam projects already studied where hydro-agricultural development possibilities exist, are listed below :

- the NOUMBIEL dam where development possibilities represent 5,000 irrigable hectares;

- the KOMPIENZA dam (an affluent of the PUDPAIN) where interesting possibilities exist in a region which is not rich in potential. The feasibility study, stressing the "energy" component of the development, showed an irrigable potential of 7,000 to 8,000 hectares. Carried out within the framework of Canadian bilateral aid, this study seems to need additional information by examining different potentialities available through water reservoirs.

CONCLUSIONS

This inventory of the main projects begun in the field of irrigated agriculture shows :

- that an important effort widely supported by donor agencies has been undertaken by the Voltaic authorities to constitute hydro-agricultural project dossiers. Certain studies concern major hydraulic operations (Sourou-Black Volta, White Volta) where most of the medium term installations will be made.

  This study effort is not complete and should be continued so as to have basic information for the preparation of real overall programming which still remains in embryo and at the sole initiative of donor agencies.

- as in the past, most achievements concerned hydraulics projects (lowlands, downstream from the dam, truck farming) which do not require long studies or important investments, nor the creation of new management agencies.

- the urgent implementation of a policy to expand irrigated agriculture as envisaged by the Government because of the precarious national food balance, implies that efforts be developed in the following four directions :

- continue project studies and programming consistent with national production objectives,
- improve the running and coordination between the divisions among departments responsible for project preparation and monitoring,
- organize and regulate marketing of farm products,
- train and progressively create new structures adapted to managing major projects.

It is within this framework that external aid should be centralized and hereafter we suggest some elements.

IV. PROPOSALS FOR A SECOND GENERATION PROGRAMME (1980-1985)

4.1 Studies and implementation of hydro-agricultural projects

The following table shows the main hydro-agricultural operations established as of May 1, 1979. Their status varies but most have not gone pas the feasibility stage which should motivate financing decisions[1/].

In these circumstances it appears risky to try and establish precise programming of installations for the coming 5 years.

An examination of project studies underway shows that feasibility study results of the major projects which will provide programming elements will be available during 1980 and 1981.

Only the BAGRE project has been prepared to the PID stage. The cost of the first phase of the project (dam, hydro-electric station and irrigation of 5,000 hectares for 37 million FCFA) as well as the need to test conditions for agricultural development in this area have prompted the creation of a pilot development covering 80 hectares whose start-up is planned during the coming months. The implementation of the big Bagre project is not expected to begin before 1982, due to financing problems.

1/ Only the Banzo operations (currently underway), Niena Dionkele (IDA funding being discussed) and certain small hydraulics projects have received an implementation agreement.

Among the studies to be carried out, the following should be distinguished :

- those representing a normal continuation of preliminary phases underway and for which a principle financing agreement has been formulated by an already committed donor;
- new studies for which financing must be obtained.

The following five projects can be included in the first category :

SOUROU valley (FAC financing underway)

Studies of the financing dossier for a first installation phase (construction of hydraulic infrastructure and development of 3,000 - 5,000 hectares). The terms of reference for this study will be established as soon as the guideline studies are completed i.e. around the middle of 1980. Their duration is estimated at 12 months and thus the start-up of the first activities can only be envisaged in 1982 at the earliest.

Valley of the BLACK VOLTA (current FAC financing, IBRD funding acquired)

Feasibility study and financing dossier for a first tranche of development (2,000-3,000 hectares). Terms of reference to be established after termination of guideline study underway i.e. beginning of 1981.

Earliest implementation around 1982-83.

LOUMANA and KAMADENA projects (FRG and IBRD financing)

Feasibility study and project to be implemented will be defined in 1980 after hydraulic studies currently underway have been completed.

Earliest implementation around 1982.

DOUNA project (EDF financing)

Eventual study for a regulating dam on the LERABA after the feasibility study (agreement being signed).

Start-up of implementation at the earliest at the end of 1981.

Among the studies to be presented to donors we suggest the following :

- List of sites and development of lowlands for rice farming

This study is necessary for preparing projects in this field. It should be available in 1980 to permit programme financing in 1981-85.

- Master plan for the development of the COMOE and YANNON waters

This study would include :

- updating the master plan by taking into account new agricultural production objectives (abandonment of a project to extend the sugar perimeter);
- programming developments and a feasibility study for a priority installation phase (main infrastructure of the BADADOUGOU dam).

These studies could be undertaken as of 1979 and achieved in 1980-81. The first start-up can be envisaged at the earliest in 1982-83.

- Master plan for the Development of the KOMPIENGA valley

This study which is complementary to the feasibility study recently carried out for the hydro-electric dam should define agricultural development possibilities provided by the dam and indicate installations to be constructed for an integrated development of the region.

This study could be undertaken as of 1979 and finished in 1980-81. Hydro-agricultural development implies of course the construction of a relatively large scale project at PAMA which will mobilize funds estimated at 10 billion FCFA.

- BOUGOURIBA master plan

This affluent of the Black Volta was the subject of a partial survey. It appears desirable to undertake, along with the planned irrigated agriculture pilot project, a study of hydro-agricultural and agricultural potentialities and to identify a first set of projects to be implemented in priority. The series of studies necessary to decide on the implementation of projects should take between 1980-82.

The ten projects mentioned above form the basis of a programme to be implemented during the coming years. As stressed before, the implementation phase of the large scale projects (BAGRE, SOUROU, COMOE, etc..)can only be undertaken at the earliest in 1982 or 1983. This is due to the fact that project studies remain to be completed, there are delays imposed by pre-development or applied research activities as well as necessary steps to be taken for mobilizing external financing.

It is clear that constraints and difficulties in promoting irrigated agriculture will determine the rythm of development compatible with Upper Volta's mobilisation of resources and ability to assure control over project operations. Voltaic authorities agree that, for the short term, development should not exceed 2,500 hectares a year.

This will imply :

- choosing among priority projects and preparing a realistic installation policy. These choices will come up rapidly, particularly between large scale projects such as BAGRE and SOUROU,
- establishing adapted project management structures and training of corresponding personnel.

4.2 Accompanying activities

Thus, along with technical preparation and economic programming of projects, it is essential to undertake institutional and training activities. We suggest two operations :

- establishing a training center for irrigation supervisors (see Annex 4)

This project is on the CILSS first generation list and still remains to be financed. The Netherlands seem to be interested in the project which nevertheless requires a more precise definition of its characteristics. A project evaluation mission should be carried out during the coming months.

- study to support institutions responsible for irrigation development

We have stressed the problem of the number of agencies involved in irrigation. This situation is prejudicial to an overall apprehension of problems set by the development and control of irrigation projects.

This study would include :

1) Assessment of existing organizations : Assessment of their objectives, competence and means in the field of hydro-agricultural development : HER, ONBI, ORD, AVV.

2) Preparation of proposals concerning structures to be developed or created at the following three stages :

- preparation of agricultural hydraulics programmes, which include :
  - general studies (up to the project feasibility level);
  - project synthesis and programming studies (preparing PID);

  This task is currently carried out by HER, ONBI and AVV.

- implementing and controlling the execution of activities
  - preparing technical and detailed pre-project dossiers
  - entering into contracts
  - implementation of activities under management control
  - control and guidance of activities

- Protection, control and technical support for hydro-agricultural project management agencies

  The development of hydro-agricultural regions such as SOUROU and BAGRE implies establishing new structures adapted to the size and complexity of planned developments. The operation and organization of these structures must be planned right now, as well as the corresponding technical and financial resources. This planning should be based on existing projects in Upper Volta (Kou valley - Niena Dionkele project) and mostly on other Sahelian countries where large scale development projects have already achieved a certain level (particularly Senegal and Mali).

  It is desirable that a central agency monitor the different projects and, if necessary, provide the technical support for project structures.

  The AVV within its geographical region and ONBI for the rest of the territory seem to be suited for this role after certain statutory reform of the ONBI.

  The ONBI, involved in three stages of the operation, should play a more important part in the future in the field of promoting and monitoring irrigation projects.

4.3 RECAPITULATION OF OPERATIONS TO BE FINANCED

PROJECT	TYPE OF OPERATION	ESTIMATED COST IN MILLIONS OF FCFA	EARLIEST IMPLEMENTATION DATE	FINANCING To be sought	under negotiation	preliminary interest
1. Lowlands for rice farming	Inventory and programme	80	1979	X	IBRD	
2. Kompienga	Guideline	75	1979	X		
3. Bougouriba	Guideline	100	1979	X		
4. Comoe	Guideline and feasibility first tranche	100	1979	X		
5. Loumana	Feasibility	75	1980		FRG	
6. Kamadena	Feasibility	75	1980		IBRD	
7. Douna	Study of dam project	80	1980			EDF
8. Upper Black Volta	Feasibility first tranche (3,000 ha.)	150	1981		IBRD	
9. Sourou	Project study first tranche (5,000 ha.)	200	1981		FAC	
	Development of 5,000 ha. plus infrastructure	12 to 15,000	1982	X		
10. Bagré	Implementation of first tranche (dam plus 5,000 ha.)	37,000	1982	X		
11. Training centre for irrigation supervisors	Study - Implementation & operation	600	1979 1981			Netherlands
12. Mission organization	Study	25	1979	X		

H.E.R. Document, 1978
for the attention of the
ORDs

A N N E X 1

THE DEVELOPMENT OF LOWLANDS ("BAS FONDS")

1. Methods for development

The large quantity of water which flows on to the hydromorphic soils of the lowlands during the rainy season maintains the ground water at low depth and permits rice farming with decent harvests, if rain distribution is adequate.

However, reality is different when one knows that drought periods longer than ten days lower yields. Thus the technical approach is to retain water.

This is carried out by constructing bunds (see figure 1). They consist of two parts :

- the main bund,
- retaining wings.

Water is retained after every rain up to the limit defined by the height of the bund's wing (see figure 2).

In Upper Volta rains are heavy and create flood waters which the development system must let through with a minimum of risk to the bunds. However, if water falls on a bund 50 cm high, it hopelessly erodes it and creates a break. That's why the bund's wings were made lower than the crown of the main bund and thus make the water flow laterally (see figures 3A and 3B).

There are several types of developments depending on the lie of the land :

- Simple open type (figure 4)

Bunds are built on countour lines with 15 cm difference in level with lateral inlet and outflow of water. Trickling water fills the upper level. When it is full of water, which continues to trickle on, it flows out through a side channel spillway (lateral escape).

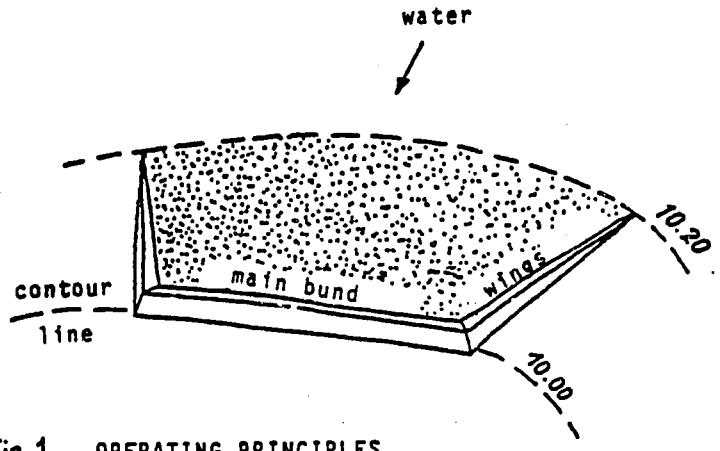


fig 1 OPERATING PRINCIPLES

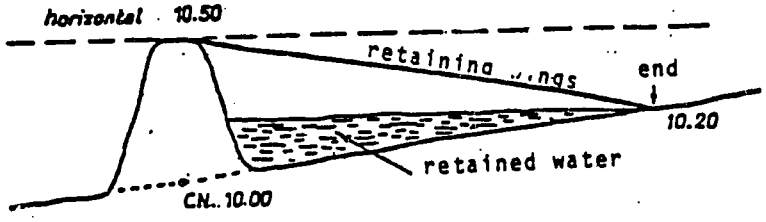


fig 2 SECTION

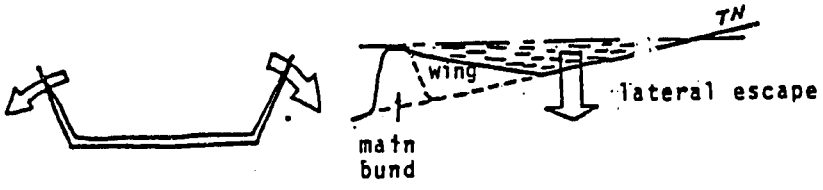


fig 3A LATERAL ESCAPE

fig 3B SECTION

- Semi-open type (figure 5)

This type differs from the preceding one by protecting the installation against backwater flooding with a protective bund 70 cm high.

- Central channel type (figure 6)

This system corresponds to developments supporting more important floods than the simple open type.

Remark : During the first years of development, a closed type of installation was also used. Its disadvantage was that it could not receive small trickling water and was thus abandoned entirely.

Unfortunately not everything that looks like a lowland to a farmer can be developed. In reality, the limiting factor is the size of floodwaters which induce inundations and outlets. The size of floods is related to what we call "watershed". A watershed is the surface of land which collects all water going through the said lowland. Our current estimates have led us to limit the size of watersheds eligible for development to 30 square kilometers.

2. Implementation of activities

Implementing lowland development activities requires the participation of extension agents, teams of topographers, motorized units and farmers.

After the programming and selection operations carried out by the technical departments of the ORDs, the HER and the Rural Development Fund's Directorate (which are not described in this document), extension workers sensitize farmers.

After acceptance, the ground survey begins. Topographers survey the ground cleared by the farmers and prepare a detailed plan of the ground relief. Afterwards activities are carried out in the office with calculations and drawings of the plan.

The project is then drawn up by trying to obtain a maximum of floodable surface with a minimum of bund construction. The project is controlled by the HER.

Afterwards topographers return to the field to stake out the project. It is hereby noted that ground surveying and pegging out is stretched over 2 campaigns due to the ORDs annual implementation programme. The location of the bunds is indicated by different colored pegs (colors indicate order of bunds). This is done in the presence of the extension agent.

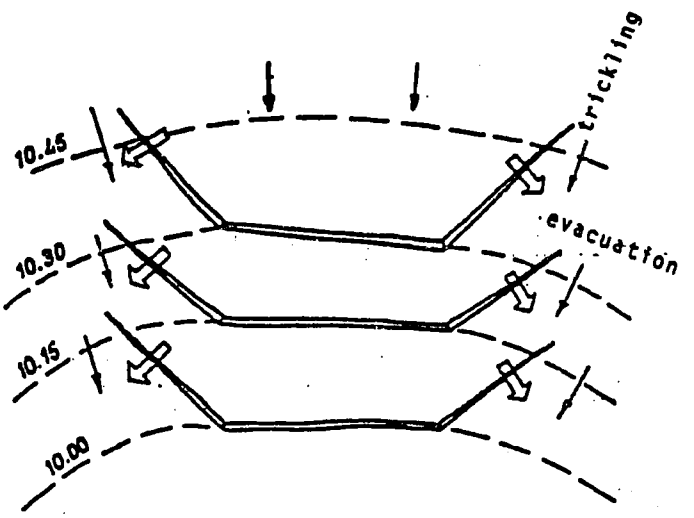


fig 4 SIMPLE OPEN TYPE

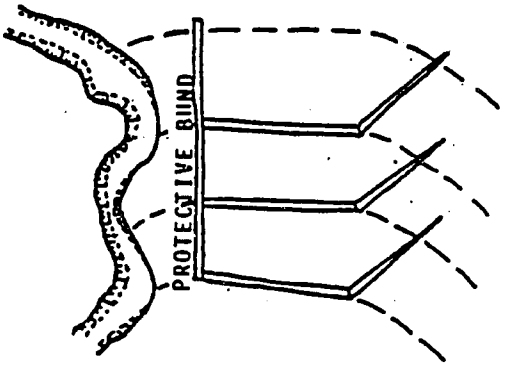
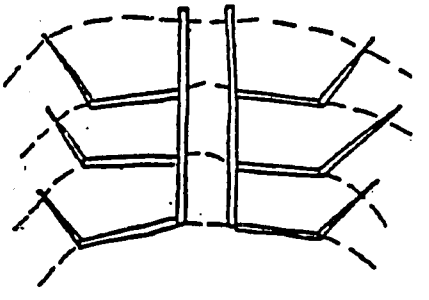


fig 5 SEMI OPEN TYPE

fig 6 WITH A CENTRAL CHANNEL



Farmers clear the ground of tree stumps before the arrival of the tractor drivers who, under the supervision of the extension agent, mark the site of the bund with either a disc plow or a bund dril Then the land is plowed. It is called ground breaking to indicate that it is an assistance to the farmer on non-cultivated land. It will not be carried out again the following years.

Afterwards, farmers construct the bunds with equipment supplied to them : shovels, pickaxes, rammers, wheelbarrows. Under the direction of the extension agent they build the bund by successive layers at 10cm each to obtain a total height of 50 cm. The bund is built, but it is fragile. After the first rains, it must be recompacted while still wet. Grass will be planted on the bunds afterwards with fixing plants such as antropogon guyanus or other similar lowland type plants. The bunds will never be weeded.

Farmers prepare the soil for rice farming which we will summarize below :

SOWING :

- Choice of a selected variety depending on the lowlands' characteristics :
  - . humid = SINTANE, C 74 IR 1529, VIJAYA
  - . dry = DOURADO or local varieties, IRA/10
  - . spreading out - around 25 to 30 cm
  - . direct seeding after furrowing or transplanting from a seed bed currently being demonstrated by a Rural Development Fund officer.

FERTILIZER :

- The use of fertilizer is not recommended during the first year because the development is neither solid nor stabilized.

- Second year : average proportions
  - . cereals fertilizer 50 kg/hectare during soil preparation
  - . urea 50 kg/hectare during the first weeding,
  - . urea 50 kg/hectare during the second weeding,

The amount of fertilizer used depends on the type of soil and the variety chosen.

WEEDING :

- Two weedings must be carried out during the first 40 days of a 110 day rice variety.

TREATMENT :

- Use the treatment recommended by the Agricultural Services Directorate for diseases and insects i.e. Furadan 3G or 10G at 15 to 20 kg/hectare[1/].

Note on the quality of developments : the best Rural Development Fund installations were found in the Bougouriba ORD; bunds 0.8 m high with 1 m. wide ridges.

3. Maintaining developments

These installations require regular maintenance in order to function properly and provide the expected yields. Farmers neglect maintenance too often or carry it out at the wrong moment. We already stressed this point in the chapter on anti-erosive sites.

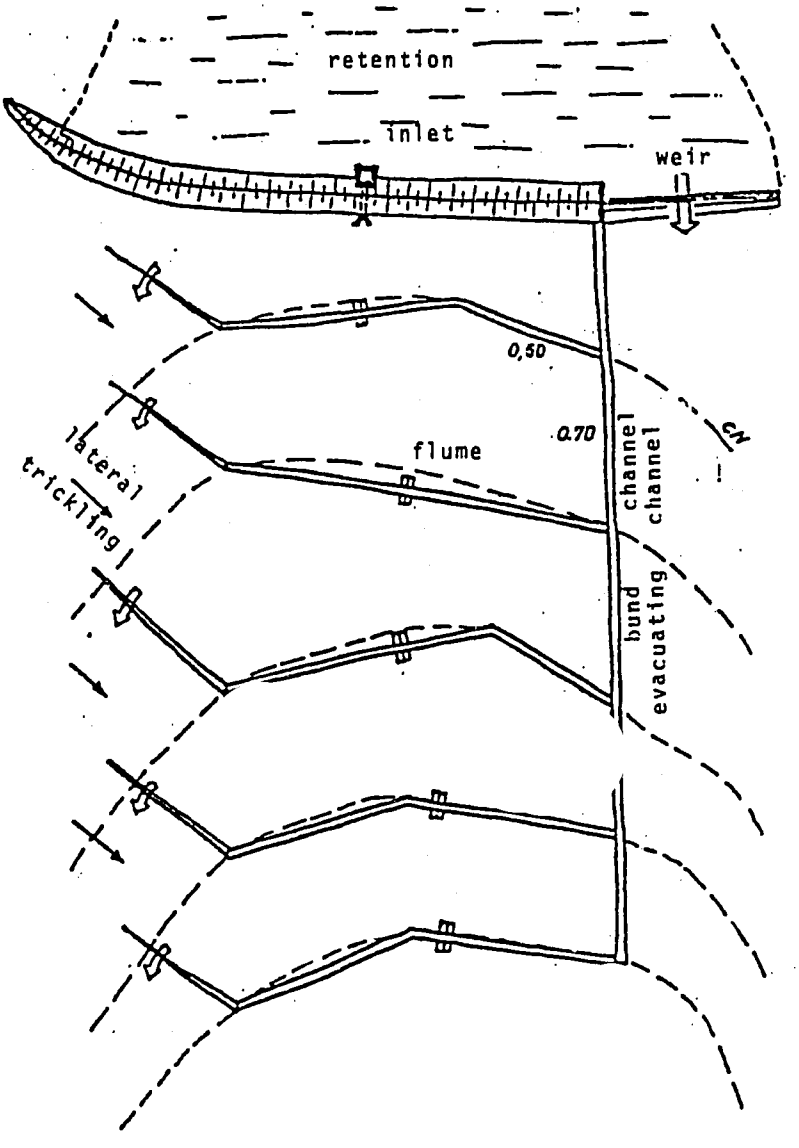
The bunds must be heightened at the end of the harvest when they are still a bit humid so as to compact them. They will be much more solid after the dry season and resist the first floodwaters.

Specialists also recommend plowing after the harvest to farmers who have oxen and plows.

Putting land under grass must be done slowly during the rainy season with appropriate plants.

1/ D.S.A. Rural Development Seminar for extension agents of developed lowlands by Michel KOUTABA

fig 7 : DEVELOPED LOWLAND



IMPROVED LOWLANDS

The main problem in the development of lowlands is hydraulic. In its second phase (1976-1980) the Rural Development Fund has advocated the development of lowlands.

The problem to be solved is that of water control. The floods in the beginning of the season discharge large quantities of water due to heavy rains and create outlets. However, at the end of the rice cycle, there is not enough water. Thus an effort has been made to stem the floodwaters and steer them to form a reserve for extra irrigation in order to avoid dry spells longer than 10 days.

1. Operating principles

Where an installation exists, the population is motivated, the surface to be developed is more than 10 hectares, yields can be improved, and hydraulic and topographic conditions are favorable to the creation of a small reservoir, the following is carried out (see figure 7) :

- a small bund 1.5 m high with a weir and an evacuation channel,
- one or two coffer dams (of the monk pool type) to carry out extra irrigation.

2. Experimentation

It is anticipated to experiment with 4 systems :

Improved lowlands over :

1. major watershed
2. small watershed (less than 30 sq. km at the head)
3. overflow plain
4. site with an indicated marigot (tapping).

The first three systems have been carried out. From preliminary observations it can be assumed that both the small watershed and the overflow plain are adaptable to the system in question. However, the major watershed cannot be developed through our system.

3. Operation

After each rain the reservoir fills up. If the rain is heavy, water flows through the weir into the evacuation canal.

During dry spells and particularly during the ripening of rice, coffer dams are opened up to permit extra irrigation. The parcels are then irrigated by cascades : first the upper ones and then the lower ones, either by aids or pointing sills located in the main bunds.

4. Expected advantages

Through the use of this system, it is expected to insure better floodwater control, provide water to rice fields without any interruption, protect seedlings, and thus succeed in doubling the average annual lowland production which currently amounts to 1,500 kg/hectare.

However, two or three more years will be necessary to improve the system depending on the evolution of farmers, and to define rational criteria in deciding on improvements to make to the system. 1/

1/Approximate costs for rice developments : (1977 prices)
- without water control : classical lowlands 50,000 FCFA/ha
- with improved water control : 200,000 FCFA/ha
- downstream from the dam 1,000,000 FCFA/ha

ANNEX 2

MAIN CONSTRAINTS TO THE DEVELOPMENT OF IRRIGATED AGRICULTURE IN UPPER VOLTA BY MR. H. VINK (Netherlands)

The experience acquired in the field of modern irrigation in Upper Volta allows us to make a number of observations which concern both irrigation activities on the country level as well as already developed perimeters.

1. On the country level

Efforts undertaken by the Government of Upper Volta in preparing feasibility dossiers for several projects and guidelines (Volta and Comoe Basins) are considerable. Nevertheless, a number of constraints are apt to slow the development of irrigation. Even though these constraints have already been identified by the Voltaic Authorities, several deserve attention.

1.1 Geographic planning of irrigation operations and calendar for planning the implementation of these operations

It appears to us that implementation of irrigated perimeters in Upper Volta is planned at the rate of 1,500 hectares per year. Based on the fact that major operations have already been or are still being studied, the Voltaic Government will on one hand be led to indicate priority projects and regions and on the other to study modalities for developing such an area in a given year.

The complexity of the above points could lead to (re)defining the exact tasks of every service concerned. Otherwise the creation of a national structure which would cover all activities related to irrigation projects would be useful. This should permit an increase in the absorptive capacity of foreign aid through the correct functioning of a balanced liaison structure.

1.2 Agronomic research

Research for development systems to be proposed to irrigated farming is underway. After consultations with the responsible authorities, we consider that within a major programme of implementing irrigation operations, the experience acquired in the field of permanent farming and out of season irrigation stresses the usefulness of this research which should be pursued and even intensified as much as possible.

1.3 Training

Planning operations over time should allow a better assessment of the necessary technical training capacities to cover considerable needs at the stages of project preparation and implementation but mostly in supervising farmers.

1.4 Management

The hydraulic design of major developments and implementation costs necessarily lead to sustained agricultural intensification. This implies that the farmer strictly adheres to the suggested technical themes accompanied by additional management activities. Organization of the community should be efficient (supply, marketing).

Such organization of sustained production is an important change from traditional methods. This will require support or the creation of management structures for irrigated perimeters. It is important that a national policy for efficient management of irrigated perimeters be established or defined. The local population's capacity to absorb new ideas will be an important criteria in developing such a policy.

1.5 Marketing

Due to growing national demand, an important increase in cereals production is necessary (FAO 1976). It is even to be feared that if nothing is undertaken to increase production, important food deficits will be the rule rather than the exception.

Increased productivity could cover these deficits if it is accompanied by a firm marketing policy on the part of the Government : guarantee the outflow of the producer's goods at a profitable price and stabilize the supply of the national market with local produce.

Currently OFNACER provides insufficient guarantees for the sale of farmer produce at official prices. It also appears that the Voltaic market is supplied by unofficial channels.

The marketing problem should be solved rapidly. An inadequate solution could be a major bottleneck in obtaining necessary external assistance.

2. On the irrigated perimeter level

2.1 Farming

Irrigated farming should guarantee satisfactory income to farmers without incurring large production costs and insuperable work loads for the family.

Raising producer prices with a view to satisfying this income can work out only if all national supply is purchased and this implies strict control over all imports and exports (see the Kou situation).

However, the cost of investments in developing irrigated perimeters will not allow users to face also operating expenses and amortization of infrastructure costs. It appears necessary that certain donors or the State cover part or all amortization costs. This is necessary even if several cash crops are associated with food crops.

2.2 Land tenure problems

A precise knowledge of land tenure is necessary before undertaking development. This will allow official distribution of land at the time of farmer settlement.

The guarantee for a definite settlement should stimulate certain productive investments and improve chances for establishing permanent farming.

2.3 Organization

The supply and marketing of produce should be organized in an efficient way. In the beginning, these activities will probably be entrusted to statal or para-statal agencies. However, it is desirable that already at the stage of preparing perimeter development,proposals promoting farmer organization be considered as the operation's objective. The number and quality of managerial staff would be based on this objective and their main purpose would be to train farmers. Once more this stresses the need for training programmes.

ANNEX 3

NUMBER OF IRRIGATION SPECIALISTS IN THE REPUBLIC OF UPPER VOLTA

	ACTIVE	IN TRAINING		
		1979	1980	1981
I.E.R. Engineer	14	2	2	2
Technical assistants in agricultural engineering (Kamboinse School)	50	10	11	6

ANNEX 4

LIST OF PROJECTS

An outline of terms of reference for:

1. Creation of a training centre for irrigated agriculture instructors.
2. Study mission for supporting institutions responsible for irrigation.
3. Development of lowlands for rice farming.
4. Master plan for the development of the Comoe and Yamnon basins.
5. Integrated development master plan for the Kompienga valley.

PROJECT N° 1

CREATION OF A TRAINING CENTER FOR IRRIGATED AGRICULTURE INSTRUCTORS

Upper Volta possesses important hydro-agricultural potentialities, of which only approximately 5,000 hectares are used. In the near future it is envisaged to develop 1,500 to 2,000 hectares annually.

This programme will include pursuing small hydraulics projects (lowlands, downstream from the dams, flooded rice plots) and major developments (Bagre, Comoe). This programme implies the availability of numerous cadres, particularly extension agents specialized in irrigated agriculture.

The unavailability of these cadres would be one of the most serious handicaps to the development of irrigated farming. It thus appears urgent to rapidly train extension agents in the field of irrigation techniques.

1. The project's purpose

- To establish a new training center or expand an existing one to train extension agents in the development and use of irrigated perimeters.

- Organize refresher courses for technical, agricultural and senior hydraulics and rural development agents.

- Theoretical courses immediately followed by on the spot activities. These would preferably be carried out together with already trained farmers and/or on a modest irrigated perimeter managed by the center itself.

- The duration of training depends on the beginning level. If accepted students already have a one year agricultural experience after the BEPC level, then training would be limited to one year. However, if they are only at the BEPC level, then agricultural/irrigation training could, may be, take two years.

The recruitment level remains to be indicated by the Voltaic authorities. It may depend on the establishment of the BOGANDE and SAKIA centers in addition to the already existing MATOURKOU center.

2. Location

There appear to be two possibilities. First of all, it could be conceived as a complement to the MATOURKOU center, or eventually to that of BOGANDE or SARIA. Moreover, the creation of a new center can be envisaged which would be integrated into Upper Volta's training structures, at LOUDA or MOSTEDO for example.

3. Staffing

The center will be operated by Voltaic cadres and technical assistants. Expatriate technicians will be used only during four years.

It will consist of the following :

Irrigation AGRONOMIST, experienced, with a solid knowledge of training problems and capable of demonstrating the implementation of all activities.

- pre-irrigation, inundation
- labor, plowing
- seeding, transplanting
- weeding
- harvest
- drying
- seed production, disinfection.

The AGRICULTURAL ENGINEER will teach all hydraulics subjects and train students in simple constructions and in maintaining and reparation of small hydraulics infrastructure

- bund construction
- levelling and planishing
- intake structure and water handling
- drainage
- construction and maintenance of infrastructure

Besides these agricultural engineering tasks, he will also teach "village technology" (mills, pumps, threshing, etc..).

The SOCIO-ECONOMIST will teach groups, management and development of the perimeter, extension and leadership techniques, marketing, organization of activities, monitoring the installation of farmers, the creation of villages, etc..

4. Equipment and infrastructure

Constructions include all necessary building for the Center including housing for teachers and their homologues.

All the equipment necessary for operating the center will be included (teaching aids, agricultural and technical equipment, etc..) as well as for classrooms and houses..

Moreover, the project foresees that the donor will cover part of the operating expenses during the first four years of operation.

5. Estimate of costs

Due to uncertaincies in modalities for implementation, it is very difficult to establish an estimate for the activities described above.

A first estimate based on 30 students over a two year training period (thus 60 students/year) would amount to 600 million FCFA.

- expatriate staff	200 million FCFA
- local staff	50 million FCFA
- construction	100 million FCFA
- equipment	50 million FCFA
- operating costs	100 million FCFA
- unforeseen expenses 10%	100 million FCFA
	600 million FCFA

This project identification document presents only a few comments on different possibilities.

We suggest that the Voltaic Government comment on the themes described and suggested options. A mission (Dutch) could then define project elements with the authorities concerned.

Project N° 2

STUDY MISSION FOR SUPPORTING INSTITUTIONS RESPONSIBLE FOR IRRIGATION

This study would consist of:

1. A diagnosis of existing institutions: analysis of their purpose, their competency and resources in the field of hydro-agricultural developments HER, ONBI, ORD, AVV.

2. Preparation of proposals for structures to be strengthened or created at the following three levels:

   . preparation of agricultural hydraulics programmes, including:

   - general studies (to the project feasibility level)
   - synthesis studies and project programming (preparation of project identification documents).

   These activities are currently carried out by the HER, ONBI, AVV.

   . implementation and supervision of activities:

   - preparation of detailed pre-project technical dossiers
   - preparing contracts
   - carrying out activities under state supervision
   - supervising and directing activities
   - protection, control and technical assistance to management agencies of hydro-agricultural projects.

The hydro-agricultural development of areas such as Sourou, region of Bagré, will require the creation of new structures adjusted to the size and complexity of these project developments. The operational and organisational policies of these structures must be elaborated now, as well as their technical and financial aspects. This elaboration should be based on experience learned from existing developments in Upper Volta (Kou Valley, Niena Dionkele project) as well as in other Sahelian countries where major developments exist (particularly Senegal and Mali).

It also appears desirable that a central organisation provide project monitoring and eventually technical assistance to project structures.

The AVV - within its geographical limits - and ONBI on the remainder of the area appear to be qualified for this role if certain statutory changes are made for the latter.

ONBI, concerned by the three development stages, seems to be receiving an increasingly important role for promoting and monitoring irrigation projects.

The study mission outlined above could be carried out by three experts:

- 1 specialist in irrigated perimeter organisation,
- 1 development specialist,
- 1 administrative and legal expert.

Amounting to a total of about 4-5 man/months.

Project N° 3

DEVELOPMENT OF LOWLANDS FOR RICE FARMING

The purpose of the study is to define the potential and the development programme to be implemented for the next ten years.

It will include:

- a critical analysis of existing development methods and a review of results achieved in sample projects;
- a study of the potential based on available documents (aerial photography, remote sensing) and photo interpretation, as well as mapping of locations at 1/200,000;
- photographs at a scale of 1/20,000 of areas with the highest potential and land surveys of areas suitable for development;
- preparing an implementation programme (5,000 hectares) and recommendations for development techniques and farming start-up.

A preliminary estimate of costs for this study is 75 million F CFA which should take 8 to 10 months.

Project N° 4

MASTER PLAN FOR THE DEVELOPMENT OF THE COMOE AND YANNON BASINS

A preliminary study was carried out in 1975. It should be revised taking into account the changes in agricultural objectives previously based on the development of the sugar perimeter (4,000 hectares).

The abandonment of the sugar project in this area leads to a re-examination of the potential use of available water resources from the Comoe and Yannon basins based on hydro-agricultural development (estimated at over 10,000 hectares) for both rice and fruit farming, and a redefinition of the maximum capacity of regulating dams planned.

This master plan depends on construction of the BADADOUGOU dam whose maximum capacity is 150 million cu. meters.

Additional studies to be undertaken would include:

- a definition of agricultural projects and priority programmes based on available data;
- a definition of water requirements, size of regulating dams and power channels;
- preparation of a development master plan;
- programming equipment and estimating priority activities.

A preliminary cost estimate of the study which takes into account the amount of available data is 8-10 man/months or 20 to 25 million F CFA.

Project N° 5

INTEGRATED DEVELOPMENT MASTER PLAN FOR THE KOMPIENGA VALLEY

The study is proposed in addition to the feasibility study recently carried out on the site of the hydro-electric dam. Its purpose is to define the agricultural and hydro-agricultural potential to be developed once the reservoir is built.

Therefore the agricultural component of the dam is to be studied and an integrated development programme of the valley to be prepared.

The studies would cover:

- a definition of water resources available to irrigation;
- an agro-pedological survey and the preparation of a soil capability map at a scale of 1/50,000 for all areas around the reservoir;
- an agro-socio-economic study defining:
  - . rainfed and irrigated crop rotations for the different developed areas;
  - . rainfed and irrigated development which takes into account the socio-economic constraints of the valley;
  - . type of organisation and equipment required by the agricultural development;
- a study of the master plan for hydraulic equipment and management guidelines;
- a study of the overall economic rate of return for suggested developments;
- a programming of implementations (investments and man-power requirements).

A preliminary estimate of these costs amounts to approximately 100 million F CFA.