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MAURITANIA

GORGOL NOIR IRRIGATION PROJECT
(Credit 1068 MAU)

DRAFT PROJECT COMPLETION REPORT



FAO/WORLD BANK COOPERATIVE PROGRAMME
INVESTMENT CENTRE

MAURITANIA

GORGOL NOIR IRRIGATION PROJECT (Credit 1068 MAU)

DRAFT PROJECT COMPLETION REPORT

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ISLAMIC REPUBLIC OF MAURITANIA

GORGOL NOIR IRRIGATION PROJECT

(CREDIT 1068-MAU)

DRAFT PROJECT COMPLETION REPORT

Monetary Unit : Ouguiya (UM)
1US\$ = 73 UM (June 1987)
1UM = US\$0.014 (June 1987)



List of Acronyms

ADFAED	Abu Dhabi Fund for Arab Economic Development
CSA	Commissariat à la sécurité alimentaire
DCA	Development Credit Agreement
EDF	European Development Fund
FAC	Fonds d'aide de coopération (France)
FND	Fonds national de développement
GOL	Government of Libya
GPC	Groupement pre-coopératif
GPD	Gorgol Project Directorate
IDA	International Development Association
IDB	Islamic Development Bank
IFAD	International Fund for Agricultural Development
KFW	Kreditanstalt für Wiederaufbau
MDR	Ministère de développement rural
PA	Project Agreement
SDF	Saudi Development Fund
SONADER	Société nationale pour le développement rural



MAURITANIAGORGOL NOIR IRRIGATION PROJECT

(Credit 1068 MAU)

PROJECT COMPLETION REPORTBasic Data SheetKey Project Data

<u>Item</u>	<u>Appraisal Estimate</u>	<u>Revised Estimate</u> <1>	<u>Actual Achievement or Estimate (1987)</u> <2>
Project cost (US\$ million)	93.2	93.2	93.2 (end 1988)
Overrun (%)	-	-	0
Credit amount (US\$ million)	15.0	15.0	14.9
- Disbursed	15.0	15.0	14.8 (Dec. 1986)
- Cancelled	-	-	0.1 (expected)
- Re-imbursed	-	-	-
- Outstanding	15.0	15.0	14.9

Achievement of Physical Targets

	Dec. 82	Aug. 83	June 83
Completion date of dam	3.5	3.5	3.5
Conveyance canal (km)	12.3	10.9	10.9
Main canals: P1 (km)	21.1	15.1	15.1
P2 (km)	18.5	15.0	15.0
Main drains (km)	40	40	40
Main roads (km)	90	69	69 <3>
Secondary canals (km)	105.5	70	70
Secondary drains (km)	149	85	7
Road network (km)			
Tertiary network and)			
land preparation) ha	3,600	2,000	600
Rice mill	1	-	-

<1> Although the project cost has remained unchanged, the targets were scaled down

<2> Unless otherwise stated

<3> Of which only 60 km have embankments constructed

Economic Rate of Return:

Appraisal:	7.4%
Project completion <1>:	0%
Financial performance:	satisfactory
Institutional performance:	satisfactory

<1> Up to the end of the second phase

Cumulative, Estimated and Actual Disbursements (UM millions)

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Estimated	4.7	8.8	12.2	13.2	14.2	15.0
Actual <1>	3.1	7.0	8.6	11.4	11.6	14.8
Actual as % of estimated	66	80	70	86	82	99

<1> Slight discrepancies may occur as data was drawn from figures in UM

Other Project Data

<u>Item</u>	<u>Original Plan</u>	<u>Revisions</u>	<u>Estimated Actual</u>
First mention in files			June 1974
Government's application			Feb. 1978
Appraisal			26.Sept.-6 Oct. 78
Negotiations			30 July 1980
Board approval			16 Sept. 1980
Credit agreement date			21 Nov. 1980
Effectiveness date			19 Nov. 1981
Closing date			31 March 1987
Borrower:	Islamic Republic of Mauritania		
Fiscal Year of borrower:	January 1-Dec. 31		
Executing Agency:	Société nationale de développement rural		
Follow-on project name:	Projet d'irrigation Gorgol II		

Mission Data

<u>Item</u>	<u>Month/year</u>	<u>No. of days</u>	<u>No. of persons</u> <1>	<u>Man- weeks</u>	<u>Date of Report</u>
Re-identification	1976				
Preparation	Feb. 1978				
Pre-appraisal	May. 1978				
Appraisal	Sept. 1978				
Total					
Supervision I	Feb. 1981	6	1 e	1	17.03.81
Supervision II	June 1981	10	2 e a	3	20.07.81
Supervision III	Nov. 1981	9	3 e e a	4	05.12.81
Supervision VI	Nov. 1982	12	3 e f s	5	17.01.83
Supervision V	April 1983	16	3 e a l	7	07.04.83
Supervision VI	Nov. 1983	10	1 e	2	30.11.82
Supervision VII	May 1984	12	2 e a	4	29.06.84
Supervision VIII	Dec. 1984	10	2 e a	3	19.12.84
Supervision IX	April 1985	6	2 e a	2	31.03.85
Implementation	Dec. 1986	7	1 e	1	21.01.87
Completion	June 1987	7 <2>	3 e a b	3	
Total		105		35	

<1> e = engineer; a = agriculturist; f = financial analyst;
s = sociologist; l = lawyer; b = economist

<2> Mission combined with Identification/Preparation of Second Phase;
assessment of time spent is an arbitrary estimate

Country Exchange Rate

Name of currency (abbreviation)	Ouguiya (UM)
Exchange rates	US\$1 = UM
Appraisal year (1978)	45.0
1981 - Average (IMF estimates)	48.3
1982 - Average (IMF estimates)	52.2
1983 - Average (IMF estimates)	54.8
1984 - Average (IMF estimates)	63.8
1985 - Average (IMF estimates)	77.1
1986 - Average (IMF estimates)	70.0
1987 - Average (IMF estimates)	73.0

MAURITANIA

GORGOL NOIR IRRIGATION PROJECT (Credit 1068 MAU)

DRAFT PROJECT COMPLETION REPORT

I. INTRODUCTION

1. Mauritania's economic performance during the 1970s was characterised by a high investment rate (22 to 32% of GDP) combined with slow growth (annual GDP growth rate of 1.0 to 1.5% at constant prices). The near-stagnation of the economy was due to prolonged drought, misguided investment policies and the Spanish Saharan war. This period was followed by the fall of the 18-year old government and the country's withdrawal from the war.
2. An IMF-supported stabilization programme was launched in 1978 and continued in 1980 but the decline continued in the 1980s due to falling world prices of iron ore, intensification of the drought in 1983/84 and the mounting debt service burden (reaching a projected 40% of export earnings on debts contracted up to the end of 1984). Over the decade ending 1983, the Mauritanian economy grew by an average rate of 2.3%, hardly keeping pace with the rate of population growth (Table 1).
3. The Government's response to this situation was, in collaboration with the Consultative Group of donors for Mauritania, to launch a comprehensive Economic and Financial Recovery Programme for the period 1985/88. This programme involves a range of economic policy adjustments and institutional reform measures, including flexible exchange rates, encouragement of the private sector, reform of the banking, public and para-public sectors, and an investment programme giving priority to rural development, mining, infrastructure development and public services. It is still too early to judge its effects, but the preliminary results of the programme appear encouraging.
4. The Government continues to place high priority on the development of irrigation in order to both diversify the economy and reduce its dependence on food imports. The unreliable rainfall does not allow rainfed agriculture to be considered as a viable alternative for reaching these goals. The country's irrigation potential is about 150,000 ha (140,000 along the Senegal River and 10,000 ha in the Gorgol Valley) of which only about 8,000 ha have been developed.
5. The Bank's association with the irrigation sub-sector dates back to June, 1974, when, on the basis of a UNDP-financed feasibility study, a US\$1.1 million IDA credit (S-16-MAU) was provided to finance preparation of the final designs of two dams and the first phase of the irrigation development of Gorgol Valley. In FY 77 an IDA credit for US\$3.5 million was made available for the SONADER Technical Assistance Project (Credit 694-MAU) which was intended to strengthen the project preparation and implementation

capacity of SONADER <1> , which took over these functions from the Rural Engineering Department.

6. Other Bank Group operations in Mauritania in the irrigation sector include the Gorgol Irrigation Project, the project with which this completion report is concerned, (Credit 1068-MAU; US\$15.0 million, 1981), the Second Technical Assistance to the Rural Sector (Credit 1414-MAU; US\$8.1 million, 1983) and the Small Scale Irrigation Project (1571-MAU; US\$7.5 million; 1985).

7. The Gorgol Irrigation Project was designed to provide irrigation and land development for some 3,600 ha at a total cost of US\$93.2 million with the objectives of reducing the country's dependence on food imports and of stabilizing the agriculture and increasing incomes and living standards of some 4,600 farm families. The project was expected to be completed in September, 1986 and the IDA Credit closed in March 1987.

8. This project completion Report (PCR) is based on: a review of the Staff Appraisal Report (SAR) 2517a-MAU dated August 21, 1980; the Development Credit Agreement (DCA) and Project Agreement (PA), both dated November 21, 1980; the draft PCR prepared by the Gorgol Irrigation Project Directorate of SONADER; reviews of supervision reports; and visits to the project site and discussions with project staff as well as SONADER Head office staff, in June, 1987.

II. PROJECT IDENTIFICATION, PREPARATION AND APPRAISAL

Identification

9. Irrigation development of the Gorgol River Valley was always favoured by the Government because (i) it would increase and stabilize Mauritanian cereal production and reduce dependence on food imports; (ii) it could be the nucleus of development in the south-eastern region which lacks other development possibilities, and (iii) it did not depend on international agreements or water control structures in other countries as was the case with development of the Senegal River. Identification of the project started in 1971 with studies financed by UNDP. On the basis of the resulting "preparation report", IDA financed (Cr. S-16 MAU) the preparation of final designs of two proposed dams (El Bir and Fouta Gleita) and of the first phase of the irrigation development programme. However, when this work was completed in April 1975, the Bank refused to appraise the project on the grounds that:

- i) there were serious doubts about the technical suitability of the design of the El Bir dam, further topographic and engineering studies being required;
- ii) on the basis of past experience it was felt that the Mauritanian irrigation development agencies did not have adequate managerial capacity to handle medium to large-scale irrigation projects; and
- iii) while a preliminary evaluation of the whole 10,000 ha project indicated that it would be viable, the first phase for the construction of both dams and the development of 3,800 ha was expected to yield a very low rate of return.

<1> Société nationale pour le développement rural.

10. A revised first phase limiting itself to the construction of only one dam (Foum Gleita) and the downstream development of 3,600 ha was identified on the basis of a Bank desk study and a field visit by an FAO/CP mission. This alternative was accepted by the Government after extensive discussions with the Bank and FAO.

Preparation

11. The additional investigations and feasibility studies required to prepare this revised first phase were supported by Credit 694-MAU (US\$3.5 million) which also aimed at strengthening the managerial capacity of SONADER, the new rural development agency. Preliminary feasibility studies for the irrigation perimeter were completed by Italian consultants in February 1978 and final documents including technical specifications, tender documents, execution plans and agricultural and socio-economic studies, were submitted in September 1978. A special study of the design and specifications of the Foum Gleita dam by a panel of dam experts was completed in April, 1979.

Pre-Appraisal

12. The project was pre-appraised in March 1978 and the pre-appraisal report distributed in May 1978. The project as then conceived had a total cost net of taxes estimated at US\$52 million, with the cost per family of beneficiaries at US\$11,000 and an ERR around 7%.

13. The low rate of return was attributed to:

- i) the early stage of development of the sector, with the need for a long gestation period required to settle farmers and the high management and training costs necessary to build up the executing agency, and
- ii) the exorbitant cost of civil works (which would affect any major investment in Mauritania), mainly due to the high cost of importing technical and managerial skills, the need to transport equipment and materials over long distances on poor roads, lack of local maintenance and support services for equipment, and the lack of competition among contractors.

14. The request to the Loans Committee for permission to appraise the project was justified on the grounds that:

- the Bank had a long association with the Gorgol project and had financed much of the preparation work;
- the objectives of the Bank's technical assistance to SONADER had been met and it was now a viable organisation capable of implementing the project;
- there was a shortage of investment opportunities in Mauritania, particularly in the Southern Region;
- on account of the availability of considerable funds as grant aid and soft loans, an appreciable proportion of the Gorgol project costs could be discounted and the corresponding financial charges included in the stream costs, thus increasing the rate of return.

15. The Region was authorized to appraise the project (despite its low rate of return and high investment cost per family), with the provision that the project should be reviewed at appraisal, in view of the special conditions prevailing in Mauritania.

Appraisal

16. The appraisal of the project took place in September/October 1978. On the basis of the report of the panel of dam experts, the pre-appraisal proposal for an earth-fill dam was replaced by a proposal for a concrete arch dam. The resulting revised designs and cost estimates were to be available only in April 1979, when project cost estimates would be firmed up. Slightly higher costs for the irrigation work were also indicated by the detailed engineering studies which were completed at appraisal. The economic prices of project outputs (paddy, milled rice, sorghum and maize) were also revised upwards following appraisal.

17. The appraisal mission's revised estimate of the project cost at that time was US\$55 million, allowing for increased physical contingencies on the dam and irrigation costs on account of the changes in design. The mission's preliminary calculation of the project's economic rate of return remained at about 7%. In order to partly bridge the financing gaps that were evident at this stage, it was proposed to raise IDA's contribution to US\$ 15 million.

18. Subsequent up-dating of project costs on the basis of bids made by potential contractors for the dam and irrigation works brought up the total cost considerably, to US\$93.2 (including physical and price contingencies as well as US\$0.5 million for refinancing credit S-16 MAU). After much debate regarding the acceptability of the low economic rate of return of the project, it was decided to consult the Bank's President, Mr. McNamara, before going ahead with the processing of the project.

19. The President very reluctantly agreed to the further processing of the Gorgol Irrigation Project on the grounds of:

- lack of development alternatives for the people of the region;
- higher project costs, partly reflecting tied procurement required by some donors; and
- lack of basic infrastructure in the area.

20. After further refinements, the yellow-cover version of the SAR issued in August, 1980 showed an ERR of 7.4%.

Project Description

21. The project, as planned at appraisal, comprised the following components:

1) Dam and Conveyance Works

- Construction of an arch-dam with a maximum height of 37 m and length of 95 m to give a storage capacity of 500 million m³; and

- construction of a conveyance canal with a capacity of 10.73 m³/s and length of 3.6 km along the left-bank, subdividing into a left bank canal reaching the irrigated area 3.0 km further downstream and a right bank canal (with a canal bridge) which reaches the irrigation area after 1.9 km.

ii) Gorgol Perimeter

- Construction of two main canals (26.5 km long) 37 secondary canals (61 km), 360 km of tertiary canals and 484 km of drains;
- on-farm development including land levelling and access roads serving 4,200 ha;
- construction of houses, offices, storehouses, a rice mill, social infrastructure (schools, mosques, dispensaries, etc) and other facilities close to the perimeter; and
- provision of agricultural equipment and vehicles.

iii) Agricultural Development

- Provision to farmers of soil preparation (ploughing) and threshing services, and inputs (seeds, pesticides, fertilizers), on credit, and extension and marketing services.

iv) Technical Assistance

- Provision of technical assistance and equipment and vehicles for execution and initial operation of the project.

III. PROJECT IMPLEMENTATION

Credit Negotiations and Effectiveness and Start-Up

22. Negotiations for the credit took place on 30 July 1980 following technical discussions conducted between 3 and 10 July, 1980. The Bank's Board of Directors approved the credit on 16 September, 1980 and the agreement was signed on 21 November, 1980. Conditions for effectiveness included, in addition to the normal legal opinion: authorization and ratification by Government; setting up of the Gorgol Project Directorate (DGP), appointment of its director, opening of special operating accounts and deposit of initial amounts by Government, proof of effectiveness of the agreements with IFAD, BID, FSD and Libiya and proof of signature of agreements with FADDEA, FAC, FED and KFW <1> .

<1> See list of Acronyms.

23. The project was expected to become effective on 21 January, 1981. By February, 1981, compliance with conditions for which the Government was entirely responsible was well advanced and the only missing document was the legal opinion. Legal problems persisted as there were discrepancies between the financing plans mentioned in the World Bank's Development Credit Agreement and the plans of certain other donors, with respect to the financing of some components; this was delaying payments to the contractors and re-imburement of SONADER, which was pushed to the limit of its own capacity to finance the on-going operations.

24. Finally, on 19 November, 1981, the IDA Credit (and on 22 November, the IDB Credit) became effective, thus rescuing the project from the brink of disaster. However, doubts persisted as to when the Libyan credit would be available and there was no confirmation about the disbursement of IDB and SFD funds.

25. Because of long negotiations, late award of the contracts, and problems imposed by river flows, the project completion date was put back by one year (as compared with the date envisaged in the SAR) and the implementation plan changed accordingly. Other minor snags that arose during the start-up of the project were:

- rejection of the site for the base camp selected by the contractors in the vicinity of the dam, as SONADER wished to use the buildings later for its project administration;
- the benchmarks for the topographic survey could not be provided in the period allowed in the contract owing to delays in the appointment of the Chef de service topographique;
- delays in recruitment of the supervising engineers prevented SONADER from providing the necessary plans on time;
- inadequacy of detail in topographic maps (1:5,000 scale, on which bids were called) resulting in new, more detailed, surveys having to be carried out before the construction could start; and
- discrepancies between the financial regulations applicable to the project and those attached to the tender documents.

26. Sociological activities commenced satisfactorily and a protocol was agreed on between the Government and traditional land owners in the project area on the use of the land. Financing difficulties, however, continued to plague the infant project with Libya still not honouring its commitment and IDB deciding not to finance its share of expenditure made in local currency. The Government also failed to make timely deposits in the project operating account.

27. The performance of the Gorgol Project Directorate (GPD) was affected by the problems of achieving a satisfactory disbursement routine with ten different financing sources. Senior GPD staff, including the Project Director, showed tardiness in moving out to the project site and compliance with this condition of funding was achieved only after a threat by IDA to suspend disbursements.

Project Revision

28. A number of serious problems surfaced during the early phases of project implementation. The more important of these were:

1) The Cost Overrun Problem. By mid 1982, it became obvious that there was a major cost-overrun problem. Its magnitude was estimated as being potentially US\$44 million, or 52% above appraisal estimates, by the time the project would be completed. The cost overrun on the dam and primary and secondary works was not major and arose mainly from the long delay before project effectiveness. The major overrun was on the tertiary network and on-farm development, arising from:

- abandonment of the force-account approach, which in any case had been severely under-costed;
- substantial increases in quantities, which had been estimated on the basis of preliminary designs;
- increases in prices and quantities, well above appraisal estimates and
- inclusion of facilities, machinery and staff not originally foreseen.

All the co-financiers as well as the Government ruled out any supplementary financing to meet the increased costs. There was no alternative therefore except to re-design the project.

ii) The Settlement and On-Farm Development Problem

- A review of the settlement and on-farm development proposals indicated that, besides contributing substantially to the potential cost overrun, they were not viable. It was decided therefore to take this opportunity to also redesign this component in order to permit beneficiary participation in tackling the problem of land development, and to reduce costs.
- Accordingly, in November, 1982, at the instance of the Bank, the project was substantially reformulated. Subsequently (May, 1983), the Government and donors agreed to re-allocate available funds in order to implement the project according to the new concept. It was also agreed to prepare a new financial plan for this purpose.
- The reformulation of the project involved a significant reduction in the area to be irrigated and major revisions in the plans for: (i) construction of tertiary networks and on-farm works; (ii) settlement programme; and (iii) agricultural development. The revised project included (a) a concrete arch-dam to store about 500 MCM of water; (b) primary, secondary and tertiary irrigation and drainage networks and roads to serve a net area of about 2,000 ha (reduced from 3,600 ha proposed originally); (c) settlement of 4,100 families vs 4,400 at appraisal; and (d) agricultural development in which all farming operations were to be entirely the responsibility of the beneficiaries, (e) the acquisition of rice hullers instead of a rice mill; and (f) technical assistance.

- On account of these revisions, the project cost was reduced to US\$78.8 million. The strengthening of the US\$ further reduced the cost to US\$71.6 million. Another reduction to US\$70.1 million was made on the optimistic assumption that the completion date could be advanced by one year.

Le programme d'exécution

29. A la lumière des premiers décomptes de l'entreprise, il est apparu que le projet allait entraîner des dépassements importants des quantités des différentes rubriques des travaux. L'étude de réévaluation a identifié la nature des dépassements et a chiffré leur montant. Le tableau 1 donné en annexe présente les deux évaluations.

30. Il a alors été décidé de procéder à une réduction dans la masse des travaux surtout au niveau des lots B, C et D. Le nouveau programme des travaux est présenté au tableau 2.

31. D'autre part en ce qui concerne la réalisation du lot D, il était prévu que les travaux soient réalisés en régie par la SONADER suite à l'expérience qu'elle était en train d'acquérir dans la réalisation du périmètre de Bogué. Seulement là aussi les études de base se sont avérées insuffisamment précises (canevas hydrauliques au 1/5000ème) pour démarrer les travaux. La SONADER a alors contracté un marché de travaux topographiques pour une couverture aérienne et une restitution au 1/2000ème.

32. Le chantier du barrage a eu du retard suite à une rupture d'approvisionnement en ciment pour une question de quota de transport entre la Mauritanie et le Sénégal. L'entreprise a subi un préjudice pour lequel elle a demandé un dédommagement. Devant le désaccord des deux parties (Entreprise et SONADER), l'AID a suggéré au Gouvernement Mauritanien de faire appel à un médiateur international de L'ICSID (International Center of Settlement of Investment dispute). Sur la base du rapport de l'expert désigné, un accord à l'amiable a été conclu entre le Gouvernement et l'entreprise pour évaluer le préjudice à 68 millions de francs français.

33. En ce qui concerne les aménagements terminaux, suite à la remarque mentionnée au paragraphe 16, les bailleurs de fonds ont décidé (Paris Mai 1983) de ne réaliser qu'une première tranche de 600 ha pour tester les principes de l'aménagement et l'intérêt des paysans pour le projet. Un appel d'offres international a été lancé en juillet 1983 et une seule entreprise a répondu. Les négociations avec cette entreprise, prenant en compte les travaux qui pourront être pris en charge par les paysans, ont abouti à un montant de 170.6 millions d'UM. La surveillance des travaux, bien que n'ayant pas été prévue au départ, a été confiée par extension du contrat à l'ingénieur conseil responsable de la surveillance des travaux des lots B et C.

34. A la fin de la campagne 1985, les résultats obtenus sur les 600 ha aménagés ont été jugés concluants, un appel d'offre d'étude d'avant projet détaillé sur le reste de la superficie de la phase 1 (1.400 ha) a été lancé. Cette étude a permis de lancer en Janvier 1986 un appel d'offre internationale pour la réalisation des travaux. Une entreprise chinoise a remporté le marché pour un montant de 594 millions d'UM. Pour la première fois, le montant a été inférieure à l'estimation (650 millions d'UM). Un bureau d'étude Luxembourgeois a été retenu pour assurer la surveillance des travaux (40 millions d'UM). Le chantier a démarré au mois de février 1987 et il est prévu de réaliser les travaux en 19 mois.

35. Le tableau 3 donne l'évolution des superficies aménagées, exploitées (mises en valeur) et programmées. Il apparaît que les principaux retards ont été enregistrés pour la réalisation des ouvrages secondaires (2 ans) et surtout des ouvrages tertiaires (près de 4 ans). Ceci est dû essentiellement à un manque de précision dans les études de base. Ce manque de précision a eu deux conséquences majeures sur le projet, la première c'est qu'il était impossible d'exécuter les travaux sans d'autres études complémentaires, la seconde et la plus importante c'est qu'elle a fortement sous estimé le coût du projet et donc elle a basé le processus de négociation du prêt sur des valeurs erronées.

Project Costs

36. Table 3 gives actual project costs up to 31 December 1986 compared with appraisal estimates. The original cost estimate for the whole area (3,600 ha) to be developed during 1980-86 was UM4,197 million (in 1980 prices). The actual cost during 1981-86 for developing an area only one sixth as big (600 ha) was, however, around UM4,000 million (in current prices). Expressed in terms of 1987 prices, investment costs for the 600 ha developed during 1985-86 was about UM 5,200 million. With additional investment during 1987-89 (1,400 ha) and 1898-93 (1,600 ha), the total cost is estimated at about UM8,000 (US\$110 million at the 1987 rate of exchange). Costs per hectare would thus exceed US\$30,000.

37. The major reasons for the cost overruns which led to the project targets being reduced were:

- long delays before effectiveness of the credits;
- abandonment of force account construction (which was underestimated anyway) in favour of contracting out;
- under-estimation at appraisal of the requirements of farm machinery and staff; and perhaps most importantly
- substantial increases in quantities, which had initially been calculated on designs based on preliminary data.

38. After the project was scaled down, the cost was reduced to US\$78.8 million. The strengthening of the US dollar against all other currencies used in the project further lowered to US\$71.6 million. Finally, a reduction due to advancing completion by one year brought down the cost to US\$70.0 million. Subsequently an increase occurred in the cost due to settlement of a disputed contractors' claim of US\$7.4 million. The last estimate made in 1987 for the total of the revised project (2000 ha) remained at US\$93.2 million.

Niveau de réalisation de chaque composante

39. Les différentes composantes du projet ont été réalisées à des degrés différents compte tenu des diverses changements qui ont été apportés au contenu et à la dimension du projet. Le niveau actuel de réalisation est le suivant:

- Le barrage a été entièrement réalisé conformément aux spécifications initiales. La réception définitive n'a pas encore été prononcée. Des défauts ont été observés sur la ventellerie (potence au dessus de la cheminée d'équilibre, vanne secteur d'alimentation

du canal d'irrigation).

- Le réseau de canaux principaux a été réalisé conformément aux objectifs du projet révisé. Les caractéristiques sont les suivantes:

<u>Canal</u>	<u>Superficie dominée</u> (ha)	<u>Tête morte réalisée</u> (km)	<u>Longueur prévue</u> (km)	<u>Longueur réalisée</u> (km)	<u>Débit en tête</u> (m3/s)
P1*	1.145	1.9	10.4	9.0	3.1 P2
2.746	3.1	18.0	12.0		7.3

* Le canal P1 traverse le Gorgol par un pont canal de 60 m de portée divisée en 5 travées.

- Le réseau de canaux secondaires n'a été réalisé qu'en partie; sur les 36 canaux prévus 3 ont été entièrement réalisés, 19 ont été uniquement remblayés et 13 n'ont pas été entamés. Cela correspond à un linéaire de 9 km réalisés, 60 km entamés et 20.5 non entamés. Ces derniers correspondent à la partie du périmètre abandonnée lors de la révision du projet.
- Le réseau de canaux tertiaires, les aménagements des sols et les aménagements terminaux n'ont été réalisés que sur une superficie de 600 ha correspondant aux secteurs S9, S10, S18 et S 27. Les travaux sur les 1.400 ha restants de la phase I du projet Gorgol viennent d'être commencés. Il est prévu de les terminer à fin 1988.
- Le réseau de drainage extérieur canalisant les eaux sauvages qui proviennent des bassins versants limitrophes a été réalisé sur presque la totalité du périmètre (15 km sur 18.5). Ce réseau est nécessaire pour protéger les canaux principaux et l'aménagement interne. Certains passages prévus initialement en siphon ont été changés en aqueduc ou en dalot (la solution dalot s'est avérée non efficace compte tenu de l'imprécision sur les données hydrologiques des bassins versants).
- Le réseau de drainage secondaire a été réalisé sur la totalité de la superficie de la phase I (2.000 ha) soit 70 km. Il reste les 35.5 km de la phase II. Le réseau de drainage tertiaire n'a été réalisé par contre que sur la superficie aménagée (600 ha).
- Le réseau de pistes principales a été entièrement réalisé tout au long des canaux primaires existants (40 km). Le réseau secondaire par contre ne concerne que la partie aménagée pour l'irrigation (7 km sur 149 km).
- Settlement and agricultural development were delayed by slow delivery of irrigation facilities, and the decision by donors to assess the agricultural development on the first tranche of 600 ha before continuing with further downstream development. However, by the second season of irrigated rice cultivation over 550 ha (discounting the first pilot or demonstration season in 1984 in which 46 ha were cultivated) an average yield of 4.6 t/ha was obtained for wet season rice which was slightly above appraisal expectations.

Disbursements and Financial Sources

40. The project was financed by nine external financiers and the Government. Cost overruns and the redesign of the project necessitated changes in financing. After Lybia's default in 1984 (for UM280 million) other donors had to increase their shares. As of end 1986, the project cost was still within the sum fixed initially but its scope was substantially reduced:

<u>Donor <1></u>	<u>Financing Plan 1980</u>	<u>Actual Financing (End 1986)</u>
	(UM million).....	
IDA	675	807.35
FIDA	450	292.86
BID	270	348.46
FED	733.5	802.95
FAC	243	200.98
KFW	360	532.92
ADF	288	) 360.92
Lybia	450	)
FSD	450	457.30
Government	274.5	153.83
TOTAL	4,194.0	3,957.57

<1> See list of acronyms at the beginning of the report.

41. Details of the financing plan by donor and sub-component at time of appraisal and the last quarter of 1986 are given in Tables 4 and 5 respectively. The phasing of the disbursements as conceived at appraisal and actual disbursements are compared in Table 6. As would be expected, on account of the delays in effectiveness and implementation of the project and changes in its components, the disbursements started late and did not follow the pattern expected.

42. Delays in disbursement seriously threatened the start-up of the project. Subsequent delays were caused by difficulties in implementing the project and revisions thereof, rather than by delays in disbursements, although some minor hold-ups were caused by Government's failure to make deposits in the Project Operating Account. The default of the Libyan Government and the refusal of BID to finance local costs despite its earlier commitment were, as described before, major causes of delay in the project's execution.

IV. INSTITUTIONAL PERFORMANCE AND DEVELOPMENT

43. La création de la Direction du Projet Gorgol basée à Foug Gleita était une des conditions de l'accord de prêt.

La DPG SONADER

44. La Direction du Projet Gorgol (DPG) dépendant de la SONADER est un organisme jouissant de l'autonomie de gestion et de l'autonomie financière. Elle a été créée pour assurer le suivi de la réalisation du projet et de sa mise en exploitation (pour l'organisation voir rapport d'achèvement développement agricole).

La surveillance des travaux

45. En ce qui concerne l'exécution des travaux, la DPG a mis en place un service travaux dirigé par un Ingénieur Génie civil mauritanien et comprenant deux agents de contrôle des travaux et une brigade topographique. Nous avons pu constater que l'équipe actuelle a bénéficié d'une bonne formation sur le "tas" compte tenu de l'importance et de la diversité des travaux déjà réalisés. Il est probable qu'avec l'expérience de la dernière tranche de la phase I (aménagement 1.400 ha), les homologues mauritaniens pourront prendre en charge entièrement en grande partie la surveillance des travaux futurs.

La gestion des réseaux

46. Dans le domaine de la maîtrise de l'eau et de sa gestion rationnelle, le projet n'a pas atteint ses objectifs pour diverses raisons. La principale est que le périmètre n'étant pas encore entièrement aménagé, les ressources en eau n'ont pas constitué durant les dernières campagnes agricoles une contrainte de gestion. Les disponibilités en eau dans le barrage dépassant largement les besoins des 600 ha irrigués (300 m3 contre 30), la tendance dans la distribution a été le gaspillage. Bien que les responsables de la gestion aient cherché à rationaliser la distribution, cette tendance leur a été imposée par les difficultés qu'ils ont eu à maîtriser les débits dans le réseau et à faire respecter un calendrier d'irrigation. Quelques améliorations ont été amenées après deux années de tâtonnement.

47. Actuellement l'organisation de la gestion est faite en fonction de la demande des agriculteurs et non pas des besoins des cultures. Le mode de régulation du débit retenu par les concepteurs du projet étant la régulation par l'amont, tous les refus de débit par les paysans s'en vont vers le réseau de drainage et donc c'est des pertes pour le périmètre. L'analyse de débits moyens mensuels au niveau des canaux pour l'année 1986 montre bien qu'il n'y a pas eu d'adaptation du débit en fonction des besoins saisonniers des cultures (voir tableau 4). Le volume mensuel oscille autour d'une valeur presque constante de 5 millions de m3 par mois. Sur le même tableau 4 on a représenté les volumes distribués par secteur. Le volume moyen par hectare délivré durant la campagne 1986 est de 63.430 m3 soit plus du double des besoins réels. On ne peut incriminer pour cela les paysans sachant que quand ils ont rejoint le périmètre ils ignoraient tout de l'agriculture irriguée. En réalité le personnel affecté à cette tâche est insuffisant, très peu formé pour ce genre d'activité et se trouve débordé par la multitude des petits défauts constatés sur le calage des ouvrages.

48. Des tentatives avaient été faites pour réduire de moitié le débit de nuit afin d'économiser l'eau, mais elles n'ont pas abouti à cause du nombre de manipulations des vannes que cela nécessitait et des fortes variations de niveau d'eau dans les canaux engendrant des détériorations des talus. Il faut absolument que les paysans acceptent d'irriguer durant au moins une certaine partie de la nuit pour ajuster les volumes affluents aux besoins.

Entretien des ouvrages

49. Malgré la "jeunesse" relative du périmètre, les problèmes d'entretien qui ont surgi à la mise en service sont importants. On ne peut imputer cela à la qualité des travaux réalisés par l'entreprise qui, malgré les conditions et les difficultés qu'elle a eu, a fourni un travail louable (surtout dans le cas d'un réseau en terre), mais uniquement aux normes de

dimensionnement restrictives dans certains cas (pentes des talus des canaux) et imprécises dans d'autres (dalots de traversée de canaux). Les solutions qui ont été introduites par la Direction du projet Gorgol sont originales et inspirées des moyens locaux existants sur place (affleurements schisteux des monts Oua-Oua, main-d'oeuvre disponible dans cadre projet "vivre contre travail"). L'équipe actuelle qui s'occupe de l'entretien est assez dynamique et réalise un travail remarquable malgré les moyens matériels limités (surtout en véhicules).

50. L'entretien est organisé de différentes manières selon le type d'ouvrage.

- i) Au niveau du barrage, l'entretien consiste à vérifier et à s'assurer le bon fonctionnement du matériel hydro ou électromécanique installé. L'hydromécanicien et l'électricien de la base vie affectés à cette tâche, à temps partiel, disposent d'une check-liste définissant les différentes consignes d'entretien du matériel. Ce travail est réalisé une fois par semaine. En outre le contrôle de la stabilité du barrage se fait par le relevé systématique d'un certain nombre d'observations sur des appareils placés sur le corps de l'ouvrage. L'interprétation des premières campagnes de mesures a été confiée dernièrement à l'ingénieur Conseil qui était chargé de la surveillance des travaux.
- ii) Au niveau du canal d'amenée et des canaux primaires, le service d'entretien est en train d'assurer une protection totale des talus intérieurs et extérieurs de ces canaux. Les talus intérieurs s'affaissent et se détériorent à cause de l'action des vagues, du batillage et des animaux qui viennent s'abreuver. La protection consiste à enfoncer dans les berges des plaques de schiste dans la zone d'action du remous, en particulier là où la mise en vitesse des lignes de courant est forte (zones courbes du canal). Les talus extérieurs et la crête sont détériorés par les ruissellements de l'eau de pluie qui provoque des ravinements profonds. La protection consiste à remplir les cavités avec la terre humide et à couvrir la crête et les talus par du matériaux schisteux broyé et damé.
- iii) Au niveau de la jonction des parties en terre avec les zones revêtus en béton il se produit des affouillements dus en général au dimensionnement insuffisant du bassin de dissipation et à l'utilisation de ces zones par les personnes voulant se laver ou puiser l'eau. La protection consiste à prolonger la partie revêtue par des gabions.
- iv) Au niveau du périmètre et après la période d'hivernage, une série d'opérations doivent être systématiquement réalisées:
 - désherbage et curage des canaux primaires en particulier les tronçons où les vitesses sont très faibles;
 - curages des ouvrages de traversées (dalots);
 - confortement des talus extérieurs des canaux et des talus intérieurs des drains;
 - curage des drains secondaires et parfois de certains tertiaires;

- reprofilage des pistes.

Extension Services

51. The Extension Services have been remarkably effective in that they were able to train settlers, who had very little previous knowledge of farming, in modern techniques of rice cultivation over two or three cultivation seasons. However, they have not been very efficient because the ratio of extension workers to farmers has been excessively high (1 extension worker per 96 farmers at present). Furthermore, extension workers lack basic training and only the highly motivated performance of the extension officers in charge and the possibility of conveying the technical recommendations in small, easily remembered instalments under the "Training and Visit" system permitted such good results to be obtained.

Technical Assistance

52. Technical assistance envisaged at appraisal included 113 man months for supervision of the construction and 546 man months for implementing the project. Some adjustments were made (eg. shortening of the contract of the Technical Director and increasing consultancy services to cover supervision of tertiary networks formerly expected to be done by force account) in view of revisions of project plans.

53. Performance of technical assistance personnel has ranged from excellent to mediocre, but on the whole the jobs got done. However, as might be expected from the number of expatriates involved, some resistance to further inputs of technical assistance has arisen from staff of the GPD and of SONADER generally. This "technical assistance fatigue" would need to be taken into account in future project preparation exercises involving SONADER.

Procurement

54. SONADER'S experience with a number of projects had led to the establishment of effective procurement procedures and no major difficulties were encountered in meeting the Bank's guidelines for procurement.

Training

55. No specific provision was made for training under this project, but on-the-job training was provided for extension agents, irrigators and farmers.

Accounting and Reporting

56. The GPD has maintained project accounts satisfactorily as required under the DCA. Reporting on physical and financial progress also appeared to be adequate.

Agricultural Inputs, Credit and Marketing

57. Agricultural inputs were distributed free of charge during the first major cultivation season (1985 wet season). It was only in 1986 that inputs (mainly fertilizer and seed) were given on interest-free credit. The credit was recovered in kind and, by the end of 1986, the rate of recovery stood at 76.7%. All input supply and credit sources have been provided to farmers by GPD.

58. Fertilizers were purchased from private dealers who delivered them to the project site, but usually with considerable delays. It was only the fact that the actual demand had been over estimated in 1985 and left-over stocks could thus be utilized in 1986 when deliveries were delayed, that saved the situation. The same sequence of events was repeated next year.

59. Treated seeds of good quality have been available from the Centre Semencier at Kaédi, but farmers tended to revert to seed from local sources or repeatedly used their own seed unless a strict check was kept on them.

60. Market outlets for surplus cereals (mainly rice) have been less than satisfactory. Although the Comité de sécurité alimentaire (CSA) theoretically buys the grain at an attractive guaranteed price, its buyers are not usually present when the farmers want to sell (generally soon after harvest) and farmers are compelled to sell at much lower prices (eg. UM 10 to 12 per kg for rice vs UM 18.5 kg paid by CSA). Nor has the CSA adequate financial resources to buy sufficient quantities to have a significant impact on the prices offered by the private trade.

Prices

61. Financial prices of both agricultural products and inputs were considerably higher in 1987 than at the time of appraisal. This was partly due to increasing world prices but more due to Government actions in increasing the guaranteed prices of cereals and removing subsidies on fertilizers. The economic prices of cereals have, however, gone down slightly in comparison with those in the SAR and economic prices of inputs have gone up (Table 7).

Farmers' Organisations

62. The establishment and development of farmers' organisations was not among the original project proposals contained in the SAR. However, on the GPD'S own initiative, ten voluntary farmers' organisations or Groupements précoopératifs (GPCs), each comprising 50 to 100 members were set up, thus covering about two thirds of the families settled so far.

63. In fact, the most obvious way in which SONADER and GPD could disengage themselves from activities like input distribution and maintenance of tertiary canals and drains and involve the beneficiaries in the construction of social infrastructure is to promote the take-over of these functions by GPCs. Considerable progress has been made in this direction.

64. However, one of the drawbacks encountered is that people from the same village and ethnic group have not been settled in common irrigation turn-outs while GPCs have been formed along village and ethnic lines. Thus, GPCs often cut across irrigation areas and this makes it difficult to organise canal and drain maintenance operations through them.

Covenants

65. In general, the covenants contained in the Development Credit Agreement (DCA) and Project Agreement (PA), have been complied with by the borrower. Some revisions in the legal covenants of the DCA and PA were proposed to the co-financiers meeting in Paris in 1983 but no definitive legal document is available concerning these changes. A few temporary snags in borrower compliance that occurred were:

- failure to deposit the required sums of money in the project operating account in a timely manner (PA Section 4.01 b) ; in some instances SONADER Head Office retained the funds without passing them on to the GPD;
- delays in furnishing financial statements of project accounts and auditors' reports (PA Section 4.03 a, ii).

However, no important delays occurred in the actual implementation of the project as a result of these lapses.

V. AGRICULTURAL IMPACT AND ECONOMIC RE-EVALUATION

A. Impact on Agricultural Production

Yields

66. The yields projected in the SAR are compared on an annual basis with those actually obtained, in Table 9. In the case of rice, the yields obtained in 1986, admittedly over a limited area, already exceed appraisal predictions marginally in the wet season (4.7 t/ha actual vs 4.5 t/ha predicted), but fall short in the dry season (2.8 t/ha actual vs 4.5 t/ha predicted). Yields of maize and sorghum have been highly variable on the small extents grown and are nowhere near appraisal expectations.

67. Although the average yield levels of paddy are very satisfactory, examination of yields obtained by individual farmers shows a sizeable proportion of them getting very low yields of the order of 1-2 tons/ha, indicating that there is potential for further improvement.

68. Areas and Cropping Intensities. Areas cropped are also below appraisal estimates mainly due to delays in project implementation. Even the revised targets have not been met as shown by the following table:

	<u>Area Cultivated (ha)</u>							
	<u>..1983..</u>		<u>..1984...</u>		<u>.....1985.....</u>		<u>.....1986.....</u>	
	DS	WS	DS	WS	DS	WS	DS	WS
Appraisal <1>	400	400	736	1,200	1,076	2,000	1,432	2,800
Revised (1982)	-	-	-	580	290	980	490	1,360
Actual	-	-	-	46	110	505	320	550

<1> Includes areas originally meant to be cultivated by the Project Authority.
Note: DS = Dry Season WS = Wet Season

Most of the farmers cultivated rice. Sorghum and maize were grown in small extents and vegetables, which were expected to contribute significantly to farm incomes, were not grown at all. This may be partly due to the almost exclusive concentration of the extension services on rice. Cultivation intensities rose from 1.1 in 1985, the first full year of cultivation to 1.6 in 1986.

Crop Production

69. Crop production levels envisaged at appraisal and actually achieved up to the end of 1986 are shown in Table 9. Production of paddy in 1986 was 22% of appraisal estimates. Once again this reflects mainly, in the case of paddy at least, the delayed delivery of irrigated land to farmers. Paddy production actually rose from 130 tons in 1984 (over 46 ha) to 1,600 tons in 1985 and 3,150 tons in 1986. On a pro-rata basis, the production in 1986 represents, for 550 ha, more or less the rice production level at full development envisaged in the original appraisal estimate.

70. As would be expected from the small extents cultivated with maize and sorghum and the mediocre results obtained, the production of these crops are well below appraisal projections.

Use of Farm Inputs

71. Since no records have been maintained on the use of farm inputs in the project area, an accurate assessment cannot be made. In the first year of cultivation fertilizer was given free of charge, while in the second year it was given on interest-free credit although it was agreed during negotiations that a 12% interest rate would be charged. The recovery was combined with the recovery of water charges. It is not clear whether the general resentment shown by farmers to the recovery applied only to water charges or whether they had also assumed that the fertilizer was free once again.

Farm Level Impact

72. Table 10 shows representative summary farm budgets for the cultivation year 1986. When compared with appraisal projections (SAR, Annex 2, Table 6), farmers, especially rice farmers, appear to be already doing much better than was expected in terms of the net value of production. The main reason for this appears to be the considerably higher cereal prices in 1986 as compared with those that prevailed at the time of appraisal. Since 1986 was only the second full year of cultivation, even better results could be expected at full development when farmers have improved their skills further and yields have correspondingly increased.

Cost Recovery

73. It was envisaged at appraisal that project O&M costs would be recovered by the imposition of water charges on farmers. The raising of water charges to include the recovery of capital costs was thought to be inadvisable, given the already high rent recovery index. Accordingly, at negotiations it was agreed that SONADER would collect water charges amounting to UM12,000/ha/year.

74. No water charges were in fact collected during the first full year of cultivation on account of the relatively low yields obtained by farmers. In the second year (1986), water charges were fixed at UM10,000/ha/year.

B. Economic Re-evaluation

75. This economic re-evaluation has been undertaken, with appropriate projections, for the end-case in which the whole project area has been developed, as it is not possible to realistically apportion costs and benefits for the area presently developed. The analysis has been carried out in 1987 prices, with past expenditures converted to 1987 prices by using the GDP deflator.

76. Actual costs during 1981-86 were converted to economic prices by adjusting the local cost portion with the standard conversion factor (SCF) of .867. Actual shares of local costs during 1981-86 were not available and the values from the SAR were used. Investment costs during 1987-89 for 1,400 ha were estimated from the contract with the construction company. Projected costs for 1989-93 period for the last 1,600 ha (2nd phase of the project) were taken directly from the relevant preparation document <1> No adjustments were made for taxes and duties since the project is exempted from all identifiable fiscal obligations.

77. Delays in project implementation influenced the flow of benefits which are substantially behind schedule. In 1986, paddy was cropped on only 792 ha (21% of original projections) and sorghum/maize on only 25 ha (6% of original projections):

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	At full develop.
	(UM million).....								
Projected econom. benefits (SAR)	0	23.5	72.2	149.0	238.5	332.5	440.2	481.0	485.2
Actual econom. benefits	0	0	-0.87	12.3	26.4	37.8	50.2	59.3	321.6

78. Financial prices of crops and inputs have increased between appraisal time and the present (Table 7). Economic prices of crops, however, have been reduced due to a fall in the world price of rice (-51% during 1980-87 in current US\$) and maize (-42%). These movements and the lag in benefits flow are bound to reduce project profitability.

79. Benefits have been identified for each of the cost sub-periods. Benefits from investments in the first 550 ha (1981-86 period) have been estimated by using actual output of paddy and sorgho/maize (Table 11). To obtain the economic benefits, this output was priced at actual world prices and actual exchange rates (Table 12). From 1987, production on this surface was projected at 1987 prices and exchange rates. Benefits from 1,400 ha (Table 13) were estimated by using the Farm Model 3 (paddy-maize-vegetables-forage) which is expected to be practised on these areas. Only 70% of these benefits were taken into account, and 30% were imputed to the influence of the second phase of the project. These latter benefits from 1,600 ha were taken directly from the Gorgol Noir 2 Project Preparation Report <2> .

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- <1> Mauritania: Gorgol Noir Porject - Second Phase. Project Brief and Working Papers 1-5, Report No.: 101/87 CP-MAU 18 PB (E) (1987). Investment Centre, FAO, Rome.
- <2> See Mauritania: Gorgol Noir Irrigation Project - Second Phase. Project Brief (id.)

80. In addition to these three types of benefits, corresponding to separate investment stages, benefits from fishing (Table 13) and flood recession crop production (Table 14) were also taken into account. It was assumed that because of the project, incremental production of sorgho and millet have developed around the lake. Part of this production, attributed to better extension services, use of fertilizer and improved seeds, has been identified under the benefits of the 1,600 ha. The rest, related solely to the fact that the lake has created conditions for flood-recession production, is considered an additional benefit of the whole project and is counted as such for the PCR.

81. Projected incremental economic benefits thus increase from UM12.3 million in 1985 and reach UM321.6 million at full development. Incremental benefits for 1984 are negative because output forgone from traditional crops has had higher value than the irrigated production attained during 1984, when only 49 ha of paddy and 110 ha of sorghum and maize were cropped.

82. Economic analysis based on the above assumptions shows (Table 16) that the estimated ERR for the whole project, extending from 1981 to 2019, is 0% as compared with the appraisal estimate of 7.4%.

	ERR (%).....	
	<u>SAR</u>	<u>PCR</u>
Base	7.4	0.0
Increase in benefits 10%	n.a	0.55 <2>
Increase in costs 10% <1>	6.6.	-0.25 <2>
Simultaneous increase in) benefits and reduction) in costs by 10%	n.a.	0.78 <2>

<1> In SAR, a reduction of benefits of 10% was assumed.

<2> Changes in benefits (costs) after 1987.

83. In spite of its reduced profitability the project has not resulted in a net loss for the economy. Future improvements in institutional arrangements (improved efficiency of SONADER, liberalisation of cereals marketing, provision of credit) could increase benefits or reduce costs beyond those expected at present. There is also considerable uncertainty over future changes of paddy prices and exchange rate movements. If prices of cereals increase in real terms over the next 10-15 years, benefits of the project would be considerably increased. If past trends continue, there is also the likelihood that the Mauritanian currency (ouguiya-UM) will depreciate vis-à-vis major convertible currencies. All these factors could improve the justification of the project and make its contribution to the national economy positive.

VI. BANK PERFORMANCE

Overall Performance

84. Although delays in implementation have plagued the project, Government's major objectives in launching the project viz. (i) to reduce the country's dependence on food aid, and (ii) to provide a steady income to farmers to meet their basic needs are well on the way to achievement. As the first major irrigation scheme in Mauritania, certain intrinsic risks were foreseen by the Bank and efforts made to reduce them. Thus, through a long and arduous process of preparation, numerous adjustments were made to arrive at the technical solution finally chosen, and an efficient implementing institution (SONADER) was built up.

85. The risks that appeared most prominent at appraisal were:

- the high cost of, and lack of experience with, the execution of major works by force account and/or through contracts in Mauritania; these were counteracted by pre-selecting bidders, obtaining firm contract prices, allowing a margin for uncertainty in bid proposals and having strong technical supervision;
- possible shortfalls in projected yields resulting from the difficulty of converting semi-nomadic rainfed farmers to settled, irrigation farmers practising double cropping.

86. In fact, the major problems that hampered the execution of the project as planned were (a) legal problems involving the DCA and PA and their interpretation by other donors and by the Government, (b) the use of inadequately detailed, preliminary data in preparing the designs for the tertiary systems resulting in high cost overruns and long delays from the additional time required to generate more detailed basic data and (c) the difficulties of co-ordinating disbursements among ten different financing sources (one of whom, pulled out).

87. Although, in retrospect, the Bank has to take some of the blame for items (a) and (b) above, a striking feature of project implementation has been the strong co-ordination and rapport between the Bank and the executing agency which led to effective solutions being worked out as problems arose in the course of execution.

88. The Bank did an excellent job in identifying implementation problems at an early stage and taking resolute action to revise project targets to more realistic levels and to re-design the settlement and agricultural development components. The Bank was also able to co-ordinate the activities of the donors effectively and arrive, after some initial difficulties, at a satisfactory disbursement routine.

Supervision

89. The Bank supervised the project adequately, fielding nine supervision missions. However there were long intervals without supervision missions (1982, 1985-86), although supplementary missions were active during one of these periods. Mission composition was technically strong and good staff continuity was maintained (see Basic Data Sheet).

90. Although corrective action was taken to revise the project before matters came to a head, there is no record of the reformulation having received broad approval. Neither does any attempt seem to have been made to assess the impact of the revisions proposed on the economic rate of return of the project.

VII. CONCLUSIONS AND LESSONS LEARNED

91. It is too early to make final judgements on the successes and failures of the project as a whole. First, although the Bank's share of the loan has been disbursed, project investments are still continuing from funds provided by the other donors. Secondly, the relegation of part of the original project objectives to a second phase (presently being prepared) in which first phase investments are regarded as sunk costs, and thirdly, the yet incomplete state of the first phase, make it difficult to do more than make a provisional economic re-evaluation of the project.

92. Nevertheless, despite an apparent shortfall in the ultimate project ERR in comparison to original appraisal expectations, the major objectives of reducing the country's dependence on food imports and ensuring an adequate income to settler-farmers are certainly likely to be achieved. Furthermore, much valuable experience was gained in implementing what is really the first major irrigation project in Mauritania, with probable benefit to future projects to be taken up for implementation under the "Après-barrage" master plan for development of the Senegal River Valley. As discussed exhaustively in the course of pre-appraisal, Mauritania lacks investment opportunities, especially in the Southern Region in which the project is sited, and the 0.0% economic rate of return has to be viewed in this light.

93. The lessons to be learned from the project are as follows:

- It is absolutely essential for irrigation projects in Mauritania to have final designs, based on accurate base data, on which project costs could be estimated and construction scheduled before pre-appraisal if not at preparation;
- A large number of donor agencies is best avoided, but if unavoidable, firm commitments and financing schedules for each donor should be agreed to before final negotiations. Dependence on unreliable or marginal donors for financing key components of the project should also be avoided. A project co-ordination unit specifically charged with monitoring disbursements should bring problems encountered to the notice of the relevant donors without delay and call a meeting of donors, if necessary.
- A legal officer should be assigned to spot potential legal problems especially those lying in the critical path of the project, long before they occur.
- It is necessary that irrigation projects in Mauritania should be monitored and course corrections made as frequently as needed by a strong team of Bank supervising staff, as was the case in the Gorgol Irrigation Project.

MAURITANIA

Projet Du Gorgol

(Credit - 1068 MAU)

GROSS DOMESTIC PRODUCT BY SECTOR OF ORIGIN, 1973-83

In Constant 1982 Prices (million Ouguiya)

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Primary Sector	10,472	10,437	8,785	9,015	9,537	9,271	9,440	10,527	11,466	11,656	13,414
Agriculture, Forestry	1,157	1,136	1,056	1,005	1,073	981	1,267	1,608	1,335	1,147	848
Livestock	7,695	8,064	7,005	7,258	7,608	7,935	8,011	8,200	8,541	8,768	9,357
Fishing	1,620	1,237	890	752	856	355	162	719	1,590	1,741	3,207
Secondary Sector	7,665	8,843	7,989	8,929	7,944	8,295	9,177	8,580	8,576	8,228	7,752
Mining	5,103	5,858	4,558	4,947	3,845	3,768	4,637	4,338	4,377	3,550	3,841
Fish processing	234	300	419	296	318	436	459	483	508	535	562
Other Industry and Handicrafts	873	1,031	1,019	1,073	1,207	1,165	1,321	1,284	1,297	1,255	1,288
Construction, Public Works	1,455	1,654	1,993	2,613	2,584	2,926	2,760	2,475	2,394	2,888	2,061
Tertiary Sector	10,595	11,493	13,100	14,264	14,823	15,126	15,259	16,740	16,529	15,316	15,936
Transport and Communications	2,165	2,014	1,971	2,496	2,697	2,772	2,870	2,962	2,904	3,035	3,293
Trade and Other Non-Government	5,145	5,815	6,670	6,609	6,730	7,930	7,771	8,618	8,176	6,687	6,634
Government Services	3,285	3,664	4,459	5,159	5,396	4,424	4,618	5,160	5,449	5,594	6,009
GDP at Factor Cost	28,732	30,773	29,874	32,208	32,304	32,692	33,876	35,847	36,571	35,200	37,102
Indirect taxes net of subsidies	3,097	4,347	3,179	3,486	3,008	2,449	2,823	2,416	3,121	3,637	4,299
GDP at Constant 1982 Market Prices	31,829	35,120	33,053	35,694	35,312	35,141	36,699	38,263	39,692	38,837	41,401
Annual Growth Rate		10.3	-5.8	8.0	-1.0	-1.4	4.4	1.5	3.7	-2.2	6.6

Source: Direction de la Statistique, Central Bank of Mauritania, IMF and Bank staff estimates.

MAURITANIEPROJET IRRIGATION GORGOL NOIR IRAPPORT D'ACHEVEMENT COMPOSANTE IRRIGATIONPROGRAMME DES TRAVAUX APRES LA REEVALUATION 1982 (OBJECTIF ET REALISATION)

<u>Lot</u>	<u>Désignation</u>	<u>Evaluation</u> (1980)	<u>Réévaluation</u> (1982)	<u>Réalisation</u> (1987)
A.	Barrage	Aucun changement		
B.	Ouvrages principaux			
	Canal d'amenée	3.5 km	3.5	3.5
	Canal primaire P1	12.3 km	10.9	10.9
	Canal primaire P2	21.1 km	15.1	15.1
	Drains principaux	18.5 km	15.0	15.0
	Pistes principales	40 km	40	40.0
C.	Réseau secondaires			
	Canaux d'irrigation	90	69	69*
	Canaux drainage	105.5	70	70
	Réseau de pistes	149	85	7
				600
D.	Réseau tertiaire et aménagement des sols	3.600 ha	2.000	
E.	Rizerie	oui	non	non

* dont 60 km seulement remblayés

MAURITANIA

GORGOL IRRIGATION PROJECT - PROJECT COMPLETION REPORT

Actual Project costs 1981-1986 (in UM million)

Compared with Appraisal Estimates

	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>Total</u> <u>1986</u>	<u>1981-86</u>
1. <u>Construction</u>								
Dam (lot A)	-	209.6	315.2	380.9	31.7	-	254.8	
Primary canals (lot B)	-	78.4	303.4	299.7	103.2	-	207.9	
Secondary canals (lot C)	-	0.8	266.3	201.0	50.4	-	137.3	
Tertiary canals (lot D)	-	-	4.3	11.5	171.3	15.9	97.9	
Social infrastructure	-	25.9	23.6	-	18.6	10.9	9.0	
<u>Total construction</u>		<u>314.7</u>	<u>912.8</u>	<u>893.1</u>	<u>375.2</u>	<u>26.8</u>	<u>706.9</u>	<u>3,229.5</u>
(Appraisal estimate)	(423.3)	(908.3)	(1142.4)	(140.5)	(121.5)	(124.1)	(104.6)	(2,964.7)
2. <u>Materials and equipment</u>			<u>11.6</u>	<u>15.3</u>	<u>7.9</u>	<u>3.4</u>	<u>4.4</u>	<u>42.6</u>
(Appraisal estimate)	(15)	(28.5)	(99.4)	(62.7)	(40.2)	(44.5)	(22.3)	(299.1)
3. <u>Supervision of works</u>								
Lot A - expatriates		27.4	55.7	38.6	11.1	-	1.8	
- local		-	-	3.3	5.8	-	-	
Lots B and C - expatriates		11.8	34.1	27.0	7.7	-	-	
- local		-	-	7.1	3.8	-	-	
Lot D - expatriates		-	-	-	22.3	5.2	2.9	
<u>Total supervision</u>		<u>39.2</u>	<u>89.8</u>	<u>76.0</u>	<u>50.7</u>	<u>5.2</u>	<u>4.7</u>	<u>265.6</u>
(Appraisal estimate)	(9.4)	(36.3)	(36.6)	(7.5)	-	-	-	(87.8)
4. <u>Total investment (1+2+3)</u>		<u>353.9</u>	<u>1014.2</u>	<u>984.4</u>	<u>433.8</u>	<u>35.4</u>	<u>716.0</u>	<u>3,537.7</u>
5. <u>Operating and maintenance costs</u>								
Technical assistance		14.3	18.5	51.6	17.4	28.7	29.5	
General operations		9.2	21.7	32.4	83.9	80.7	55.9	
Food for work		-	-	-	10.3	5.1	5.9	
Total O and M cost		<u>23.5</u>	<u>39.9</u>	<u>84.0</u>	<u>111.6</u>	<u>114.5</u>	<u>91.0</u>	<u>464.5</u>
(Appraisal estimate)	(26.0)	(23.5)	(50.4)	(93.1)	(173.6)	(217.7)	(261.2)	(822.9)
6. <u>Total project costs</u>		<u>377.4</u>	<u>1054.1</u>	<u>1068.4</u>	<u>545.4</u>	<u>149.9</u>	<u>807.0</u>	<u>4,002.2</u>
(4 + 5)								
(Appraisal estimates)	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1981-86</u>
	460.2	994.6	1,328.8	303.8	335.4	386.1	388.1	4,197.0

Source: SONADER, annual reports

MAURITANIA
PROJET DU GORGOL
PLAN DE FINANCEMENT AOUT 1980

(1\$ = 4,5ff)

DESIGNATION	Prévision: Août 1986	IDA	FIDA	BID	LIBYE	FSD	ADFKED	FAC	FED	KFW	Gouvernement Partenaire
1 - Barrage - Entreprise	903,8								542,3	361,5	
2 - Périmètre irrigué - Entreprise	1491,9	477,4		373,0	238,7	402,8					
3 - Périmètre irrigué - Régie	392,9	172,9	220,0								
4 - Surveillance											
Lots a) coordination + Lot A	41,2								24,7	16,5	
b) Lots B et C + Bâtiment	46,6					46,6					
5 - Bâtiment + Infrs.Sociales	258,1				183,3		74,8				
6 - Rizerie	81,9						81,9				
7 - Véhicule et équipement agricole	135,4						195,4				
8 - Salaire personnel national	146,2		42,4		17,5						86,3
9 - Assistance Technique											
8 Expatriés	282,1							282,1			
1 " "	44,1		44,1								
10 - Intrants agricole	133,4		38,7		16,0						78,7
11 - Autres Coûts de Fonctionnement	217,4		63,0		26,1						128,3
12 - Refinancement crédit S. 16	22,5	22,5									
Total en UM	4197,5	672,8	408,2	373,0	481,6	449,4	292,1	282,1	567,0	378,00	293,3
Pour Mémoire											
Révision Paris 15/17 Sept. 1981	4194	675,0	450,0	270,00	450,00	450,0	288,00	243,0	733,5	360,00	274,5

MAURITANIA

PROJET DU GORGOL

VENTILATION DES FINANCEMENTS DU PROJET AU 31/12/86

DESIGNATIONS	TOTAUX	FED	KFW	IDA	FSD	BID	ABU LIBYE DHABI	ABU DHABI	FIDA	RIM	FAC
1 Lot A Barrage	1187,29	712,77	474,52	-							
2 Surveillance Lot A Expatriés	134,50	80,00	54,50	-							
3 Surveillance Lot A Locaux	14,08	10,18	3,90	-							
4 Lot B Réseaux Principaux	992,50		-	387,41	211,85	218,32	96,33				78,59
5 Lot C Réseaux Secondaires	655,52		-	272,45	129,12	130,14	71,90				51,91
6 Surveillance Lots B et C Exp.	80,53		-	-	80,53						
7 Surveillance Lots B et C Locaux	10,85		-	-	10,85						
8 Lot D Entreprise	259,72		-	75,07	24,95			32,08	127,62		
9 Lot D Régie	57,83		-	26,35				-	31,48		
10 Surveillance Lot D Expatriés	30,29		-	13,33					16,96		
11 Assistance Technique	114,05		-	32,74					10,83		70,48
12 Bâtiments	52,89						35,15	17,74			
13 Infrastructures Sociales	35,12						12,89	22,23			
14 Matériel et Equipements	42,53							42,53			
15 Fonctionnement Général	268,63						30,07		100,28	138,28	
16 Opérations Vivres	21,24								5,69	15,55	
T O T A U X	3957,57	802,95	532,92	807,35	457,30	348,46	246,34	114,58	292,86	153,83	200,98

1°) Les rubriques 1, 2, 3, 4, 5, 6, 7, 12, sont entièrement achevées et la colonne Totaux représente leur coûts définitif

2°) Le P.A.M. a participé au financement du Projet par la fourniture sur le site du Projet de 6.357 tonnes de vivres (5.475 tonnes de sorgho, 423 tonnes de lait en poudre et 370 tonnes de beurre). Le programme global porte sur 9550 tonnes jusqu'à fin 1986.

Table 6

MAURITANIAGorgol Irrigation Project - Project Completion Report

(CR. 1068-MAU)

Review of Disbursements (US\$ million)

FY and Semester		Appraisal Estimate	Revised ^{1/} Estimate (1981)	Revised ^{1/} Estimate (1984)	Actual	Actual % of Appraisal
FY 81	1st	2.9	-	-	0.0	0.0
	2nd	4.7	-	-	0.0	0.0
FY 82	1st	6.4	2.9	-	2.0	31.5
	2nd	8.8	4.7	-	N.A.	53.4
FY 83	1st	11.2	6.4	-	4.7	42.9
	2nd	12.2	8.8	-	5.4	45.9
FY 84	1st	12.7	11.2	6.0	5.6	44.1
	2nd	13.2	12.2	7.4	6.5	49.2
FY 85	1st	13.7	12.7	9.0	7.0	51.1
	2nd	14.2	13.2	10.6	7.8	54.9
FY 86	1st	14.7	13.7	11.2	8.7	59.1
	2nd	15.0	14.2	12.8	N.A.	-
FY 87	1st	-	14.7	13.6	14.7	99.3
	2nd	-	15.0	14.3	-	-
FY 88	1st	-	-	14.8	-	-
	2nd	-	-	15.0	-	-

^{1/} Not available.

Source: SAR and Supervision Reports

Table 7

MAURITANIA
GORGOL IRRIGATION PROJECT- PROJECT COMPLETION REPORT
Financial and Economic Prices

	<u>SAR 1/</u>		<u>PCR 2/</u>	
	<u>Financial</u> <u>Prices</u>	<u>Economic</u> <u>Prices</u>	<u>Financial</u> <u>Prices</u>	<u>Economic</u> <u>Prices</u>
	----- in UM/kg -----			
<u>Crops</u>				
Paddy	10.0	16.6	18.5	14.6
Sorghum	9.0	16.1	21.0	15.4
Maize	9.0	17.2	21.0	15.4
Vegetables	5.0	5.0	12.5	12.5
<u>Inputs</u>				
Urea	18.0	21.3	24.0	25.1
TSP	14.0	18.6	24.0	26.4
<u>Seeds</u>				
Paddy	12.0	16.6	35	40

1/ Prices 1980, Staff Appraisal Report
2/ Prices 1987, Project Completion Report

MAURITANIA

PROJET DU GORGOL

Rendements - Previsions et Realisations en T/ha

Culture	1983		1984		1985		1986		1987		Plain
	Prevision	Realisation	Prevision	Realisation	Prevision*	Realisation	Prevision*	Realisation	Prevision*		Previ
1. Riz	-	-	3.0	-	4.0	-	4.5	2.8	4.5		
- SH	3.0	-	4.0	2.8	4.5	3.9	4.5	4.7	4.5		
2. Sorgho	-	-	1.5	-	2.3	-	2.7	-	3.0		
- SH	-	-	-	-	-	-	-	1.3	-		
3. Mais	-	-	2.0	2.4	3.0	-	3.5	0.3	4.0		
- SH	-	-	-	-	-	1.9	-	-	-		
4. Legumes	-	-	20	-	20	-	20	-	20		

* Revisée en 1983.

MAURITANIA

GORGOL IRRIGATION PROJECT - PROJECT COMPLETION REPORT

Projected and Actual Output of Paddy and Sorghum-Maize

		<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u> <u>onward</u>
<u>Paddy</u>									
Area cropped (ha) 1/	-P	785	1,803	2,752	3,631	4,621	4,688	4,785	4,872
	-A	-	46	408	774	792	n.a	n.a	n.a
Production (t)	-P	2,355	6,509	10,693	14,413	19,491	20,794	21,533	21,924
	-A	-	131	1,997	3,140	3,812	n.a	n.a	n.a
<u>Sorghum and maize</u>									
Area cropped (ha) 1/	-P	-	58	188	406	711	1,078	1,305	1,392
	-A	-	110	97	25	55	n.a	n.a	n.a
Production (t)	-P	-	102	433	1,076	2,100	3,519	4,463	4,872
	-A	-	262	188	33	25	n.a	n.a	n.a

1/ In both seasons: P projected -SAR A actual

MAURITANIAGorgol Irrigation Project - Project Completion ReportCompte d'exploitation Paysans en 1986

Cas d'une superficie de 0,5 ha par exploitant (sans mécanisation)

Désignation (UM):	RIZ-RIZ	RIZ-MAIS	SORGHO-MAIS	RIZ	SORGHO
Production	83.000	63.000	42.000	42.000	21.000
Engrais :					
TSP	1.200	1.200	1.200	1.200	1.200
Urée	4.800	4.200	3.600	2.400	1.800
KCL	-	1.200	2.400	-	1.200
Semences :	1.200	1.125	1.050	600	525
Travaux mécani-	-	-	-	-	-
ques					
Entretien	5.000	5.000	5.000	5.000	5.000
Total charges	12.200	12.725	13.250	9.200	9.725
Résultat	70.800	50.275	28.750	32.800	11.275
Proportion d'explo-	65%	4%	6%	22%	3%
itation					

Le résultat moyen est donc de 57.310,25 UM par ménage et par an.

Paddy	18,5 UM/kg	- 4,5 t/ha
Mais-Sorgho	21 UM/kg	- 2 t/ha

Engrais:

TPS	24 UM/kg
Urée	24 UM/kg
KCL	24 UM/kg

Semences :

Maïs	35 UM/kg
Sorgho	35 UM/kg
Paddy	30 UM/kg

Table 11

MAURITANIAGORGOL IRRIGATION PROJECT - PROJECT COMPLETION REPORTIncremental Financial Benefits from 550 ha (1st phase)

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u> <u>-2019</u>
<u>Rice</u>					
Land area (ha)	46	408	525	495	495
Cropped area (ha)	46	408	774	792	891
Production (tons)	131	1,997	3,140	3,812	4,703
Value of production (000 UM)	<u>2,424</u>	<u>39,945</u>	<u>58,090</u>	<u>70,522</u>	<u>87,006</u>
Cost per ha (UM)	<u>17,140</u>	<u>17,140</u>	<u>17,140</u>	<u>24,092</u>	<u>27,000</u>
Total costs	788	6,993	8,999	12,371	13,365
Net benefits (000 UM)	1,636	29,952	49,091	58,151	73,641
Value of production foregone ^{1/} (000 UM)	1,200	9,700	12,700	12,000	12,000
Net incremental benefits (000 UM)	<u>436</u>	<u>20,252</u>	<u>36,391</u>	<u>46,151</u>	<u>61,641</u>
<u>Sorgho-maize</u>					
Land area (ha)	110	97	25	55	55
Cropped area (ha)	110	97	25	99	99
Production (tons)	262	188	33	250	280
Value of production (000 UM)	5,502	3,948	693	5,250	5,880
Costs per ha (UM)	15,450	15,450	15,450	20,480	21,495
Total costs (000 UM)	1,700	1,500	386	1,150	1,150
Net benefits (000 UM)	3,802	2,448	307	4,100	4,730
Val. of production foregone (000 UM) ^{1/}	2,670	2,350	600	1,350	1,350
Net incremental benefits (000 UM)	<u>1,132</u>	<u>98</u>	<u>-300</u>	<u>2,750</u>	<u>3,380</u>
Total incremental net benefits (000 UM)	<u>1,568</u>	<u>20,350</u>	<u>36,091</u>	<u>48,901</u>	<u>65,021</u>

1/ 24,305/ha (traditional sorgho-millet model)

Table 12

MAURITANIAGORGOL IRRIGATION PROJECT - PROJECT COMPLETION REPORTIncremental Economic Benefits from 550 ha <1> (1st phase)

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u> <u>-2019</u>
<u>Rice</u>					
Production (tons)	131	1,997	3,140	3,812	4,703
Value of production (000 UM)	24,235	29,355.9	46,472	58,323.6	68,664
Costs of production (000 UM)	1,616	14,337	18,449	21,281	21,281
Net benefits (000 UM)	<u>807.5</u>	<u>15,018.9</u>	<u>28,023</u>	<u>37,042.6</u>	<u>47,383</u>
Value of production foregone <2> (000 UM)	81.7	724.6	932.4	879.2	879.2
Net incremental economical benefits 000 UM)	<u>725.8</u>	<u>14,294.3</u>	<u>27,090.6</u>	<u>36,163.4</u>	<u>46,503.8</u>
<u>Sorgho-maize</u>					
Production (tons)	262	188	33	250	280
Value of production (000 UM)	2,279.1	1,428.8	204.6	3,850	4,312
Costs of production (000 UM)	3,680	3,246	836	2,140	2,140
Net benefits (000 UM)	-1,400.6	-1,817.2	-631.4	1,710	2,170
Value of production foregone <2> (000 UM)	195.4	172.3	44.4	97.7	97.7
Net incremental economical benefits (000 UM)	<u>-1,596.0</u>	<u>-1,989.5</u>	<u>-675.8</u>	<u>1,612.3</u>	<u>2,072.3</u>
Total incremental net benefits (000 UM)	<u>-870.2</u>	<u>12,304.8</u>	<u>26,414.8</u>	<u>37,775.7</u>	<u>48,576.1</u>

<1> Actual world prices of rice (corn) and actual exchange rates for 1984-86 used.

<2> UM1,776/ha of sorgho-millet output

MAURITANIA
Cereals Irrigation Project - 2nd Phase
TABLE 16.2 Benefits on 1400 ha Project
Economic Budget
(in UM)

	calendar year				
	1990	1991	1992	1993	1994
Incremental					
Main Production					
Paddy	3,735,990.0	35,817,500.0	68,970,600.0	84,568,300.0	102,665,000.0
Maize	767,999.0	3,225,590.0	7,357,430.0	12,573,600.0	22,370,200.0
Vegetables	-	6,687,490.0	18,437,430.0	33,999,900.0	44,374,300.0
Forage	-	300,000.0	1,179,990.0	2,175,990.0	3,359,990.0
Sub-Total Main Production	9,503,970.0	44,030,600.0	95,945,400.0	137,517,000.0	181,073,000.0
By Products					
Paddy and other subproducts	369,999.0	3,544,490.0	6,716,390.0	8,748,890.0	9,795,990.0
Gross Value Of Production	10,373,900.0	47,575,000.0	102,661,000.0	146,265,000.0	190,867,000.0
On-Farm Consumption					
Paddy	2,729,990.0	11,101,900.0	20,201,900.0	22,902,800.0	22,902,800.0
Maize	767,999.0	3,225,590.0	6,935,030.0	10,288,000.0	12,080,600.0
Vegetables	-	624,999.0	2,874,990.0	5,824,990.0	7,149,990.0
Sub-Total On-Farm Consumption	3,497,980.0	14,952,500.0	30,011,900.0	38,916,000.0	42,133,400.0
Net Value Of Production	6,875,990.0	32,622,500.0	72,649,700.0	106,860,000.0	148,733,000.0
Purchased Consumption					
Maize	-	0.2	1.5	3.0	2.1
Vegetables	312,499.0	812,499.0	662,499.0	-	-
Sorgho	2,111,990.0	7,603,190.0	12,080,600.0	12,080,600.0	12,080,600.0
Sub-Total Purchased Consumption	2,424,490.0	8,415,690.0	12,743,100.0	12,080,600.0	12,080,600.0
INFLOWS	4,451,490.0	24,206,800.0	59,906,600.0	94,779,400.0	136,653,000.0
Production Cost					
Operating Inputs					
Seed	369,999.0	1,396,990.0	2,415,390.0	2,747,190.0	3,117,990.0
Urea	544,749.0	2,302,920.0	4,037,860.0	6,560,900.0	9,826,430.0
TSP	283,999.0	1,131,890.0	2,377,970.0	3,370,450.0	3,775,190.0
Veg. Seeds	-	10,000.0	36,000.0	57,200.0	57,200.0
Engrais maralterer	-	131,999.0	541,198.0	1,370,150.0	1,510,070.0
Pesticides	-	47,750.0	179,374.0	350,874.0	500,499.0
Sub-Total Inputs	1,198,740.0	5,017,560.0	10,187,700.0	14,116,100.0	17,192,600.0
Hired Labor	704,398.0	2,847,380.0	4,811,890.0	5,262,890.0	5,465,450.0
August	171,598.0	639,207.0	1,080,210.0	1,181,460.0	1,226,930.0
September	249,598.0	929,757.0	1,571,220.0	1,784,630.0	1,784,630.0
October	1,216,790.0	4,532,570.0	7,659,750.0	8,377,660.0	8,700,110.0
November	670,799.0	2,498,720.0	4,222,680.0	4,618,450.0	4,796,210.0
December	280,799.0	1,180,520.0	2,343,660.0	3,947,410.0	5,006,030.0
January	39,000.0	198,899.0	494,128.0	966,183.0	1,489,640.0
February	66,299.9	342,029.0	822,117.0	1,103,140.0	1,433,470.0
March	66,299.9	310,829.0	691,624.0	1,026,320.0	1,433,470.0
April	-	-	-	-	-
May	-	-	-	-	-
June	-	-	-	-	-
Sub-Total Hired Labor	3,504,380.0	13,715,800.0	24,730,890.0	28,742,900.0	32,688,900.0
Sub-Total Operating	4,703,120.0	18,733,360.0	34,918,590.0	42,859,000.0	50,881,500.0
Other Costs	874,999.0	3,049,990.0	14,004,900.0	21,804,900.0	33,604,900.0
OUTFLOWS	5,578,119.0	21,783,350.0	48,923,490.0	64,663,900.0	84,486,400.0
CASH FLOW BEFORE FINANCING	-1,204,219.0	-7,208,350.0	-14,262,490.0	-18,398,900.0	-23,623,400.0
BENEFITS BEFORE FINANCING	2,331,740.0	14,775,900.0	41,417,300.0	89,310,300.0	140,485,000.0

Table 14

MAURITANIAGORGOL IRRIGATION PROJECT - PROJECT COMPLETION REPORTAssumptions for Incremental Benefits from Fishing

	<u>Until</u> <u>end 1989</u>	<u>1990</u>	<u>1991</u>	<u>1992-2009</u>
Fish catch (tons p.a.)	350	600	725	850
Value of catch (000 UM) <u>1/</u>	8,750	15,000	18,125	21,250
Operating costs (approx. 25%)	2,200	3,750	4,500	5,300
Net financial benefits	6,550	11,250	13,625	15,950
Incremental net financial benefits -		4,700	7,075	9,400
Labor costs <u>2/</u>	702	1,170	1,590	1,872
Net economic benefits	5,848	10,080	12,035	14,078
Incremental net economic benefits -		4,232	6,187	8,230

1/ Assumed 50% of catch sold fresh and 50% dried

2/ Shadow priced - 120 days at 78 UM/day

MAURITANIA

GORGOL IRRIGATION PROJECT - PROJECT COMPLETION REPORT

Assumptions for Incremental Benefits from Flood Recession Crop Production

	<u>Without Project</u>	<u>With Project</u>		<u>Without Project</u>	<u>With project</u>	
		<u>Year 1</u>	<u>Years 2 to 20</u>		<u>Year 1</u>	<u>Year 2-20</u>
		<u>.....Millet.....</u>			<u>.....Sorgho.....</u>	
Yield (Kg/ha)	250	300	325	400	500	550
Market price (UM/kg)	21	21	21	21	21	21
Economic price (UM/kg)	15.4	15.4	15.4	15.4	15.4	15.4
<u>Costs</u>						
a) Seed (kg/ha)	10	10	10	10	20	20
Price (UM/kg)	35	35	35	35	35	35
Cost of seed	<u>350</u>	<u>350</u>	<u>350</u>	<u>350</u>	<u>700</u>	<u>700</u>
b) Fungicide (g/ha)	0	25	25	0	50	50
Price (UM/g)	- 1/	15	15	- 1/	15	15
Cost of fungicides	0	<u>375</u>	<u>375</u>	0	<u>750</u>	<u>750</u>
c) Small tools (UM)	<u>500</u>	<u>500</u>	<u>500</u>	<u>500</u>	<u>500</u>	<u>500</u>
Operating costs (UM/ha)	<u>850</u>	<u>1,225</u>	<u>1,225</u>	<u>850</u>	<u>1,950</u>	<u>1,950</u>
Net financial benefits (UM/ha)	4,400	5,075	5,600	7,550	8,550	9,600
Incremental net financial benefits (UM/ha)	-	675	1,200	-	1,000	2,050
Net economic benefits (UM/ha)	3,000	3,395	3,780	5,310	5,750	6,520
Labor requirements (mandays)	47	51	53	56	62	65
Net economic benefits less labor costs	-666	-583	-354	942	914	1450
No. of hectares cropped	370	370	370	630	630	630

1/ Not bought in the without project situation

Calculated: September 16, 1987

Mauritania: Gorgol noir irrigation project
Project completion report -economic analysis
(In UM million, prices 1987)

	1981	1982	1983	1984	1985	1986	1987
1. BENEFITS							
Incremental econ.benefits (550 ha)	0.00	0.00	0.00	-0.87	12.30	26.41	37.78
Incremental econ.benefits (1440 ha)							
Incremental econ.benefits (1600 ha)							
Ben. from flood-rec. crops (1000 ha)							
Incremental total econ. benefits	0.00	0.00	0.00	-0.87	12.30	26.41	37.78
2. COSTS							
Investment costs	546.10	1433.60	1329.10	525.80	30.20	727.20	101.85
of which:							
Construction	486.90	1293.10	1207.40	455.70	29.60	717.70	100.35
Equipment and vehicles		16.90	21.40	9.90	3.80	4.60	0.00
Tech. assistance & supervision	59.20	123.60	100.30	60.20	4.80	4.90	1.50
Recurrent costs	37.70	58.20	117.60	127.60	123.80	89.50	123.70
Food-for-work				10.3	5.1	5.9	4.7
Total costs	583.80	1491.80	1446.70	663.70	167.10	822.60	230.25
Benefits-minus costs	-583.80	-1491.80	-1446.70	-664.57	-154.80	-796.19	-192.47
Memo:							
GDP deflator (1987=100)	62.40	68.50	71.40	79.40	88.40	95.10	100.00

	1988	1989	1990	1991	1992	1993	1994
1. BENEFITS							
Incremental econ.benefits (552 ha)	48.58	48.58	48.58	48.58	48.58	48.58	48.58
Incremental econ.benefits (1440 ha)	1.62	10.34	28.99	54.82	69.91	86.33	98.34
Incremental econ.benefits (1600 ha)			28.63	44.95	78.10	109.03	146.55
Ben. from flood-rec. crops (1000 ha)		0.35	0.35	0.35	0.35	0.35	0.35
Incremental total econ. benefits	50.20	59.27	98.55	148.70	196.94	244.29	285.82
2. COSTS							
Investment costs	262.70	554.31	549.00	555.10	231.80	73.30	10.79
of which:							
Construction	261.20	493.42	485.70	501.60	201.60	0.00	
Equipment and vehicles	0.00	35.20	33.90	22.40	11.30	60.00	10.79
Tech. assistance & supervision	1.50	25.69	29.40	31.10	18.90	12.50	
Recurrent costs	149.27	107.98	30.00	35.00	39.60	42.90	43.20
Food-for-work	5	5	5.49	11.28	10.48	6.29	
Total costs	416.97	667.29	584.49	601.38	301.88	122.49	53.99
Benefits-minus costs	-366.77	-608.02	-485.94	-452.68	-84.94	121.80	231.83
Base:							
GDP deflator (1987=100)	105.00	110.30	115.00	121.60	127.70	134.10	140.00

1. BENEFITS

Incremental econ.benefits (550 ha)	48.58	48.58	48.58	48.58	48.58	48.58	48.58
Incremental econ.benefits (1440 ha)	98.82	98.82	98.82	98.82	98.82	98.82	98.82
Incremental econ.benefits (1600 ha)	163.85	175.34	181.59	181.83	181.83	181.83	181.83
Ben. from flood-rec. crops (1000 ha)	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Incremental total econ. benefits	383.60	315.09	321.34	321.58	321.58	321.58	321.58

2. COSTS

Investment costs	4.32	0.00	1.00	5.39	10.79	4.32	0.00
of which:							
Construction							
Equipment and vehicles	4.32	0.00	1.00	5.39	10.79	4.32	0.00
Tech. assistance & supervision							
Recurrent costs	43.20	43.20	43.20	43.20	43.20	43.20	43.20
Food-for-work							
Total costs	47.52	43.20	44.20	48.59	53.99	47.52	43.20
Benefits-minus costs	256.08	271.89	277.06	272.99	267.59	274.06	278.38
Memo:							
GDP deflator (1987=100)	147.80	155.20	162.90	171.10	179.70	188.69	198.12

	2002	2003	2004	2005	2006	2007	2008
1. BENEFITS							
Incremental econ.benefits (550 ha)	48.58	48.58	48.58	48.58	48.58	48.58	48.58
Incremental econ.benefits (1440 ha)	98.82	98.82	98.82	98.82	98.82	98.82	98.82
Incremental econ.benefits (1600 ha)	181.83	181.83	181.83	181.83	181.83	181.83	181.83
Ben. from flood-rec. crops (1000 ha)	8.35	8.35	8.35	8.35	8.35	8.35	8.35
Incremental total econ. benefits	321.58	321.58	321.58	321.58	321.58	321.58	321.58
2. COSTS							
Investment costs	1.08	5.39	10.79	4.32	0.00	1.08	5.39
of which:							
Construction							
Equipment and vehicles	1.08	5.39	10.79	4.32	0.00	1.08	5.39
Tech. assistance & supervision							
Recurrent costs	43.20	43.20	43.20	43.20	43.20	43.20	43.20
Food-for-work							
Total costs	44.28	48.59	53.99	47.52	43.20	44.28	48.59
Benefits-minus costs	277.30	272.99	267.59	274.06	278.38	277.30	272.99
Memo:							
GDP deflator (1987=100)	208.03	218.43	229.35	240.82	252.86	265.50	278.77

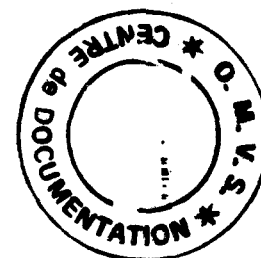


Table 16

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	2009	2010	2011	2012	2013	2014	2015
1. BENEFITS							
Incremental econ.benefits (552 ha)	48.56	48.56	48.56	48.56	48.56	48.56	48.56
Incremental econ.benefits (1448 ha)	92.82	92.82	92.82	92.82	92.82	92.82	92.82
Incremental econ.benefits (1527 ha)	181.83	181.83	181.83	181.83	181.83	181.83	181.83
Ben. from flood-rec. crops (1202 ha)	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Incremental total econ. benefits	321.58	321.58	321.58	321.58	321.58	321.58	321.58
2. COSTS							
Investment costs	10.79	4.32	0.00	1.08	5.39	10.79	4.32
of which:							
Construction							
Equipment and vehicles	10.79	4.32	0	1.08	5.39	10.79	4.32
Tech. assistance & supervision							
Recurrent costs	43.20	43.20	43.20	43.20	43.20	43.20	43.20
Food-for-work							
Total costs	53.99	47.52	43.20	44.28	48.59	53.99	47.52
Benefits-minus costs	267.59	274.06	278.38	277.30	272.99	267.59	274.06
Memo:							
GDP deflator (1987=100)	292.71	307.35	322.72	338.85	355.79	373.58	392.26

	2016	2017	2018	2019
=====				
1. BENEFITS				
Incremental econ.benefits (550 ha)	48.58	48.58	48.58	48.58
Incremental econ.benefits (1440 ha)	98.82	98.82	98.82	98.82
Incremental econ.benefits (1600 ha)	181.83	181.83	181.83	181.83
Ben. from flood-rec. crops (1000 ha)	0.35	0.35	0.35	0.35
Incremental total econ. benefits	321.58	321.58	321.58	321.58

2. COSTS				
Investment costs	0.00	1.08	5.39	-144.16

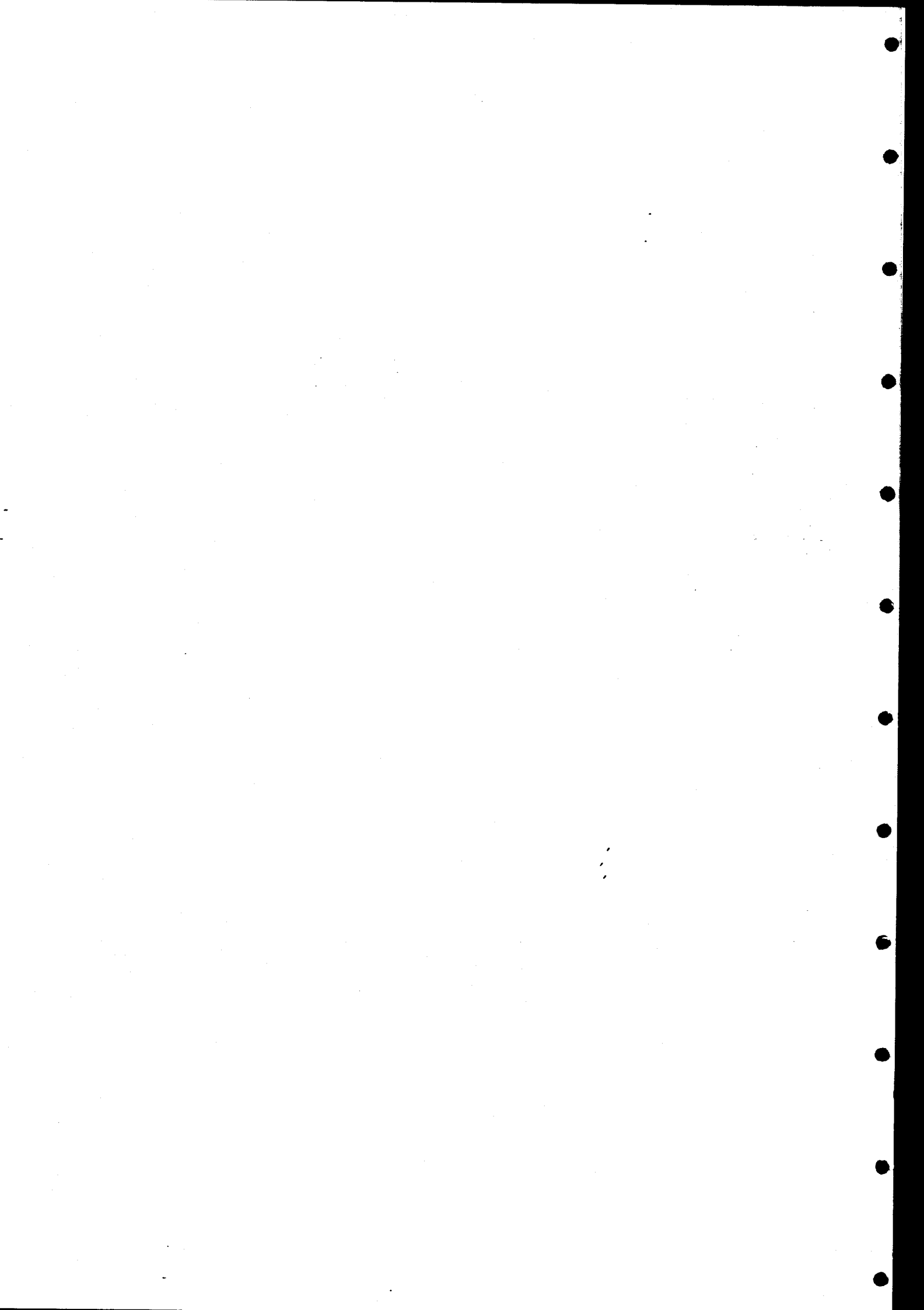
of which:				
Construction				-139.58
Equipment and vehicles	0	1.08	5.39	-4.58
Tech. assistance & supervision				
Recurrent costs	43.20	43.20	43.20	43.20

Food-for-work				

Total costs	43.20	44.28	48.59	-100.96

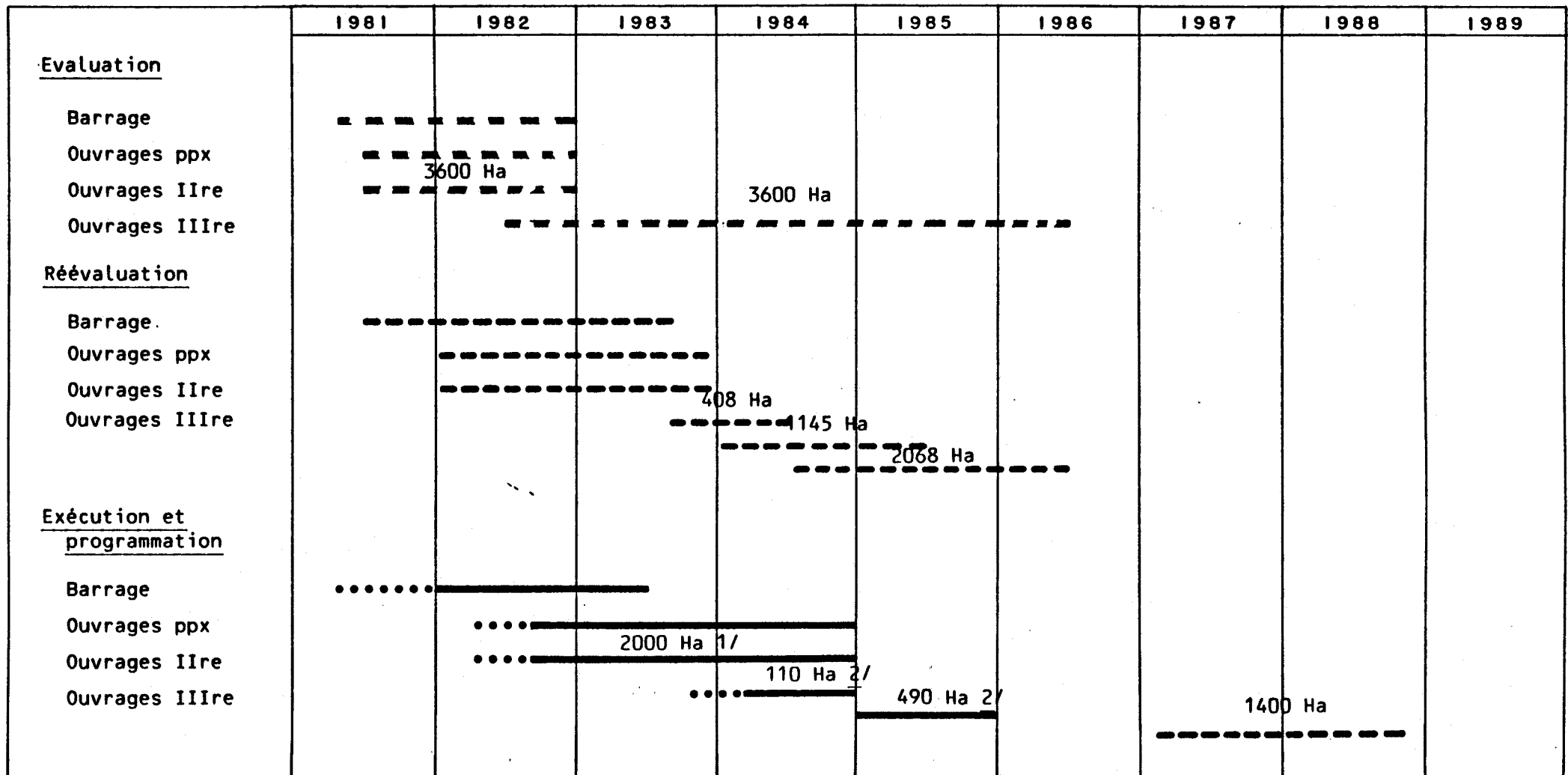
Benefits-minus costs	278.38	277.30	272.99	422.54

Memo:				
GDP deflator (1987=100)	411.88	432.47	454.09	476.80



REP. ISLAMIQUE DE MAURITANIE
PROJET D'IRRIGATION GORGOL NOIR I - RAPPORT D'ACHEVEMENT

PROGRAMMATION ET REALISATION DES TRAVAUX



réalisation ——— 1/ Pour la 2ème tranche de la phase 1 (1.400 ha) les canaux IIre ont été remblayés mais il manque le déblai

