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IMPLEMENTATION COMPLETION REPORT

SUDAN

GEZIRA REHABILITATION PROJECT
(CREDIT 1388-SU)

MARCH 2, 1995

Agriculture and Environment Operations Division
Eastern Africa Department
Africa Region

CURRENCY EQUIVALENTS

At Appraisal: Sudanese Pound (LSd) 1.0 = US$ 0.66 (official)
At Completion: Sudanese Pound (LSd) 10.0 = 1 Dinar
Sudanese Pound (LSd) 1.0 = US$ 0.0026
Dinar 1.0 = US$ 0.026

WEIGHTS AND MEASURES

Feddan (fd) = 0.42 hectare (ha)
Kantar (seed cotton) = 141.5 kg

FISCAL YEAR OF BORROWER

Government of Sudan: The Islamic Calendar Year
IDA: 1 July to 30 June

ABBREVIATIONS AND ACRONYMS

AF2AE	Agriculture and Environment Operations Division
AF	Arab Fund for Development
ARC	Agricultural Research Corporation
ARETP	Agricultural Research, Extension and Training Project
ASC	Agricultural Services Company
BNHP	Blue Nile Rehabilitation Project
CMC	Cotton Marketing Company
EMC	Earth Moving Corporation
FAO	Food and Agriculture Organization of the UN
FAOR	FAO's Representative
FB	Farmers' Bank
FOG	Field Outlet Gate
FOP	Field Outlet Pipe
GIS	Gezira Irrigation Scheme
GLR	Gezira Light Railway
GOS	Government of Sudan
GRP	Gezira Rehabilitation Project
GRS	Gezira Research Station
HRL	Hydraulics Research Limited, UK
HRS	Hydraulics Research Station, Wad Medani
I&D	Irrigation and Drainage
ICR	Implementation Completion Report
IDA	International Development Association
IIMI	International Irrigation Management Institute
IWC	Irrigation Works Corporation
MFEP	Ministry of Finance and Economic Planning
MOA	Ministry of Agriculture
MOH	Ministry of Health
MOI	Ministry of Irrigation
O&M	Operation and Maintenance
OFWM	On-Farm Water Management
PPF	Project Preparation Facility
RPMU	Rehabilitation Project Management Unit
RWSA	Rural Water Supply Administration
SAR	Staff Appraisal Report
SF	Saudi Fund for Development
SGB	Sudan Gezira Board
SPTC	Sudan Public Telecommunications Corporation
T&V	Training and Visit Extension System
WB	World Bank
WHO	World Health Organization
WUA	Water Users Association

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Preface

This is the Implementation Completion Report (ICR) for the Gezira Rehabilitation Project (GRP), Sudan, for which Credit 1388-SU in the amount of SDR 74.2 million was approved on June 16, 1983, signed on August 9, 1983 and became effective on May 5, 1985.

The original closing date of June 30, 1989, was extended to December 31, 1995 but the credit closed early on December 31, 1993 due to suspension of disbursements in the Sudan, which led to non-accrual status. Total disbursement amounted to SDR 53.5 million or about 72 percent of the original amount. Final disbursement took place on May 17, 1994, at which time a balance of SDR20.7 million was canceled. Co-financing for the project was provided by Arab Fund US$ 47.8 million; Saudi Fund US$ 2.4 million; Italian Grant US$ 8.4 million; British Grant US$ 8.2 million and Japanese Grant US$ 29.0 million. GOS contribution totalled US$ 24.6 million.

This ICR was prepared by a mission from FAO/World Bank Cooperative Programme, which visited Sudan from September 12-29, 1994, preparation by the Agriculture and Environment Operations Division (AF2AE), Eastern Africa Region and reviewed by Mrs. S. Ganguly, Division Chief, AF2AE and Mr. G. Sengupta, Acting Project Advisor, AF2. It is based on the material collated from the project files, supervision reports, field investigations and discussions with the Bank and GOS staff associated with the project. The borrower contributed to the preparation of the ICR by arranging field visits and meetings, providing substantive comments on the mission Aide Mémoire and submitting a comprehensive "Project Completion Report."

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Evaluation Summary

Introduction

1. The Gezira Irrigation Scheme (GIS) was the first large-scale gravity irrigation scheme in Sudan, which was started mainly to grow cotton during 1920s, following the construction of the Sennar Dam. In the 1970s, it was expanded with the incorporation of the Menagil area. The total project area now extends over 2.2 million feddans which is equivalent to 0.9 million hectares. The performance of the Gezira scheme declined mainly due to lack of maintenance and its production fell sharply during the late 1970s and the early 1980s. The Government of Sudan (GOS) requested the Bank Group's assistance in 1979 in the rehabilitation of the GIS.

2. The Bank had been involved in agricultural operations in Sudan since the early 1960s. Agricultural credit constituted a large proportion of total Bank lending to Sudan, which included seven irrigation projects, three rainfed mechanized smallholder development projects, two livestock projects, an agricultural research project and ten area rehabilitation projects.

3. The main objective of the project was to raise crop yields and production through the rehabilitation of the Gezira irrigated area and its supporting services, thereby increasing foreign exchange earnings in line with the Government's overall strategy of achieving better utilization of existing capital investments. The main project components included the: (i) improvement of the Gezira irrigation, drainage, and pumping systems; (ii) rehabilitation of the infrastructure including roads, communication network, railway, staff housing and ginneries; (iii) provision of critical inputs such as farm machinery; (iv) improvement of farmer training, research, and extension; and (v) support to improve health through schistosomiasis control and sanitary systems.

4. Actual project cost at the time of project closing is estimated at US$ 191.4 million. Final overall disbursement includes: IDA US$ 70.9 million; Arab Fund US$ 47.8 million; Saudi Fund US$ 2.4 million; Italian Grant US$ 8.4 million; British Grant US$ 8.2 million; Japanese Grant US$ 29.0 million; and GOS contribution US$ 24.6 million. IDA disbursement, expressed in SDR, amounted to SDR 53.5 million or about 72 percent of the original credit amount of SDR 74.2 million. After the last disbursement, which took place on May 17, 1994, the balance of about SDR 20.7 million was canceled. The GOS contribution reached only 24 percent of SAR estimates at project closure on December 31, 1993 (Part II, Table 8B) compared to 32 percent of net project costs envisaged at appraisal. There were 41 Legal Covenants, of which 39 had been fulfilled by project closure (Part II, Table 10).

Implementation Experience and Results

5. **Implementation record:** The project was to be implemented over a 5-year period to 1988. Project implementation got off to a slow start because of the delay in the establishment of the Rehabilitation Project Management Unit (RPMU) and the appointment of its Executive Director. Despite the slow start up and the suspension of funding by IDA and by two of the five

co-financiers at various stages of the project, the overall project implementation can be considered satisfactory.

6. As indicated in the appraisal report, a total of 20 sub-components were to be implemented during the project. To this list, two additional sub-components: the Rehabilitation of the Earth Moving Corporation (EMC) and the Desilting of Canals were included and funds were to be secured by co-financiers. The details regarding the physical implementation of each sub-component are given in Part II, Table 5. Under the irrigation and drainage improvement program, the Canal Regulators and Structures, the Sennar Dam was not completed and the Desilting of Canals was not implemented after contracts were awarded due to suspension of disbursements by the Saudi Fund. The renovation on the Sennar Dam started in early 1983 and remains incomplete due to suspension and later cancellation of the IDA credit.While the Canal Maintenance component was partially implemented, the installation of new Drainage Pumps and rehabilitation of Pumping Stations and the EMC (after great deterioration) were fully carried out. Activities under the agricultural improvement program including procurement of Agricultural Machinery, modernization of the Research Station, enhanced Seed Production, Pilot Farm testing and analysis schemes, upgrading of MOI and SGE Workshop Facilities and Renovation of Gins were completed. However, new Roller Gins were not procured pending the outcome of agreement on possible future privatization of the ginneries. Implementation relating to the upgrading of project infrastructure including Roads, Telecommunications, and Gezira Light Railway is to be recorded as highly successful. The Rural Water Supply and the Schistosomiasis programme were also fully implemented, but the sanitation sub-component was only 30 percent completed. The level of completion of Staff Housing and Utilities sub-component varies from 40 percent to 100 percent. Only one of the five components relating to institutional strengthening (Sudan Gezira Board (SGB) Management Information System) was not implemented. Of the remaining four, three were implemented in full (procurement of vehicles, creation of a Rehabilitation Project Management Unit (RPMU) and completion of 14 studies) and one, partially (Training and TA).

7. **Project results:** The significant improvements in the irrigation and drainage facilities have contributed to increasing the area under irrigation from 1.2 million feddan to 1.5 million feddan and the cropping intensity from 58 percent to 72 percent. The training of engineers and extensionists also had a positive impact on on-farm water management. The improved land and water management, coupled with the adaptive research, has resulted in significant increases in yields of wheat, groundnuts and sorghum by 18 percent, 40 percent and 60 percent respectively in on-farm trials. The benefits derived from the upgraded seed cotton processing equipment are significant both in terms of lint grade improvement and increased capacity and efficiency of the ginning process. The production of cotton, sorghum and wheat seed showed an increase of 20 percent as a direct result of project intervention. The effective control of schistosomiasis in 89 of the 105 blocks of the project area is a significant achievement. Some 200,000 people living in 370 villages in the Gezira now enjoy a reliable, protected drinking water supply for the fist time as a direct result of the project. Although cost recovery through crop-based water charges does not yet cover the total annual O&M costs, it is a good beginning.

8. **Key factors affecting project achievements:** The most important factor which adversely affected project implementation and impact on its effectiveness was the suspension of disbursements for the Saudi Fund (SF) and the Arab Fund (AF) and later the IDA credit. As a result of the premature closure of the project, two vital components--the Sennar Dam Renovation and the Desilting of Canals using private contractors were not implemented. Repair of damaged and worn out Canal Regulators and Structures also had a notable negative impact on the achievement of project objectives. The Canal Maintenance component was only partially

implemented due to the unexpected closure of AF financing. In the case of the Sennar Dam, which was originally to be financed under the Arab and Saudi Funds, out of safety concerns for the aging structure IDA agreed in 1989 to fund the component when cofinancing was not available. Work had been initiated, but suspensions of disbursements as a result of non-payment of arrears by the Government delayed its rehabilitation. IDA sought assurances from Sudan to continue funding of this component if IDA credits remained suspended.

9. **Sustainability:** At the present level of operation, the project is likely to be sustainable. However, the future of the project would largely depend on uninterrupted water availability from the Sennar Dam, silt and weed removal from canals, efficient O&M of the irrigation and drainage system and the infrastructure throughout the project area, continued support to farmers through extension, research and training, adequate level of funding to research station in the project area, and controlling the impact of any adverse environmental effects due to salinity and water logging in the future. Although the Sennar Dam renovations had been started by the contractors, the component was interrupted due to non-payment by GOS of its arrears that led to cancellation of IDA funding and premature closing of the project before the December 31, 1995 Closing Date. GOS has negotiated with the contractor for the resumption of repair work from November 1994 under MOI supervision. The problem of canal siltation and weed growth has become acute in recent years and the project has only partially contributed towards its solution through the project. As for O&M, the GOS is subsidizing the total annual cost by as much as 33 percent. The continuation of the research activities initiated under the GRP and the maintenance of the infrastructure created will depend on the level of funding from the ARC.

10. **Bank and borrower's performance:** The performance of both the Bank and the Borrower was generally satisfactory. However, the preparation of certain project components was not adequate. Similarly, the Borrower should have devoted more attention to on-farm water management through the establishment of a Water Management Advisory Unit as required in the SAR.

11. **Overall project outcome:** The project outcome assessment is rated as "Satisfactory".

Summary of Findings, Future Operations and Key Lessons Learned

12. **Findings:** The most important finding relates to the key irrigation and drainage components of the project some of which could not be implemented due to suspension of funding by various donors. This had a negative impact on project achievements and could impinge on future sustainability of the project.

13. **Future operations:** Most of the components of the GRP that could not be fully completed/implemented could be pursued under a possible new project. The activities which need most urgent support are: (i) Sennar Dam renovation, (ii) Silt/weed clearance from canals, and (iii) replacement of spares for agricultural machinery, pumping stations and rural water supply pumps as well as supply of medicines/chemicals for schistosomiasis control. The raising of the Roseires Dam is also essential in order to utilize fully the total water resources available to Sudan. It is the GOS's intention to pursue these objectives in the near future through bilateral/multilateral financial assistance.

14. **Key lessons learned:** The key lessons learned are:

(i) Long-term solutions to the canal siltation problem should be found, as the silt inflow into the canals has increased substantially in recent years;

(ii) Projects should be adequately designed at appraisal taking into account a more realistic estimate of the capability of the borrower in meeting its financial and production obligations;

(iii) The number of project components, the diversity of the procurement, and the involvement of many different agencies to implement the project led to both various delays in project start up and implementation.

(iv) In-service training should focus on relevant and practical short-term courses or study tours rather than on narrow post-graduate degrees;

(v) The various studies under the project were implemented satisfactorily, but the contracting of most relevant studies (for example the Role of Private Sector in Agriculture Mechanization, Mechanical Weed Control and Silt Clearance Methods and Acquatic Weed Control) under the PPF facility prior to project implementation would have contributed significantly to the timely implementation of some project components.

(vi) A considerable body of proven research results on tillage practices and low cost systems, which should have been applied in the selection of ancillary agricultural equipment, was not given due consideration in the replacement of inventories; and

(vii) Although measurable cropping increases in yields have been achieved, there is potential to further increase cropping intensities;

(viii) IDA's timely assumption of some components suspended from financing by AF/SF was very helpful in keeping the project moving and is a valuable lesson for future projects with similar circumstances.

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Part I: PROJECT IMPLEMENTATION SUMMARY

A. STATEMENT OF OBJECTIVES

1. The principal objective of the project was to raise crop yields and production, thereby increasing farmers' incomes as well as national foreign exchange earnings. In order to achieve this objective, the project aimed at improving/upgrading: (i) the irrigation and drainage facilities in the project area (2.2 million feddans/0.9 million ha), through installation of canal regulators and other control structures, removal of silt and weeds from canals, rehabilitation or replacement of existing pumping stations, and repair and renovation of the Sennar Dam--the main source of irrigation water; (ii) the agricultural services through provision of appropriate machinery, introduction of improved crop production technologies, strengthening of the adaptive research and extension linkage, and modernization of ginneries; and (iii) the project infrastructure through repairs and maintenance of roads and railway, provision of rural water supply and sanitation, installation of a project-wide telecommunication system, and control of schistosomiasis. In addition, the project provided institutional strengthening through in-service training (both within the country and abroad) of professional and other staff, consultancies and problem-oriented studies (see Table 7).

2. At appraisal there were 20 sub-components, and these increased to 22 as a result of the addition of two new components: "Rehabilitation of the Earth Moving Corporation (EMC)" and "Desilting of Canals." Two of the original 20 components (Research-Extension and Renovation of Gins) were also separated to facilitate implementation. Materials and machinery specifications were modified in the case of some components.

3. Project objectives are simple, clear and very relevant to the country and sector. The planned physical targets were attainable within the project's implementation period. However, the multi-donor financing of the project and the premature closure of disbursements by some of the donors generated a situation where reallocation of funds between disbursement categories was required to support essential elements of the implementation.

B. ACHIEVEMENT OF OBJECTIVES

Physical Objectives

4. **Canal Regulators and Structures (Component No. 1 - Saudi Fund, SF):** Several items of this project component could not be fully implemented due to the suspension of SF disbursements. The roller sluice gates and moveable weirs were not imported from a German supplier as planned and the Ministry of Irrigation (MOI) is now considering a proposal to manufacture the sluice gates locally. The order for pipe regulators and gates from a Saudi supplier was only partially executed due to lack of funds; only the steel

gates were delivered in August 1991. The GOS is arranging payment for the 29,000 Field Outlet Gates (FOG), manufactured and supplied by a Chinese sub-contractor.

5. **Canal Maintenance (Component No. 2 - IDA/Arab Fund (AF)/Italian Grant):** The services of the Earth Moving Corporation (EMC) (see Component 21; para 28) were enlisted not only for the removal of the accumulated silt backlog in the canal system but also for desilting the canals annually. The machinery procured as part of this component (loaders, lorries, graders) was very effective in the maintenance of canal banks and drains. This component had a major positive impact despite the fact that its weed clearance sub-component was only partially implemented due to the suspension of AF disbursement.

6. **Drainage System (Component No.3 - AF/Italian Grant):** The construction of five new pumping stations to replace the existing derelict stations, and the provision of 60 mobile pump units made a positive impact on the protection of buildings, animals and crops through improved drainage. Due to the suspension of the AF loan, however, this component was only partly executed.

7. **Pumping Stations (Component No. 4 - IDA/Italian Grant):** This component was fully implemented with the IDA credit/Italian grant and has been extremely effective in irrigation management.

8. **Sennar Dam (Component No. 5 - IDA):** This important component was initially to be financed by the Arab and Saudi Funds. However, due to difficulties in obtaining cofinancing and the GOS's default in repayments, the scope of this component was reduced. Increasing concern on the safety of the aging structure led IDA to agree during the mid-term review in 1989 to take over the financing of the renovation of the dam. In December 1992, because of previous delays in tendering due to unacceptable procurement procedures the closing date for civil works to accommodate the Sennar dam (along with the Technical Services component for supervision of the works) was extended by IDA to December 31, 1995. This covered the entire renovation contract period of 30 months. IDA had disbursed over 20 percent of this component for payments to the contractor. However, due to non-payment of arrears, a second suspension of disbursement of all IDA credits to Sudan with effect from September 14, 1993 was invoked. In view of the importance of security and sustainability of the dam, at various times since May 1993 IDA had sought assurances from Sudan to continue uninterrupted funding of this component from its own sources if IDA credits remained suspended. Whereas no assurances were received from GOS, it was learned that GOS has subsequently negotiated with the contractor for the resumption of repair work from November 1994 under MOI supervision.

9. **Agricultural Machinery (Component No. 6 - IDA):** Prime movers and ancillary equipment were procured according to requirements and in a timely manner (up to the 1992/93 growing season) for the replacement of the existing agricultural machinery. Significant increases in cultivation programs were achieved, with a reversal of hitherto decreasing production trends. The equipment procured, however, did not provide for improvements in existing tillage practices. The preparation of specifications did not take into account the necessity to introduce a low cost system including chisel ploughing and heavy duty cultivators.

10. **Research Station (Component No. 7 - AF/IDA/GOS):** The Gezira Research Station was modernized with the provision of new laboratory equipment, chemicals and agricultural machinery. The staff houses and other buildings are 70 percent complete. After the suspension of the AF, the GOS was able to provide funds for completing the remaining housing sub-component.

11. Provision was made for the introduction of the T&V extension system, with supporting training and equipment, but transport and operating expenses were not included as part of the project. While research extension agreed that the performance at Rahad and New Halfa had shown significant benefits, they showed

reluctance to convert inspectors into extension agents. A Department of Extension Services was established during the project and now consists of 20 officers under a Senior Extensionist. Assistance is being given by field extension assistants. The foundation for the introduction of a T&V system in Gezira is now well in place but will require adequate transport facilities and incremental funding to become fully operational.

12. **Seed Propagation (Component No. 7a - AF/IDA):** After suspension of the AF loan facility, this item was brought under IDA funding and has been fully implemented. The production of cotton, sorghum and wheat seed showed an increase of 20 percent as a direct result of project intervention.

13. **Pilot Farm (Component No. 7b - IDA):** The Pilot Farm was established to demonstrate improved crop production techniques. The farm demonstrations provided useful support for both extension and farmer training. Agricultural machinery and seed quality laboratory equipment were procured according to proposed requirements.

14. **Workshops (Component No. 8 - IDA):** Consultants were recruited to advise on upgrading, reorganization and re-equipping the Sudan Gezira Board (SGB) and MOI workshops, and to establish a central repair and maintenance system. They completed their recommendations by 1988. Minor changes in specifications were accepted by IDA, but procurement of equipment and tools was subjected to long delays. Cuts in funding due to reallocation of priority activities resulted in final limited procurement of equipment for SGB and Rural Water Supply Administration (RWSA) workshops only.

15. **Vehicles (Component No. 9 - IDA):** The total number of vehicles (795 against an SRA total of 414) and their allocations to various implementing agencies such as EMC, BNHP, RWSA, ARC and RPMU were adjusted by Supervision Missions in accordance with the needs of the implementing agencies. Three deliveries were received and the inventory was completed by early 1992. The procurement was efficiently carried out and the benefits to communication and logistics were evident.

16. **Roads (Component No. 10 - AF/GOS):** Ten motor graders procured since 1988 have been used in upgrading some 6,000 km of tracks along the canals and drains. A 94-km long road is being built connecting El Gorashi and Wad Medani, until now with GOS funding. An agreement with the Islamic Development Bank has been signed recently for the funding of this component.

17. **Telecommunications (Component No. 11 - Japanese grant):** The Japanese grant, amounting to about US$29 million, has been fully disbursed. A new telecommunication "point to multipoint" VHF radio network was installed in 1988. The central radio exchange in Wad Medani is connected to 1,720 lines, representing about 95 percent of the total 1,827 subscribers, as proposed by the project. In addition, 200 mobile telephones have been procured for SGB and MOI. This component, implemented by the Sudan Public Telecommunication Corporation (SPTC), has offered stable telephone service based on the latest technology.

18. **Gezira Light Railway (GLR, Component No. 12 - British grant):** Deliveries of equipment and spare parts took place during the period 1985-86 and by September 1987 deliveries of all goods were completed as well as the rehabilitation of the locomotives and wagons. TA of 19 person-months was provided to support the rehabilitation program and to carry out training of personnel dealing with O&M of engines and locomotives. Furthermore, 13 engineers attended training courses abroad on different aspects of O&M. Because of a shortage of sleepers, the renewal of 33 km of track was not implemented. However, the improvements restored 70 percent of the GLR carrying capacity.

19. **New Roller Gins (Component No. 13 - IDA):** The installation of saw gins was initially recommended at appraisal, but discarded due to differences of opinion on whether to continue to grow long staple in the Gezira. Local authorities preferred the procurement of roller gins and TA was provided to test a prototype. One trial gin stand was obtained, tested and results were encouraging. It was decided to proceed with gin stand trials until the cotton policy on varieties was clarified. Since there was insufficient time to complete trials and to proceed to formulate detailed specifications, the component was terminated in December 1992.

20. **Renovation of Gins (Component No. 13a - IDA/AF):** Two traditional gin stands and manual presses were replaced and three gins were renovated. Cleaning and humidification processes were introduced, together with mechanical conveyance systems in three factories. The contract was completed on schedule. Substantial modifications were required, however, before commissioning due to the low quality of the steel used in construction. The gins are now operating efficiently. Improvements to factory workshops, yard storage and infrastructure were also implemented satisfactorily.

21. **Schistosomiasis Program (Component No. 14 - IDA):** This is one of the most effective components of the project. Out of the 105 blocks covered under the project, the control program for schistosomiasis had been implemented in 89 blocks by June 1993. The incidence of schistosomiasis has already fallen from 54 percent to 7 percent in those blocks where the program has been in operation over the longest period (i.e. since 1985). In other blocks the decline varies from 8 percent to 20 percent, according to the length of operation of the program. The results achieved so far confirm that the reduction in the prevalence of the disease is a direct consequence of the duration of the disease control program.

22. **Rural Water Supply and Sanitation (Component No. 15 - IDA):** Almost all the targets of this component have been achieved and it stands out as another most effective component of the GRP, having provided protected drinking water supply to some 370 villages with a total population of about 200,000. Some of the 105 deep wells drilled have depths of over 300 m. The quality of water being supplied is being regularly monitored. As part of the sanitation sub-component, two latrine slab factories were constructed under the project. However, due to constraints in the availability of cement and steel, only 15,000 of the planned 50,000 latrine slabs have been manufactured to date.

23. **Staff Housing (Component No. 16 - GOS/IDA):** The level of completion of the SGB and MOI houses ranges from 95 percent to 100 percent and that of offices, stores and workshop units from 40 percent to 100 percent. Equipment, including generators funded by IDA, have been procured. The quality of construction of the completed houses is reasonable, but their maintenance will require MOI's and SGB's attention.

24. **RPMU (Component No. 17 - IDA):** The RPMU has functioned effectively since its establishment and is now working only with a skeleton staff. The Executive Director was due to leave the RPMU at the end of September 1994. The Draft Project Completion Report prepared by the RPMU was considered satisfactory and provided a valuable source of information for the preparation of the ICR.

25. **SGB Management (MIS) (Component No. 18 - IDA):** The implementation of this component would have helped the SGB and RPMU in project management, but its implementation did not go beyond some technical recommendations prepared by two consultancy firms hired by the project. Its implementation was finally discontinued in December 1992 due to differences in management technical committees and required changes of the system from time to time among other reasons.

26. **Training and TA (Component No. 19 - IDA/GOS):** The initial assessment of training needs at all levels for SGB, MOI and the Earth Moving Corporation (EMC) was prepared by the British Council. The total training plan covered over 4,000 staff (while the SAR estimate was 6,450), including overseas (445), in-country (737), in-house (1,623) and on-the-job training (1,122). About 80 percent of the SGB, 40 percent of the MOI, and 100 percent of the EMC programs were implemented. Major problems with in-house and in-country programs were due to the limited availability of training facilities. The delays in construction of the Wad Medani training facility were mainly due to the shortfalls in GOS funding of this component. Notwithstanding the above, the training program was efficiently carried out and reported.

27. **Studies (Component No. 20 - IDA):** The total number of studies to be completed was revised from 8 planned in the SAR to 14 (see Table 7), following a desk review of the available literature on the Gezira scheme. These studies have been fully completed and the reports received by the RPMU. The consultants selected to conduct these studies were of high calibre, and the reports produced by them are considered satisfactory by both the GOS and IDA. The studies provide valuable recommendations for future agricultural policy to be applied within the Gezira scheme.

28. **Rehabilitation of EMC (Component No. 21 - AF/Italian Grant):** The bulk of the AF loan and Italian grant (US$12.52 million) was spent on re-equipping the EMC and in overhauling its old machinery. Rehabilitation also included purchase of vehicles and workshop tools. The Irrigation Works Corporation (IWC) was also provided with building materials and equipment, vehicles and tools at a total cost of US$2.42 million. The EMC was engaged in the desilting of canals and the annual silt removal increased from 9 million m^3 in 1988 to 18 million m^3 in 1990.

29. **Desilting of Canals (Component No. 22 - IDA):** The decision to carry out silt and weed clearance from canals under an innovative approach of using private contractors could not be implemented due to the suspension of all IDA credits to Sudan.

Sectoral Objectives

30. Although some of the physical objectives, particularly in relation to irrigation and drainage improvement, could not be realized due to suspension of funding rather than due to any technical or institutional constraints, the achievement of sectoral objectives, on the whole, was substantial. The significant improvements in the irrigation and drainage facilities and the strengthening of agricultural research, training and extension services have contributed to increasing the area under irrigation from 1.2 million feddan to 1.5 million feddan and the cropping intensity from 58 percent to 72 percent.

31. The project strengthened the Gezira Research Station (GRS) and its three outreach sites at Maatug, Haj-Abdullah and Turabi to support adaptive research and on-farm trials on cotton, wheat, sorghum and groundnuts. The training of extensionists also had a positive impact on on-farm water management. The improved land and water management, coupled with the adaptive research, has resulted in significant increases in yields of certain crops. For example, the yields of wheat, groundnuts and sorghum have increased by 18 percent, 40 percent and 60 percent respectively in on-farm trials. The benefits derived from the upgraded seed cotton processing equipment are significant both in terms of lint grade improvement and increased capacity and efficiency of the ginning process. In addition, plant protection measures were refined and farm mechanization was strengthened. However, the integration of livestock and crop production was not seriously attempted.

32. The effective control of schistosomiasis in 89 of the 105 blocks of the project area is an outstanding achievement. Moreover, some 200,000 people living in 370 villages in the Gezira, who hitherto did not have access to potable water, now enjoy a reliable, protected drinking water supply as a direct result of the project.

Economic and Financial Objectives

33. Total project cost is estimated to be US$191.4 million (Part II, Tables 8A and 8B). Final overall disbursement was IDA US$71.0 million, Arab Fund US$47.8 million, Saudi Fund US$2.4 million, Italian Grant US$8.4 million, British Grant US$8.2 million, Japanese Grant US$29.0 million; and GOS contribution US$24.6 million. IDA disbursement, expressed in SDRs, amounted to SDR53.5 million or about 72 percent of the original amount of SDR74.2 million (Part II, Table 4). After the last disbursement on May 17, 1994, the undisbursed balance of SDR20.7 million was canceled. Percentages of original allocation that were disbursed from other donor funds were as follows: Arab Fund 62 percent, Saudi Fund 7 percent, Italian Grant 93 percent, British Grant 99 percent, Japanese Grant 100 percent. The GOS contribution reached 23 percent of appraisal estimates, but only 13 percent of total project costs when the project closed on December 31, 1993.

34. The Economic Rate of Return (ERR) at appraisal was estimated to be 35.8 percent. The ERR at project completion has been estimated at 19 percent. Details are included in Appendix C-1, Tables 1 to 13 of the FAO full report dated November 4, 1994. The re-estimated ERR differs from the appraisal estimate mainly because: (i) the canal regulators and structure component was not implemented; (ii) the area under cotton decreased dramatically since 1984/85 as a result of low world market prices; (iii) low cropping intensity; and (iv) economic benefits generated as a result of the successful implementation of both the schistosomiasis program and the rural water supply components have not been taken into account as they were difficult to quantify.

C. MAJOR FACTORS AFFECTING THE PROJECT

Factors Not Generally Subject to Government Control

35. The most important factor which adversely affected project implementation was the suspension of funding by three of the six cofinanciers: IDA, the Saudi Fund (SF) and the Arab Fund (AF) (Part II, Table 8B). As a result of the premature closure of IDA disbursements, two vital project components--the Sennar Dam Renovation and Desilting of Canals--in so far as using private contractors were not implemented. IDA, having agreed to extend the credit closing date for the Sennar Dam Renovation to December 31, 1995 because of "the dam safety concerns," canceled the credit after the second suspension of disbursements of all IDA credits to Sudan with effect from September 14, 1993. This cancellation brought about a difficult situation since both the contractor and the consultant for the dam renovation were still working on the site. With seven of the 80 sluice gates from the dam removed by the contractor for repairs, the MOI was fortunate in dealing adequately with the highest flood since 1988 of 10,650 m^3/sec on August 17, 1994. Ever since May 1993 IDA had sought a commitment from Sudan to continue uninterrupted funding of the contract from its own sources if IDA credits remained suspended and no such assurance was received from GOS. In view of the importance of the Sennar Dam renovation, the GOS has negotiated with the contractor for the resumption of repair work commencing November 1994 under MOI supervision.

36. The cancellation of SF disbursements for an equally important component--Canal Regulators and Structures--also had a notable negative impact on the achievement of project objectives. The roller sluice gates and moveable weirs were not imported from a German supplier as planned, and the payment for 29,000

Field Outlet Gates (FOG), supplied by a Chinese sub-contractor, was subsequently made by the GOS since they were delivered after the SF cancellation. Two other components which were critical to the project, namely, the Canal Maintenance and the Drainage System, were not fully implemented due to the suspension of AF financing for these components.

37. Project implementation was delayed by a variety of factors; consequently, the project was given four extensions (to December 1990, 1991, 1993 and 1995). The longest delay was in the start-up of the project, due to problems in securing co-financing. Other significant factors which caused subsequent delays were: the sheer size and diversity of the procurement program, the major plant and equipment needs, modification of some project components and the addition of new ones, and the selection/ appointment of both project staff and consultants. Another major factor which contributed to the delay was the involvement of some seven different agencies in project implementation. Despite RPMU's persistent efforts to achieve their cooperation, it found this task most daunting.

38. Other factors which affected project implementation were: (i) interruptions in the civil works program due to shortages of cement and other materials in the market. For example, two new factories which were built to manufacture 50,000 latrine slabs were able to produce only 15,000; (ii) changes in specifications for some agricultural machinery and the delays in procurement; and (iii) the SAR proposed the introduction of a T&V system using converted field inspectors. In effect, the project set up a parallel extension service with 20 extensionists as staff members of the ARC. The research/extension linkage as envisaged did not fully materialize.

Factors Generally Subject to Government Control

39. Project implementation got off to a slow start because of the delay in the establishment of the Rehabilitation Project Management Unit (RPMU) and the appointment of its Executive Director. GOS's contribution amounted to US$24.6 million–about 24 percent of SAR estimate (Part II, Table 8B).

Factors Generally Subject to Implementing Agency Control

40. The factors which could have contributed further to the project performance and achievement and which were under the RPMU control are:

- Some of the most promising results of the special study and the experimental work at Pilot Farms carried out under the project to test various options for sediment management in canals should have been applied to a few selected canals in the project area;

- Measured data on irrigation efficiencies hardly exist for the Gezira scheme. Collection of such data before and after project implementation would have provided useful information on the project's impact on overall project irrigation efficiency;

- The selection of ancillary agricultural equipment should have been made on the basis of available research results and expert advice; and

- Advance planning in the choice of trainees and in identifying skill gaps would have helped in highlighting specific needs and assisted in selection of courses;

D. PROJECT SUSTAINABILITY

Overview

41. At the present level of operation the project is likely to be sustainable. Future improvement would, to a large extent, depend on: (i) uninterrupted water availability for irrigation from the Sennar Dam; (ii) long-term solution of the problem of canal siltation and the growth of aquatic weeds; (iii) efficient operation and maintenance (O&M) of the irrigation and drainage (I&D) system and the infrastructure throughout the project area; (iv) continued support to farmers through extension, research and training; (v) adequate level of funding for research stations in the project area; and (vi) mitigation of the effects of any negative environmental impact due to water-logging, salinity, siltation and other soil-plant-water reactions under irrigation.

42. **Water Availability:** The Sennar Dam was built in 1925 and it has already outlived its economic life. Its active storage has diminished from the initial 930 Mm^3 to 480 Mm^3. The present live storage of 480 Mm^3, together with the available Roseires live storage of 2,200 Mm^3, is adequate to meet the irrigation demands of all schemes, including the Gezira, located along the Blue Nile in an average year. The Sennar Dam repair and renovation component of the project was aimed at reducing the unacceptably high seepage losses through the sluice gates and the spillway gates, and improving generally the operation of the reservoir. The non-implementation of this component could seriously affect project sustainability, and it is encouraging to note that GOS is continuing with the implementation of the renovation works. The present cropping intensity within the Gezira scheme remains low due to: (i) lower water availability due to unfinished irrigation and drainage network improvements; (ii) fixed allocation of crop rotation; (iii) lack of adequate agricultural machinery services; and (iv) limited availability of seed for short production cycle crops such as legumes, fodder and vegetables.

43. **Silt and Weed Removal from Canals:** The problem of canal siltation and sediment deposition has become acute in recent years especially between July and November each year, based on studies (refer to Table 7) carried out under the project. Sediment deposition of approximately 14 percent, 22 percent and 33 percent are estimated in the Main, Major and Minor canals respectively, the remaining 31 percent being carried beyond into the fields. Although the rehabilitation and re-equipping of the EMC proved highly effective in silt/weed removal during the project's life, the MOI may not be able to sustain this important activity without further technical and financial assistance. Also, the non-procurement of the Canal Desilting equipment due to suspension of the IDA credit has aggravated the problem. The implementation would have brought in private contractors to clear the vast backlog of sediment from the canals.

44. The growth of aquatic weeds in the Gezira canals not only reduces velocities in canals but also contributes to the general deterioration of the distribution system. Although a number of manual, mechanical, chemical and biological methods have been applied in the Gezira with varying degrees of success, weed control still remains a major problem. Weed removal sub-component was a part of the Canal Maintenance component which was partially implemented due to the cancellation of AF disbursements.

Operation and Maintenance (O&M)

45. **Irrigation and drainage system:** The O&M organization for the Gezira scheme consists of seven field divisions, with each division having 3 to 4 subdivisions. Each subdivision is in charge of the O&M of 30,000 feddans. It appears that the present system of cost recovery through crop-based water charges meets only about 67 percent of the total annual O&M costs and the GOS subsidizes the remaining 33 percent of the cost. As a result of the rehabilitation of the scheme and especially when the Sennar Dam Renovation and

Canal Maintenance components are implemented, the O&M charges are likely to rise due to the increased irrigated area, and the GOS would then have to raise the water charges to meet the increased O&M expenditure. It must be emphasized that efficient O&M of the I&D system is essential to the sustainability of the project's achievements. The active involvement of farmers in O&M should also be sought through the establishment of Water Users Associations (WUA) (see para 54).

46. **Infrastructure:** The maintenance of roads repaired, upgraded or constructed under the project is the responsibility of the MOI at Gezira. The O&M of 370 new rural water supply schemes is being carried out by the respective Village Councils set up by the RWSA, and two persons from each village are being trained in the O&M procedures. However, the RWSA may not have the resources to finance the purchase/import of spares for pumps, water tanks, etc, in the future. The substantial reduction achieved in the incidence of schistosomiasis in 89 of the 105 blocks in the Gezira would depend on the regular supplies of drugs and chemicals (e.g. praziquental tablets, focal molluscicides, etc.).

Agricultural Services and Research

47. Although the project has made a significant impact on agricultural production through the rehabilitation of cultivation equipment, the scheme remains under-mechanized. A schedule of continual replacement supported by adequate financial resources is necessary if the current level of land preparation is to be maintained. An important decision taken by the GOS in 1992 was to allow privatization of agricultural services, including credit, mechanization and crop marketing. For this purpose new private entities have been recently established and include the Farmers Bank, the Agricultural Services Company and the Cotton Marketing Company. As a result, SGB activities in providing partially subsidized agricultural services are being scaled down. The Farmers' Bank has recently procured 150 tractors and 30 combine harvesters either to be handed over to private farmers on credit or to adequately equip its affiliated Agricultural Services Company. Responsibilities of SGB regarding farm services and collection of agricultural produce will be maintained on a self-financing basis.

48. The research activities initiated under the GRP and the infrastructure created will depend, to a large extent, on the level of funding from ARC. As long as the ARC's commitment to maintain GRS as a leading center of crop research in the country continues, the future outlook appears favorable.

Environmental Aspects

49. The wells drilled in the project area for rural water supply have reached depths of 300 m or more and some of them are located close to the Blue Nile. The depths of these wells indicate that deep percolation from the project area is extremely low and water-logging will not be a problem in the immediate future. Although soil salinity has not been noticed so far, increased cropping intensity in the future may result in salinization of soils in some parts of the project area. The project authorities were advised to monitor possible environmental impacts on a regular basis.

E. BANK PERFORMANCE

50. The project was identified by the Bank and prepared by the GOS assisted by local and foreign consultants. The preparation was jointly financed by the IDA and the Kuwait Fund. Although the project was generally well conceptualized, prepared and appraised, some components were better prepared than others. A key component under irrigation and drainage improvement was "Canal Maintenance" which was included in the project because of the serious deterioration in the performance of the water distribution system

due to silting of canals and growth of aquatic weeds. When the project implementation commenced in 1985, there was already a huge backlog of silt and weeds to be cleared from the canals. The implementation of this component was also closely linked to a special study by the HRS which formed part of the 14 studies under the project (para 27 and Table 7). Soon after implementation started, two new components "Rehabilitation of EMC" and "Canal Desilting" were added to the project. Although the mission could not trace the background or history of these new components from the project files or from the Supervision Mission reports, it appears that these components were linked to the "Canal Maintenance" component. In retrospect, if the canal siltation study had been carried out under the PPF prior to project implementation, its recommendations could have helped in the timely implementation of this component.

51. Another important aspect to which adequate attention was not paid at project preparation and appraisal pertains to cropping patterns and cropping intensities at the Gezira. Water being a limiting factor in Sudan under the Sudan-Egypt Nile Agreement of 1959, it is not possible to achieve very high cropping intensities. However, the reduction in the cotton area in recent years makes it feasible to achieve intensities of over 100 percent if: (a) the existing cropping pattern, based on a four-course (cotton, groundnut, wheat and sorghum) rotation including a fallow, is changed in areas where cotton is not being grown; (b) the choice of the cropping pattern is left to the farmers; (c) appropriate agricultural machinery is made available; and (d) supplies of legume seeds for fallow are made available. The increase in cropping intensity from 58 percent to 72 percent (para 30) could well have been exceeded.

Project Supervision

52. A total of 23 Supervision Missions, including a Mid-Term Evaluation Mission, were mounted between September 1983 and April 1993 (Part II, Table 13). This is above the average for a project of this nature and indicates the emphasis placed on project supervision. The missions usually consisted of an economist, an irrigation engineer and an agriculturalist, and occasionally included a procurement specialist. Inclusion of an agricultural machinery expert in early Supervision Missions would have assisted the project management in the choice of relevant machinery and the preparation of detailed technical specifications. On the whole, the project was monitored effectively and its progress--or lack thereof--was well reported.

F. BORROWER'S PERFORMANCE

53. The borrower's performance was generally satisfactory. The various institutions involved in project implementation--MOA, MOI, RPMU, SGB, ARC, RWSA, BNHP--also performed satisfactorily despite the multi-source financing of the project. The in-service training of both the managerial and professional staff also contributed to smooth project management. The RPMU controlled the project most efficiently and maintained a regular liaison with the donors and the implementing agencies. It cooperated with visiting donor missions and supplied them with all the project implementation data. However, despite the continued Bank assistance in explaining procurement procedures, the RPMU found them too complex and cumbersome. Although each individual implementing agency performed well, the three agencies which implemented the most effective project components were the BNHP, RWSA and the SPTC. The unique experience gained by these agencies would be immensely useful elsewhere in the future.

54. Although the SAR recommended "group action by farmers in proper water management and upkeep of field channels" (SAR: para 4.13), neither the MOI nor the SGB took any initiative in the establishment of Water Users' Associations (WUA). The report by an IIMI Water Management Adviser commissioned by the SGB under the project makes several relevant recommendations on improving On-Farm Water Management (OFWM), but it does not specifically emphasize the need for establishing WUAs. At a time when farmers'

participation in the management of irrigation schemes is being actively practiced through the formation of WUAs, the MOI/SGB seem to have lost an opportunity to establish WUAs at Gezira not only to improve OFWM but also to enlist the farmers' cooperation in O&M and in other on- and off-farm activities.

G. ASSESSMENT OF OUTCOME

55. The project's outcome is assessed as satisfactory, notwithstanding the non-implementation of some important project components relating to irrigation and drainage improvement due to suspension of funding. The project's outcome, especially in relation to agricultural research and training, infrastructural improvement and institutional strengthening, was substantial.

H. FUTURE OPERATIONS

56. The future sustainable operation of the project will depend on the successful completion of those vital I&D components which could not be implemented due to withdrawal of funding. It is understood the Government has already initiated work on these components through its own funding or other sources. The activities which will require donor and the Bank's urgent support, when the Bank resumes its lending to Sudan, are (i) Sennar Dam renovation, (ii) Silt/weed clearance from canals, and (iii) replacement of spares for agricultural machinery, pumping stations and rural water supply pumps, as well as supply of medicines/ chemicals for schistosomiasis control.

57. The major constraint in expanding/intensifying agriculture in the Gezira is the limited availability of water from the Blue Nile and the capacity of the conveyance and distribution system. The GOS, in order to utilize fully the allocated water resources under the 1959 Sudan-Egypt Nile Agreement wants to proceed with the raising of the Roseires Dam as originally planned. The GOS attaches top priority to this activity and is looking for potential donors to finance it.

I. KEY LESSONS LEARNED

58. The key lessons learned from the project are as follows:

(i) The present practice of removing large amounts of silt from canals mechanically is only a temporary O&M measure. Long-term solutions to the canal siltation problem should be found, as the silt inflow into the canals has increased substantially in recent years;

(ii) Projects should be adequately designed at appraisal taking into account a more realistic estimate of the capability of the borrower in meeting its financial and production obligations;

(iii) The number of project components, the diversity of the procurement, and the involvement of many different agencies to implement the project led to both various delays in project start up and implementation.

(iv) In-service training should focus on relevant and practical short-term courses or study tours rather than on narrow post-graduate degrees;

(v) The various studies under the project were implemented satisfactorily, but the contracting of most relevant studies (for example the Role of Private Sector in Agriculture Mechanization, Mechanical Weed Control and Silt Clearance Methods and Acquatic Weed Control) under the PPF facility prior

to project implementation would have contributed significantly to the timely implementation of some project components.

(vi) A considerable body of proven research results on tillage practices and low cost systems, which should have been applied in the selection of ancillary agricultural equipment, was not given due consideration in the replacement of inventories; and

(vii) Although measurable cropping increases in yields have been achieved, there is potential to further increase cropping intensities;

(viii) IDA's timely assumption of some components suspended from financing by AF/SF was very helpful in keeping the project moving and is a valuable lesson for future projects with similar circumstances.

PART II: STATISTICAL ANNEXES

Table 1: Summary of Assessments

A. Achievement of objectives	Substantial (✓)	Partial (✓)	Negligible (✓)	Not Applicable (✓)
Macro policies				✓
Sector policies		✓		
Financial objectives	✓			
Institutional development	✓			
Physical objectives	✓			
Poverty reduction		✓		
Gender issues			✓	
Other social objectives	✓			
Environmental objectives		✓		
Public sector management		✓		
Private sector development		✓		
Other (specify)				✓

B. Project sustainability	Likely (✓)	Unlikely (✓)	Uncertain (✓)
	✓		

C. Bank performance	Highly satisfactory (✓)	Satisfactory (✓)	Deficient (✓)
Identification		✓	
Preparation assistance		✓	
Appraisal		✓	
Supervision		✓	

D. Borrower performance	Highly satisfactory (✓)	Satisfactory (✓)	Deficient (✓)
Preparation		✓	
Implementation		✓	
Covenant compliance		✓	
Operation (if applicable)			

E. Assessment of outcome	Highly satisfactory (✓)	Satisfactory (✓)	Unsatisfactory (✓)	Highly unsatisfactory (✓)
		✓		

Table 2: Related Bank Loans/Credits

Loan/Credit Title	Purpose	Year of Approval	Status
1. Savannah Development (Cr.No. 0718-SU)	Rainfed area development	1977	Closed June 1984
2. Roseires Irrigation (Cr.No. 0002-SU)	Irrigation	1961	Closed December 1971
3. Second Mechanized Farming (Cr.No. 0311-SU)	Agricultural Mechanization	1972	Closed December 1980
4. Rahad Irrigation (Cr.No. 0364-SU)	Irrigation	1973	Closed June 1980
5. South Region Agric. Rehab. (Cr.No. 0476-SU)	Area development	1974	Closed December 1979
6. Livestock Marketing (Cr.No. 0782-SU)	Livestock	1978	Closed December 1986
7. Third Mechanized Farming (Cr.No. 0804-SU)	Agricultural Mechanization	1978	Closed December 1985
8. Agricultural Research (Cr.No. 0834-SU)	Research & Extension	1978	Closed December 1987
9. Southern Region Agriculture (Cr.No. 0904-SU)	Area development	1979	Closed June 1984
10. Agric. Rehab. Programme (Cr.No. 1000-SU)	Area development	1980	Closed March 1983
11. New Halfa Irrigation Rehab. (Cr.No. 1022-SU)	Irrigation improvement	1980	Closed June 1989
12. Blue Nile Pump Scheme Rehab. (Cr.NO. 1118-SU)	Irrigation improvement	1981	Closed Sept. 1990
13. White Nile Pump Scheme Rehab (Cr. No. 1119-SU)	Irrigation improvement	1981	Closed December 1987
14. Western Savannah (Cr.No. 1181-SU)	Rainfed area development	1981	Closed June 1986
15. Agricultural Services (Cr.No. 1201-SU)	Support services	1982	Closed Sept. 1989
16. Agric. Rehabilitation II (Cr.No. 1389-SU)	Area development	1983	Closed November 1986

Loan/Credit Title	Purpose	Year of Approval	Status
17. Sugar Rehabilitation (Cr.No. 1506-SU)	Agro-industry	1984	Closed December 1993
18. Drought Recovery Programme (Cr.No. 1614-SU)	Area development	1985	Closed June 1988
19. Western Savannah II (Cr.No. 1640-SU)	Rainfed area development	1985	Closed June 1993
20. Agric. Rehabilitation III (Cr.No. 1866-SU)	Area development	1987	Closed December 1992
21. Emergency Drought Recovery (Cr.No. 2290-SU)	Area development	1991	Closed Sept. 1993
22. Agric Extension & Training (Cr.No. 1639-SU)	Support services	1985	Closed June 1993
23. Southern Kordafan Agri. Dev. (Cr.No. 1867-SU)	Rainfed area development	1987	Closed December 1994
24. Southern Kassala Agric. (Cr.No. 1961-SU)	Area development	1988	Closed Sept. 1995
25. Emergency Flood Reconstruction (Cr.No. 2011-SU)	Area development	1989	Closed October 1993

Table 3: Project Timetable

Steps in Project Cycle	Date Planned	Date Actual
Identification		June 1979
Preparation[1/]		April 1981 to May 1982
Appraisal Departure Post Appraisal Departure	May 1982	May 26, 1982 September 28, 1982
Negotiations	April 1983	April 7-15 1983
Board presentation	June 1983	June 16, 1983
Signing		August 9, 1983
Effectiveness	September 1983	May 9, 1985
Mid-term Review		January 1989
Completion Date	June 30, 1988	December 31, 1993
Credit Closing[2/]	June 30, 1989	December 31, 1993

1/ The project was prepared by consultants, under contract to the Ministry of Finance and Economic Planning. The WB visited Sudan twice: September 1981 and December 1981, to participate in the review of project preparation and hold discussions with GOS and the consultants. Time taken to prepare the project is 12 months.

2/ The closing date was exttemded to December 31, 1995. However, because of the second supervision of disbursement of all IDA credits to Sudan, the credit was closed on December 31, 1993 and the undisbursed balance of US$20.7 million was cancelled.

Table 4: Credit Disbursements: Cumulative Estimated and Actual

	FY83	FY84	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93	FY94
						(US$ million)						
A. Expressed in US$												
Appraisal estimate	0.3	6.1	27.2	44.6	61.5	71.7	80.0	-	-	-	-	-
Actual	-	-	0.3	1.2	11.0	18.0	31.2	44.0	56.0	62.1	67.2	71.0
Actual as % of estimate	-	-	1.1	2.7	17.9	25.1	39.0	55.0	70.0	77.6	84.0	88.8
						(SDR million)						
B. Expressed in SDR												
Appraisal estimate	0.3	5.7	25.2	41.4	57.0	66.5	74.2	-	-	-	-	-
Actual	-	-	0.2	0.9	8.3	13.5	23.5	33.2	42.2	46.8	50.7	53.5
Actual as % of estimate	-	-	0.8	2.2	14.6	20.3	31.7	44.7	56.9	63.1	68.3	72.1

Date of final disbursement: 17 May 1994

Table 5: Key Indicators for Project Implementation

(Ending December 1993)

I. Key Implementation Indicators (SAR)	Unit	Estimated	Actual
1. Canal Regulators and Structures			
- Roller Sluice Gates	Nos.	16+66	)
- Regulator Doors	Nos.	475	) Not
- Steel Pipes	Nos.	680	) Implemented
- Field Outlet Gates (FOG)	Nos.	2400	)
- Water Level Gauges	Nos.	200	)
2. Canal Maintenance			
- Loader	Nos.	6	6
- Tipper Lorries	Nos.	18	18
- Graders	Nos.	12	12
- Mechanical Weed Clearance	LS[1]		) Not
- Chemical/Biological Weeding Research	LS		) Implemented
3. Drainage			
- Desilting of Major Drains	km	1480	1480
- Excavation of New Main Drains	km	190	190
- Reconstruction of Minor Drains	km	4000	4000
- Pumping Stations	Nos.	5	5
- Mobile Pump Units	Nos.	60	60
- Syphons	Nos.	2	2
- Road Crossings on Major Drains	Nos.	600	600
4. Pumping Stations			
- Rehabilitation of Pumping Stations	Nos.	9	9
- Replacement of Pumping Stations	Nos.	1	1
5. Sennar Dam			
- Repair of Gates			)
- Overhauling of Cranes		Overall	) Not
- Upgrading of Mechanical Equipment		Rehabilitation	) Implemented
- Upgrading of Workshop			)
6. Agricultural Machinery			
- Tractors (55 kw)	Nos.	150	150
- Farm Implements	-	Various	100%
7. Research Station			
- Building (existing)	Nos.	Various	70%
- Building - new houses	-	17	-
- Building at Kenana Station	-	12	20% completed
- Vehicles	-	16	16
- Agricultural Machinery	-	122	17
- Lab Equipment and Chemicals	-	Various	100%
- Electr. Equipment	set	1	1

[2]

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[1] Lump Sum provision.

[2] All figures provided by FAO.

I. Key Implementation Indicators (SAR)	Unit	Estimated	Actual
7a. Seed Production			
- Lab Building	Nos.	1	100%
- Agricultural Machinery	-	Various	100%
- Lab Equipment and Chemicals	-	Various	100%
7b. Pilot Farm			
- Agricultural Machinery	-	Various	100%
- Lab Equipment and Chemicals	-	Various	100%
8. Workshops			
- Building	Nos.	1	100%
- Equipment	-	Various	100%
- Fuel Storage Tank	Nos.	LS	60%
- Generators	Nos.	LS	(3 SGB/ 2+10 MOI)
9. Vehicles[1/]			
- 2x4 WD Pickups	Nos.	61	291
- 4x4 WD Pickups	Nos.	286	254
- 4x4 WD Station Wagon	Nos.	-	58
- Saloon cars	Nos.	4	11
- 7T Cargo Trucks	Nos.	39	130
- Fuel Tankers	Nos.	15	42
- Fire Engine Trucks	Nos.	9	9
TOTAL		414	795
10. Roads			
- Repairs and Maintenance	km	6000	6000
- Machinery (Graders)	Nos.	10	10
11. Telecommunications			
- Exchanges	Nos.	3	3
- Telephone Lines (New/Expansion)	Nos.	1500/1000	1500/1000
12. Gezira Light Railway			
- Trolleys (Motorised/Hand Pumped)	Nos.	3+3	3+3
- Elevating Motor Graders	Nos.	2	2
- Hand Tools	-	Various	100%
- Replacement of Tracks	km	38	38
- Rehabilitation of Wagons	-	Spares	100%
- New Tanker Wagons	Nos.	20	20
- New Locomotive Engines	Nos.	10	10
13. New Roller Gins	Nos.	2	Not Implemented

1/ The vehicle requirements were revised to meet the needs of 7 implementing agencies (SGB/MOI/EMC/BNHP/ARC/RWSA/RPMU) during implementation. Allocations to individual agencies are given in the Borrower's Report.

I. Key Implementation Indicators (SAR)	Unit	Estimated	Actual
13a. Renovation of Gins	Nos.	5	5
14. Schistosomiasis Programme			
- Blocks Covered for Schistosomiasis Control	Nos.	89	89
15. Rural Water Supply and Sanitation			
Water Supply:			
- Boreholes with Handpumps	Nos.	145	145
- Pumps+Storage Tanks	Nos.	60	60
- Rehabilitation of Sand Filters	Nos.	100	100
- Maintenance Workshops	Nos.	4	4
Sanitation:			
- Latrine Slab Factories	Nos.	2	2
- Latrine Slab Production	Nos.	50000	15000
16. Staff Housing and Utilities			
SGB Staff:			
- T1 Houses	Nos.	24	81%
- T2 Houses	Nos.	54	97%
- T3 Houses	Nos.	21	100%
MOI Staff:			
- T1 Houses	Nos.	2	95%
- T2 Houses	Nos.	3	95%
- T3 Houses	Nos.	15	95%
- Training Centre Building	Nos.	1	70%
- Canal Gateman Houses	Nos.	50	40%
- Utilities (Electricity/Water Supply/Sanitation)	-	LS	50-100%
17. RPMU (Staff, TA, Other Services)	-	LS	100%
18. SGB Management Information System	-	LS	Not Implemented
19. Training and TA			
SGB: - Abroad	Nos.	201	198
- In-country	Nos.	603	486
- In-house	Nos.	1493	1194
- On-the-job	Nos.	855	855
MOI: - Abroad	Nos.	204	89
- In-country	Nos.	133	83
- In-house	Nos.	184	7
- On-the-job	Nos.	267	167
EMC: - Abroad	Nos.	16	16
- In-country	Nos.	70	70
- In-house	Nos.	186	186
- On-the-job	Nos.	130	130
20. Studies	Nos.	8	14[1/]

[1/] The total number of studies was revised to deal with such problems as canal siltation, weed control etc. A desk review of existing literature, included under this component, identified/formulated TORs for additional studies.

II. Other Implementation Indicators[1/]	Unit	Estimated	Actual
21. Rehabilitation of EMC			
- Rehabilitation of Old Machinery	Nos.	124	124
- Dragline	Nos.	29	29
- Bulldozers	Nos.	12	12
- Scrapers	Nos.	20	20
- Motor Graders	Nos.	12	12
- Excavators	-	-	-
- Vehicles (included under Component 9 above)			
22. Desilting of Canals (Using Private Contractors)	-	-	Not Implemented

1/ Theses indicators were neither mentioned specifically in the SAR nor detailed when some other project components were modified.

Table 6: Key Indicators for Project Operation

Not applicable to this Project

Table 7: Studies Included in Project

Study	Purpose as Defined at Appraisal	Status	Impact of Study
1. Desk Review	To determine TORs for other studies	Completed 1987	Helped in identifying other studies
2. Initial socio-economic survey (Tenancy Study)	To obtain demographic, occupational and agricultural data	Completed 1994	Assistance in project planning
3. Intensive socio economic study	Detailed survey	Completed 1994	Impact on project planning/design
4. Credit Study	To study credit/debt situation in project area	Completed 1990	Impact on pricing, marketing
5. Integration of Livestock	Integration of livestock into cropping pattern	Completed 1987	Positive recommendations
6. Role of Private Sector in Agricultural Mechanization	To get a better insight into the capability of private sector	Completed 1991	Positive recommendations
7. Profitability of Vegetable Production	To get a quantitative assessment of profits from veg. production	Completed 1991	Positive recommendations
8. Migrant Labour Settlements	To explore cost of re-location/re-settlement	Completed 1994	Not yet implemented
9. Crop Choice and Cropping Patterns	To determine cropping patterns for individual farmers	Delayed, Completed 1994	Positive recommendations
10. Privatised Agriculture by Enterprising Tenants	To draw up scheme for privatized agriculture by entrepreneurs tenants	Completed 1994	Implemented according to schedule
11. Mechanical Weed Control/ Silt Clearance Methods	To assess cost/benefits of combined silt/weed clearance operations	Completed 1989	Recommendations not yet applied in field
12. Aquatic Weed Control	To assess cost of chemical/biological control programmes	Completed 1988	Recommendations not implemented yet
13. Ginning Efficiency	To review existing systems	Completed 1990	Recommendations adopted
14. Sediment Control by Settling Basins	To determine cost and sediment trapping efficiency of settling tanks	In progress	HRL (UK) also involved. Recommendations awaited.

Table 8A: Project Costs

Item	Appraisal estimate (US$M)			Actual/latest estimate (US$M)		
	Local costs	Foreign costs	Total	Local costs	Foreign costs	Total[1/]
1. Irrigation	10.7	10.9	21.6	8.5	8.5	17.0
2. Drainage System	11.8	11.2	23.0	-	6.8	6.8
3. Pumping Stations	2.0	4.5	6.5	-	5.0	5.0
4. Sennar Dam	1.7	2.5	4.2	0.3	9.2	9.5
5. SBG	2.2	10.1	12.3	-	7.5	7.5
6. Extension & Research	2.1	3.5	5.6	0.5	2.9	3.4
7. Workshops	5.8	10.5	16.3	-	0.9	0.9
8. Vehicles	10.8	8.2	19.0	-	9.0	9.0
9. Roads	1.7	2.9	4.6	11.3	0.2	11.5
10. Telecommunication	3.1	8.6	11.8	-	29.0	29.0
11. GLR	1.4	3.6	5.0	-	8.2	8.2
12. Ginneries	7.2	14.1	21.3	-	21.9	21.9
13. Schisto.....	0.4	5.6	6.0	0.4	2.8	3.2
14. RWS	8.2	7.1	15.3	1.1	7.7	8.8
15. Housing	5.8	3.5	9.3	-	0.1	0.1
16. RPMU	2.7	1.7	4.4	0.4	4.0	4.4
17. SBG Inf. Syst.	1.3	2.5	3.9	2.1	0.1	2.2
18. Training	1.8	2.4	4.2	-	4.0	4.0
19. Other TA	0.3	1.5	1.8	-	1.3	1.3
20. Studies	1.2	1.2	2.4	-	25.0	25.0
21. EMC[2/]	-	-	-	. . .	12.7	12.7
Total Baseline Costs	82.5	116.2	198.6			
Physical Contingency	8.5	11.9	20.5			
Price Contiongency	21.9	21.7	43.6			
TOTAL:	**112.9**	**149.8**	**262.7**	**24.6**	**166.8**	**191.4**

1/ Data provided by FAO and RPMU.

2/ Not included at appraisal.

Table 8B: Project Financing

Source	Appraisal estimate (US$M)			Actual/latest estimate (US$M)		
	Local costs	Foreign costs	Total	Local costs	Foreign costs	Total
IBRD/IDA	3.6	76.4	80.0	-	71.0	71.0
Cofinancing institutions	-	73.4	73.4	-	95.8	95.8[1/]
Other external sources	-	-	-	-	-	-
Domestic contribution	109.3	-	109.3	24.6	-	24.6
TOTAL	**112.9**	**149.8**	**262.7**	**24.6**	**166.8**	**191.4**

1/ Including: Arab Fund: US$ 47.8 million; Saudi Fund: US$ 2.4 million; British Grant: US$ 8.2 million; Italian Grant: US$ 8.4 million; Japanese Grant: US$ 29.0 million.

Table 9: Economic Costs and Benefits

The economic rate of return (ERR) at appraisal was estimated to be 35.8 percent. The high ERR reflected the large amount of sunk capital in the project area, and increased efficiency of operations. The ERR at project completion has been estimated at 19 percent. The re-estimated ERR differs from the appraisal estimate mainly because: (i) several items under the canal regulators and structure component could not be implemented due to the suspension of SF disbursements; (ii) although the total irrigated area in the Gezira scheme increased from about 1.2 feddans (average 1984/85-1986/87) to some 1.5 million feddans (average 1991/92-1993/94), the area under cotton decreased dramatically since 1984/85 as a result of low world market prices of cotton. Presently, only 150,000 feddans are occupied by cotton. At appraisal, the area under cotton was projected to reach 460,000 feddans at project completion; (iii) the cropping intensity in the Gezira scheme still remains low (72 percent); (iv) only the investment costs relative to the GLR component (US$29.0 million) have been excluded from the economic re-evaluation; (v) the re-estimated ERR is considered conservative since the economic benefits generated as a result of the successful implementation of both the schistosomiasis programme and the rural water supply components, impossible to quantify, have not been taken into account. Detailed analysis and assumptions are given in Appendix C-1, Tables 1 to 13 of FAO's Completion Report dated November 3, 1994.

Table 10: Status of Legal Covenants

SUDAN
Gezira Rehabilitation Project

Para of Agreement (DCA)	Requirement	Status
2.02 a	Withdrawals from credit account in accordance with provisions of schedule I to this agreement.	In compliance
2.02 b	After effectiveness, association shall withdraw PPF.	In compliance
2.03	Procurement shall be in accordance with Schedule 3.	In compliance
2.05	Payment of commitment charge and service charge to association.	In compliance
3.02 (b) (i)	Establish and maintain project management committee and project procurement committee.	In compliance
3.02 (b) (ii)	Prepare and submit by April 1, each year to PMC for its review and approval, a draft annual work programme, acceptable to association.	In compliance
3.02 (b) (iii, iv, v, vii)	Borrower shall make quarterly transfers of funds to SGB.	Not complied with but MOP agreed to give advance and replenish as and when vouchers are submitted
3.03	Borrower shall employ consultants whenever required acceptable to association.	In compliance
3.04 (a)	The borrower undertakes to insure or make adequate provision for insurance of imported goods.	In compliance
3.05 (a)	Submit to association plans, specification, reports, contract documents procurement schedules for the parts of project for which it is responsible as per request of association.	In compliance
3.05 (b)	Maintenance records and procedures adequate to record and monitor the progress of parts of the project to enable association representative to verify.	In compliance
3.05 (d)	Prepare and furnish to association and report of such scope on the execution and initial operation of project its costs, and benefits derived.	In compliance

3.07	Enter agreement with SPTC for tariffs for facilities included in part "K" of project.	In compliance
3.08	Borrower ensure that Agriculture Bank of Sudan make available finance for purchase of 75 tractors and implements to tenants.	Not complied with as bank has no funds, project purchased tractors
4.01 (a)	Borrower shall maintain separate accounts of each implementing agency.	In compliance
4.01 (b)	Borrower shall maintain separate accounts for all expenditure relating to withdrawals which were requested from credit on the basis of statement of expenditure.	In compliance
4.01 (c)(i) (ii)	Borrower shall submit unaudited accounts not later than six months after the end of each fiscal year to association. Borrower shall submit audited accounts and auditors report to association not later than nine months after end of each fiscal year.	In compliance In compliance
4.02 (b) (i)	Provide funds for proper maintenance of the Roseries Dam.	In compliance
4.02 (b)	Borrower shall make periodical inspection of Sennar and Roseries Dams in accordance with Sound Engineering practice and submit association maintenance requirements.	In compliance
4.03	Borrower prepare and submit to association for its review and comments ten year programme for its proposed investments in irrigation sub-sector.	NRIP project document prepared under ARPIII
4.04	Borrower shall set cotton and wheat prices levels applicable to producers.	In compliance
4.05 & 4.06	Borrower shall set annually the levels of machinery hire applicable, water and land charges to the tenants of project area on the basis of full recovery of costs.	In compliance In compliance
6.01	Conditions of loan effectiveness.	Fully met

Project Agreement (GRP)	Requirement	Status
2.01 (b) i	By April of each year prepare annual work programme and submit to association.	In compliance
2.01 (b) ii	Carry out annual work programme approved by association, satisfactorily.	In compliance
2.02	Employ consultants whenever required, satisfactory to association.	In compliance
2.03 (a)	To insure the imported goods.	In compliance
2.04 (a)	Submit to association plans, specification, reports, contract documents, construction and procurement schedules to association for approval.	In compliance
2.04 (b) (i)	Shall maintain records and procedures adequate to record and monitor progress of project operations and submit and be available to association's representative for verification.	In compliance
2.04 (b) I	Prepare and submit association a report of such scope on the execution and initial operation of project parts for review.	In compliance
2.04 (t)	Allow association representative to examine all plants, sites, works, etc.	In compliance
2.07	SGB shall transfer to MOI the operation of minor canals of the project area according to timetable.	In compliance
2.09	Establish research and production committees for part G of project.	In compliance
3.01 (a)	Shall carry on its operations and conduct its affairs in accordance with Sound Administrative, financial practices.	In compliance
3.01 (b) (i)	Employ MD, Dy MD, R/E coordinator.	In compliance
(ii)	Prepare action programme to strengthen M.I.S.	In compliance
(iii)	Prepare training programme and submit to association.	In compliance
3.02	Maintain and keep plant, machinery, etc., in good condition.	In compliance
3.03	To take out insurance with responsible insurers risks satisfactory to association.	In compliance
4.04 (a)	Maintain records and accounts as per principles of account practices and details of expenditure claimed under statement of expenditure.	In compliance

4.02 (b)(i)	Submit to IDA copies of unaudited accounts not later than six months after the end of the fiscal year.	Audits have been completed but were frequently delayed.
(ii)	Submit to IDA audited accounts and Auditor's report not later than nine months after the completion of the fiscal year.	Same as 4.02 (b)

Table 11: Compliance with Operational Manual Statements

Statement number and title	Describe and comment on lack of compliance
No significant lack of compliance with applicable Bank Operational Manual Statement (OD or OP/BP).	

Table 12: Bank Resources: Staff Inputs

Stage of project cycle	Planned		Revised		Actual	
	Weeks	US$	Weeks	US$	Weeks	US$
Through appraisal	n.a.	n.a.	n.a.	n.a.	154.2	n.a
Negotiations	n.a.	n.a.	n.a.	n.a.	4.5	n.a.
Supervision	131	n.a.	170.4	n.a.	292.9	n.a
Completion			11.0	n.a.	13.0[1/]	n.a.
TOTAL	. . .	. . .	. . .	n.a.	464.6	n.a.

NOTE: Planned Staff Weeks are not available prior to 1989 due to data remapping.

[1/] Carried out by FAO/CP.

Table 13: Bank Resources: Missions

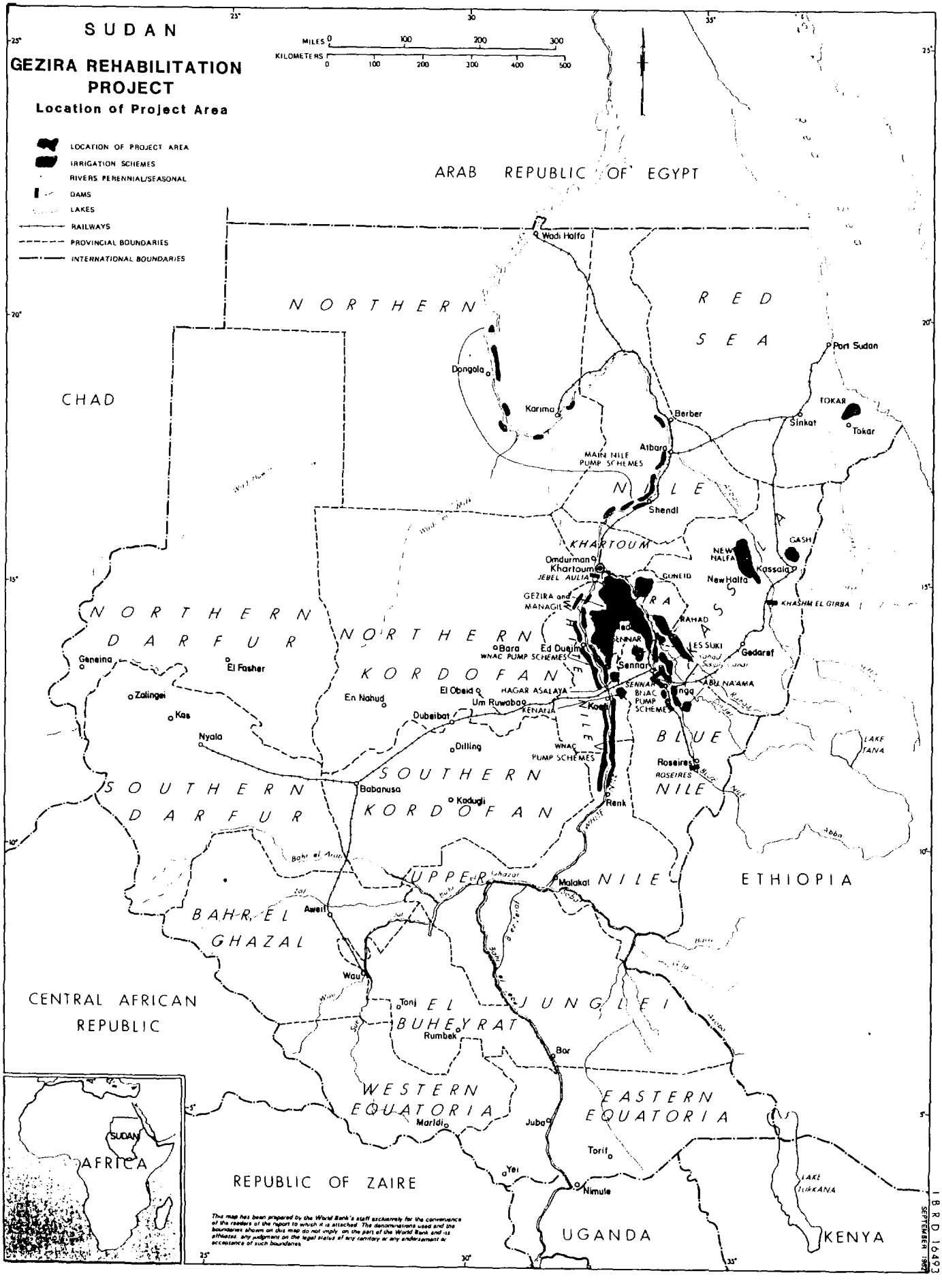
Stage of Project Cycle	Month/ Year	No. of Persons	Days in Field	Specialised Staff Skills Represented[1/]	Performance Rating		Types of Problems[2/]
					Implement. Status	Development Objectives	
Identification	June 1979[3/]	3	14	FA,C,NA	-	-	-
Preparation[1/]	Sept 1981 Dec 1981	5	NA	A,E,EC,FA,S	-	-	-
Appraisal	May/June 1982	15	27	A,E,EC,FA,I DS,PR,RE,	-	-	-
Post Appraisal	Oct 1982	3	14	EC,FA,OP	-	-	-
Supervision	Sept 1983	3	30	EC,FA,OP	-	-	-
	Jan 1984	2	11	OP,PS	-	-	-
	Apr 1984	4	12	FA,ME,E,ID	2	1	F
	Nov 1984	4	21	EC,A,E,FA	2	1	F
	Feb 1985	1	12	0P	-	-	-
	June 1985	4	15	NA	1	1	F
	Nov 1985	3	15	NA	1	1	T,F
	Jan 1986	1	5	EC	-	-	-
	June 1986	4	44	A,E,IE(2)	1	1	M
	Nov 1986	4	15	A,EC,F,PR	1	1	T
	June 1987	5	12	A,IE,PR,TR	2	2	M,T
	Dec 1987	4	17	A,IE,NA,NA	-	-	-
	Feb 1988	3	3	A,IE,NA	-	-	-
Mid Term Review	Jan 1989	4	19	NA	2	2	M,T,F
Supervision	Nov 1989	5	30	A,EC,FA,E(2)	3	3	F
	Mar 1990	4	16	A,EC,FA,E	2	3	T
	Oct 1990	3	19	A,E,PR	2	2	T
	May 1991	2	16	A,E	2	2	M
	Oct 1991	2	11	A,E	2	2	T,F
	Apr 1992	2	15	A,E	2	2	F
	Sept 1992	2	15	E,OP,	2	1	F
	Dec 1992	4	9	A,E,PR(2)	2	2	T
	Apr 1993	1	8	E	2	2	T
Completion	Sept 1994	4[4/]	19[4/]	A(2),EC,E	-	-	-

1/ A: Agriculturalist; C: Consultant; E: Irrigation Engineer; EC: Economist; FA: Financial Analyst; ID: Institutional Development Specialist; ME: Monitoring & Evaluation Specialist; NA: Not Available; OP: Operations Officer; PR: Procurement Specialist; RE: Roads Engineer; S: Sociologist; TR: Training Specialist.

2/ F: Financial; M: Management; T: Technical.

3/ WB missions only to participate in the review of project preparation.

4/ The same mission also carried out the ICR for the Agricultural Research, Extension and Training project (Cr. 1639-SU). Draft ICR prepared by FAO/CP.


SUDAN
GEZIRA REHABILITATION PROJECT
Location of Project Area
LOCATION OF PROJECT AREA
IRRIGATION SCHEMES
RIVERS PERENNIAL/SEASONAL
DAMS
LAKES
RAILWAYS
PROVINCIAL BOUNDARIES
INTERNATIONAL BOUNDARIES
MILES 0 100 200 300
KILOMETERS 0 100 200 300 400 500
ARAB REPUBLIC OF EGYPT
Wadi Halfa
NORTHERN
RED SEA
Port Sudan
Dongola
Karima
Berber
Atbara
TOKAR
Sinkat
Tokar
MAIN NILE PUMP SCHEMES
NILE
Shendi
CHAD
KHARTOUM
Omdurman
Khartoum
JEBEL AULIA
GUNEID
NEW HALFA
Kassala
GASH
New Halfa
KHASHM EL GIRBA
GEZIRA and MANAGIL
RAHAD
NORTHERN DARFUR
NORTHERN KORDOFAN
Bara
WNAC PUMP SCHEMES
Ed Duein
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LES SUKI
Gedaref
Geneina
El Fasher
Zalingei
Kas
En Nahud
El Obeid
HAGAR ASALAYA
Um Ruwaba
KENANA
Kosti
SENNAR
BNAC PUMP SCHEMES
ABU NA'AMA
Dubeibat
Nyala
Dilling
WNAC PUMP SCHEMES
BLUE NILE
LAKE TANA
Roseires
ROSEIRES
SOUTHERN DARFUR
SOUTHERN KORDOFAN
Babanusa
Kadugli
Renk
UPPER NILE
Malakal
ETHIOPIA
BAHR EL GHAZAL
Aweil
Wau
CENTRAL AFRICAN REPUBLIC
Toni
EL BUHEYRAT
Rumbek
JUNGLEI
Bor
WESTERN EQUATORIA
Maridi
Juba
EASTERN EQUATORIA
Torit
Yei
Nimule
LAKE TURKANA
REPUBLIC OF ZAIRE
UGANDA
KENYA
SUDAN
AFRICA
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IBRD 16493
SEPTEMBER 1982

IBRD 16494
JUNE 1982

SUDAN
GEZIRA AND MANAGIL IRRIGATION AND DRAINAGE SYSTEM