

UNCLASSIFIED
CLASSIFICATION

PROJECT EVALUATION SUMMARY (PES) - PART I

Report Symbol U-447

1. PROJECT TITLE Rahad Irrigation Project			2. PROJECT NUMBER 650-H-017	3. MISSION/AID/W OFFICE USAID/Sudan
5. KEY PROJECT IMPLEMENTATION DATES			4. EVALUATION NUMBER (Enter the number maintained by the reporting unit e.g., Country or AID/W Administrative Code, Fiscal Year, Serial No. beginning with No. 1 each FY) 650-80-01	
A. First PRO-AG or Equivalent FY 73	B. Final Obligation Expected FY 76	C. Final Input Delivery FY 79	<input type="checkbox"/> REGULAR EVALUATION <input checked="" type="checkbox"/> SPECIAL EVALUATION	
6. ESTIMATED PROJECT FUNDING			7. PERIOD COVERED BY EVALUATION	
A. Total \$ 99,000,000			From (month/yr.) February 1973	
B. U.S. \$ 11,000,000			To (month/yr.) April 1979	
			Date of Evaluation Review December 1979	

B. ACTION DECISIONS APPROVED BY MISSION OR AID/W OFFICE DIRECTOR

A. List decisions and/or unresolved issues; cite those items needing further study. (NOTE: Mission decisions which anticipate AID/W or regional office action should specify type of document, e.g., airgram, SPAR, PIO, which will present detailed request.)	B. NAME OF OFFICER RESPONSIBLE FOR ACTION	C. DATE ACTION TO BE COMPLETED
1. That USAID issue Implementation Letter No. 15 to allow the Government of Sudan to utilize equipment financed under their project which is no longer of use to the Rahad project, for other agricultural or infrastructure development activities in Sudan. Currently by Sec. 406 of the loan agreement the use of this equipment is limited to the Rahad project.	USAID/Sudan	June 1980
2. That USAID bring to the attention of the Government of Sudan the need for small amounts of foreign exchange to purchase spare parts for dead-lined equipment financed by the project which continues to have a useful life, and the availability of foreign exchange through the recently signed CIP grant.	USAID/Sudan	June 1980

9. INVENTORY OF DOCUMENTS TO BE REVISED PER ABOVE DECISIONS	10. ALTERNATIVE DECISIONS ON FUTURE OF PROJECT
<input type="checkbox"/> Project Paper <input type="checkbox"/> Implementation Plan e.g., CPI Network <input checked="" type="checkbox"/> Other (Specify) Issue II <input type="checkbox"/> Financial Plan <input type="checkbox"/> PIO/T <input type="checkbox"/> Logical Framework <input type="checkbox"/> PIO/C <input type="checkbox"/> Other (Specify) <input type="checkbox"/> Project Agreement <input type="checkbox"/> PIO/P	N/A A. <input type="checkbox"/> Continue Project Without Change B. <input type="checkbox"/> Change Project Design and/or Change Implementation Plan C. <input type="checkbox"/> Discontinue Project

11. PROJECT OFFICER AND HOST COUNTRY OR OTHER RANKING PARTICIPANTS AS APPROPRIATE (Names and Titles)	12. Mission/AID/W Office Director Approval
Richard Aitken, USAID/S, Supply Management Arlene O'Reilly, USAID/S, Evaluation Officer Herbert Blank, REDSO/EA, Water Resources Engineer Helen Soos, REDSO/EA, Evaluation Officer	Signature <i>Gordon K. Pierson</i> Typed Name Gordon K. Pierson Date 6-23-80
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EVALUATION OF RAHAD IRRIGATION PROJECT

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13. Summary

The Rahad project was authorized in February, 1973 as an \$11,000,000 loan for the procurement of equipment and related services in support of the development of 300,000 feddans^{1/} into irrigated agriculture along the Rahad River in Eastern Sudan. The initial cost estimate for the project was \$99 million, with the World Bank (IDA) and Kuwait providing \$42 million and \$11 million, respectively. (Present cost estimates approach \$400 million. See Table I for original and subsequent cost estimates). The major components of the project include a pumping station at Meina on the Blue Nile (See Map, Annex A); a 53-mile supply canal from Meina to the Rahad River; a dam on the Rahad River, irrigation infrastructure for distribution and drainage for 300,000 feddans; construction of headquarters, maintenance facilities, offices and houses; village infrastructure (including health and education); a road network; storage and processing facilities for cotton and groundnuts; an electrical system; seed production and research farms; and feasibility studies for a Phase II project.

The AID portion of the project supplied equipment to the Rahad Corporation and the Ministry of Irrigation's Earthmoving Corporation for agricultural development and irrigation works, respectively. About \$10 million of AID funds were disbursed between 1974 and 1976 for earthmoving and agricultural equipment, and for the services of Louis Berger, Inc., to assist the GOS with procurement.

In general, the AID contribution to the project achieved and is continuing to achieve its purpose of supporting irrigation works and agricultural development in the Rahad project. Some vehicles and heavy equipment have worn out as a result of the rough conditions which prevailed during the initial stages of the project. Of 392 pieces of AID-financed equipment, approximately 47% is operating, 24% is not operating but repairable, 13% is not repairable due to cannibalization, and 16% is expended or has completed its useful life. Heavy equipment generally has not been used to its potential due to lack of spare parts; therefore significant life remains in most heavy equipment units. Generally, the equipment provided was suited to the work required. Shortages of some essential spare parts contributed to the decline of some of this equipment and continues to constitute a major problem. Some of the equipment, particularly that procured for the Earthmoving Corporation has completed its contribution to the Rahad project and can now be utilized for other development activities in Sudan.

^{1/} One feddan equals 1.038 acres.

T A B L E 1

PROJECT COST ESTIMATES
(in million U.S. dollars)

	<u>Original</u>	<u>Revised-1975</u>	<u>Revised-1979</u>
IDA	42	62	67
Kuwait Fund	11	50	50
USAID	11	11	11
Arab Fund	--	9	9
Saudi Fund	--	28	28
Gov. of Sudan	35	80	235
TOTAL	99	240	400 ^{1/}

^{1/} Estimated by World Bank. Of this amount, about \$16 million represents foreign exchange requirements. Assuming that the World Bank provides \$5 million as part of the \$60 million Irrigation Subsector Project proposed for 1980, the government will require foreign exchange of about \$11 million from other sources.

The cost estimate includes inflation through the final construction phase of the project, June 1981. Currently local funds are available to complete 60% of the remaining work by June 1980, leaving less than 10% of the total project area to be completed during the last year of the project.

It is significant that the major portion of AID's contribution to the project was delivered relatively promptly and efficiently. AID-financed equipment was the first equipment available to the project and it contributed to the early start-up of construction. Sudanese officials who were interviewed acknowledged the critical role of AID inputs.

By early 1977, about \$10 million has been disbursed and the remaining \$1 million were committed. At this time AID considered de-obligating the remainder of the loan since all essential equipment in the loan agreement had been procured. However, the Rahad Corporation developed a plan to use the remaining funds for spare parts and other items. Therefore the Berger procurement contract was briefly renewed during 1977. Despite three extensions in the terminal disbursement date (TDD), through April 1979, only a total of \$10,348,047 was disbursed, largely because suppliers failed to make final deliveries, and/or Letters of Credit were not extended for a sufficient length of time. In addition, small cost-savings occurred in numerous orders. The committed but undisbursed amounts were not fully analysed and acknowledged until late February, 1979. Thus, major project implementation emphasis was placed on keeping Letters of Credit and Letters of Commitment extended rather than on placing new orders. Some dealers apparently no longer intended to make deliveries by the final stages of the project, even though Letters of Credit were open. Thus, the \$651,943 which remained undisbursed as of April 27, 1979 were deobligated. The items which were not delivered include six Ford trucks, a low-boy trailer, a tanker and various spare parts and tools. Annex C, Exhibits 1 and 2, illustrate the problems with keeping Letters of Commitment open after they expire.

The evaluation team found evidence that AID's contribution would have been enhanced by further disbursements for essential spare parts,^{1/} minor equipment and additional vehicles. While the Berger contract fulfilled in general the services it was expected to provide, neither Berger, AID nor the government were effective in identifying the cause for slow disbursements during the final years of the project. Unfortunately it is the fledgling Rahad Corporation which bears the consequences of this inability to disburse the entire loan.

The current status of the Rahad project (apart from AID's contribution) is approximately three years behind schedule, and is expected to be completed by June, 1981. The pumping station and main canal have been functioning for nearly three years, and the third crop on about 200,000 feddans was harvested in early 1980. Contractors are completing housing and administration infrastructure, the road network and the electrical network. In view of the complexity of the project, implementation has been commendable. The World Bank loan of \$62 million is all but about \$8 million disbursed, with only \$1.9 million uncommitted. Cost overruns have been primarily local costs and are being provided by the GOS. See footnote for Table I for discussion.

^{1/} It has been learned since the evaluation that both Rahad Corporation and the MOI have been continually placing orders in-country for spare parts which have resulted in a recent flow of spare parts for AID-financed equipment through local equipment dealers.

The primary outstanding problem is to obtain local currency and limited foreign exchange to complete the project.

The managerial and financial aspects of the project also require attention. The World Bank provisionally estimates operating losses for the Rahad Corporation of LS 10 million in 1979, LS 12 million in 1980, and LS 7 million in 1981 and 1982, respectively. These losses do not take into account the amortization of investment costs. The bank is planning to extend technical assistance in finance and accounting, supplies, maintenance and operations in an effort to render the Rahad Corporation more viable financially. Since the Corporation was founded in 1973 and is still making the transition in emphasis from construction activities to agricultural production, considerable improvement in its operations should be forthcoming in the early 1980's.

14. Evaluation Methodology

This evaluation is the final evaluation for the A.I.D. component of the Rahad Irrigation Project. The primary purposes of the evaluation are to assess the contribution of the A.I.D. inputs toward the completion of the Rahad Project, to determine what lessons may be learned with respect to the procurement problems encountered in the loan, and to determine how some of the A.I.D.-financed equipment should be utilized if the Rahad Project has no further use for it. The evaluation is based on a review of project files and contacts with appropriate individuals of the Rahad Corporation, the Ministry of Irrigation's Earthmoving Corporation, the World Bank and USAID/Sudan. (Annex B).

15. External Factors

No major external factors have affected the overall implementation of the project, apart from cost overruns which are simultaneously related to and affected by the difficult economic situation faced by Sudan over recent years. Inflation within the economy, fiscal and budgetary problems within the government and balance of payments difficulties have exacerbated the delays and cost overruns experienced by the project. If local funds are made available on a timely basis, the project will nonetheless be completed within one year.

16. Inputs

A. Delivery of Inputs

Approximately \$10,000,000 of project inputs were delivered between 1974 and 1976, consisting of about 392 pieces of equipment. The timely arrival of this equipment, as compared to the inputs of other donors, enabled the project to commence without major delays. Annex C shows that project implementation actions proceeded relatively smoothly at the initial stages of the project. One major problem was the lack of responsive bidders with the result that small companies with

inadequate representation in Sudan won major bids. Another problem was the short time period for which bidders were willing to honor bids, during a period of rapid inflation. Many bids therefore expired before the GOS reviewed them. It was in the disbursement of the last \$1,000,000 that problems were encountered with expiration dates of various inter-related documents, including Letters of Commitment, Letters of Credit and proforma invoices. Delays in the delivery of equipment were due to a strike at one plant, shipping problems, heavy demand in the world market, and slow bureaucratic procedures in both AID and the GOS that resulted in a series of three Terminal Disbursement Date (TDD) extensions to April, 1979.

Even with these extensions a total of \$651,943 remained undisbursed and were deobligated. This occurred at a time when the project was sorely in need of spare parts and additional equipment. A number of items specified in Amendment No. 10 to Letter of Commitment No. 3, dated October 4, 1976 were not delivered. Included were: six mechanical trucks with spare parts, a low boy trailer and spare parts, a fuel tanker and spare parts, and special tools and testing equipment for overhaul of HD-16 tractors. Thus, the inability to expend remaining funds is attributable in large part to the complex inter-relationships between numerous action documents for many small orders, e.g. L/C and L/Comm; slow bureaucratic processes within the GOS as to problems and the intentions of suppliers. One supplier finally wrote during the final months of the projects that owing to the bureaucratic difficulties he had had with payments, he felt no obligation to deliver six outstanding trucks, and had no intention of using the last Letter of Credit which had been extended.

Another major factor was that at this stage of the project there was inadequate staff time by all parties (A.I.D.; Berger, MOI and Rahad Corporation) devoted to following up on procurement actions. It must be noted, however, that the complex and indirect relationships which were established between AID, the GOS, the Central Bank, U.S. Banks (the Bank of America), and finally the suppliers greatly complicated the task of follow-up. Some problems were not identified until the last TDD extension of the project. With the benefit of hindsight, the evaluation team also identified problem areas ex post facto. The team believes that some problems still are not understood completely. Incomplete files contribute to this lack of understanding. But in all fairness, the team must acknowledge that procurement procedures were very complex. (See Lessons Learned for possible remedies.)

B. Analysis of Procurement Problems

A review of the Rahad procurement files revealed that Rahad Corporation and the Ministry of Irrigation experienced severe difficulties resulting from the issuance of inaccurate, incomplete and relatively

non-responsive Letters of Credit. Within Sudan, all public sector purchases are covered by Letters of Credit issued through the Central Bank which has its own operating rules and constraints. Applications for a Letter of Credit must detail the terms of particular purchases. However, if the Bank's own operating rules are in conflict, those operating rules are reflected in the actual letter of credit received by a supplier. The public sector importer has little to say about the final letter of credit document issued to support his purchase.

The evaluation team believes that the use of direct A.I.D. Letters of Commitment to a supplier would help to assure consistency in the Letter of Credit terms with those of his sale by eliminating the complex mix of issuance errors and inter-bank misunderstandings that occur through the banking system. Apparently this was done by AID/W for large transactions, but could not be done for small ones at the time the project was being implemented. Additionally, many of the Rahad procurement delays were attributable to documentary credits expiring before suppliers completed shipments because of A.I.D.-established terminal disbursement dates reflected in letters of credit. Direct A.I.D. Letters of Commitment to suppliers would, by the direct routing of communications on document terms and conditions, provide A.I.D. with an alert notice that extensions and changes are necessary. Using banks, the traditional route for such communications is supplier to buyer, buyer to U.S. bank to Bank of Sudan, Bank of Sudan to buyer. When one of the four realizes that a problem exists, no change is possible until A.I.D. changes its internal documents. This then requires A.I.D. to seek approval of the host government and an exchange of cables to Washington, coupled with transmittal of A.I.D. Letter of Commitment to the respective banks before a buyer's Letter of Credit amendments could be acted upon. In one case this series of communications and multi-organization involvement effectively reduced a one year extension of procurement leadtime to seven months actual leadtime, severely restricting supplier capability to perform, since traditionally, suppliers do not schedule production without valid, unexpired Letters of Credit. The delay of five months in an extension of the Letter of Commitment caused all existing Letters of Credit to expire for the same period of time.

As procurements were frequently subjected to short leadtime terminal disbursement dates, there were occasions when all existing Letters of Credit expired. This required new amendments to extend each outstanding Letter of Credit and caused suppliers to place a hold on shipments until they could be assured of payments for partial shipments already outstanding. The initial terminal disbursement date for the Louis Berger, Inc. procurement contract was established almost two years short of the project's 36-month execution.

Rahad procurement activities were reviewed several times by A.I.D.'s representative in Sudan in collaboration with REDSO and by TDY assistance from A.I.D. procurement specialists. In each case, the identification of problems with specific actions to be taken resulted in some

progress. However, the amount of time needed for the A.I.D. representative to constantly review progress and identify new problems and actions was not available. Similarly, REDSO and other IDY specialists could not be expected to keep on top of transaction development in the Sudan while working on other projects in East Africa. The establishment of an A.I.D. procurement review schedule is recommended as it could assist in the identification of problems and follow through on actions for equipment procurement. While it is recognized that A.I.D. does not have sufficient experienced procurement specialists to staff any broad application of this recommendation, a detailed review of actions required to move a procurement transaction along is needed in future commodity support projects of the Rahad type.

17. Outputs

A. Contribution of Input. to Outputs

AID inputs contributed primarily to the construction element of the project, although some equipment and vehicles were allocated to project operations. The construction element of the project is nearing completion. The major supply components including the pump station at Meina, the main supply canal and Dinder River siphon, and the barrage on the Rahad River have been completed as have the supply canals and minor drainage canals for 200,000 feddans. Major canals in the remaining 100,000 feddans are expected to be completed by the MOI during 1980. Rahad Corporation is to complete the "on farm" canals and village infrastructure in these blocks. The current schedule is to open the remaining three blocks in 1981, providing funding is secured. Road construction and installation of the electrical system are currently underway. Other construction activity in the original six blocks has been virtually completed.

AID-financed equipment played an important role in the early construction phase. Heavy equipment utilized for earth-moving operations in the construction of the main canals is still being used in land clearance, leveling and initial preparation; vehicles have been utilized throughout the project area; concrete mixers, vibrators, dump trucks, and a wheel loader have been used in constructing irrigation structures; and mobile workshops have been instrumental in keeping equipment running.

It is not feasible to attempt a quantitative measurement of the contribution that AID-financed equipment made to overall project construction. The contribution has been substantial, particularly in the early construction. In recent years, the lack of spare parts has been a major factor in reducing that contribution. Furthermore, equipment such as scrapers, the heavy bulldozers, and land planes are not needed in the current advanced phase of construction.

B. Progress Against Output Targets

Annex D, prepared by the World Bank, sets forth the status of project outputs as of May, 1979. The original Bank appraisal and AID Project Paper estimated project completion in June, 1978. The current completion date is projected for June, 1981. The project will be completed essentially as designed. The three year construction overrun seems to have been caused by the contribution of a number of factors. Procurement delays were one factor. Delivery of AID-financed commodities was delayed due to the lack of responsive bids to the original IFB; other donors have faced similar procurement problems. The general economic conditions in the Sudan, particularly fuel shortages, are also a contributing factor. The inability of MOI and Rahad to efficiently utilize all equipment, due in part of lack of spare parts, is a third factor. The evaluation team did not find that the delays were unreasonable or that they impaired the overall construction of the project. On the other hand, the original cost estimate of \$99 million has been revised to approach \$400 million and there are serious questions regarding the economic and financial viability of the project. In summary, the physical project outputs have nearly been achieved but at a cost which may render the project economically unviable.

One output which does not appear in the project economic analyses is livestock production. Tenants are allowed to keep livestock, primarily sheep and goats, which are herded communally. These herds appear to be healthy: they feed on crop residues and graze on uncropped land.

The Rahad project provided funds (not from AID sources) for health services for tenants and other residents in the Project area. Dispensaries have been built at the village level, health centers at the three group headquarters, and a hospital is planned for Fau, the project headquarters. In an interview with a village paramedic it was learned that malaria and schistosomiasis are found occasionally among tenants who have brought these diseases in from Gezira and New Halfa. The project design specifically recognized the problem of water related diseases and the budget included funds for an initial inventory of molluscicides and larvicides. The GOS has submitted a program for the control of bilharzia and malaria in the project area. In a detailed survey conducted for snails it was found that snail hosts have not yet invaded the scheme. The team did note abundant potential habitat for snails, the alternate host of the schistosome worms, in weeds along canal banks. Malaria is moderately endemic and spraying activities are carried out regularly.

Ground water supply for drinking has been feasible in only two villages so far. Other villages will depend on filtered canal water when facilities are installed. The team visited a facility for the treatment of canal water which is distributed at community stand pipes. The team noted several instances of villagers collecting canal water. Apparently, as our guide suggested, old habits are ingrained deeply, and tenants will need some sensitizing before they rely on treated water

for their consumption requirements. It should also be pointed out that all villages have not yet been supplied with filtering facilities. Since gastro-enteritis is common, the team believes that villages will use treated water when it is available.

C. Evaluation of Outputs

In looking at the physical structures completed under the Project one cannot help but be impressed. For example, the quantity of earth moved, 33 million cubic meters, is staggering. Also impressive is the fact that much of the project has been constructed through GOS force account methods.

A minor difficulty resulting from inadequate designs is poor drainage in several sections of the project area amounting to less than 5% of the total area. The evaluation team was shown several areas where drains were not operating due to inadequate gradient. Standing water and uncontrolled growth of Sudan grass were observed. Both World Bank and Rahad Corporation officials discussed several alternatives for solving the problem in a cost-effective manner.

The evaluation team did not attempt to evaluate the management capability of Rahad Corporation or MOI's Earthmoving Corporation. It did, however, note indications of management problems. The first of these is the delay in the construction of the Rahad maintenance facility at Fau which is critically needed at this stage of project development. A second problem is the continuing lack of spare parts. Although the project has a high priority in the GOS and is a potential foreign exchange earner, this problem has not been resolved. Finally, the financial, technical and economic viability of the Rahad scheme ultimately depends on an adequate management capability, as well as on external economic factors. There is considerable scope for improvement in financial management and in technical aspects such as timeliness of tractor operations. These problems are expected to be solved with experience.

D. Evaluation of AID-Financed Equipment

1. Status of Equipment (See Annex E)

The evaluation team identified 392 pieces of AID-financed equipment which were received by MOI and Rahad Corporation. Of this total 233 pieces were allocated to Rahad and 159 to the MOI. As summarized in Table II, 47% of this equipment is currently operating; 24% is not operating owing to lack of spare parts; 13% is not repairable owing to excessive cannibalization and/or accidents; and 16% has been utilized to the point where its usable life has expired.

TABLE II

SUMMARY OF EQUIPMENT STATUS

() INDICATES PERCENTAGE

	I Operating	II Non-Operating Repairable	III Non- Repairable	IV Usable Life Expired	Total
Rahad	133 (57)	60 (26)	31 (13)	9 (4)	233 (100)
MOI	49 (31)	34 (21)	21 (13)	55 (35)	159 (100)
TOTAL	182 (47)	94 (24)	52 (13)	64 (16)	392 (100)

Definition of Categories

- I. Equipment which is currently operating at the project site.
- II. Items which could be economically repaired if adequate spare parts were supplied.
- III. Items which are not economically repairable due primarily to cannabilization and/or accidents. This category also includes items which are not operating due to the inappropriateness of the equipment and items which were received in non-repairable condition
- IV. Items whose life was expended during the initial development phase and other items (i.e., tool sets) which may be classified as expendable.

The team inspected only a small portion of equipment. Additional data for the compilation of Table II were supplied by MOI or Rahad Corporation officials. Based on the equipment that was seen, the team believes the data are reasonably accurate.

In view of the volume of work undertaken, the conditions to which the equipment was subjected, and the extreme lack of spare parts, the team's judgment is that the percentage of non-repairable equipment is not excessive.

In Reference to Table II, lack of spare parts accounts for most of the equipment in Column II and approximately 50% of the items in Column III which had been cannabailized solely for the lack of spare parts (many of the remainder are vehicles cannabailized after accidents). It should be noted that two items, concrete mixers and concrete vibrators which were expended during the initial development stage, account for 50 of the 64 items in Column IV.

2. Utilization of Equipment

Heavy equipment was delivered and put into service throughout the calendar year of 1975. The evaluation team found that a significant number of heavy equipment units (bulldozers, scrapers, and graders) were down with relatively low operating hours. The team inspected several machines whose operating hour guages ranged between 2,000 and 5,000 hours. Similar equipment operating in the U.S. would have registered approximately 7,000 hours at the end of the 1979-80 season with an expected life of up to 9,800 hours. All Fiat Allis HD-41 and Wabco 339-F Scrapers were down with requirements for engine overhauls and various repairs which require spares such as bearings, seals, etc.^{1/} The team inspected the MOI workshop and confirmed that MOI has the capability to rebuild the equipment if spares were to be made available. MOI has been able to obtain spares for Wabco 555 graders and has kept seven out of eight machines running. Rahad Corporation which is currently constructing a major maintenance facility has two out of six similar machines operating. It should be emphasized that the needed spares are not sub-assemblies or units (i.e., transmissions, starter motors, etc.) but rather the basic spares to rebuild these units (i.e., bearings, spindles, seals, gears, etc).

The team compared heavy equipment usage to average U.S. conditions (See Table III). Obviously this is not a fair comparison since the conditions of the two countries differ radically. However, assuming that the average economic life of equipment and average use hours per year are comparable, the team concludes that (1) the heavy equipment has been operated for only 64% of its potential utilization; and (2) the equipment, in the aggregate, has significant (50%) remaining life. The team's observation of the equipment supported these conclusions.

^{1/} It has since been learned that spare parts for overhaul of some of these pieces of equipment have arrived in Sudan.

TABLE III
Analysis of Heavy Equipment Usage

	Number	Average Economic Life (hours)	Total Economic Life (hours)	Average Use hours/ ¹ (hours)	Total Potential Use/ ² (hours)	Actual Use/Comments	Total Actual Use (hours)
<u>MCI</u>							
Fiat Allis 41-B tractor (550 hp)	5	9,800	49,000	1,400	35,000	2 seasons	14,000
Wabco 339f Scrapers (500 hp 34/25 yd 3)	8	9,800	78,400	1,400	56,000	2 seasons	22,400
Fiat-Allis 16-B tractors 195 hp power shift	15	8,400	126,000	1,400	105,000	(11 operating (5 seasons) (4 cannibalized after 2 seasons) ³	77,000 11,200
Wabco 555 Grader	8	8,400	67,200	1,400	56,000	2 seasons ³	22,400
<u>RAHAD</u>							
Fiat Allis HD-16 Tractor 195 hp direct drive	12	8,400	100,800	1,400	84,000	(6 operating (5 seasons) (6 not operating (3 seasons)) ³	42,000 25,200
Wabco Grader 555	5 ⁴	8,400	42,000	1,400	35,000	(2 operating (5 seasons) (3 not operating (2 seasons)) ³ (1 received non-operable (0 seasons))	14,000 8,400 -
			463,400		371,000		236,600
			Theoretical potential use expended		80%	Percentage of Economic Life Expended	51%
						Percentage of Potential use	64%

1. Per Contractors Equipment Manual, Associated General Contractors of America, Seventh Edition,

2. Based on 5 seasons assuming 1,400 hours per season (75-76 season through 79-80)

3. Estimated

4. Based on 5 potentially usable motor graders.

The team members found that project equipment has been or was presently being used according to its intended purpose. They observed various units operating in the project area. These included HD-16B tractors, pickup trucks, tankers, IHC trucks, and mobile workshops. Rahad and MOI officials provided information on other equipment utilization (See Annex E). Although some equipment has been diverted to other irrigation projects under construction by the MOI, in each case it was reported that the particular equipment was no longer needed in the project area. It was confirmed that certain items of equipment, particularly the HD-14B tractors and the Wabco 339F scrapers, are no longer required since the work for which they were utilized has been completed. The Marvin land plines also will shortly be excess of project needs.

Approximately ten tractors (HD-16B) are currently involved in bush clearance and initial land preparation in Blocks 7, 8 and 9. MOI officials expect that this operation will be completed on schedule with the available equipment.

MOI's non-repairable equipment is composed primarily of concrete mixers (30), concrete vibrators (20), and Ford pickup trucks (15). The first two items are relatively short lived and would be expected to be retired after three years of continuous use. Although Rahad Corporation has a higher percentage of operating equipment than MOI (57% vs 31%) this percentage is much closer if "life expired" items are netted out. However, in terms of overall maintenance capability, the MOI appears to be superior to Rahad Corp. MOI has been repairing equipment since the 1920's as the Gezira scheme was developed, and has one of the best machine shops in East Africa, whereas Rahad Corporation's only maintenance capability is the Mobile Workshops, pending the completion of permanent facilities. MOI has been able to rebuild its Wabco graders, purchasing spare parts locally, whereas Rahad Corporation has not been fully aware of the spare parts availability in Sudan.

Large numbers of Ford trucks operated both by Rahad and MOI have been cannabalized due to non-receipt of spare parts orders and the lack of Ford spares in Sudan.^{1/} At the time of the evaluation, after over four years of service, approximately 41 trucks were operating out of the original order of 96. Many trucks expended their usable life and/or suffered from accidents. The Project is presently primarily served by Landrovers and officials expressed their preference for this vehicle in terms of spare parts availability, familiarity by local mechanics, and its ability to hold up under difficult conditions.

^{1/} It has been learned since the evaluation that this applies to the Rahad project area and that Ford spares are becoming available in other areas of the Sudan.

The team found no cases of obvious equipment abuse or mishandling. Some equipment is not economically repairable due primarily to extensive body damage and subsequent cannibalization. Equipment used during the early construction period, particularly Ford pickups, was exposed to hard use and as a result the useful life is less than average.

Officials informed the team that both Rahad Corporation and MOI had skilled operators and mechanics at the inception of the project. Although the makes of most equipment were new to Sudan, operators and mechanics were reportedly able to familiarize themselves with the equipment without major problems. Both organizations have on-going programs for training new operations and maintenance personnel.

Rahad Corporation is currently installing equipment in its major maintenance facility. The question of staffing this facility with skilled machinists and mechanics was raised. After visiting the extensive MOI major maintenance facility which employs over 600 workers, the team was convinced that staff is available in-country and can be recruited by Rahad Corporation with adequate incentives.

The one major piece of equipment that has not been utilized is the decorticator (groundnut sheller). The unit was installed with technical assistance provided by the manufacturer. However, the decorticator has not been used due to a lack of stable power supply. Rahad Corporation is currently installing a power grid throughout the project area which will supply the units with power. The unit has been partially damaged by fire (some wooden crossmembers were charred). Electrical motors have been removed from the unit and reportedly placed in storage for protection against weather conditions and theft. Rahad Corporation officials stated that the unit would be repaired and placed in operation as soon as power is available. Various AID communications have advised Rahad Corporation that the decorticator should be enclosed in a protective structure. However, the unit is still exposed and although structurally sound it was impossible to determine if there had been internal damage. Rahad Corporation is currently not involved in the marketing of groundnuts. Farmers sell to private processors who have installed several smaller decorticators adjacent to the AID-financed units. Whether Rahad Corporation will take over the processing and/or marketing of groundnuts, and consequently whether this machine will be put into service is a moot point.

3. Suitability of Equipment

The team discussed the suitability of various units of equipment with Rahad officials. In general, the officials found the equipment adequate to undertake the work required. The following are summaries of these comments.

- (1) Fiat-Allis Tractors. Equipment is new to Sudan. Officials prefer Caterpillar as it has a proven performance record and operators and mechanics are familiar with it. However, Caterpillar did not respond to the IFB. The HD41-B tractor was larger than required because at the time of procurement this was the only unit available within a reasonable delivery period. Similarly with other makes, Fiat-Allis has not established an adequately stocked spare parts dealership in Sudan. The HD-41s are no longer useful to the Rahad Project and are a problem in that they are not easily transported. (Note: As of 4/23/80 spare parts for engines have been obtained and the engines are now repairable).
- (2) Wabco Scrapers and Graders. No problems were raised with this equipment other than lack of spare parts. (Note: As of 3/80 spare parts have become available at least in the short term.)
- (3) Phoenix Mobile Workshops. These are self-contained units equipped with a generator, compressor, lathe, drill press, tool storage, etc. Officials praised these units, stating they were the best equipment provided to the project. Up to the present time, they have provided all maintenance services for project equipment.
- (4) Ford Pickups. These were an unfortunate choice due to the lack of available spare parts in Sudan.^{1/} Officials cited the Fords for not holding up well, and mentioned suspension problems specifically.
- (5) IHC Trucks. Rahad Corporation apparently is satisfied with these since they awarded IHC a second contract financed by another donor. Rahad's spare parts inventory for these trucks was adequate.

18. Purpose

The stated purpose of the loan was "to assist in financing the foreign exchange costs of machinery, equipment and procurement services for use in the construction of the Rahad Irrigation Scheme." As defined above, the purpose has been achieved.

A broader purpose implicit in the stated purpose is to establish irrigated agricultural production of 300,000 feddans along the Rahad River. This broader purpose is still being implemented, and is scheduled for completion in June, 1981.

There is considerable controversy in Sudan with respect to the role of irrigated agricultural development. Irrigation combines two of Sudan's most abundant productive resources: arable land and the waters of the Nile River. Furthermore, Sudan's development strategy calls for modern

^{1/} The original bid documents require suppliers of major pieces of equipment to establish local dealerships. For various reasons the initial bids were non-responsive and the OS had to negotiate with suppliers. Apparently, in the case of Ford, the local dealership requirement was a casualty of these negotiations.

agricultural development as the productive lynchpin of the economy. However, irrigation requires large capital investments. The cost of the Rahad project, for example, is about \$1,350 per feddan, or about \$30,000 per small farm family. While the World Bank finances irrigation at two to three times this cost, the cost is clearly very high, and surpasses industrial job creation in capital-intensity. In addition, irrigated agriculture in Sudan has historically been of questionable profitability, owing largely to managerial problems. The Gezira Scheme has continually suffered from management problems and has generally been subsidized by the GOS. Compared to mechanized rain-fed agriculture or improvements in traditional agriculture, irrigation probably has the lowest benefit/cost ratio, and the lowest net foreign exchange benefit because of the high import content of its operating and investment costs. Combined with lower than expected performance in most irrigation schemes, which generally produce only one crop per year, irrigation represents a questionable investment until management improves. Both the 1976 ILO Mission and the IBRD's 1979 Agricultural Sector Survey recommended a reappraisal of investment priorities within the agricultural sector to reduce investments in irrigated agriculture.

The social implications of capital-intensive agricultural development should also be taken into account. At current levels of yield, most irrigation schemes estimate over 20 feddans per farm family to provide a reasonable family income. The Rahad scheme will ultimately allocate 22 feddans to about 15,000 families for cotton/groundnut production. About 1,000 families will receive one feddan for horticultural production. Each cotton-producing family requires at least ten migrant laborers to harvest the cotton crop. Thus, job creation is based on a ratio of ten migrant laborers to one good income-producing job. Groundnut harvesting is mechanized, resulting in even less equitable distribution of benefits to migrant laborers.

19. Goal

In the absence of a stated goal in the project paper, the evaluation team has defined the following goal for the project: to promote agricultural development in Sudan and to improve small farmer incomes and living conditions.

The project has clearly contributed to the development of Sudan's agricultural development. To date some 200,000 feddans or 207,600 acres have been brought under cultivation. By 1982 about 300,000 feddans will be under cultivation. Without the project, a very small portion of this land would be cultivated or even inhabited owing to scarce rainfall in the project area. Prior to the project, the settled population included a few villages in the southern part of the area which depended on pools of water in the river bed during the dry season, and scattered villages in the northern part where a limited number of wells functioned.

The economics of the project raise many issues. According to World Bank projections made in December 1979, the Rahad Corporation will operate at a loss at least through 1982. It is unlikely that future profits will ever repay the initial investment costs of the project; indeed it would be optimistic to project that operating margins will always be positive and will cover the present value of past operating losses. Apart from the operations of Rahad Corporation, tenant farmers and migrant laborers are deriving income from the project. By the end of the project there will be 16,727 tenants making approximately SL 1,800 per annum. There will also be several thousand migrant laborers for the cotton harvest, earning about SL 5 per feddan harvested.

The value of agricultural production, in 1979-1980 prices, has been calculated as follows for 300,000 feddans:

<u>Crop</u>	<u>Feddans</u>	<u>Value (SL)</u>
Cotton, Acala	140,000	30,520,000
Groundnuts, Ashford	102,000	9,282,000
Fodder	38,000	N/A
Fruit and vegetables	7,500	10,500,000
Forestry and pastures	12,500	N/A
	<hr/>	<hr/>
	300,000	50,302,000

The economic value of fodder, forestry and pastures has not been included because estimates were not available and because the end use of these products was uncertain. Clearly, however, there is an economic value to these products, especially if fodder is plowed back into the grounds to economize on imported fertilizers.

Unfortunately, in 1980 the economic cost of producing SL 56 million of cotton, groundnuts, fruits and vegetables will be approximately SL 29.4 million in costs charged to tenants, plus SL 10 million in unreimbursed operating costs for Rahad Corporation. Thus only SL 16.4 million can be considered economic returns in 1980 prices against an investment of about \$400,000,000. At a conservative discount rate of 15%, the present value of all future production for the next 20 years, exclusive of fertilizer, and other costs is \$134,000,000. After 20 years, the present value is negligible at a discount rate of 15%. Since much of the investment occurred beginning in 1975, the present value of investment costs is more than \$400,000,000. At this cost the project has a current benefit/cost ratio of .335 (a B/C ratio of 1.0 represents breaking even). The rising world value of agricultural crops may favor a positive balance for operating costs, but it cannot alter the benefit/cost ratio, since inflation is assumed to exist on the cost as well as the benefit side of the equation.

The second goal of improving small farmer incomes and living conditions is also being met. The only farmer interviewed appeared to be content as a tenant, as long as management provided tractor and irrigation services on a timely basis. He stated that the risk of inadequate water (e.g., rainfall versus reliable irrigation) was greatly reduced, and he could make ends meet. The average farm income of SL 1,800 plus other income from livestock and family labor compares favorably with prevailing small farmer incomes in Sudan.

20. Beneficiaries

The beneficiaries of the project are the 16,727 tenants and their families who will derive a living from the Rahad Irrigation Scheme. As of mid-1979, nearly 9,000 tenants had been selected who are expected to earn about SL 1,600 to SL 2,000 per annum from profits, family labor and livestock. Table IV sets forth the revenue and costs faced by small farmers in the Rahad Project.

The estimated average income per feddan of cotton in the 1979-80 season was about SL 101 while production costs (see Table IV) are estimated at SL 116.58. Production cost estimates include optional expenditures for labor, herbicides, etc., which could result in additional income of about SL 25. Thus, total income from 11 feddans of cotton per small farmer, is estimated to range from SL 1,116 to SL 1,380. This income obviously varies according to yield. In 1978-79, the yield fell to 4.5 kantars (versus a normal yield of 8 kantars) per feddan due to excessive rains, flooding, and fuel shortages, resulting in less than optimal farm operations. Apart from production covered by farm insurance, the small farmers must bear the cost of lower yields, regardless of cause. Management always collects tractor, land, water use and production input fees from the top, since marketing of cotton is controlled by the Corporation.

From the small farm budget for groundnut production set forth in Table IV, it is obvious that both production costs and revenue are much lower for groundnuts than for cotton production. Groundnuts are cultivated in rotation to help maintain soil fertility.

Tenants were selected according to the provisions of the Rahad Act of 1972, which accorded priority to prior landowners in the area (about 600) and those with cultivation rights (about 400). Next in order of priority were Sudanese living in the area (about 7,000). Forty-six villages have been established, of which 36 are new villages. All tenants are located within five kilometers of their tenancies. A cash dole of SL 50 is paid to each new tenant. Tenants live in conventional circular straw huts which they build.

About 90% of the tenants are illiterate. Their background is varied. A few are previous land-owners or ex-laborers from Gezira. However, the vast majority are new to irrigated agriculture. During the first two years (1977-79), only 177 tenants or about 2% left. Most of these tenants were nomads.

Table IV

Farm Production Costs and Profits
Estimated for Crop Year 1979-80
(in Sudanese pounds)

I.	Cotton*	
A.	Costs per feddan	
	Tractor plowing and sowing	22.30
	Land and water use	15.00
	Seed	0.42
	Fertilizer	8.32
	**Herbicides (if needed)	8.10
	Insecticides (compulsory)	34.26
	**Laborers (for harvesting)	4.75
	**Transport for Laborers from Western Sudan	12.00
	**Crop Insurance	1.27
	**Sacks	2.80
	**Ginning	7.54
	Total Costs	<hr/> 116.76
B.	Gross Revenue per feddan	218.00
C.	Net Revenue per feddan	101.24
D.	Net Revenue per tenant (11 feddans)	1113.64
II.	Groundnuts	
A.	Cost per feddan	
	Tractor clearing, sowing, harvesting	16.04
	Land and Water Use (8 irrigations)	12.00
	Seeds	5.00
	Herbicides (if needed; unusual)	(7.00)
	Total Costs	<hr/> 33.04
B.	Gross Revenue per feddan	91.13
C.	Net Revenue per feddan	58.09
D.	Net Revenue per tenant (8 feddans)	464.72

* Based on average yield of 8 kantars per feddan

** Optional

Health facilities will include a 70-bed hospital and a doctor at Fau, medical assistants in four of every six blocks, male nurses in all villages, and five trained mid-wives. General sanitation services are provided by a staff of sixty backed by two tractors.

Schooling is provided at the village level for primary education. Secondary schools are located at block levels, and are segregated by sex. A high school is planned for project headquarters at Fau. Two school buses operate to transport children, and a free breakfast is provided.

A court and a police station have been established at Fau. Other infrastructure is provided by private commercial enterprises which offer a wide variety of goods and services. Private entrepreneurs are required to purchase shop sites from the project.

The one farmer interviewed stated that he preferred life in the project area because of the decrease in risk. One disadvantage, however, is his increased dependence on others for a supply of food, fuel, building materials and other items which are normally available in villages, and the unreasonably high cost of these items. Livestock production enables him to reduce the risk and lessen his dependence on other. His herd of sheep and goats has doubled to 40 head in two years.

21. Unplanned Effects

There are few unplanned effects to the project owing to sophisticated planning and significant experience with irrigated agricultural production in Sudan. Apart from a \$300m cost overrun, livestock production is the main unplanned effect of the project that the team identified.

22. Lessons Learned

Lessons learned fall into two categories: procurement problems and the economic rate of return. The evaluation team identified procedural improvements to facilitate the procurement and operation of equipment as follows:-

a. Use direct A.I.D. Letters of Commitment to suppliers to eliminate unnecessary involvement of U.S. and host country banks in communications and procurement processes. AID/W has generally followed these procedures for large orders including fertilizer orders in the past.

b. Establish and assure adequate terminal dates on all implementation documentation related to procurement. This should be done by a procurement specialist and continually monitored by the project officer to maintain sufficient lead time to complete purchases.

c. Consider establishment of an A.I.D. procurement review cycle, independent of procurement cycles established by host governments or

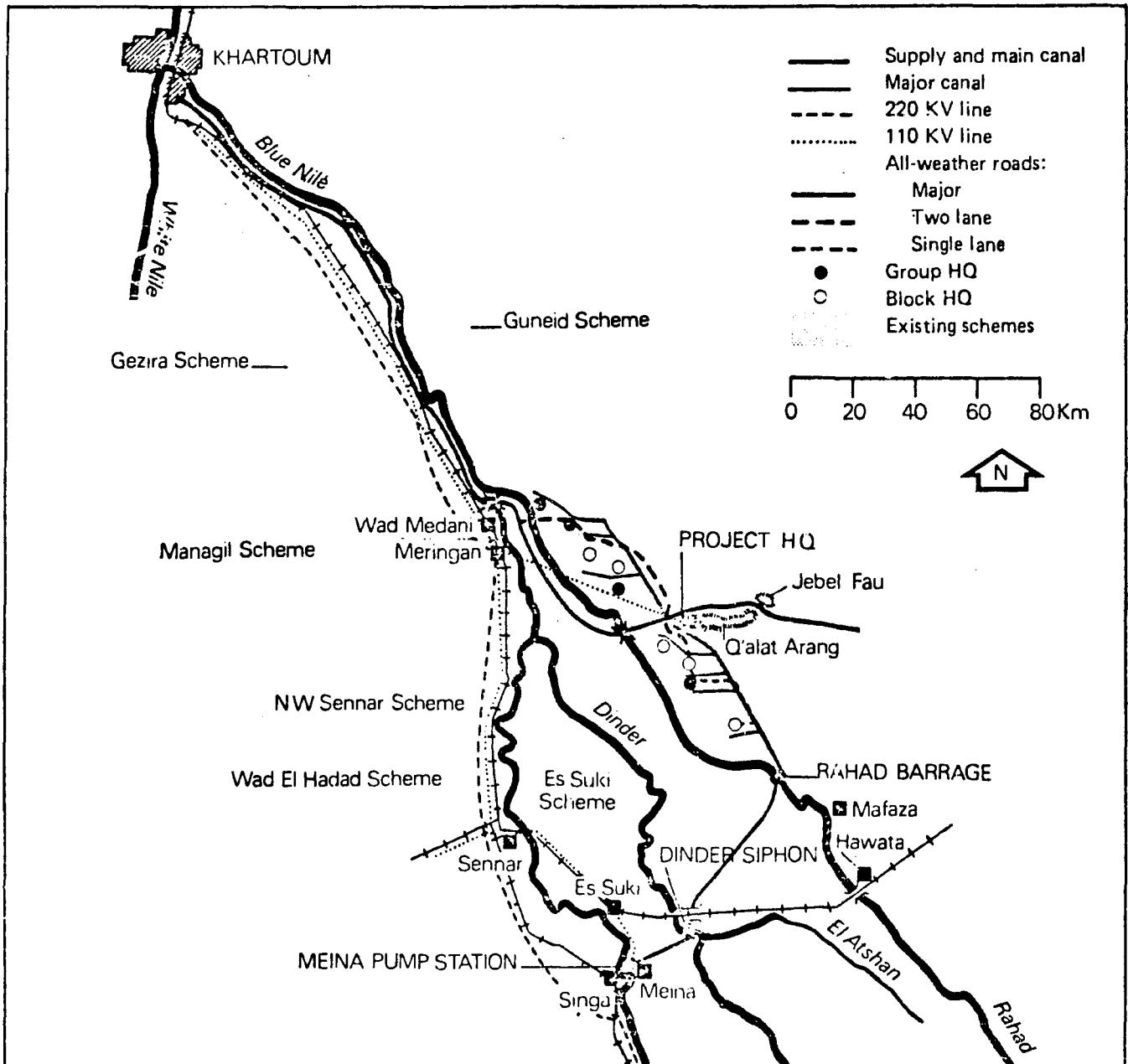
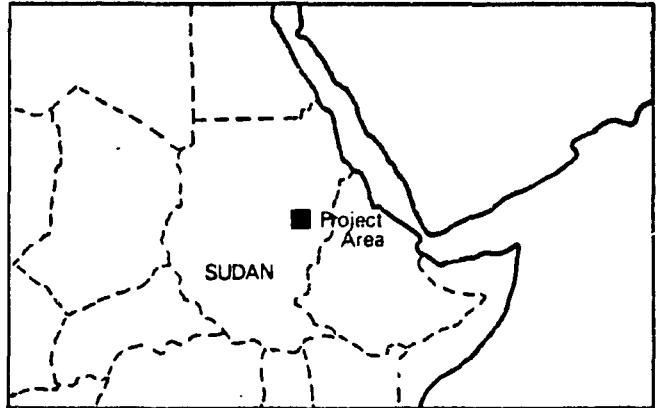
contract procurement agents, which would follow procurement transactions after issuance of letters of commitment to suppliers or letters of credit after purchase awards are made. The review should be made monthly or quarterly by a procurement specialist to identify with follow-up on pastactions and their results.

In addition, it appears that some AID project management alternatives were not explored. One of these might have been to consolidate all available funds in a new L/Comm for the purchase of spares from local dealers. However, this, or other alternatives, may not have been practicable due to the lack of USAID staff in Khartoum at the time.

Regarding the economic rate of return, the project provides an example of a costly capital intensive project which may never pay for itself unless a spectacular turn-around in production and management occurs. The cost of the project has quadrupled while the time needed to complete it has nearly doubled. Yet the value of the benefits has not increased correspondingly. Thus the project has a benefit/cost ratio of .335 (1.00 is break-even), assuming that inflation of capital inputs occurs to the same extent as increase in world cotton prices

ANNEX A
THE PROJECT AREA

The Project Area is located on the east bank of the River Rahad and extends from near Mafaza in the south to the confluence of the Rahad and Blue Nile in the north. The area is a flat alluvial plain with a gentle slope from south-east to north-west of about 0.5 metre per kilometre. The supply canal from the Blue Nile originates from Meina, near Singa, crosses under the River Dinder at a point just south of El Gueisi and joins the River Rahad just north of Mafaza. The project main canal stems from the River Rahad and skirts the eastern edge of the area passing to the west of the Q'alat Arang range of hills, of which Jebel Fau is the highest.



ANNEX B

KEY PERSONS CONTACTED DURING EVALUATION

Rahad Corporation:

Osman Mohamed Bileil, General Manager
Khider El Sayed Mohamed, Deputy Manager, Purchase Dept.
El Sheik Simsa, Chief Agricultural Engineer Dept.
Fatah El Alieh Mohammed Khalid, Director, Maintenance and Operation
Abdalla Abdalla Suliman, Chief Mechanical Engineer
Khalid Mukhtar Khalid, Electrical Engineer
Siddig Abdeen, Deputy Agricultural Manager
Khidir Babiker, Field Inspector, Block 2
Mahmoud, Field Inspector, Block 6
Abdel Razig, Finance Dept.

Ministry of Irrigation: Earthmoving Corporation:

Osman Mustapha Mohammed Kheir, Director General
Mahmoud Salih, Deputy Director General
Mohamed Taha, Director for Supplier and Operations
Abu Zied,

World Bank:

Chris Walton, Chief, East Africa Project
Northern Agriculture
Rene Stevenin, Rahad Project Manager
Guy Madhani, Consultant, Ag. Engineer
Allan Dedvick, Consultant, Ag Engineer
Salim Gafsi, Economist

USAID/Sudan:

Gordon K. Pierson, Director
James S. Holtaway, Deputy Director
Ray Carpenter, Chief, Agricultural Division
Mohamed Khalifa Bakheit, Agricultural Division

Implementation Schedule: Rahad Irrigation Project

Action	Date
AID/W Review of Project	February 7, 1973
Loan Agreement Signed	February 26, 1973
1st Condition Precedent Met	October 4, 1973
2nd Condition Precedent Met	April 22, 1974
<u>Letters of Commitment</u>	
1. 650-H-017 01. Amount: \$300,000 TDD: 12/31/74	November 14, 1973
Amendment No. 1. Extension of TDD to 12/31/77	October 4, 1976
Amendment No. 2. Extension of TDD to 6/30/77	January, 1976
Amendment No. 3. Extension of TDD to 4/28/78	June 27, 1977
2. 650-H-017 02. Amount: \$50,000. Expiration Date: 2/26/76	March 22, 1974
Amendment No. 1. Expiration date extended to 5/26/76	March 23, 1976
Amendment No. 2. Extension of TDD to 12/31/76	August 17, 1976
Amendment No. 3. Extension of TDD to 5/31/77	January 10, 1977
3. 650-H-017 03. Amount: \$5,000,000. Expiration Date: 2/26/76	April 3, 1974
Amendment No. 1. Increase \$5,000,000 Total \$10,000,000	July 25, 1974
Amendment No. 2. Deletion of Special Provisions of original L/Com and replace- ment with new provisions.	November 14, 1974
Amendment No. 3. Changes specifications and quantities of equipment, and basis of delivery to "FAS U.S. port of export."	December 17, 1974
Amendment No. 4. Changes specifications on 30 pick-up trucks and adds 5 elevating grader attachments for Cat. Model 12 Motor.	January 22, 1975
Amendment No. 5. Changes specifications on 66 pick-up trucks.	January 24, 1975
Amendment No. 6. Increase of \$650,000. Total: \$10,650,000.	July 31, 1975

ANNEX C
EXHIBIT 1

Amendment No. 7.	Increase Amendment No. 6 for the financing of additional spare parts for construction and agric. equipment.	August 21, 1975
Amendment No. 8.	Changes in Para. A.10 of Spec. Provisions	October 14, 1975
Amendment No. 9.	Expiration date extended to August 26, 1976	February 5, 1976
Amendment No.10.	Extension of TDD to 5/31/77	October 4, 1976
Amendment No.11.	Extension of TDD to 4/28/78	June 6, 1977
Amendment No.12.	Extension of TDD to 4/27/79	September 28, 1978

ANNEX C

EXHIBIT 2

RAHAD IRRIGATION PROJECT
LOAN NO. 650-H-017

<u>Implementation Letter No.</u>	<u>Date</u>	<u>Subject</u>
1	February 5, 1973	Procedures for Utilization of Loan
2	July 18, 1973	Communications - Section 8.01 (a)
3	August 24, 1973	TDD Extended to September 30, 1973
4	October 4, 1973	Conditions Precedent Satisfied
5	December 19, 1973	TDD Extended to April 30, 1974
6	April 22, 1974	Conditions Precedent Satisfied
7	May 7, 1975	Agreement to use \$1.4 million for procurement of groundnut decorticator & construction equipment.
8	February 25, 1976	Extension of terminal date for requesting and amending disbursement authorizations from 2/26/76 to August 26, 1976
9	July 7, 1976	Sets forth actions to be taken in response to Audit Report No. 3-650-76-47 dated 6/18/76.
10	July 26, 1976	Extension of Terminal date for disbursement to May 31, 1977.
11	August 11, 1976	Approval of Proposed Amendment to Contract with Louis Berger; Notice that Attachment C to Imp. Ltr. 1 no longer applicable; Proprietary Procurement Waiver granted for certain items.
12	August 26, 1976	Term Date for Disbursement extended from Aug. 26, 1976 to March 31, 1977.
13	June 14, 1977	Extension of Terminal Date for Disbursement from May 31, 1977 to April 28, 1978.
14	May 9, 1978	Extension of Terminal Date for Disbursement from April 28, 1978 to April 27, 1979

Description	Unit	Quantity	Achievement In Percentage		Planned	Remarks
			Last Mission (Aug. 14-31, 1978)	Present Mission (Mar. 23-Apr. 10, 1979)		
<u>Buildings</u>						
Total	No.	887	55	60	80	Completion scheduled for March 1980.
Phase I			85	88	100	
Phases II and III			0	45	60	
<u>Road System</u>						
Spine Highway	km	82	0	10	35	Contract period: March 1978 to December 1980.
Feeder Roads	km	75	0	30	35	
Bridges	Unit	4	0	20	40	
<u>Telecommunications System</u>	Lot	1				New bids already opened and evaluated. Contract award expected soon.
<u>Transmission Lines</u>						
Permanent transmission Lines	km	137	90	100	100	
Substations	Unit	4	50	75	100	Full power available at Meina, ginning factories, but not as yet at Fau due to delay in delivery of transformer.
<u>Processing & Storage</u>						
Ginning Factories	No.	4	100	100	100	
Warehouses	No.	4	100	100	100	
<u>Agricultural Development</u>						
<u>Phase I</u>						
On-Farm Development	Feddans	145,000	93	100	100	
Settlement of Tenants	No.	6,500	100	100	100	
<u>Phase II</u>						
On-Farm Development	Feddans	55,000	50	65	100	
Settlement of Tenants	No.	4,000	60	60	100	
<u>Total Cultivated Area (1978)</u>						
Area under Cotton	Feddans	100,000	83	83	100	Late planting and heavy weed infestation.
Area under Groundnuts	Feddans	90,000	40	40	100	

SUDAN

RAHAD IRRIGATION PROJECT

Key Indicators of Project Progress

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Achievement in Percentage</u>			<u>Remarks</u>
			<u>Last Mission</u> (Aug. 14-31, 1978)	<u>Present Mission</u> (Mar. 23-Apr. 10, 1979)	<u>Planned</u>	
A Irrigation and Drainage						
1 <u>Excavation, Phase I</u> <u>Supply Canal & Distribution System</u>	m ³	23,338,000	100	100	100	
Tertiary System	km	2,498	100	100	100	
Drainage System	m ³	3,200,000	60	95	100	Expected to be completed in June 1979
2 <u>Excavation, Phase II</u> <u>Main, Major, Minor Canals</u>	m ³	2,500,000	90	100	100	
Tertiary System	km	1,200	80	100	100	Expected to be completed in June 1979.
Drainage System	m ³	4,000,000	40	90	100	
3 <u>Excavation, Phase III</u>						Detailed design under preparation
4 <u>Maina Pump Station Building</u>	Unit	1	95	95	100	Shortage of windows and electrical fittings.
Pump Installation	No.	11	95	95	100	Flow metering equipment still to be installed and pumps to be tested.
5 <u>Cylinder Siphon</u>	Unit	1	100	100	100	
6 <u>Rahad Barrage & Regulator</u>	Unit	1	100	100	100	
7 <u>Gated Outfall</u>	Unit	1	40	60	100	Six gates not yet installed
8 <u>Major Distribution & Drainage Structures</u>						
<u>Phase I and Main Canal to Km 76.5</u>						
Concrete Structures	No.	103	90	90	100	Expected to be completed in June 1979
Gates Installation	No.	65	100	100	100	
<u>Phase II</u>						
Concrete Structures	No.	18	22	50	100	Expected to be completed in June 1979
<u>Phase III</u>						Detailed design under preparation.
9 <u>Minor Distribution & Drainage Structures</u>						
<u>Phase I</u>						
Concrete Structures	No.	594	90	95	100	Expected to be completed in June 1979.
Gates Installation	No.	305	100	100	100	
Other	Lot	1	50	70	100	Expected to be completed in June 1979.
<u>Phase II</u>						
Concrete Structures	No.	267	40	50	100	Expected to be completed in June 1979.
Field Outlet Pipes	No.	801	45	100	100	
<u>Phase III</u>						Detailed design under preparation

Annex E

Rahad Irrigation Project 1)
AID Financed Equipment
A. Ministry of Irrigation

Annex E
Page 1 of 11 pages

Equipment Type	No	Supplier	L/C No	Amt L/C	Payment FAS	Unliq Bal.	Status		Comments
							Operating	Non-Operating	
HD 41-B Tractors (550hp)	5	Fiat Allis	814-74	1,097,357	1,097,357	-		5	Need spares for engine overhaul
Spares	Lot	Fiat Allis	1396-75	178,574	152,617	25,956			Includes Spares for 16-B partial delivery.
Spares	Lot	Fiat Allis	4-76	2,772	2,772	-			Includes spares for 16-B
Spares	Lot	Fiat Allis	469-76	45,615	-	45,615			Includes spares for 16-B
Spares	Lot	Fiat Allis	52-77	82,312	-	82,312			Includes spares for 16-B
Wabco 339f scrapers (28 cu yds)	8	Wabco	815-74	1,132,440	1,132,440	-		8	Need spares for hydraulic system.
Spares	Lot	GAR	1428-75	140,710	138,970	1,740			Includes Spares for 555 grader
Spares	Lot	GAR	1395-75	900	879	21			Includes spares for 555 grader.
Spares	Lot	GAR	5-76	796	796	-			
HD 16-B Tractors (power shift)	15	Fiat Allis	816-74	1,141,812	1,141,812	-	11	4	4 cannibalized, 7 in Northern province
Spares	Lot	Fiat Allis	1349-75	46,581	29,588	16,993			Partial delivery
Spares	Lot		1396-75			-			Included under 41-B spares
Spares	Lot		469-76			-			Included under 41-B spares
Spares	Lot		52-77			-			Included under 41-B Spares

1) comment followed by question marks indicate that the team was unable to determine the status owing to incomplete project records.

Equipment Type	No.	Supplier	LC/ No.	Amt. L/C	Payments FAS	Unliq. Bal	Status		Comments
							Opera- ting	Not- operating	
Wabco 555 Grader	8	Wabco	813-74	328,792	328,792	-	7	1	Spares available for engine; equipment located at Bahad.
Spares	Lot			-	-	-			Included under scraper spares (1428-75)
Spares									
Truck tractors 60 ton (Autocar)	2	GAR	865-74	87,160	87,160	-	2		Good condition
Spares	Lot	GAR	965-76	17,920	17,353	567			Full Delivery?
Lowbed Trailer	2	Hobbs, Intl.	1241-74	46,220	46,220	-	2		Good condition
Spares	Lot	GAR	963-76	4,169	2,068	2,100			
Spares									
Dump Trucks	10	Autocar	866-74	353,250	353,250	-	5 ¹	5 ¹	Used by MOI Irr. Corp for construction work
Spares	Lot	GAR	1429-69	33,569	33,562	7			MOI reports no spares received.

1. Estimated

Equipment Type	No.	Supplier	L/C No.	Amt LC	Payment FAS	Unliq Bal	Status		Comments
							Opera- rating	Nor- operating	
Mobile Workshop	2	Phoenix Mfg.	811-74	171,734	171,734	-	2		Located at Rahad
Spares	Lot		966-76						
Spares	Lot								
Hydraulic Crane (8 ton)	2	Grove Intl.	812-74	83,996	83,996	-		2	Need engine and transmission over-haul spares
Spares	Lot	GAR	9-76	10,412	9,223	1,188			
Spares	Lot								
Concrete Mixers	30	Brown & Sitas	817-74	37,980	37,980	-	-	30	Useful life expired, used by Irr. Corp.
Spares	Lot	Brown & Sitas	961-76	5,973	5,632	341			
Spares	Lot								
Loader, Wheel 930	1	Cat.	820-74	46,792	46,792	-	1	-	Used by Irr. corp. for construction work.
Spares	Lot	Cat.	51-77	5,671	5,287	384			
Trucks, P/U, F 250	30	Ford Export	819-74	147,057	147,057	-	5 ¹	25 ¹	Lack spares, possibly cannabalized
Spares	Lot	Ford Export	118-76	18,727					Delivered by mfg? MOI reports no spares were received.
Spares									

1. Estimated

Equipment Type	No.	Supplier	L/C No.	Amt LC	Payment FAS	Unliq Bal	Status		Comments
							Opera- rating	Non- operating	
Hacksaws, Electric	4	New World Research	818-74	5,796	5,796	-	4	-	
Vibrators, Concrete	20	Combined Agencies	810-74	16,592	16,592	-	-	20	Useful life expired.
Spares		Combined Agencies	964-76	1,595	751	-			
Spares									Not ordered
Tools, Hand (sets)	10	Warner	466-75	3,945	3,945	-	5 ¹	5 ¹	Some expended
Elevators, Grader	5	Rivinius	370-75	140,622	126,219	14,403	4	1	One received in non-operable condition, has never operated.
Spares	Lot	Rivinius	1,435-76	32,553	31,368	1,185			Some spares not received.
CAT Spares for Existing Equipment	Lot	Cat Overseas	1,204-74	49,928	36,729	13,199	-	-	Utilized
Lub. Units	2	Phoenix Mfg.	1,350-75	11,402	11,402	-	-	2	Not repaired, reason unknown.
Spares	Lot	Phoenix Mfg	962-76	2,806	2,806	-			?
Spares	Lot								
<u>Additional Equipment</u>									
Trucks, Mechanical	6	Ford	308-77	184,338	-	184,338	-	-	Not delivered from Mfg.
Spares	Lot								Not ordered.

1 Estimated

Equipment Type	No.	Supplier	L/C No.	Amt L/C	Payment FAS	Unliq. Bal	Status		Comments
							Opera- rating	Non- operating	
Special Tools	Lot	Fiat Allis	352-77	32,343		32,343	-	-	Not delivered from Mfg.
Automatic Welding Mach.	1	Ivan Bartter	314-77	28,257	?		-	1	Part of shipment still in Port Sudan.
Spot Welding Mach	1	George Warner	315/77	402	?		-	1	Received with missing parts, has never operated
			1236-77			303			
Truck, Tanker, Fuel 1500 gal	1	Intl. Harvester	53-77	21,744	?		-	-	Delivered by Mfg? Not received by MOI
Drawing Equip.	Lot	Charette Corp.	1434/76	15,617	15,617	-	1	-	In use.

B. Rahad Corp

Equipment Type	No	Supplier	L/C No.	Amt. L/C	Payment FAS	Unliq Bal	Opera- rating	Non - operating	Comments
HD-16 Tractor, Direct Drive	12	Fiat Allis	BS/742/74D	669,786	669,786	-	6	6	2 cannabalized, Lack spares.
Spares 10%	Lot	Fiat Allis	BS/20/76D	75,059	75,059	-			Partial shipment recd.
Spares 5%	Lot	Fiat Allis	BS/1361/76D	37,530	33,537	3,993			
Waboo Grader	6	Waboo Trade	BS/746/74D	246,594	246,594	-	2	4	Fuel pump, alternator, starter problems; 1 never operated and cannabalized.
Spares 10%	Lot	GAR Intl.	BS/213/76D	23,774	21,326	2,448			At least partially received.
Spares 5%	Lot			16,800	?				Not ordered?

Equipment Type	No.	Supplier	LC/ No.	L/C Amount	Payment FAS	Status		Comments	
						Unliq. Balance	Operating Non-operating		
Mobile Workshop	2	Phoenix Mfg	BS 747/74D	238,704 ¹	238,704 ¹		2	-	Being utilized fully
Spares	Lot	Phoenix Mfg.							Shipped with Trailers
Spares	Lot	Phoenix Mfg.		15,572	?				Not ordered ?
Trucks, P/U F-250	66	Ford	BS/745/74D	323,527	323,527	-	36	30	No spares available in country, 15 cannabalized.
Spares	Lot	Ford	BS/530/76D	29,426	?	6,820			Received?
Spares	Lot	Ford	BS/207/77-D	23,004 ²	?	1,074			Received?
Bus 44 passenger	2	Ford	BS/748/74-D	31,564	31,564	-	-	2	1 cannabalized, 1 needs starter.
Spares	Lot	Ford	BS/207/77-D	-	-	-			Included in order for P/U spares
Marvin Land Planes	8	Oppenheimer	BS/743/74-D	125,988	125,988	-	4	1	3 not received Rahad has adequate spares, Will not be needed after development
Spares	Lot	Oppenheimer	BS/18/76-D	13,153	?	?			Shipped March 1978
Spares	Lot	Oppenheimer	BS/1380/76-D	- 1	1	-			Includes spares for trailers.
Spares	Lot	Oppenheimer	BS/197/77-D	863	?				Received?
Spares	Lot	Oppenheimer	BS/196/77-D	5,437	5,211	226			

1 Includes 4 fuel tankers, 6 trailers and spares

2 Includes order for Bus spares

Equipment Type	No.	Supplier	L/C No.	L/C Amount	Payment FAS	Uliq. Bal.	Status		Comments
							Opera- rating	Non- operating	
Disc Harrow, Rome	6	Rome Intl.	BS/744/74-D	46,630	46,630	-	6	-	In good order
Spares	Lot	Rome Intl.	BS/212/76-D	4,814	4,011	803			Spares received.
Spares	Lot	Rome Intl.	BS/1362/76-D	2,264	2,264	-			Received?
Disc Harrow, Offset	20	Allis Chalmers	BS/741/74-D	46,630 ¹	46,630 ¹	-		20	Need bearings, spindles eto.
Spares	Lot	Allis Chalmers	BS/19/76-D	4,998	4,998	-			Received?
Spares	Lot	Allis Chalmers	BS/1364/76-D	3,330	2,939	391			Received?
Tankers, 2 Water, 2 fuel, Towed	4	Phoenix Mfg	BS/747/74-D	_2	_2	-		4	
Trailers, Towed	6	Phoenix Mfg	BS/747/74-D	_2	_2	-		6	
Spares for 10 trailers	Lot	Oppenheimer	BS/1380/76-D	4,538 ³	4,538 ³	-			Received?

1. Includes Versatile Blades
2. Included under I/C for Mobile workshop
3. Includes spare parts for Land Planes.

Equipment Type	No.	Supplier	L/C No.	L/C	Amount	Payment FAS	Unliq. Bal.	Opera- rating	Non- operating	Comments
Versatile Blade	16	Allis Chalmers	BS/741/74-D		-1	-1	-	16		
Spares	Lot	Allis-Chalmers	BS/19/76-D		-2	-2	-			Received?
Tilt Trailers	10	Oppenheimer	BS/878/74-D		30,540	30,540	-	5 ³	5 ³	Now used to haul fertilizer, more useful during development
Spares	Lot	Oppenheimer	BS/18/76-D		-4	-4	-			Received?
Spares	Lot	Oppenheimer	BS/1363/76-D		715	680	36			Received?
Mechanical Tool Sets, 18 sets, + 6 Welding Sets	24	G.W. Warner	BS/77/75-D		12,590	12,590	-	18 ³	6 ³	At least partially received, estimate six expended.
Truck, IHC 4 x2 chassis	16	IHC	BS/1220/75-D	}	278,460	278,460	-	16	12	Lack of spares, at least six cannabalized.
Truck, IHC, Tanker 1500 Gal water	2	IHC	BS/1220/75-D							
Truck, IHC Tanker 1500 Gal fuel	2	IHC	BS/1220/75-D							
Truck, IHC, Mechanical	8	IHC	BS/726/76-D		261,138	261,138	-			
Spares for 28 IHC trucks	Lot	IHC	BS/230/77-D		112,016	106,134	5,882			Received?
Spares for 28 IHC trucks	Lot	IHC	BS/1048/77-D		42,089	41,046	1,043			Received?

1. Included in L/C for offset disc Harrow
2. Included in L/C for spares for offset disc harrow
3. Estimated
4. Included in L/C for spares for land planes

Equipment Type	No.	Supplier	L/C No.	L/C Amount	Payment FAS	Uliq. Bal.	Status		Comments
							Opera- rating	Non- operating	
Portable Lube Units (Gracolube)	10	GAR	BS/1020/74-D	56,750	56,750	-	5 ¹	5 ¹	Received and have been operational, nearing end of useful life. Est- mated 3 non repairable.
Spares	Lot	GAR	BS/212/77-D	8,691	8,691	-			
Lube Units, P/U mounted	2	Phoenix	BS/1219/75-D	11,772	11,772	-	-	2	Received, never installed and utilized.
Spares				2,100	-				Ordered?
Central shop + maintenance Tools	Lot	Harold Dessu Int.	BS/78/75-D	39,090	39,090	-	-	-	At least partial received.
Central shop tools & Equip.	Lot	G. Warner	BS/1096/75-D	35,833	26,569	9,264	-	-	At least partial received.
Trucks, P/U F-150 4 x 2	10	Ford	BS/727/76-D	39,209	39,209	-	5	5	Lack spares, Est. -3 non repairable.
Spares	Lot	Ford	BS/343/77-D	10,473	10,150	323			Received?
Decorticator and spares	1	Paul Hattaway	BS/288/76-D	75,585	75,585	-	-	1	Installed, damaged by fire, inadequate power supply.
Spares (6 screens)	Lot	Paul Hattaway	BS/414/77-D	2,093	?	-			Received?
Technician for Installation		Paul Hattaway	BS/90/77-D	16,400	14,027	2,373			Services perfor- med.

1. Estimated

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