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**Report No. 14217**

**PROJECT COMPLETION REPORT**

**MYANMAR**

**YE-U IRRIGATION REHABILITATION AND MODERNIZATION PROJECT  
( CREDIT 1731-BA)**

**April 3, 1995**

**Agriculture and Natural Resources Operations Division  
Country Department I  
East Asia and Pacific Regional Office**

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Currency Equivalents  
(Kyats per US\$)

<u>GOM Fiscal Year</u>	<u>Exchange Rate</u>
Appraisal Year 1986-87	8.80
1987-88	6.78
1988-89	6.35
1989-90	6.60
1990-91	6.45
1991-92	6.01
1992-93	6.24
Completion Year 1993-94	6.50

Fiscal Year

April 1 - March 31

Weights and Measures

1 foot (ft)	=	0.305 meters (m)
1 acre (ac)	=	0.405 hectares (ha)
1 pound (lb)	=	0.454 kilograms (kg)
1 cubic foot/second	=	0.028 cubic meters/second
ton	=	metric ton = 2,200 pounds

Abbreviations

CDZ	Central Dry Zone
DCA	Development Credit Agreement
EIMS	Equipment Inventory Management System
GOM	Government of Myanmar
ID	Irrigation Department
MAS	Myanmar Agriculture Service
MB	Mechanical Branch of the Irrigation Department
MOA	Ministry of Agriculture
O&M	Operation and Maintenance
R&M	Rehabilitation and Modernization
SAR	Staff Appraisal Report
TA	Technical Assistance
UNDP	United Nations Development Program
WC	Water Course

THE WORLD BANK  
Washington, D.C. 20433  
U.S.A.

Office of Director-General  
Operations Evaluation

April 3, 1995

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Project Completion Report on Myanmar  
Ye-U Irrigation Rehabilitation and Modernization Project  
(Credit 1731-BA)

Attached is a copy of the report entitled Project Completion Report (PCR) on Myanmar—Ye-U Irrigation Rehabilitation and Modernization Project (Credit 1731-BA) prepared by the East Asia and Pacific Regional Office. The Borrower did not contribute a Part II to the PCR.

The project was to be the first of several to both rehabilitate and modernize (R&M) five old run-of-the-river irrigation schemes in the central dry zone of "Upper Burma". No storage was present or planned, and the principal objective was to maximize the supplementary use of irrigation on about 50,000 hectares of paddy under command in the rainy season. Substantial institution-building components were added to improve the Irrigation Department's (ID) planning and mechanical divisions. As discussed in an excellent PCR originally prepared by FAO/CP, the project reached its main physical targets and, despite government's reluctance to make full use of the technical assistance provision, the improvements in ID were also mostly realized.

The project outcome is rated as marginally satisfactory. Actual cropping intensities are better than expected, a substantial area is now planted to a second, relay crop of chick pea that had not been planned, and family farm incomes have risen. Recent liberalization of agricultural markets has provided a further boost. But a 35 percent decline in international paddy prices brought the re-estimated economic rate of return down to 7.4 percent, from the 20.2 percent projected at appraisal. The Project Completion Report also states that not enough attention was given to improve farmer management of water in the tertiary systems. Nevertheless, sustainability of the project works seems likely and institutional development is rated as substantial. The Bank's lending program was curtailed in the late 1980s and no further R&M projects were financed.

No audit is planned. A "tank" irrigation project in Myanmar's central dry zone is presently being audited simultaneously with an impact assessment of it and another storage irrigation project.



Attachment

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MYANMAR

YE-U IRRIGATION REHABILITATION AND MODERNIZATION PROJECT

(Credit 1731-BA)

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PROJECT COMPLETION REPORT

MYANMAR

YE-U IRRIGATION REHABILITATION AND MODERNIZATION PROJECT

(Cr. 1731-BA)

PREFACE

This is the Project Completion Report (PCR) for the Ye-U Irrigation Rehabilitation and Modernization Project in Myanmar, for which Credit No. 1731-BA in the amount of SDR12.3 million (US\$14.0 million equivalent) was approved on August 26, 1986. The Credit closed, six months behind schedule, on December 31, 1993. The undisbursed balance of SDR2,588 (US\$3,625) remaining after the last disbursement on March 31, 1994, was cancelled.

Parts I and III of the PCR prepared by the Food and Agriculture Organization of the United Nations/World Bank Cooperative Program (FAO/CP), are based, inter alia, on the findings of a PCR mission in January 1994; the Staff Appraisal Report No. 5534-BA, dated July 14, 1986; the Development Credit Agreement dated October 15, 1986; the Bank's supervision reports; the Borrower's Quarterly Reports; project files; interviews with the Bank staff associated with the project; and the data supplied by the implementing agencies.

The Bank wishes to express its appreciation to the officials of the Government and the implementing agencies for their valuable assistance in preparing this PCR.



PROJECT COMPLETION REPORT

MYANMAR

YE-U IRRIGATION REHABILITATION AND MODERNIZATION PROJECT

(Cr. 1731-BA)

EVALUATION SUMMARY

Project Objectives

1. The main objective of the project was to rehabilitate and modernize the Ye-U irrigation and drainage system commanding 121,900 acres (ac) in the Mu river basin, located in the Central Dry Zone (CDZ) of the country, mainly to increase the production of rice in the area. The restoration of the system to its full irrigation and drainage capacity, coupled with provision for better availability of agricultural inputs and extension service, was expected to increase the production of paddy and non-paddy crops, thus raising the average income of the 20,000 farming families in the system command area. The other objective was institutional strengthening of the Irrigation Department (ID) and the Myanmar Agriculture Service (MAS), mainly through technical assistance, training, and provision of facilities, including vehicles and equipment.

Implementation Experience

2. The major portion of the rehabilitation and modernization (R&M) works was completed as scheduled. The implementation of the R&M was entirely under force account, using both manual labor and machines. However, the planned use of construction equipment for earthwork on the canals and drains could not materialize fully due to shortages of diesel and proper lubricants. The Credit Agreement was amended in November 1987 to allow financing of oil and lubricant imports. Cement, which was short for some time, also adversely affected progress of work. Moreover, there were major delays in the procurement of equipment and spare parts of construction equipment and other goods due to the Government's time-consuming procedures for clearances.

3. Although implementation was generally good, the project preparation and appraisal had some flaws. There was a serious underestimation of quantities of earthwork for the re-sectioning of the canals and drains as the appraisal estimates were based on old surveys. The functioning of the Kabo diversion structure was not adequately examined. Provision should have been made for remedial measures to prevent the waste of water down the river at a time when it could do a lot of good to the crops. Though shortcomings in the ID operation of the system in respect of water management were recognized during project preparation, sufficient provision was not made for consultants' time under TA to identify the weaknesses and introduce an improved system operation. The project also did not provide a strong program for the formation of water users' groups at the water course (WC) level, and for training them to assure that the available water was distributed to the entire command of each WC equitably and that each WC was properly maintained.

4. The actual project cost (US\$39.78 million or Kyat 250 million) was about 50% higher in US dollars than that estimated at appraisal (US\$26.14 million or K 230 million) due to underestimates of work quantities at appraisal, cost increases, and exchange rate movements between appraisal and project completion. The Credit closing date of June 30, 1993 was extended by only six months and the Credit of SDR 12.3 million was almost fully disbursed on March 31, 1994, with only SDR 2,588 (US\$3,625) cancelled. The UNDP contribution increased from US\$1.8 million at appraisal to US\$3.4 million equivalent at project completion.

## Results

5. The project has been successful in achieving the objective of improving the irrigation and drainage system up to the WC offtake to the extent originally intended. The system operation, however, continues to be deficient in assuring proper distribution of water. Though control structures have been constructed on direct outlets on the main canals to regulate the supplies, the ID is hesitant to put these into operation due to the possibility of these being damaged by farmers.

6. Although the irrigated area under the first crop of paddy (the rainy season) will most likely be 111,000 ac, compared to 121,000 ac estimated at appraisal, the project's agricultural impact will be clearly positive. The 10,000 ac shortfall will be due to the fact that 2,000 ac will be grown with rainfed non-paddy crops, while another 8,000 ac will not be cultivated due to various agronomic and peace and order problems during the rainy season. However, it is expected that an area of 17,000 ac will have a second paddy in the first crop season (not foreseen at appraisal), making the total paddy cropped area 128,000 ac, some 7,000 ac larger than foreseen at appraisal. At project completion, the total cropped area in the main season had already reached 117,200 ac (101,335 ac first crop and 15,884 ac second crop). The total expected maximum non-paddy crop area (under rainfed and residual moisture) of 23,500 ac at full development (compared to 18,000 ac at appraisal) is already expected to be reached during 1993/94 (2,000 ac rainfed and the remainder on residual moisture).

7. At full development in 1996, the total paddy production would be 184,100 tons compared to 184,800 tons at appraisal. Yields at full development are expected to remain at the 1993/94 level i.e., 1.438 tons/ac (1.50 tons at appraisal). Almost the entire non-paddy crop area is planted with chick peas, the production of which is about 3,900 tons (4,500 tons at appraisal). No yield increase of chick peas over the pre-project level was assumed at appraisal or completion. However, the yield at project completion is estimated at 0.17 tons/ac, compared to 0.25 tons/ac at appraisal. Overall cropping intensity at full development is expected to be higher than at appraisal (125% against 115%). The project has, therefore, basically achieved more than anticipated at appraisal.

8. The institutional impact has been favorable as well, particularly with regard to the mechanical branch (MB) of ID on which the project had focused in terms of institutional strengthening. Twenty MB engineers were trained overseas; MB technicians were given on-the-job training by expatriate specialists who also streamlined the operations in MB workshops; and machines lying idle or those which required minor repairs were put back in operation. Strengthening of MAS was carried out mainly through overseas training and study tours for staff who were subsequently placed in key positions either in headquarters or in the field.

9. The project ERR is expected to be about 7.4% compared to the appraisal estimate of 20%. The ERR is lower mainly due to the significantly lower international price of paddy at project completion compared to the price projected at appraisal. If the international prices projected at appraisal had materialized, the re-estimated ERR at project completion would be about 17%.

## Sustainability

10. Sustainability of the project at its present level of efficiency will be subject to proper maintenance of the irrigation and drainage system. Since the Government is currently giving high priority to the maintenance of the irrigation systems in the country and intends to allocate sufficient annual operation and maintenance (O&M) funds, the project is considered sustainable. Moreover, once the ID system operation procedures have been improved and formation and strengthening of water user groups realized, crop production is expected to increase further on a sustainable basis. Cost recovery of K 61 million in 1992/93 was satisfactory compared to the annual O&M cost of K 7 million and investment cost of K 282 million.

### Findings and Lessons Learned

11. The main lessons learned are the following:

- (a) in formulating a R&M project for an irrigation system where farmer groups involved in water management at farm level are known or thought to exist, it is important to review in detail the status of these farmers' groups. A well designed component dealing with water management at farm level through full farmer participation should be included in R&M projects (PCR, paras. 4.4, 5.4 and 8.1);
- (b) a R&M project should look into the system deficiencies up to the very source of water and problems in diverting supplies to the system. Should there be possibilities of obtaining better supplies from the source, the necessary measures should be included under the project (PCR, para. 4.2);
- (c) in planning the improvement of an irrigation system, the issue of whether the system operation procedures are conducive to equitable distribution of water in all sections should be reviewed. If procedures are deficient, studies for revised procedures and introduction of an improved system should be pursued under the project (PCR, para. 4.3); and
- (d) the timely procurement of goods is critical for the implementation of any project. The Borrower should, therefore, critically review its procurement procedures and monitor closely the procurement process to assure timely deliveries (PCR, para. 9.2).



# PROJECT COMPLETION REPORT

## MYANMAR

### YE-U IRRIGATION REHABILITATION AND MODERNIZATION PROJECT

(Cr. 1731-BA)

#### PART I: PROJECT REVIEW FROM BANK'S PERSPECTIVE

##### 1. Project Identity

Project Name	:	Ye-U Irrigation Rehabilitation and Modernization Project
Credit No.	:	1731-BA
RVP Unit	:	East Asia and Pacific
Country	:	Myanmar
Sector	:	Agriculture
Sub-sector	:	Irrigation

##### 2. Background

2.1 The Fourth Five Year Plan (1982-83 to 1985-86) of the Government of Myanmar (GOM) emphasized consolidation of investments in the medium term. For irrigation, the Plan emphasized completion of on-going projects and improved capacity utilization by rehabilitation of existing schemes to restore original performance and to attain higher efficiency. These objectives were in harmony with the recommendations of the two 1982 World Bank (WB) studies - "Irrigation Sector Review" and "Priorities for Continued Growth".

2.2 In line with this policy, the rehabilitation and modernization (R&M) needs of the various existing irrigation systems in the Central Dry Zone (CDZ) of the country, which has maximum potential both for increase in rice production and crop diversification, were quickly assessed. Priority was accorded to the R&M of the Ye-U irrigation system, commanding 121,000 acres (ac) of mainly rice area in the Sagaing division. Although the Ye-U system does not receive water in the dry season to irrigate a second paddy or non-paddy crop, the preference for Ye-U rehabilitation and modernization (R&M) was based on the need to reduce the rice deficit in the Sagaing division and to support the development needs of the region. For the R&M of other irrigation systems in CDZ under a long range program, the sector policy also emphasized the strengthening of the planning and implementation capacity of the implementing agencies.

2.3 To support the GOM program, the International Development Association (IDA) agreed to provide funding for the Ye-U Irrigation Rehabilitation and Modernization Project (Ye-U project) which included strengthening of the concerned implementing agencies. At GOM request, FAO/World Bank Cooperative Programme (FAO/CP) was assigned in June 1982 the task of the preparation of the Ye-U project. FAO/CP had earlier been associated in the identification of the Ye-U project and preliminary studies. In May 1983, FAO/CP was also assigned the task of formulation of proposals for an Equipment Inventory Management System (EIMS) and the strengthening of the mechanical branch (MB) workshops of the Irrigation Department (ID). FAO/CP submitted in May 1984 separate preparation reports for (i) Ye-U R&M and (ii) improvement of MB facilities for operating and maintaining the construction equipment. Both these reports formed the basis for the Ye-U project appraisal, which was undertaken in November 1984.

### 3. Project Objectives and Description

3.1 Project Objectives. The project was to be implemented over a period of six years and had the main objectives of:

- (a) raising farmers' income and living standards in the Ye-U command area through improved irrigation, easier access to agricultural inputs, and better extension services;
- (b) strengthening the ID's capacity to plan and implement the R&M of irrigation infrastructure through the elaboration of a Master Plan for the rehabilitation of at least five major schemes; and
- (c) creating the capacity within the ID's Mechanical Branch for effective management of ID's fleet of heavy equipment, including overhauling and major repairs.

3.2 Project Components. The project had the following components:

(a) Irrigation Civil Works

- (i) Rehabilitation. Repairs to the Ye-U intake structure, bifurcation structure, cross-drainage and drop structures, head regulators, road and foot bridges; and resectioning of the main, distributary and minor canals, cross drains, feeder drains, and the Payanpaga and Moksi Chaungs (trunk drains);
- (ii) System Modernization. Construction of a sediment excluder, an ejector, cross regulators, control structures at the heads of minor canals and water courses, and side and tail escapes in the main canals; installation of measuring devices at branch canal heads and at distributary intakes; improvement of inspection roads; and provision of telephone communication for operation of the Ye-U system;
- (iii) Incremental O&M. Increased outlays for operation and maintenance of the Ye-U system, in order to ensure adequate maintenance of irrigation infrastructure; and
- (iv) On-farm Development. Remodelling and realignment of water courses to limit the command area to 75 ac.

(b) Earthmoving Equipment. Procurement of 20 items of major construction equipment, 51 items of minor equipment, and spare parts for R&M work.

(c) Construction Supervision

- (i) Construction Camps. Construction of offices, dormitories, stores, and equipment repair facilities for implementing the R&M; and
- (ii) Engineering and Administration. Provision of office and engineering equipment, running expenses, vehicles, and about 500 personnel of the ID to be redeployed from other projects.

(d) Institutional Strengthening and Technical Assistance

- (i) ID (Civil Engineering). Provision of technical assistance, counterpart staff, and facilities, including vehicles, for preparation of a long-term master plan for irrigation system rehabilitation and of a follow-on project; provision of technical assistance, counterpart staff, sampling equipment, model studies, and training for design of structures for sediment exclusion and R&M of Ye-U system as well as for improved system operation, based on new operational guidelines;
- (ii) ID (Mechanical Engineering). Provision of technical assistance, counterpart staff, and facilities for establishing an equipment inventory management system (EIMS), and for training of operators and mechanics; and provision of fellowships for training in management of construction, equipment operation and specialized repair, and running the training centre; and
- (iii) Myanmar Agriculture Service (MAS).1/ Addition of about 60 extension personnel, and provision of vehicles and fertilizer godowns for the three townships in which Ye-U command area is located; and provision of fellowships in rice agronomy, cropping systems, and water management.

(e) Mechanical Circle Workshops

- (i) Mechanical Circle Services. Provision of additional fuel and lubricant facilities, and tools and consumables for base and regional workshops and engine overhaul shops; upgrading of a hydraulic components workshop; and construction of a dredger base at Okkyin; and
  - (ii) Construction Equipment Spare Parts. Provision of spare parts for overhaul of selected construction equipment, to be used in other irrigation projects.
- (f) Monitoring and Evaluation. Provision of staff support, office supplies, and computer software to MAS for the execution of benchmark, mid-term, and final agro-economic surveys.

4. Project Design and Organization

4.1 Overall design of civil works was good although some changes were introduced during implementation. Based on the results of model tests for sediment control, the ejector in the canal was omitted. Also following detailed analysis of water level control in the main canal for feeding the distributaries, seven (instead of 11 proposed at appraisal) cross regulators were found to be sufficient, and the proposed new escapes (except one) were not considered necessary.

4.2 Due to a design oversight during preparation and appraisal, the much needed improvement in the facilities at the Kabo weir on the Mu river, for diverting the available river water into the Ye-U as well as Shwebo irrigation systems, had not been included in the project. The Kabo weir has drop shutters on the crest which are dropped from the two ends of the weir, whenever the river has a flood. For raising of these shutters to pond water for feeding the canals, however, the labor has to go to each shutter, and the

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1/ This was referred to as the Agriculture Corporation (AC) in the SAR. The AC became MAS in 1987.

operation has to wait till the depth of water overflowing the weir is considered safe for the labor. Water, which could otherwise be diverted to the two irrigation systems for additional paddy irrigation, goes down the river to waste. Replacement of the shutters by a rubber dam or installing suitable mechanical devices for raising the shutters (while water overflows the weir crest) should have been included in the project.

4.3 The design of interventions to improve water management was poor. Though weakness in water management was recognized at the appraisal stage, little concrete action was proposed to (a) improve ID system operation for assuring timely and sufficient delivery of water at the heads of farmer-managed water-courses (WC), and (b) establish and train water user groups on each WC to ensure that each farmer got his share of water and that losses were minimized by good WC maintenance. The project should have provided an in-depth review of the existing operational system, which results in excess irrigation in some sections and shortages in practically all the tail areas. On the basis of this review, a revised system operations pattern should have been formulated, introduced, and problems, if any, sorted out during the implementation period. The project provided only four person-months of specialized technical assistance to ID for the establishment of improved operational procedures for the Ye-U system. This was inadequate as the expert also had responsibility for design of R&M work. The available time was sufficient only for establishing the water level control on the main canals for different flows, which determined the required number of cross regulators and escapes, and for designing the R&M structures. An analysis of the irrigation depth on each channel from 1984 to 1992 shows that the distributaries lower down in the system continue to experience water shortage, and confirms the need for a change in the system operations pattern to ameliorate the situation.

4.4 Strengthening water management at WC level was also not adequately dealt with during preparation and appraisal. The importance of forming and strengthening water users' groups (which do not exist for each WC) and their training for proper distribution of water and maintenance of WC to minimize losses was not recognized. Rather than including this as a separate component, the project provided only for advice to farmers by ID, without any additional staff or funding. This omission was probably due to an erroneous conclusion by the project preparation team (July 1983 report): "The impression has been obtained that the farmers are fully capable to organize O&M of the WC among themselves. No changes in the present situation are proposed." No remedial steps were proposed to rectify the situation during subsequent project preparation or appraisal, although the preparation team had contradicted itself by also acknowledging that: "During periods of short supply, no serious efforts are being made to evenly distribute water among the farmers. Normally when it is his turn, a farmer gets as much water as he needs. Traditionally, farmers at the head of WC receive water first."

4.5 An inter-departmental Project Coordination Committee (PCC) was set up by the Ministry of Agriculture (MOA) to oversee the project, find and pursue solutions to the inter-ministry problems, and provide administrative decisions on project matters. The PCC was successful in providing clearances necessary in the procurement process but was ineffective in ensuring quick decisions and making necessary arrangements for timely procurement processing. The Project Unit (PU) was also formed at the project level, comprising ID, MAS, and Townships' staff. The PU functioned informally, but satisfactorily, and met many times to discuss the project issues, although minutes were not recorded.

## 5. Project Implementation

5.1 General. By July 1987, the project organization was mostly in place (camps and buildings for the project staff were established) and project implementation commenced immediately after the Development Credit Agreement (DCA) became effective in July 1987. During the first working season from

December 1987 to May 1988 (the annual period of canal closure), mainly surveys and the graveling of roads were carried out. The resectioning of the main canal commenced in the next working season (1988-89) but progress was hampered due to political unrest in the country, resulting in the demobilization of the technical assistance personnel for one year (September 1988 to September 1989).

5.2 As envisaged at appraisal, the entire civil works were carried out by force account, using both manual labor and machines. In the beginning (working seasons 1987-88 and 1988-89), the machine work was affected by shortages of diesel oil and proper lubricants. The situation improved after the DCA was amended in November 1987 and project finance was provided for the procurement of crude oil (which was processed in the country) and lubricants. The situation, however, worsened again in 1991-92 and 1992-93, restricting the full use of machines. In order to finish the remaining resectioning of the drains before the 1993 rains, ID mobilized a labor force which peaked at 20,000. The Credit closing date was extended for six months to December 31, 1993. The Credit was almost fully disbursed on March 31, 1994 (para. 5.13), although the R&M work was about 85% complete at that time. ID expects to complete the remaining work by June 30, 1996, with the GOM's own resources.

5.3 Quantity estimates in the project preparation report for earthwork on the main canal and the distributaries were based on old surveys (1975 in the case of distributaries). These were found during implementation to be serious underestimates. Actual quantity was seven times in the case of distributaries. The actual quantities of earthworks for the resectioning of the drains were also considerably higher than the earlier estimates, which were based on an assumed percentage of the overall design sections needed for the drains. Although few key drains were excavated to the full section, and others to half the bed width required, the excavation quantity was still about twice the original estimate.

5.4 On-Farm Development. The program of remodelling or splitting the water courses (WC) to limit their command area to 75 ac did not meet with much success due to: (i) the lack of farmer interest (farmers indicated to ID that the original WC had existed for a long time and were being used to distribute water among themselves); and (ii) an erroneous assessment during project preparation in respect of the limit on WC command (no surveys were undertaken to confirm that the 75 ac was an appropriate size). ID, therefore, decided, although quite late, on initially remodelling only WC irrigating more than 200 ac, into minors owned and managed by farmers with pipes on each field ditch serving a couple of farmers. At Credit closing, only five such WC had been rehabilitated. Since the experience with the WC has been encouraging, ID has decided to pursue the WC remodelling. However, farmers are expected to carry out the work themselves under ID guidance (ID has been reluctant from the beginning to seek budget allocation for improving WC, in spite of the provision under the project, since WC has always been the farmers' responsibility).

5.5 Construction Equipment and Other Procurement. The status of the overseas procurement is summarized in Annex 1. Due to time-consuming GOM procedures, there were long delays in finalizing the award of contracts after the opening of the bids (extending up to 24 months in the worst case, the minimum being 12 months). The responsibility for decisions lies with several committees, which are difficult to convene. These committees did not give much importance to making award decisions within the bid validity period. The procurement of vehicles (including bicycles and motorcycles) was deleted by GOM during project implementation. ID used vehicles from its own fleet. Only four four-wheel drive vehicles were procured under the IDA Credit for the TA component. Due to lack of transport facilities, the mobility of the village extension and tract (group of villages) extension managers was low. The supplies of materials that were to be provided by GOM such as cement, diesel oil and lubricants, were not received on time or in sufficient quantity, thus adversely affecting progress of work.

5.6 Studies. UNDP provided additional funding for preparing the feasibility study for R&M of the Shwebo system, which was considered as having the highest priority out of the five systems studied under the project. This study has confirmed the economic and technical viability of the follow-up project for R&M of the Shwebo system, but does not 'include a component for strengthening of the farmers' groups and their training for better O&M and water management. The design of this component, which would have required extensive dialogue with farmers, and which could not be attempted for want of resources, would need to be undertaken in detail before the Shwebo project is implemented.

5.7 The benchmark survey of the agro-economic conditions in the project area, to be carried out by the monitoring and evaluation committee (M&EC) in MAS, was two years late. The report was submitted in August 1991, although field work was carried out in 1989. The report provided excellent information. A quick and brief survey was undertaken by M&EC in January 1994 to have a general assessment of the project impact; a full survey is planned for April 1994.

5.8 Major Repairs/Overhaul of Construction Equipment. The entire fleet of construction equipment in MB was examined for its serviceability. Out of 1,879 machines, 725 were found to be obsolete and beyond economic repairs, but only about 50% of the latter were scrapped. The other 50% have been retained for possible use of components or metal. Although equally important, scrapping of obsolete spares was not attempted under the project, mainly due to lack of clear MOA policy.

5.9 Farmers' Organizations and Water Management. The project envisaged that ID would advise farmers' groups on WC operation and water-sharing during low discharges as well as provide guidelines for WC maintenance. Unfortunately, a specific program for forming, strengthening and training the groups never materialized due to lack of funding under the project. The strengthening of the farmers' groups for assuring equity of water distribution and good maintenance being a long-term process requiring continuous effort, ID or MAS could not be expected to bring significant changes in the existing system during the project implementation period.

5.10 The age-old operation of the irrigation system by rotation of water deliveries to various distributaries on a fixed schedule did not undergo any change during project implementation. The excessive water consumption in one part of the system, specially on the direct outlets from the main canal and in the upper part of the system, and shortages in the other parts, therefore, continue to exist. This implementation drawback was mainly due to a design flaw (para. 4.3). ID is now planning to control the deliveries to each section of the irrigation system on the basis of actual requirement of the cropped areas and allowing for rainfall.

5.11 Technical Assistance. For implementation of the TA, it was agreed by GOM, IDA and UNDP to contract consulting firms instead of individual experts envisaged at appraisal. Details of the TA are at Annex 2.

5.12 Project Cost and Financing. The actual total project cost in US\$ was about 50% higher than the SAR estimate (US\$39.78 million compared to US\$26.14 million), and only 10% higher in terms of Kyats (K 250 million compared to K 230 million). In addition to the exchange rate movement between appraisal and project completion, the main factors for higher actual project cost were: (i) an increase in the cost of construction materials and labor, especially after 1988; (ii) an increase in the quantities of earthworks on the resectioning of the distributaries and drains; and (iii) the dislocations caused by the political disturbances in the country. The actual foreign exchange requirement (US\$13.87 million) also exceeded the SAR estimate (US\$10.95 million) mainly due to procurement of crude oil and lubricants not included at appraisal.

5.13 An additional investment of about US\$4 million is still to be made for the remaining works (para. 5.2), which GOM will complete by June 1996 with its own resources. UNDP increased its contribution to US\$3.4 million from US\$1.8 million. The IDA credit of SDR 12.3 million was almost fully disbursed with only SDR 2,588 (US\$3,625) cancelled.

## 6. Project Results

6.1 Impact on the Irrigation System. The installation of the excluder at Kabo weir has reduced the entry of coarser sediments into the Ye-U canal, reducing the clearing requirements. The cross regulators, now available for the water level control in the main canal, are being utilized to control the supply of water to the distributaries. Some improvement in system performance has occurred and the minimum area irrigated on each channel during the period 1990 to 1993 has been higher than the minimum for the period 1984 to 1989. However, the uncontrolled direct outlets (DO) on the main canal, irrigating about 20,000 ac, still run incessantly. Though control structures have been constructed under the project, the controls are not yet operational since ID is of the opinion that the farmers may damage the controls once the supplies on DO are regulated. ID and MAS have recently started contacting these farmers to convince them of the need to regulate their irrigation supplies to permit irrigation of another 15,000 ac lower down. Eventually, farmers will be responsible for opening and closing the gates on the DO on a prescribed schedule, in conformity with the overall revised operational pattern for the irrigation system.

6.2 Agricultural Impact. The impact of the project on the agricultural development has been positive, although the irrigated area under the first crop of paddy, anticipated in the SAR to increase from 96,400 ac (pre-project) to 121,000 ac (full development of the entire command), is not likely to be achieved. The main reason is that about 8,000 ac in the command area are not cultivated in the first crop season due to various agronomic and peace and order problems. This was not known at appraisal. Detailed review of the command area by MAS and ID has indicated that at full development (which is expected to be reached in three years hence), the first crop of irrigated paddy will not exceed 111,000 ac. In addition, about 2,000 ac will be under rainfed non-paddy crops in the main crop season and about half of the 8,000 ac remaining uncultivated during the first crop season will be cultivated with non-paddy crops in the dry season (on residual moisture as being practiced already). Furthermore, owing to MAS's extension effort, a second irrigated paddy crop, which was not anticipated at appraisal, is now being grown (para. 6.3) and is expected to result in a total irrigated paddy area at full development of 128,000 ac, which is larger than foreseen at appraisal. At project completion (1993-94), the first and second irrigated paddy crops reached 101,335 ac and 15,884 ac respectively, or a total irrigated paddy area of 117,200 ac.

6.3 Expecting better availability of water with R&M of the system, MAS commenced motivating farmers in 1987 for a second crop of paddy (during the rainy season). This innovation has been successful so far. Beginning with a modest 407 ac of the second irrigated paddy crop after other crops in 1987-88, the area in 1993-94 rose to 15,884 ac (14,559 ac after paddy and 1,325 ac after other crops). MAS expects the second paddy area to reach about 17,000 ac at full development in 1996. The total irrigated paddy area would then be 128,000 ac. The total production of paddy at full development is now estimated at 184,100 tons (SAR expectation was 184,800 tons) assuming that yield of paddy will remain at the 1993/94 level of 1.438 tons/ac (SAR 1.50 tons/ac).

6.4 Non-paddy crops (predominantly chick peas) on residual moisture in irrigated paddy areas reached about 17,000 ac in 1992-93. Total non-paddy crop area was about 22,000 ac in that year. MAS expects that the area under non-paddy crops would reach about 23,500 ac in 1993/94 and would remain

unchanged at full development. This is about 30% higher than the appraisal estimate of 18,000 ac. Since the bulk of the non-paddy crops will continue to be chick peas, the entire area under non-paddy crops is considered as growing chick peas (in conformity with the SAR assumption). On this basis, chick peas production has been estimated at 3,900 tons (compared to 4,500 tons at appraisal). The yield is expected to remain unchanged from pre-project level estimated at 0.166 tons/ac (the SAR also assumed no change in yield but estimated the yield at 0.25 tons/ac).

6.5 The cropping intensity on the command area of 121,900 ac is thus expected to reach 125% at full development in 1996 in spite of 8,000 ac remaining fallow in the rainy season (para. 6.2). This compares well with the appraisal expectation of a cropping intensity at full development of 115%.

6.6 Institutional Impact. Apart from assisting ID in formulating its first Master Plan for the rehabilitation and modernization of the five irrigation systems in the Central Dry Zone (para. 5.6), the project's main emphasis was on strengthening MB. Twenty MB staff engineers were trained overseas (about three months each) in senior management techniques, instruction methods, supervision of workshop operations, diagnosis of faults and trouble shooting in machines, control of equipment operations in the field, and inventory control of equipment and spares. In addition, MB staff were trained in their respective fields by expatriate specialists in machine shop practice, welding, electrical repairs, etc. As a result of this training and changes made in the layout of shops by the same expatriate specialists, the work in the MB workshops has been streamlined. Several workshop machineries that required some minor repairs have been made operational, a few additional machines have been procured to fill the gaps while other unused machines lying idle in stores have been brought to workshops for effective use. The training consultant helped MB in upgrading the Yangon Training Center facilities and techniques for training the mechanics and operators, and in preparing course materials, which have been very helpful in establishing local regular training programs which are proceeding satisfactorily.

6.7 Strengthening of MAS involved overseas training. Eleven MAS township extension managers were trained overseas for a total of 48 person-months: four in farm level management and three in cropping systems for about five months each; the others benefitted from study tours. The trained staff have been placed at MAS's headquarters and several townships for conducting training of farmers and MAS staff in addition to their normal duties.

6.8 Rate of Return. As in the SAR, the economic rate of return of the project has been calculated considering the investments for R&M only and the benefits from the incremental agricultural production. The investments for strengthening ID and MAS, as well as for procurement of workshop machinery and tools etc., have been excluded; these investments have resulted mainly in institutional benefits, which cannot be easily quantified. The re-estimated ERR is about 7.4% (SAR estimate was 20.2%). The reduction in ERR is mainly due to: (i) a significantly lower international price for rice in 1993, compared to the price projected at appraisal; and (ii) a higher, more realistic threshold for the without project situation in the PCR, compared to the SAR, which reduced the incremental benefit from the project at full development.<sup>2/</sup> If the international price of rice projected at appraisal had materialized, the re-estimated ERR at project completion would be about 17%.

6.9 The farm family income from a six ac farm would increase by about 15% where the farm (Model I) had pre-project irrigation in the whole area; 20%

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<sup>2/</sup> The paddy production in the without project situation for the calculation of the ERR at completion is based on the average of the actual production for the period of 1983/84 to 1988/89 (133,500 tons), which was higher than the production in the without project situation of 131,000 tons assumed at appraisal (see Annex 4, para. 1).

where the farm (Model II) increased its irrigated area by 100%; and 260% where the farm (Model III) increased its irrigated area from one ac to 3.6 ac while the rest remained fallow. The SAR figures for the first two models are 9% and 38%. The comparison of Model III is not really meaningful since the SAR assumptions for this model were not realistic: SAR assumed 100% irrigation after project completion (and a farm income increase of 289%), whereas irrigation would be at most 84% (see Part III, Section 6C and Annex 3).

## 7. Project Sustainability

7.1 The present project situation is clearly sustainable. GOM attributes high priority to the financing of O&M of the irrigation systems for ensuring their full irrigation capacity. However, the maximization of the irrigated crops area (not yet reached) can only be attained with: (i) active monitoring and control, on the part of ID staff, of the water deliveries to each distributary and water course; and (ii) full farmer participation in water management at water course level. ID efforts have been insufficient for improving the age-old regulation pattern of the system. Now that controls are available, ID should be able to assure that no channel gets more than its share, and that in dry years the deficit is properly distributed. The strategy would vary each year due to the variation in Mu river flows. However, unless farmers' groups become strong and fully involved at water course level in maintenance and optimum utilization of water available to them, R&M measures alone will not maximize the impact of water on production.

7.2 The cost recovery is being effected directly through an average land tax of about Kyats 2.5 per ac (variation from Kyats 8 for first class paddy lands to Kyats 0.5 per ac for rain-fed areas) and an irrigation charge of Kyats 10 per ac. In addition, there is an indirect recovery through collection of paddy by GOM (10 baskets<sup>3/</sup> of 46 pounds each per ac) at prices (K50/basket)<sup>4/</sup> lower than the market price (K180/basket). The total cost recovery obtained through these measures was about K 61 million in 1992/93 and will increase this year (1993/94) due to the increased obligatory paddy collection by GOM. Project investment costs to be recovered (mainly R&M) have been estimated in 1993 prices at K 282 million; total O&M annual cost in 1992/93 was about K7 million. The cost recovery of about K 61 million is therefore, satisfactory, and is a contributing factor to sustainability.

## 8. Bank Performance

8.1 Overall Bank performance and, in particular, the Bank's supervision was satisfactory. The only fundamental misstep was at the design stage when the farmer participation factor was neglected. At the time of appraisal, the Bank should have been consciously aware of the importance of this factor owing to the experience it had with irrigation projects in other countries. The SAR was misinformed when stating that water courses were controlled by farmers' groups and it is perhaps for that reason that the SAR had treated this essential project ingredient in such a cursory manner.

8.2 Water management at systems level remained inefficient and could not be suitably amended as the TA to ID for its improvement did not provide sufficient time to look into this aspect, review the problem and find a viable solution. The specialist concerned had other responsibilities and could not delve into the operational procedures of the Ye-U system. When the TOR were prepared for TA, the Bank and the Office of Project Services should have ensured that the expected tasks could be effectively carried out in the time allowed.

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<sup>3/</sup> This increased to 12 baskets in 1993/94.

<sup>4/</sup> This increased to K70/basket in 1993/94.

## 9. Borrower Performance

9.1 The Borrower was very keen to implement the Project on schedule and with maximum diligence possible after the initial delay in signing the UNDP Project Documents. However, the Borrower could not provide diesel, proper lubricants and cement to match the construction schedule. Eventually in 1988, it agreed to the persistent Bank recommendation to import crude oil under the Credit.

9.2 The Borrower's procedures for the evaluation of bids for award of contracts for the supply of equipment and materials were too time-consuming and resulted in dislocation of work schedule. For each contract, there were 37 steps, a few of which had 15 sub-steps. The procurement delays were mainly attributable to the finalization of review by the various committees which had representation from several agencies other than ID and could not meet on time. Due to the procurement delays, the TA specialists had to be rescheduled twice while the training program was affected by the delay in the procurement of workshop machinery and spare parts for the equipment selected for overhaul.

9.3 The Borrower changed the Project Director twice which caused some dislocation in project implementation. The ID and MAS field organizations were adequate for execution of civil works and agricultural extension, but could not take concrete action to form farmers' groups by water course and strengthen them for proper distribution of water and maintenance of water courses. ID and MAS intend to take serious action on this aspect soon.

## 10. Project Relationships

10.1 Throughout implementation, the project was marked by the most cordial relationship between the Bank and GOM, although the Bank continuously expressed serious concerns at the slow pace of procurement processing. The relationship between UNDP and GOM and the Bank was also cooperative and congenial.

## 11. Consulting Services

11.1 The consultancies played a major role in the implementation of the project and were effective in all respects. Compared to the initial SAR provision for TA and training, the actual cost increased significantly due to: (i) dislocation for about one year caused by the political unrest in the country; (ii) increase in the scope of work (addition of Shwebo feasibility study); and (iii) higher costs of overseas training.

## 12. Project Documentation

12.1 The appraisal report provided a useful framework for both the Bank and the Borrower to review project implementation. Both ID and MAS maintained excellent project records, cost accounting system, procurement documentation, and data on areas and yields of the different crops grown in the project area.

PART II: PROJECT REVIEW FROM BORROWER'S PERSPECTIVE

(NOT RECEIVED)

PART III - STATISTICAL INFORMATION

1. Related Bank Credits

Credit No. and Title	Purpose	Year of Approval	Status
Cr. 483-BA Irrigation I	Rehabilitate and extend flood protection embankments, repair available construction equipment, supply irrigation pumps to farmers, and construct jute baling facilities.	1974	Completed in 1978.
Cr. 642-BA Lower Burma Paddyland Development	Construct new and rehabilitate existing flood protection embankments, excavate drainage channels, and reclaim abandoned land.	1975	Completed in 1985.
Cr. 745-BA Seeds Development	Improve research capability of six central farms, develop seed program for rice and cotton, create processing facilities for seed and storage, pilot project for ground nut seed storage in lower Burma, overseas training of staff.	1977	Completed in 1984.
Cr. 835-BA Paddyland Development II	Flood protection and drainage of 175,000 ac including reclamation of 50,000 ac abandoned lands, procurement of construction and agricultural equipment, and establishing workshops in the project area.	1978	Completed in 1990.
Cr. 1031-BA Kinda Dam Multipurpose	Promote cultivation of non-paddy crops by extension of irrigation to 113,500 ac and stabilize paddy production in 88,000 ac by rehabilitating its irrigation system, as well as generate hydropower by constructing a 236 ft. high storage dam and appurtenant works.	1980	Completed in 1991.
Cr. 1092-BA Grain Storage	Improve storage facilities at selected locations within the country.	1981	Completed in 1986.
Cr. 1315-BA Tank Irrigation	Construct an 82 ft. high dam, rehabilitate and extend existing irrigation system for 5,000 ac. Construct another dam, 92 ft. high for supplying water to 850 ac of orchards, and 2,000 ac of paddy.	1982	Completed in 1990.
Cr. 1381-BA Groundwater Irrigation	Construct 106 deep tubewells, irrigation systems, and power lines. Provide agricultural support program for extension, crop trials, and strengthening ID and MAS.	1983	Completed in 1992.
Cr. 1616-BA Seeds Development II	Strengthen seed production and management capability of MAS, and establish efficient seed multiplication programme.	1986	Completed in 1992.
Cr. 1707-BA Grain Storage II	Improve efficiency of rice milling through rehabilitation of existing facilities and construction of new mills.	1986	Work is in progress.

## 2. Project Timetable

Item	Date Planned	Date Revised	Date Actual
Identification <u>1/</u>	February 1982		February 1982
Preparation <u>2/</u>	March 1983	April 1984	May 1984
Appraisal <u>3/</u>	November 1983	November 1984	November 1984
Credit Negotiations <u>4/</u>			June 1986
Board Approval <u>5/</u>	May 1984	March 1985	August 26, 1986
Credit Signatures	October 15, 1986		October 15, 1986
Credit Effectiveness <u>6/</u>	January 15, 1987		July 13, 1987
Project Completion	December 31, 1992	June 30, 1993	<u>7/</u>
Credit Closing	June 30, 1993	December 31, 1993	December 31, 1993

The "date planned" for Identification to Board Approval, is taken from the Back-to-Office Report of March 1983.

The "date revised" for Preparation to Board Approval is taken from the Project Brief of April 1984.

1/ At identification, the Project was included in the list of projects (under the five year investment program 1982-83 to 1986-87) submitted to July 1982 meeting of the Myanmar Aid Group. It did not appear in Myanmar fourth Four Year Plan (1982-83 to 1985-86). IDA received commitment from GOM for commencing implementation in 1984-85, if the project preparation was completed and IDA assistance was approved by then.

2/ The main concern during the preparation was the marginal economic viability (minor increase in paddy yields, little scope for second crop, benefits mainly from reduction in flooding of 20,000 ac). Drainage requirements were found to be much larger than envisaged initially. Other concerns were lack of a long-term plan for rehabilitation of irrigation systems, insufficient funding for O&M, insufficient ID capacity and resources (shortage of manpower for technical decision making, diesel availability), and cost recovery.

3/ In addition to the concerns at preparation, the appraisal mission concerns were (i) funding for model tests at a well known laboratory, (ii) need for increased O&M allocations, (iii) strengthening ID capacity for Project implementation and decision making, and (iv) obtaining GOM agreement for a proper component for reinforcing MB for fleet management etc.

4/ At negotiations, GOM requested for additional funding for spares for major overhaul of the old ID construction equipment, reduction of procurement of new equipment, and reduction of IDA assistance from SDR 20 million to SDR 12.3 million.

5/ The processing of the Credit after negotiations had a setback due to lessening of GOM interest in the training component for strengthening MB by use of expatriate consultants.

6/ The only condition for effectiveness was the signing of the UNDP Project documents for TA which took long to finalize.

7/ GOM expects to complete the balance R&M work by June 1996.

### 3. Credit Disbursements (SDR and US\$ million)

Bank FY	Quarter	Estimated Cumulative		Actual (US\$)	Actual (SDR)	Actual as % of Estimate	
		US\$	SDR			US\$	SDR
1988	1	0.05	0.044	0.76	0.60	1,520	1,364
	2	0.10	0.088	0.76	0.60	700	682
	3	0.250	0.220	0.76	0.60	228	273
	4	0.40	0.351	1.11	0.86	278	245
1989	1	1.40	1.230	4.66	3.61	383	293
	2	2.40	2.109	4.66	3.61	194	171
	3	4.10	3.602	4.66	3.61	114	103
	4	5.80	5.096	4.66	3.61	80	71
1990	1	6.80	5.974	5.11	3.97	75	66
	2	7.80	6.853	5.11	3.97	66	58
	3	8.60	7.556	5.11	3.97	60	53
	4	9.40	8.259	6.27	4.83	66	56
1991	1	10.05	8.830	6.27	4.83	63	55
	2	10.70	9.401	8.79	6.57	80	70
	3	11.20	9.840	9.09	6.78	81	69
	4	11.70	10.279	9.79	7.32	84	71
1992	1	12.10	10.631	9.95	7.44	82	70
	2	12.50	10.982	11.93	8.86	95	81
	3	12.85	11.290	12.69	9.41	99	83
	4	13.20	11.597	13.43	9.95	102	86
1993	1	13.45	11.817	15.13	11.12	112	94
	2	13.70	12.036	15.76	11.57	115	96
	3	13.85	12.168	16.12	11.83	116	97
	4	14.00	12.300	16.57	12.14	118	99
1994	1	14.00	12.300	16.57	12.14	118	99
	2	14.00	12.300	16.57	12.14	118	99
	3	14.00	12.300	16.78	12.30	120	100

The date for final disbursement was March 3, 1994.

A sum of SDR2,588 (US\$3.625), remaining after final disbursement, was cancelled.

The disbursement in US\$ exceeded US\$14.0 million (equivalent of SDR12.3 million provided under the Credit) since at Credit signature one SDR was equal to US\$1.138, while at Credit closure one SDR was equal to US\$1.408.

#### 4. Project Implementation

Indicators (Annex 2 of SAR)	Units	Appraisal Estimate	Revised Estimate	Actual
<b>A. <u>DELAYED MAINTENANCE (2)</u></b>				
(a) Intake structure				
Repairs		job		completed
(b) Main canals repairs				
Resectioning	th. cyd	945	658	658
Bifurcation str.		job		completed
Cross-drainage str.	numbers	29		27(2)
Drop str.	numbers	10		5(5)
Bridges	numbers	47		41(6)
Bridges (new)	numbers	-	4	3(1)
(c) DY and Minors				
Resectioning	th. cyd	218		1,460
Offtake str.	numbers	42		32(10)
Drop	numbers	155		63(92)
Bridges	numbers	77		18(59)
Heads of minors	numbers	-	11	9(2)
Bank protection		job		completed
(d) Drainage & Flood Protection				
Resectioning drains	th. cyd	2,580	4,929	4,902(27)
New main drains	th. cyd	970	44	44
New other drains	th. cyd	168	not required	
Reconstruct bridge	numbers	1	not required	
Flood embankment	th. cyd	550	66	66
<b>B. <u>SYSTEM MODERNIZATION (3)</u></b>				
(a) Sediment Reduction				
Excluder		job		completed
Ejector		job	not required	
(b) Operation Control MC				
Cross regulators	numbers	11	7	7
Side/tail escapes	numbers	10	1	-(1)
Siltation spurs		job		completed
Measuring device MBC		job		completed
Control dir. out.	numbers	-	219	103(116)
Control on minors	numbers	-	4	1(3)

Indicators (Annex 2 of SAR)		Units	Appraisal Estimate	Revised Estimate	Actual
(c) Operation Control DY					
	Measuring devices	numbers	42		42
	Offtakes of minors	numbers	22		22
(d) Roads and Communication					
	Road to Kabo	'000 feet	45		45
	Inspection roads	'000 feet	312.5		312.5
	Communication system		job		completed
<b>C. <u>ON-FARM WORKS (5)</u></b>					
	Resection WC	'000 cyd	390		37(353)
	Offtakes of WC	numbers	1,615	1,050	574(476)
<b>D. <u>BUILDINGS (7)</u></b>					
(a) R&M:	Field offices	numbers	6	7	7
	Residences	numbers	221	138	138
	Workshop, stores	numbers	9	15	15
	Temporary camps	numbers	18	3	3
(b) MAS:	Demon camps	numbers	3		3
	Godowns	numbers	2		2
(c) MB:	Stores & offices	numbers	15	12	12
	Loading platform		job		not yet done
	Jetty		job		not yet done
<b>E. <u>PROCUREMENT (6, 8)</u></b>					
(a) Construction Equipment					
	Excavating and loading	numbers	5		5
	Tractors and graders	numbers	4		4
	Hauling equipment	numbers	12	11	11
	Miscellaneous	numbers	50	25	25
(b) Jeeps, motorcycles, cycles					
	R&M use	numbers	20	procurement disallowed	
	MAS use	numbers	114	procurement disallowed	
	Workshop strengthening	numbers	4		4

Indicators (Annex 2 of SAR)	Units	Appraisal Estimate	Revised Estimate	Actual
(c) Miscellaneous				
Workshop		job		completed
Office		job		completed
Survey and design		job		completed
MAS		job		completed
M&E	numbers	2		not procured
YTC		job		completed
Fuel tanks and pumps	numbers	20		20
Lifting units	numbers	10		10
(d) Spares for overhaul		job		completed
<b>F. <u>STRENGTHENING ID</u></b>				
(a) Design and Planning (11)				
Expatriate experts	man-months	30		30.9
Model tests		job		completed
(b) Workshop (12)				
Overseas training	No./man-months	33/66		20/65.5
Expatriate experts	man-months	81		94.8
(c) MAS (10)				
Overseas training	No./man-months	4/48		11/42

**Notes:** The figure within parenthesis in the indicators column refers to the table number of Annex 2 of SAR. Figures within parenthesis in the actual columns indicate the work to be completed after the Closing date.

**Abbreviations:** str. = structure; th. cyd = thousand cubic yards; dir. out. = direct outlet; demon. = demonstration.

## 5. Project Cost and Financing

### A. Project Cost

Item	US\$'000					
	<u>Appraisal Estimate</u>			<u>Actual</u>		
	Local	Foreign	Total	Local	Foreign	Total
<b>I. INVESTMENT COSTS</b>						
A. Civil Works						
Intake Str.	762	6	768	1,872	-	1,872
Canals	1,718	100	1,818	3,983	-	3,983
Drains & Flood Protection	1,593	29	1,622	4,426	-	4,426
Roads & Bridges	950	28	978	1,828	-	1,828
Buildings	897	142	1,039	4,001	-	4,001
<b>Total</b>	<b>5,920</b>	<b>305</b>	<b>6,225</b>	<b>16,110</b>	<b>-</b>	<b>16,110</b>
B. Equipment, Vehicles & Materials						
Heavy Equipment	474	2,365	2,839	411	1,400	1,811
Vehicles	68	204	272	-	-	-
Other Equipment & Materials	270	1,307	1,577	319	1,015	1,334
Petroleum Products	-	-	-	-	3,890	3,890
Spares, tools, etc.	1,114	3,092	4,206	890	4,140	5,030
<b>Total</b>	<b>1,926</b>	<b>6,968</b>	<b>8,894</b>	<b>1,620</b>	<b>10,445</b>	<b>12,065</b>
C. Technical Assistance & Training	-	1,301	1,301	32	3,425	3,457
<b>TOTAL INVESTMENT COST</b>	<b>7,846</b>	<b>8,574</b>	<b>16,420</b>	<b>17,762</b>	<b>13,870</b>	<b>31,632</b>
<b>II. RECURRENT COSTS (INCREMENTAL)</b>						
A. Salary & Wages	1,695	-	1,695	3,164	-	3,164
B. O&M						
Irrigation Works	914	44	958	1,850	-	1,850
Equipment	14	3	17	516	-	516
Buildings	59	6	65	1,061	-	1,061
Vehicles	83	7	90	1,558	-	1,558
<b>Total</b>	<b>1,070</b>	<b>60</b>	<b>1,130</b>	<b>4,985</b>	<b>-</b>	<b>4,985</b>
<b>TOTAL RECURRENT COSTS</b>	<b>2,765</b>	<b>60</b>	<b>2,825</b>	<b>8,149</b>	<b>-</b>	<b>8,149</b>
<b>Total Baseline Costs</b>	<b>10,611</b>	<b>8,634</b>	<b>19,245</b>	<b>-</b>	<b>-</b>	<b>-</b>
Physical Contingencies	1,217	766	1,983	-	-	-
Price Contingencies	3,357	1,552	4,909	-	-	-
<b>TOTAL PROJECT COSTS</b>	<b>15,185</b>	<b>10,952</b>	<b>26,137</b>	<b>25,911</b>	<b>13,870</b>	<b>39,781</b>

**Notes:** (1) Appraisal Estimate figures are taken from Annex 2, Table 1(a).

(2) It was not possible to separate the staff time for R&M and O&M. Nor was it possible to separately allocate maintenance and repair (M&R) of equipment and vehicles (under Recurrent Costs) into R&M and O&M. Hence salary and wages include incremental cost for O&M and staff for R&M; the latter includes operators and mechanics on permanent staff, which are really chargeable to works. Similarly cost of M&R of equipment and vehicles include both R&M and incremental O&M.

Item	in Kyats'000					
	Appraisal Estimate			Actual		
	Local	Foreign	Total	Local	Foreign	Total
<b>I. INVESTMENT COSTS</b>						
A. Civil Works						
Intake Str.	6,707.6	48.7	6,756.4	12,744.8	-	12,744.8
Canals	15,119.9	882.9	16,002.8	27,052.7	-	27,052.7
Drains & Flood Protection	14,018.6	256.7	14,275.3	29,504.0	-	29,504.0
Roads & Bridges	8,361.9	248.8	8,610.7	12,279.0	-	12,279.0
Buildings	7,887.2	1,250.1	9,137.3	20,953.4	-	20,953.4
<b>Total</b>	<b>52,095.2</b>	<b>2,687.3</b>	<b>54,782.5</b>	<b>102,533.9</b>	<b>-</b>	<b>102,533.9</b>
B. Equipment, Vehicles & Materials						
Heavy Equipment	4,172.5	20,812.5	24,985.0	2,693.5	9,630.0	12,323.5
Vehicles	598.4	1,798.3	2,396.7	-	-	-
Other Equipment & Materials	2,375.5	11,501.4	13,877.5	2,075.4	6,598.5	8,673.9
Petroleum Products	-	-	-	-	24,600.0	24,600.0
Spares, tools, etc.	9,801.0	27,205.3	37,006.3	5,185.0	23,910.0	29,095.0
<b>Total</b>	<b>16,947.3</b>	<b>61,318.0</b>	<b>78,265.4</b>	<b>9,953.9</b>	<b>64,738.5</b>	<b>74,692.4</b>
C. Technical Assistance & Training	-	11,443.3	11,443.3	192.5	21,562.0	21,754.5
<b>TOTAL INVESTMENT COST</b>	<b>69,042.5</b>	<b>75,449.7</b>	<b>144,492.2</b>	<b>112,680.3</b>	<b>86,300.5</b>	<b>198,980.8</b>
<b>II. RECURRENT COSTS (INCREMENTAL)</b>						
A. Salary & Wages	14,912.9	-	14,912.9	19,821.7	-	19,821.7
B. O&M						
Irrigation Works	8,040.0	391.1	8,431.2	11,567.1	-	11,567.1
Equipment	122.2	28.7	150.9	3,175.4	-	3,175.4
Buildings	522.4	53.7	576.1	6,599.8	-	6,599.8
Vehicles	733.3	62.7	796.0	9,884.6	-	9,884.6
<b>Total</b>	<b>9,418.0</b>	<b>536.2</b>	<b>9,954.2</b>	<b>31,226.9</b>	<b>-</b>	<b>31,226.9</b>
<b>TOTAL RECURRENT COSTS</b>	<b>24,330.8</b>	<b>536.2</b>	<b>24,867.0</b>	<b>51,048.6</b>	<b>-</b>	<b>51,048.6</b>
<b>Total Baseline Costs</b>	<b>93,373.3</b>	<b>75,985.9</b>	<b>169,359.2</b>	<b>-</b>	<b>-</b>	<b>-</b>
Physical Contingencies	10,711.4	6,742.0	17,453.4	-	-	-
Price Contingencies	29,539.4	13,655.8	43,195.1	-	-	-
<b>TOTAL PROJECT COSTS</b>	<b>133,624.1</b>	<b>96,383.7</b>	<b>230,007.8</b>	<b>163,728.9</b>	<b>86,300.5</b>	<b>250,029.4</b>

Notes: (1) Appraisal Estimate figures are taken from Annex 2, Table 1(a).

(2) It was not possible to separate the staff time for R&M and O&M. Nor was it possible to separately allocate maintenance and repair (M&R) of equipment and vehicles (under Recurrent Costs) into R&M and O&M. Hence salary and wages include incremental cost for O&M and staff for R&M; the latter includes operators and mechanics on permanent staff, which are really chargeable to works. Similarly cost of M&R of equipment and vehicles include both R&M and incremental O&M.

## B. Project Financing

Source	<u>Agreement</u>		<u>Revised</u>		<u>Actual</u>	
	SDR million	US\$ million	SDR million	US\$ million	SDR million	US\$ million
IDA (Total)	12.3	14.0	12.3	n.r.	12.3	16.8
Category 1. Civil Works	3.9	4.4	4.5	n.r.	4.5	6.3
Category 2. Equipment etc.	7.8	8.9	4.8	n.r.	4.8	6.6
Category 3. Petroleum Products	-	-	3.0	3.9	3.0	3.9
Category 3, 4 Unallocated	0.6	0.7	-	-	-	-
UNDP (Total)		1.8		3.4		3.4
World Bank-Executed		1.4		2.9		2.9
OPS-Executed		0.4		0.5		0.5
GOM (Total)		10.3		n.r.		19.6
<b>PROJECT TOTAL:</b>		<b>26.1</b>		<b>n.r.</b>		<b>39.8</b>

n.r. = not revised.

## 6. Project Results

### A. Direct Benefits

Indicators	<u>Appraisal Estimate</u>				<u>Actual at Closing</u>		<u>PCR Estimate at</u>	
	<u>Future Without Project</u>		<u>Future With Project</u>		<u>Year 1993-1994</u>		<u>Full Development</u>	
	Area ( <sup>'000</sup> ac)	Production ( <sup>'000</sup> t)	Area ( <sup>'000</sup> ac)	Production ( <sup>'000</sup> t)	Area ( <sup>'000</sup> ac)	Production ( <sup>'000</sup> t)	Area ( <sup>'000</sup> ac)	Production ( <sup>'000</sup> t)
A. Irrigated Crops								
Paddy	96.4	131.0	121.1	184.8	117.22	168.59	128.00	184.10
B. Rainfed Crops								
Paddy	9.5	7.9	-	-	-	-	-	-
Pulses	16.0	4.1	18.0	4.6	23.50	3.90	23.50	3.90
Total Cropped Area	121.9		139.1		140.52		151.30	
Cropping Intensity	100%		115%		117%		125%	

- Notes:**
1. SAR production is expressed in long tons and is converted for PCR comparison into metric tons.
  2. Paddy area for 1993-94 includes 101,335 ac main paddy crop and 15,883 ac second paddy crop after first paddy or after pre-monsoon other crop.
  3. Paddy area at full development includes 111,000 ac main paddy crop and 17,000 ac second paddy crop after first paddy or after pre-monsoon other crop.
  4. Paddy yield in 1993-94 is 8,063,068 baskets, giving a yield of 68.78 baskets/ac (1.438 t/ac). Same yield is taken at full development.
  5. Pulses in SAR, as well as in actual situation and PCR projections have been considered to be entirely chick peas.
  6. The yields of pulses (chick peas) in the closing year is the average of the previous nine years, i.e. 0.166 tons/ac. No change is anticipated at full development (SAR chick pea yield was estimated at 0.25 tons/ac).

## B. Economic Impact

### (i) Economic Rate of Return and Assumptions

Indicators	Appraisal Estimate	Estimate at Full Development
Economic Rate of Return (%)	20.2	7.41/
PV of Net Benefits (Kyat million) at 12%	55.9	(-)15.7
<b>BASIC ASSUMPTIONS</b>		
Project life (years)	25	25
Constant prices used for analysis (Year)	1985	1993
Official Exchange Rate (Kyats = US\$1)	8.1	6.5
Wage Rate (Kyats/day)	5.6	15.0
Standard Conversion Factor	0.8	0.1
<b>ECONOMIC FARM GATE PRICE (K/TON) OF</b>		
Paddy	1,177.6	765
Chick peas	5,094.1	1,304

1/ Assuming that the full development stage is reached by 1996-97.

#### Notes:

Costs have been converted to 1993 prices on the basis of the following:

	1986	1987	1988	1989	1990	1991	1992	1993
- Domestic consumer index to adjust local cost	109.3	136.4	158.3	201.3	236.8	313.2	381.9	500
- Foreign costs were adjusted at 3.5% per year, based on the International Financial Statistics, January 1994. IMF.								

### (ii) 1993 Economic Farm Gate Price of Paddy (Kyats per metric ton)

Export US\$ rice price f.o.b. Yangon 1/	185
Export Kyats rice price f.o.b. Yangon 2/	1,203
Handling and loading 3/	(-)5
Transport Delta to Yangon Port 4/	(-)9
Transport Yangon to Ye-U 5/	143
Ex-mill rice price	1,332
Equivalent paddy price 6/	839
Milling cost 7/	(-)42
Storage and losses at transport and storage	(-)22
Transport farm to godown 8/	(-)10
<b>Farmgate price of paddy</b>	<b>765</b>

Footnotes are on the following page.

1/ Rice 25% broken, based on World Bank Commodity Price forecasts and quarterly review August 1993 of rice 5% broken for Bangkok. At 1993 constant prices discounted with 30% for lower quality.

2/ At official exchange rate US\$1 = K6.50.

3/ Port charges K28/m. ton and loading and unloading K20/m. ton: the total adjusted by SCF of 0.1

4/ Transport Cost from Delta to Yangon:

1. Loading on boat	K20/ton
2. Transport from Delta to Yangon (50 miles with private boat transport)	K87.5/ton
3. Unloading from boat and loading on truck	K40/ton
4. Transport to godown (2 miles)	K100/ton
5. Unloading at godown	K20/ton

**Total:** **K267.5/ton**

Transport Cost from Godown to Port:

1. Loading on truck	K20/ton
2. Transport from godown to port (2 miles)	K100/ton
3. Unloading at Port	K20/ton

**Total:** **K140/ton**

and adjusted by SCF of 0.1.

5/ Transport Cost from Ye-U to Yangon Port (by road and by rail):

1. Loading on truck	K20/ton
2. Road transport (138 miles to Mandalay - up to 5 miles K45/ton and from 5-130 miles K106.4/ton)	K110.9/ton
3. Unloading from truck	K20/ton
4. Loading on rail	K20/ton
5. Rail transport 425 miles	K125/ton
6. Unloading from rail	K20/ton
7. Transport from rail station to godown in Yangon (2 miles)	K100/ton
8. Unloading at godown	K20/ton

**Total:** **K1,434/ton**

and adjusted by SCF of 0.1.

6/ Conversion rice to paddy 63%.

7/ Weighted average of official price (15% at K60/m. ton) and rate charged by private mills (85% at K478/m. ton) and adjusted by SCF of 0.1.

8/ Transport Cost from Farm to Purchasing Centre or Godown:

1. Loading on bullock cart	K10/25 baskets of paddy
2. Hiring bullock cart/day	K100/25 baskets of paddy
3. Unloading at the purchasing centre	K10/25 baskets of paddy

**Total:** **K120/25 baskets of paddy**

Remarks. Farmers usually use their own bullock cart and handling by themselves. Therefore economic value 50% of bullock cart taken at K50/25 baskets.

Adjusted by SCF of 0.1.

(iii) 1993 Economic Farm Gate Price of Chick Peas (in Kyats per metric ton)

Export US\$ chick peas price f.o.b. Yangon <u>1/</u>	225
Export Kyat chick peas price f.o.b. Yangon <u>2/</u>	1,462
Handling and loading <u>3/</u>	(-)5
Transport Ye-U to Yangon Port <u>4/</u>	(-)143
Transport farm to godown <u>5/</u>	(-)10
Farm gate price of chick peas	1,304

1/ Average f.o.b. price Yangon for 1992-1994 considered as constant 1993 US\$ price.

2/ At official exchange US\$1 = K6.50.

3/ See footnote 3 of paddy.

4/ See footnote 5 of paddy.

5/ See footnote 8 of paddy.

(iv) Financial and Economic Farm Gate Prices of Commodities in 1993

	Unit	Financial Prices (K/Unit)	Economic Prices (K/Unit)
<b>Crop</b>			
- Paddy (Market)	basket (46 lbs)	186	16
- Paddy (Govt.) <u>1/</u>	basket (46 lbs)	50	16
- Chick peas	basket (69 lbs)	330	44
<b>Fertilizer</b>			
- Urea	m. ton	6,000	1,169
- TSP	m. ton	5,000	1,331
- Potash	m. ton	4,000	1,266
<b>OTHER INPUTS</b>			
<b>Seeds</b>			
- Paddy	basket (46 lbs)	100 <u>2/</u>	10 <u>3/</u>
- Chick peas	basket (69 lbs)	450 <u>4/</u>	45 <u>3/</u>
<b>Labor</b>			
- Human	Man-day	50	1.55 <u>5/</u>
- Animal	Animal-day	100	10 <u>3/</u>

1/ Ten baskets per ac compulsory sale to Government.

2/ Government sole seller.

3/ Adjustment by SCF of 0.1.

4/ Market price.

5/ Shadow rated at 30% and adjusted by SCF of 0.1.

### C. Financial Impact

<b>With Project Incremental Farm Family Benefit from 6 ac Farm Models</b>	<b>Appraisal Estimate (Kyats)</b>	<b>PCR Estimate at Full Development (Kyats)</b>
Model I 100% irrigated before project and improved after	837.1	61,227
Model II 50% irrigated before project and 100% after	2,789.6	53,091
Model IIIA 16% irrigated, 16% rainfed, 68% flood affected before project and 100% after <sup>1/</sup>	7,562.4	-
Model IIIB 16% irrigated and rest fallow before project, while 84% irrigated and rest fallow after.	-	33,619

<sup>1/</sup> The comparison of the SAR figures with the PCR figures are meaningless here, due to many reasons, such as the change in exchange rates and the comparison of 1985 values with 1993 values. A better comparison measure is the percentage increase in farm family benefit for the with and the without project situation of both the SAR and the PCR (see Part I, para. 6.9). SAR assumptions for Model IIIA were erroneous for both the with and the without (before) project situation. Actually before project only 16% was irrigated and the remainder fallow. SAR also assumed that all would be irrigated at full development, while in reality according to PCR only 84% would be irrigated and 16% would remain fallow (see Model IIIB). On the basis of the PCR data, farm family benefits for Model IIIB in the without project situation were also estimated (see Model III in Annex 3).

### D. Studies

<b>Study</b>	<b>Purpose as Defined at Appraisal</b>	<b>Status</b>	<b>Impact of Study</b>
R&M of Shwebo, Mon, Man, Salin and Zawgyi irrigation systems in CDZ and fixing priority.	Preparation of a long term plan for R&M of irrigation systems in CDZ.	Completed by ID with assistance from the consultants funded under TA.	ID staff got trained in the identification of R&M needs, benefit assessment, and economic analysis.
Feasibility Study of R&M of Shwebo system, established as the priority project.	Implementing a follow-up project.	Completed by ID with assistance from Consultants funded under TA. Technical and economic viability confirmed. The component for forming and strengthening farmers' organizations remains to be prepared.	ID staff got further trained in the planning and design of R&M of irrigation systems.

## 7. Status of Covenants

DCA Section	Subject	Deadline for Compliance	Status
4.01 (a)	To maintain records and accounts to reflect operations, resources, and expenditures of each department or agency carrying out the project.		Completed.
4.01 (b)	To have the accounts for each fiscal year audited and submit to IDA certified copy of the report.	12 months after the end of FY.	Completed.
4.01 (b)	To furnish to IDA unaudited accounts for each fiscal year.	6 months after end of FY.	Completed.
4.01 (c)	To maintain separate record and accounts for all expenditures for which withdrawals are requested on the basis of SOE, and ensure that such accounts are included in the audit and a separate opinion by the auditors provided for the correctness of the purpose of these expenses.		Separate record and accounts were properly maintained. The audit reports provided separate opinion on SOE. Completed.
4.02	To provide sufficient funds for O&M of the irrigation system.		Sufficient funds were provided. Completed.
Schedule 4	To establish and maintain PU and PCC.	9.30.87	Both were established and maintained. Completed.
Schedule 4	To appoint a Project Director.	9.30.87	Appointed before due date. Completed.
Schedule 4	To extend the scope of special High Yielding Programme (HYP) to the Project area.		HYP extended to the area in 1984. Completed.
Schedule 4	To make direct or indirect recovery of O&M costs.		Recovery continued both direct and indirect. Completed.

## 8. Use of Bank Resources

### A. Staff Inputs (staff weeks)

Stage of Project Cycle	Actual	Comments
Up to Appraisal	186.4	
Appraisal through Board Approval	59.5	
Supervision	55.9	
Completion Report Preparation	13.3	
<b>TOTAL:</b>	<b>315.1</b>	

## B. Missions

Stage of Project Cycle	Month, Year	No. of Persons	Days in Field	Specialty Represented	Performance Rating Status	Remarks and Type of Problems
<b>Identification</b>						
1	11/1978	1	2	En		1
2	2, 3/1979	5	26	CP (2 En, 2 Ag, Ec)		2
3	12/1981	2	7	Ag, Ec		3
4	2, 3/1982	2	30	En, CP (En)		4
5	6/1982	7	18	2 Ec, Pr, Ta, CP (En, Ag)		5
<b>Preparation</b>						
1	12/1982	1	4	CP (En)		6
2	1/1983	1	8	CP (En)		7
3	2, 3/1983	5	28	Ec, CP (2 En, Ag, Ec)		8
4	5/1983	1	27	CP (ME)		9
5	6, 7/1983	2	22	CP (ME, En)		10
6	10, 11/1983	4	21	CP (En, FA, ME, SE)		11
7	2/1984	1	1	En		12
8	3/1984	1	7	Ag		13
9	5, 6/1984	5	19	2 En, ME, Ec, Ag		14
<b>Appraisal</b>						
1	11/1984	4	30	2 En, Ec, Ag		15
2	12/1984	1	5	Pr		16
3	4/1985	1	3	Pr		17
4	9/1985	1	5	Ta		18
5	12/1985	1	5	Pr		19
<b>Supervision</b>						
1	12/1986	3	14	Ag, Ta, En	-	20
2	4/1987	1	7	Ta	-	21
3	5/1987	2	6	En, Ag	1, 2, 1, 2	22
4	12/1987	2	15	En, Ag	1, 2, 1, 2	23
5	3, 4/1988	2	6	En, Ag	-	24
6	3/1989	1	13	En	1, 2, 1, 2	25
7	5/1989	1	18	En	1, 2, 1, 2	26
8	8/1989	2	11	En, ME	-	27
9	12/1989	1	13	En	2, 2, 1, 1, 1	28
10	5/1990	1	10	En	2, 2, 1, 1, 1	29
11	10/1990	1	15	En	2, 2, 1, 1, 1,	30
12	8/1991	2	17	En, ME	2, 2, 1, 1, 1	31
13	10/1991	1	8	En	2, 2, 1, 1, 1	32
14	1, 2/1992	1	29	En	2, 2, 1, 1, 2	33
15	10, 11/1992	1	20	En	2, 2, 1, 1, 1	34
16	6/1993	1	14	En	2, 2, 1, 1, 1	35
17	12/1993	1	13	En	2, 2, 1, 1, 1	35
PCR	1/1994	2	13	CP (En, Ec)		

## B. Missions (cont'd)

**Abbreviations:** En = Engineer; Ag = Agronomist; CP = FAO/CP; Ec = Economist; Pr = Programme Staff; TA = Technical Assistance Staff; ME = Mechanical Engineer; SE = Structural Engineer.

### Notes:

1. GOM and mission agreed to the concept and need for R&M of irrigation schemes.
2. All irrigation projects in CDZ were reviewed for R&M. Issues identified were (A) R&M economically viable only if substantial increase in irrigated area, (b) GOM policy for compulsory procurement of paddy not providing any incentive to farmer for increase in production, (c) lack of storage facilities, (d) shortage of fertilizer, (e) lack of a programme for HYV seed multiplication, and (f) need for introduction of T&V system for agriculture extension.
3. Zawgyi irrigation system was selected for R&M with tentative IDA funding of US\$20 million.
4. GOM informed the mission that instead of Zawgyi system, the Mu river irrigation systems will be preferred.
5. GOM agreement was obtained to project preparation by FAO/CP for R&M of Ye-U system, with assistance from consultants (supervised by FAO/CP) funded (US\$300,000) under UNDP-funded Umbrella III.
6. Review of the Consultants preparation work.
7. Review of the Consultant preparation work. Sufficiency of Mu river flow for the two systems agreed.
8. Concerns on economic viability since only limited additional irrigation likely. Future deterioration due to insufficient funding for O&M to be studied.
9. Basic requirements of MB strengthening were studied.
10. Decisions sought from ID on a discussion paper identifying the pattern for MB strengthening.
11. Detailed review of the Consultants' preparation report.
12. Mission suggested limiting the project to modernization only, and rehabilitation to be carried out under O&M funding; IDA providing funds for equipment only.
13. Review of agriculture aspects and timetable for project processing.
14. Issues were identified as: (a) IDA preference to funding a time-slice of a long-term R&M plan with linkage to policy reforms, (b) workshop component to be scaled down from US\$30 million to US\$4 million, (c) emphasis on EIMS, (d) providing US\$2 million for spares for equipment overhaul, (e) need for doubling the allocation for O&M, (f) use of consultants considered necessary for implementing R&M, and (g) introduction of proper cost recovery.
15. Refer Table 2 for the concerns.
16. GOM not accepting use of consultants for strengthening MB.
17. Issues discussed were: (a) scope of TA for MB strengthening, (b) crop diversification, (c) preparation of a plan for development of water resources, and (d) cost-recovery measures.
18. Approval of UNDP Prodocs discussed.
19. Scope of TA for MB strengthening was the main issue.
20. Drafts of UNDP Prodocs discussed. Extension of the date of effectiveness considered necessary. Rating Status not given.
21. GOM Cabinet approval of the UNDP Prodocs confirmed. Rating Status not given.
22. Prodocs not yet signed by the UNDP and GOM. The further extension of the date of effectiveness considered necessary.
23. Design division not suitably staffed. MAS extension staff strength not yet increased. ID had not yet prepared the detailed implementation programme. ID to include WC rehabilitation in the programme as well.
24. Review during Tank II appraisal. Consultants in place and work commenced. Status not updated.
25. Project slipped by one year due to political disturbances in the country.
26. Consultants could not be remobilized yet due to uncertain security conditions. Cement in short supply. Very slow progress on surveys and design studies for R&M.
27. Tenders cleared by IDA earlier, not yet issued. GOM did not lift ban on import of vehicles. Shortage of tools a major handicap in working of the workshops. Acute shortage of proper lubricants. Rating Status not updated.
28. Hydraulic oil and lubricants in short supply. FY 1987-88 audit report delayed. Decision on dry dock and jetty being delayed too much.
29. Resectioning of the MC and drains held up due to non-availability (delay in placement of orders) of equipment. Also progress on EIMS unsatisfactory.
30. The delay in placing orders for the workshop equipment, tools, spare parts, is upsetting the scheduling of the Consultants specialists and their output. FY 1989-90 audit report delayed.
31. The deployment of Consultants specialists completely upset due to further delays in procurement. Insufficient allocation of local funds.
32. The problems remained the same as reported in the previous mission.
33. Increase in cost of balance work. Water management insufficiently addressed. Construction of the control on offtakes and work on WC lagging behind.
34. Shortage of diesel, proper lubricants and cement. Insufficient attention on water management. Further delays in processing procurement. Communication facilities for O&M not being attended to. Detailed examination necessary why irrigation area not increasing.
35. Further procurement processing delays. No attention on water management and strengthening farmers' organizations. Urgent need to review why the DY not irrigating full command area.

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YE-U IRRIGATION REHABILITATION AND MODERNIZATION PROJECT

(Cr. 1731-BA)

Procurement of Goods

Item Procured	No. of Purchase Orders	Procurement Procedure	Value US\$ million	SAR Base Cost	Remarks
Construction Equipment	10	ICB	1.40	3.55	
Vehicles	-	-	-	0.27	
Workshop Machinery	9	ICB	0.60	0.57	
Tools and Tool kits	1	PS	0.21	0.20	
Special Tools <u>1/</u>	3	PS	0.45	-	<u>2/</u>
Spare Parts <u>1/</u>	34	PS	2.76	3.66	
Tires and Tubes	8	ICB	0.62	-	<u>2/</u>
Miscellaneous items	6	PS	0.13	0.06	
Crude Oil & Lubricant <u>3/</u>	1	ICB	3.89	-	<u>4/</u>
Reinforcement Bars	1	ICB	0.40	-	<u>4/</u>

ICB = International Competitive Bidding.

PS = Prudent Shopping.

1/ These were proprietary items. Quotations were obtained from known dealers of equipment.

2/ Tires, tubes, special tools were included in the spares in SAR.

3/ Crude oil and lubricants were procured by the Petroleum Corporation.

4/ Materials and crude oil were initially not provided for funding under the Credit. DCA was later amended to meet the acute shortage of these materials in the country.

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YE-U IRRIGATION REHABILITATION AND MODERNIZATION PROJECT

(Cr. 1731-BA)

Project Consultancies

(All Cost Figures are in Thousand)

Consultancy for	..... Consultant Selection Process .....			... Contract Value ...		..... Actual Cost .....		Completion Date	SAR m/m	Actual m/m
	By	Procurement	Date	Foreign	Local	Foreign	Local			
<b>Implement</b>										
Model Tests	OPS	1	July 9, 87	US\$210.00	-	US\$224,851	-	May 1989	-	-
Designs	OPS	3	May 13, 88	-	-	-	-	Aug. 1989	12.0	10.5
<b>Assist ID</b>										
Master Plan	WB	1	March 10, 88	DG446.40	K216.9	DG545.9 + US\$9.1	K343.5	May 1991	18	18.1
Feasibility	WB	2	March 18, 91	DG595.00	-	DG595.0	-	May 1992	-	18.5
<b>Assist MB</b>										
EIMS etc.	WB	1	March 10, 88	A\$1,193	K931.1	A\$2113 + US\$105.8	K825.0	Feb. 1992	81	105.5

**Procurement 1** Consulting firms short-listed and selection on the basis of evaluation of the proposals.

**Procurement 2** Sole-source selection. The same consultant was awarded the work who carried out the Master Plan on the basis of negotiations.

**Procurement 3** Invitation to single firm selected for Master Plan study.

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YE-U IRRIGATION REHABILITATION AND MODERNIZATION PROJECT

(Cr. 1731-BA)

FINANCIAL BUDGETS OF FARM MODELS

(In Kyats)

	MODEL I Improved Irrigated Farm Model of 6 ac <sup>1/</sup>		MODEL II Full Irrigated Farm of 6 ac <sup>2/</sup> (before 50% Rainfed and 50% Irrigated)		MODEL III 3.6 ac Irrigated & 2.4 ac Fallow <sup>3/</sup> (before 1 ac Irrigated and 5 ac Fallow)	
	Without Project	With Project Full Dev.	Without Project	With Project Full Dev.	Without Project	With Project Full Dev.
<b>INFLOWS</b>						
<b>Main Production</b>						
- Rice <sup>4/</sup>	65,640	75,420	54,300	65,640	11,700	42,120
- Chick peas <sup>5/</sup>						
Gross Value of Production	65,640	75,420	54,300	65,640	11,700	42,120
<b>On-Farm Consumption <sup>6/</sup></b>						
- Rice	16,200	16,200	16,200	16,200	16,200	16,200
Net Value of Production or Gross Inflow	49,440	59,220	38,100	49,440	-4,500	25,920
<b>OUTFLOWS</b>						
<b>Production Cost</b>						
- Paddy seed <sup>7/</sup>	1,140	1,280	1,050	1,140	200	720
- Urea <sup>8/</sup>	2,286	2,606	1,596	2,286	458	1,647
- TSP <sup>9/</sup>	600	688	375	600	125	450
- MOP <sup>10/</sup>	240	275	150	240	50	180
- Hired labor <sup>11/</sup>	7,680	8,660	6,600	7,680	1,400	5,040
- Chemicals <sup>12/</sup>	516	586	390	516	100	360
Total Production Costs:	12,462	14,095	10,161	12,462	2,333	8,397
<b>Taxes</b>						
- Land tax <sup>13/</sup>	27	31	23	27	5	18
- Water charges <sup>14/</sup>	60	60	30	60	10	36
Total Taxes:	87	98	53	87	15	54
OUTFLOW	12,549	14,193	10,214	12,549	2,348	8,451
NET CASHFLOW	36,891	45,027	27,886	36,891	-6,848	17,469
FARM FAMILY BENEFIT	53,091	61,227	44,086	53,091	9,352	33,669

Footnotes:

- 1/ The without project situation of Model I assumes that 20% of the area would have been cultivated with local paddy seed and the remainder with HYV. In the with project situation also 20% will be planted with local seed, but 92% with HYV seed due to the fact that about 12% of the area is having a second rice crop.
- 2/ The without project situation of Model II assumes that the rainfed area is planted with local rice seed, thus 50% of the area and the remainder with HYV seed. In the with project situation the entire area is irrigated but still due to water insecurity 20% is expected to be planted with local rice seed and 80% with HYV seed.

- 3/ The without project situation of Model III assumes that about 16% of the area is irrigated and farmed and the remainder is fallow. In the with project situation 60% is being irrigated and the remainder is fallow. Model III in the SAR was based on incorrect data (see footnote in Part III, Section 6C).
- 4/ Rice paddy yields per acre are 75 baskets of 46 lbs each for the HYV paddy, and 40 baskets for the local paddy. The price per basket of paddy is K180 in the market and K50 for the compulsory sale to Government i.e. 10 baskets per acre.
- 5/ Chick peas are considered to be equal in area as well as in yield in the with and without project situation of the farm budgets and have therefore not been taken into account in the revenues nor in the costs. The SAR followed this line also.
- 6/ On-farm consumption is about 15 baskets of rice per family member; there are on average six members per family.
- 7/ Paddy seeding: 2 baskets of HYV/acre and 1.5 baskets of local seed/acre; each costs K100 per basket.
- 8/ Urea rate/acre: 1,525 bag of 50 kg for HYV paddy and a 0.25 bag for local paddy. Price per bag: K300.
- 9/ TSP rate/acre: 0.5 bags (50 kg) for HYV; no TSP application for local paddy. Price per bag K250.
- 10/ MOP rate/acre: 0.25 bags (50 kg) for HYV; no MOP application for local paddy. Price per bag K200.
- 11/ Hired labor rate K50/day. Man-days 28/acre for HYV paddy and 16/acre for local paddy.
- 12/ Chemicals price: K200/litre. HYV paddy 0.5 l/acre and local paddy 0.15 l/acre.
- 13/ Land tax for HYV rice is K5/acre and local paddy K2.5/acre.
- 14/ Water charges: K10/acre.

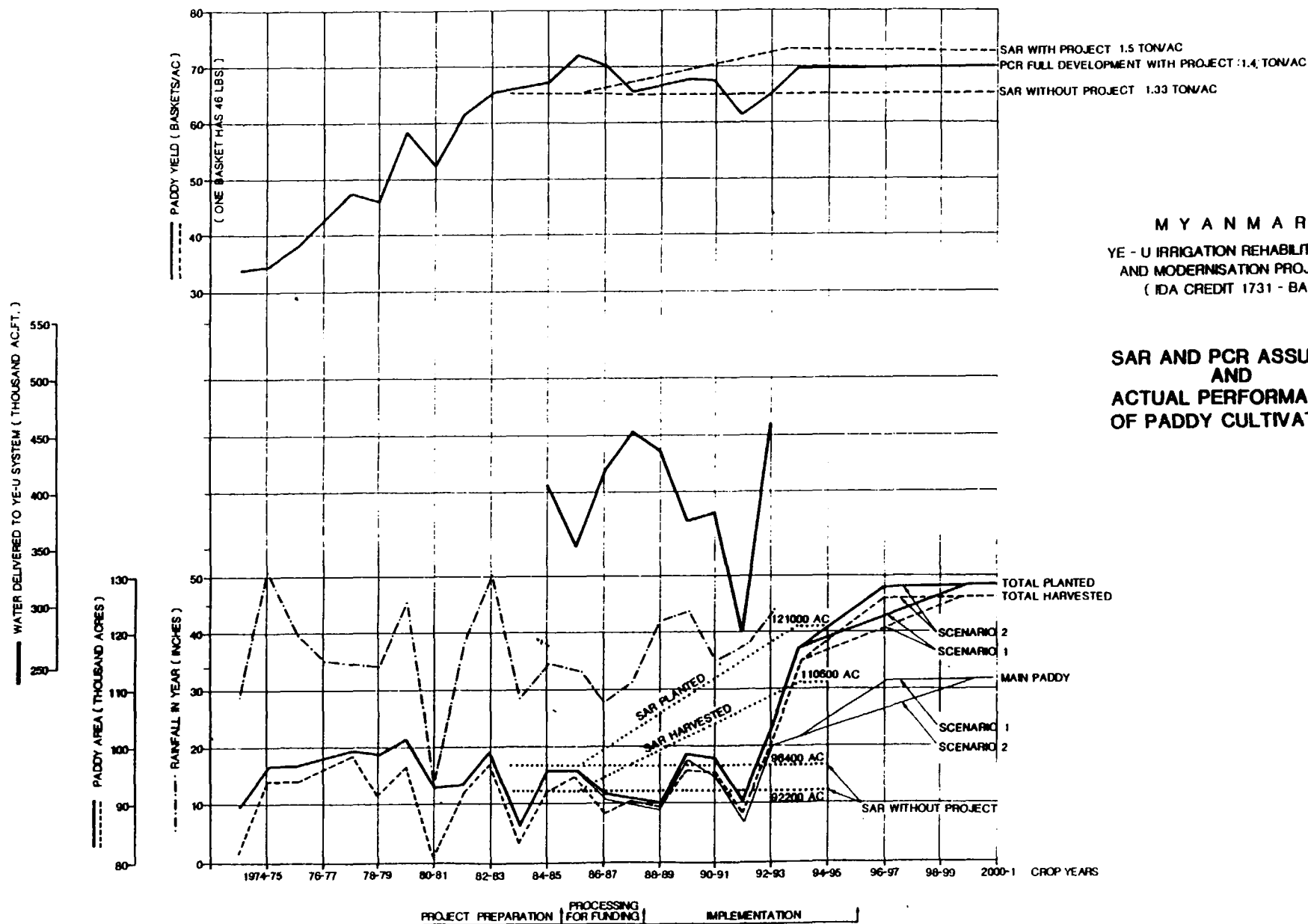
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YE-U IRRIGATION REHABILITATION AND MODERNIZATION PROJECT

(Cr. 1731-BA)

SAR AND PCR PROJECTED AND ACTUAL PERFORMANCE OF PADDY CULTIVATION

1. A graphical illustration of the irrigated paddy area planted, yields obtained and harvested since 1973-74 to 1993-94 is given in Figure 1. Also shown in the graph are the SAR assumptions for the pre-project, without-project and with-project situations. Since the resectioning of the canals started in 1987-88, and the sediment excluder and the cross-regulators on the main canal were completed by June 1990, the pre-project and without project situation for the purpose of the PCR have been taken as an average of the actual situation from 1983-84 to 1988-89 (note that although these are the years of relatively lower planted paddy areas, they recorded the highest paddy yields in the series) giving a base (for comparison with the full development) of 91,561 acres of planted area (SAR: 96,400 acres) and a production of 133,500 tons (SAR: 131,000 tons).
2. In the economic analysis, the with-project situation has been considered from 1989-90 onwards. The actual planted areas and production are considered till 1993-94 except the negative values in 1991-92, in which year the (negative) incremental production of paddy is taken as zero. Full development is assumed to be reached in three years (by 1996-97). Paddy yields achieved in 1993-94 are assumed to remain constant at 1.438 tons/acre planted in view of the shortage of fertilizer in the country (SAR assumed 1.50 ton per ac harvested).
3. Figure 1 brings out the impact of the project: the harvested area is around 98% of the area planted, instead of about 91% assumed in the SAR. The vagaries of weather (drought periods in the rainy season) thus had lesser effect on the planted area due to more reliable availability of water for the paddy irrigated area.
4. The two parameters governing the extent of irrigated paddy planted area are also shown in the figure: the average annual rainfall (inches) in the project area and the volume of water (thousand acre ft) delivered by the system for irrigation.



**PROJECT COMPLETION REPORT**  
**MYANMAR**  
**YE-U IRRIGATION REHABILITATION AND MODERNIZATION PROJECT**  
**(Cr. 1731-BA)**

Economic Analysis

Scenario 1 (Actual and Estimated at Project Completion)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14-25
<hr/>														
<u>Benefits</u>														
Total Incrém. Benefits	-	-	-	6309.0	5764.0	2531.0	11360.0	33810.0	35786.0	37763.0	45672.0	45672.0	45672.0	45672.0
<u>Costs</u>														
Total Costs	298.0	2504.0	35269.0	12360.0	20849.0	9923.0	15752.0	25847.0	29532.0	30276.0	35958.0	35958.0	35958.0	35958.0
<u>Net Benefits</u>														
Net Benefits	-298.0	-2504.0	-35269.0	-6051.0	-15085.0	-7422.0	-4392.0	7963.0	6254.0	7487.0	9714.0	9714.0	9714.0	9714.0

IRR = 7.4%

Scenario 2 (Assuming Appraisal Rice Price Projections)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14-25
<hr/>														
<u>Benefits</u>														
Total Incrém. Benefits	-	-	-	7886.0	7045.0	2501.0	13718.0	41774.0	46715.0	51659.0	56601.0	56601.0	56601.0	56601.0
<u>Costs</u>														
Total Costs	298.0	2504.0	35269.0	12360.0	20849.0	9923.0	15752.0	25847.0	29532.0	30276.0	35958.0	35958.0	35958.0	35958.0
<u>Net Benefits</u>														
Net Benefits	-298.0	-2504.0	-35269.0	-4474.0	-13804.0	-7422.0	-2034.0	15927.0	17183.0	21383.0	20643.0	20643.0	20643.0	20643.0

IRR = 16.9%

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## YE-U IRRIGATION REHABILITATION AND MODERNIZATION PROJECT

## PROJECT:

- +—+— Roads Improved
- ▲▲▲▲ New Bund
- +—+— New Escape Channels

- ⊗ New Cross Regulators

## EXISTING:

- Main and Branch Canals
- Distributary Canals
- Minor Canals
- Rivers and Drains
- ▲▲▲▲ Bunds
- Escapes
- ⊗ Headworks
- Telephone Lines and Stations
- Main Roads
- Village Roads
- Railways
- 34" Isohyets in inches
- ▲ Construction Camp

