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Report No. 8240

PROJECT COMPLETION REPORT

THAILAND

**MAE KLONG IRRIGATION PROJECT - MALAIMAN PHASE I
(TWELFTH IRRIGATION PROJECT)**

(LOAN 2022-TH)

DECEMBER 11, 1989

**Agriculture Operations Division
Country Department II
Asia Regional Office**

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CURRENCY EQUIVALENTS
Currency Unit Thailand Baht (B)

Appraisal Average: US\$ 1 = B.25
Intervening Years Average: US\$1 = B.25
Completion Year Average: US\$1 - B.26

ABBREVIATIONS

AMPP	- Automated Maintenance Planning Process
BAAC	- Bank for Agriculture and Agricultural Co-operatives
DAE	- Department of Agricultural Extension
EMPIRE M&T	- Empire Management and Technology Company Limited
ERR	- Economic Rate of Return
FY	- Fiscal Year
HYV	- High Yielding Variety
IBRD	- International Bank for Reconstruction and Development
ILACO	- International Land Development Consultants, an affiliate company of Euroconsult
MOAC	- Ministry of Agriculture and Co-operatives
MOF	- Ministry of Finance
MUV	- Manufacturing Unit Value
O/F	- On-Farm
OFD	- On-Farm Development
OFW	- On-Farm Works
O&M	- Operation and Maintenance
PCR	- Project Completion Report
POLC	- Provincial Office of Land Consolidation
RID	- Royal Irrigation Department
R-O-W	- Right of Way
TPC	- Total Project Cost
WASAM	- Water Allocation Scheduling and Monitoring
WUG	- Water Users Group

GOVERNMENT OF THAILAND

FISCAL YEAR

October 1 - September 30

Office of Director-General
Operations Evaluation

December 11, 1989

MEMORANDUM TO THE EXECUTIVE DIRECTOR AND THE PRESIDENT

SUBJECT: Project Completion Report on Thailand Mae Klong Irrigation
Project - Malaiman Phase I (Twelfth Irrigation Project)
(Loan 2022-TH)

Attached, for information, is a copy of a report entitled "Project Completion Report on Thailand Mae Klong Irrigation Project - Malaiman Phase I (Twelfth Irrigation Project) (Loan 2022-TH)" prepared by the Asia Regional Office. No audit of this project has been made by the Operations Evaluation Department at this time.

Attachment

A handwritten signature in black ink, appearing to be 'R. Appas', is written over a rectangular box.

PROJECT COMPLETION REPORT

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PREFACE

This is the Project Completion Report (PCR) for the Mae Klong Irrigation Project-Malaiman Phase I (Twelfth Irrigation Project) Project in Thailand, for which Loan 2022-TH in the amount of US\$57.0 million was approved on June 25, 1981. The loan was closed on June 30, 1988; the final disbursement took place on December 31, 1988. There were three cancellations of unused parts of loan with the final cancellation on January 18, 1989 totalling US\$22.6 million.

The Borrower's PCR was prepared by International Land Development Consultants (ILACO) in association with Empire M&T Co. Ltd., under a contract from the Government of Thailand. The Basic Data Sheet, Evaluation Summary, and Overview were prepared by the Bank (AS2AG).

The PCR was read by the Operations Evaluation Department (OED). The draft PCR was sent to the Borrower for comments and they are attached to the Report.

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BASIC DATA SUMMARY

KEY PROJECT DATA

	Appraisal estimation	Actual or current estimate	Actual as % of appraisal estimate
Project costs (US\$ million)	113.0	77.7	69.3
Loan/amount (US\$ million)	57.0	36.4*	64.0
Date Board approval		6/25/81	
Date of effectiveness		11/11/81	
Date physical components completed	6/30/88	6/30/88	100.0
Proportion than completed (%)	100.0	96.0*	96.0
Closing date	6/30/87	6/30/88	116.0
Economic rate of return (%)	23.0	7.2	31.3
Institutional performance		Satisfactory	
Agonomic performance		Satisfactory	
Number of direct beneficiaries (1987)	57,200	57,200	

CUMULATIVE DISBURSEMENTS

	FY82	FY83	FY84	FY85	FY86	FY87	FY88	FY89
Appraisal estimate (US\$ million)	2.5	12.0	25.0	39.0	52.0	57.0		
Actual (US\$ million)	0.6	4.5	8.0	11.2	18.1	26.4	31.0	
Actual as % of estimate	24.0	37.5	32.0	28.7	34.8	46.3		
Date of final disbursement						12/31/88		
Principal repaid (to 06/30/89) (US\$ million)						7.36		

STAFF INPUTS

(staff weeks)

	FY79	FY80	FY81	FY82	FY83	FY84	FY85	FY86	FY87	FY88	FY89	TOTAL						
Identification/																		
Preparation		3	51	3	1	8	2					53.6						
Appraisal					6	1						6.1						
Negotiations					9	5						9.5						
Supervision				4	17	5	22	5	13	6	7	3	12	5	15	6	11.4	100.7
Other					6		1	2	2								1.9	
Subtotal		.3	51.3	10.4	17.7	23.7	13.8	7.3	12.5	15.5	11.4		171.9					

MISSION DATA

Mission	Date (mo/yr)	No of persons	Man-days in field	Specializations represented*	Performance rating*	Trends	Type of problems†
Identification	06/77						
Preparation	1978-1980						
Appraisal	8/09/80	3	30	A, En, Ec			
Subtotal		3	30				
Supervision 1	9/30/81	5	100	A, Ec, En(2), I	1	2	M
Supervision 2	11/26/82	3	57	A, Ec, En	1	2	M
Supervision 3	5/31/83	2	44	A, En	2	2	M
Supervision 4	12/01/83	2	38	A, En	2	1	M
Supervision 5	9/30/84	3	60	A, En	2	2	M
Supervision 6	8/12/85	3	65	A(2), En	2	2	D
Supervision 7	12/02/85	3	6	A(2), En	2	2	D
Supervision 8	11/21/86	4	72	A(2), En(2)	2	2	D
Supervision 9	10/06/87	3	27	A, En(2)	2	2	O
Supervision 10	6/02/88	2	28	En(2)	2	2	O
Supervision 11							
Supervision 12							
Subtotal		27	417				
Total		30	447				

OTHER PROJECT DATA

Borrower	Kingdom of Thailand
Executing agency	Royal Irrigation Department (RID)
Fiscal year of borrower	October 1 - September 30
Name of currency (abbreviation)	Baht (B)
Appraisal year average	US\$1.00 = B 20.00
Interim year average	US\$1.00 = B 25.00
Completion year average	US\$1.00 = B 26.00

Follow-on project:

Name _____
Loan number _____
Loan amount (US\$ million) _____
Date Board approval _____

- a/ Of the appraised loan amount (US\$ 57.0 million), there were three cancellations totalling US\$ 22.6 million leaving a net disbursement of US\$ 34.4 million.
- b/ Project area was reduced from 27,000 ha to 22,000 ha at completion due to farmers refusal to grant Right-of-Way.
- c/ A = agriculturist; Ec = economist; En = engineer; I = institutions specialist.
- d/ 1 = problem-free or minor problems, 2 = moderate problems, and 3 = major problems.
- e/ 1 = improving; 2 = stationary; 3 = deteriorating.
- f/ D = development impact; F = financial; M = managerial; T = technical; and O = other.

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(LOAN 2022-TH)

EVALUATION SUMMARY

Objectives

1. The Mae Klong Irrigation Project-Malaiman Phase I (Twelfth Irrigation Project) purpose was to improve and expand irrigation facilities. This, in turn, was expected to increase production and improve socio-economic conditions of about 44,000 people living on some 27,000 ha of land on the left bank of the Mae Klong river in the Malaiman area (approximately 100 km west of Bangkok). The project comprised rehabilitation and expansion of the existing irrigation infrastructure, construction of new irrigation facilities, improvement of Operation and Maintenance, preparation for future irrigation projects and improvement of RID's operational capability.

Implementation

2. Loan 2022-TH for US\$ 57.0 million was signed August 13, 1981 and became effective November 11, 1981. At appraisal, it was anticipated that the project would be completed by June 30, 1986 and that disbursements would be completed by June 30, 1987. However, the Loan Closing Date was extended to June 30, 1988 and disbursements continued to December 31, 1988.

Implementation took about two years longer than appraised due to an unanticipated need to survey part of the area; repeated modifications of designs for drainage and on-farm works (OFW); protracted procurement procedures; contractors' poor organization and inefficient construction procedures; poor condition of RID's equipment; cash flow problems; inclement weather during long stretches of the 1986 wet season; and protracted negotiations with farmers on Right of Way (R-O-W) acquisition for on-farm (O/F) ditches and drains.

3. In addition to delays in project completion, the project area was reduced by about 5,000 ha due to some farmers' lack of cooperation. Other than that implementation quality was satisfactory.

Project Costs and Disbursements

4. Total cost of the project was appraised in 1981 at US\$115.0 million with a foreign currency component of US\$57.0 million. As a result of the slow implementation start-up, disbursements did not commence until the second project year (IBRD FY 1982) and lagged behind the appraised disbursement schedule by 55-75%. Upon RID's and MOF's request the Bank cancelled a total

of US\$26 million from proceeds under the loan (\$19.0 million on June 17, 1987; \$3.0 million on August 9, 1988 and \$0.6 million on January 18, 1989). By loan closure date (June 1988), only US\$34.4 million (or 60.4% of the original loan) had been disbursed.

5. The total project cost (TPC) amounted to US\$79.7 million or about 69.3% of the appraisal estimate of US\$115.0 million. The reason for the reduction in TPC stems both from a 25% devaluation of Thai currency which reduced the TPC in US\$ equivalent and a reduction in the project area (paras. 7, 8 and 11 of the Overview).

Results

6. By loan closure construction of targeted main canals, lateral, sublateral canals and service roads was completed; the construction, improvement and enlargement of drains and the construction of on-farm development (OFD) for 22,000 ha in the West Malaiman area was completed. The project increased wet and dry season rice and sugar production. As a result farm incomes rose and demand for labor increased significantly.

7. Improvements in RID's institutional capability were achieved by strengthening the dialogue between field and office staff, by the introduction of computerized water scheduling and monitoring (WASAM), by the introduction of computerized automated maintenance planning (AMPP), by the provision of mobile training units, and by the establishment of Working Committees for irrigators and RID at Amphoe (District) level. However, no new projects were prepared due to Ministry of Finance's (MOF) objection to use proceeds from this loan for that purpose.

Sustainability

8. The project ERR was estimated at 23% at appraisal, based on Fall 1981 Commodity Price Forecast data. The Borrower's PCR re-estimates the ERR at 11%, based on Fall 1987 Commodity Price Forecast data and on adjusted costs to September 1987. The ERR reduction from the appraisal estimate of 23% to 11% was due to a delay in the start-up of benefit flows, lower economic prices of paddy; and to lower incremental production. Substituting the latest (September 1988) Commodity Price Forecasts, the ERR was further reduced to 7.2%.

Lessons Learned

9. There are three important lessons learned from this project: (1) the need to ensure an early participation of benefitting farmers in the planning process; (2) implementation of similar projects should be planned for longer periods (i.e. 7 to 8 years rather than 5 years); (3) the water management system (WASAM) and automated maintenance planning (AMPP), implemented in this project should be expanded to similar projects throughout the country.

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OVERVIEW

General

1. This Overview is based on the Project Completion Report (PCR) of the Mae Klong Irrigation Project-Malaiman Phase I (Irrigation Project XII) prepared by International Land Development Consultants (ILACO) in association with Empire M&T Co. Ltd., under a contract from the Government of Thailand. It also draws on the Loan Agreement, the Bank's Appraisal Report, supervision mission reports, correspondence with the Borrower, and internal memoranda in Bank files.

Project Objectives

2. Irrigation Project XII was designed to assist the Royal Irrigation Department (RID) in its continuing program to improve and expand Thailand's irrigation facilities aiming to raise farm incomes through increased cropping intensities and yields for about 27,000 ha of paddy land directly benefitting about 44,000 people. This was to be achieved by construction of main canals, lateral, sublateral canals and service roads. It also included construction, improvement and enlargement of drains, construction of on-farm development (OFD) in West Malaiman area, and improved Operation and Maintenance (O&M). The project was expected to increase agricultural and agriculture-related employment opportunities and income through generating demand for additional labor which will benefit 13,000 landless agricultural people living in the project area. The project was also expected to provide for the preparation of future irrigation projects, and further improve RID's operational capability through improvements in RID's operational complex. Finally the project was expected to lead to an increase in foreign exchange earnings through an increase in the production of exportable commodities (i.e. rice and sugar).

Appraised Components of the Project

3. Irrigation and Drainage Systems. The main features of this component were:

- 3.1 construction of 19 km of main canals and service roads;
- 3.2 construction of 164 km of lateral and sublateral canals and service roads;
- 3.3 improvement and enlargement of 70 km of main and secondary drains and construction of 130 km of new secondary drains; and
- 3.4 on-farm development including tertiary systems (tertiary canals,

drains and farm roads) for a total area of 27,000 ha with turnouts to areas of (about) 4 ha each.

4. Institutional Improvement. This component provides for strengthened collaboration within RID mainly through staff training and some increases in staff.

5. Preparation of New Project. The main features of this component were:

- 5.1 selection of potential projects and preparatory studies;
- 5.2 preparation of updated feasibility studies of 2 earlier selected projects in Northern Thailand (the Mae Yom and Mae Kok Projects) covering 90,000 and 20,000 ha respectively;
- 5.3 preparation of detailed designs and contract documents for the dams and for the initial stages of the irrigation system of the Mae Yom and Mae Kok projects (subject to viable ERRs as determined under paragraph 5.2). Activities might also include detailed design of medium scale and small scale irrigation schemes;
- 5.4 baseline surveys of selected potential projects.

Implementation

6. Organization. The implementation of the project was under the responsibility of the RID of the MOAC while agricultural supporting services were carried out by other departments and divisions of the MOAC (i.e. DAE, rice Division) and an institutional lender such as BAAC. Within RID's Department, the Deputy Director General for construction and a senior RID engineer from the Greater Mae Klong Irrigation Project acted respectively as Project Director and Project Manager for this project. In addition, a Project Engineer was appointed to coordinate field operations in the project area. An association of consultants (paragraph 1) assisted the Project Management in design and construction supervision of the different project components.

7. Organizational arrangements were generally satisfactory. The Project Director, Project Manager and Project Engineer were all appointed as planned at appraisal. All positions were incorporated into a project organization structure with clear divisions of authority. The Project Manager was responsible for all aspects of project implementation and the Project Director coordinated activities of functional divisions within RID, other government agencies and consultants. This system, in contrast to earlier versions, contributed to a clearer definition of responsibilities for all parties concerned and improved the quality and timing of project implementation. It also strengthened both senior and mid-level management.

8. Construction of Irrigation and Drainage Systems. The following components have been implemented at a, generally, satisfactory quality: (the figures in between brackets indicate appraised quantities)

- 8.1 construction of 18.0 km (19 km) of main canals and service roads;
- 8.2 construction of 169.0 km (164 km) of lateral and sublateral canals and service roads;

- 8.3 improvement and enlargement of 76.0 km (70 km) of main and secondary drains and construction of 145 km (130 km) of new secondary drains;
- 8.4 construction of OFW (tertiary canals, drains and roads) covering an irrigable area of 22,000 ha (27,000 ha).

9. It was anticipated at appraisal that the project would be completed in five years, e.g. by June 30, 1986, and that the loan would be closed on June 30, 1987. Actually, the Loan Closing Date was extended to June 30, 1988 and disbursements continued until December 31, 1988. The longer than expected implementation period was due mainly to: (i) time required to survey part of the area which was covered by inadequate aerial photography and missing benchmarks (PCR Section 2.2.2); (ii) repeated modifications of designs of drainage and on-farm works (PCR Section 2.2.4); (iii) protracted procurement procedures (PCR Sections 2.4 and 2.6); (iv) poor organization of contractors and inefficient construction procedures (PCR Sections 2.4 and 2.6); (v) poor condition of equipment (PCR Section 2.4); (vi) cash flow problems (PCR Section 2.4); (vii) inclement weather during long stretches of the 1986 wet season (PCR Section 2.4.2); and (viii) protracted negotiations with farmers on R-O-W acquisition for O/F ditches and drains (PCR Sections 2.2.4 and 2.9).

10. Institutional Improvement.

(a) An important improvement in RID's institutional capability was the establishment of a feed-back mechanism from the field to the design office. By institutionalizing regular contacts between construction supervisors and designers and between O&M personnel and designers, field personnel were able to articulate to designers problems they had encountered either during construction or during operation. Designers, on their part, had an opportunity to analyze encountered problems and ascertain implications upon system design. For example, turnout gates, which presented operational problems in many (if not most) RID's projects, were re-designed and improved in response to O&M comments.

(b) A second important improvement in RID's operational capability was achieved through the introduction of computerized water scheduling and monitoring. By adapting software to local needs, the Consultant developed daily/weekly delivery schedules (WASAM) for mains and laterals of the irrigation system, down to tertiary turnouts. These were based on gross consumptive use requirements and present a breakthrough in RID's attempts to match water supplies with demands. (The same system could be used to schedule deliveries from tertiaries to individual and/or groups of farms). Computerized monitoring of programmed schedules was introduced and results (monthly monitoring graphs) were discussed by the O&M staff of each Zone.

(c) A third improvement in RID's maintenance capability was achieved by the Consultant's introduction of a computerized, automated maintenance planning process (AMPP). This program served as an incentive to RID's O&M staff to first critically review all various maintenance activities, classify them in accordance with required frequencies to sustain system performance and finally plan activities in proper sequence and frequency. (It should be noted that RID decided recently to adapt and employ programs developed for this project nationwide.)

(d) A fourth improvement in RID's capability concerned training of irrigators. It was achieved by providing fully equipped mobile training units (e.g. audio/visual aids, training booklets, irrigation calendars, and various other training materials).

(e) The project also improved RID's coordination capability with irrigators by establishing Working Committees at Amphoe (District) level. These committees helped coordinate activities of different agencies in forming and training of Water User's Groups (WUG) in newly developed area. The Committees also provided agricultural guides -- in addition to that provided by Provincial Committees for Land Consolidation (POLC).

11. Preparation of New Projects. Crop Diversification Study on the West Bank of the Chao Phya. Upon the request of MOAC, Loan 2022-TH financed a major identification and prefeasibility study by the Project Consultant on crop diversification on the West Bank of the Chao Phya. The study found little potential for dry-footed field crops (such as soybean, cotton and mungbean) or exportable fruits and vegetables due to limiting soil capabilities, but some potential for fruits and vegetables for local consumption, for combined aqua-rice culture (particularly fresh-water prawns) and for growing of orchids. In view of rapid deterioration of water quality selective, uncoordinated, flood control in parts of the basin (exacerbating floods in other parts), and already experienced water shortages, the study recommended a follow-up re-assessment of water management in the Mae Klong and Chao Phya basins and the zoning of the area for various economic activities.

12. However, neither these nor additional studies were carried out under this project because of MOF's objection to use proceeds from this loan for further project preparation or follow-up studies.

Project Costs and Disbursements

13. The appraised cost of the project was US\$115.0 million, with a foreign currency component of US\$57.0 million. By loan closure (June 1988) the actual total project cost (TPC) was US\$ 79.7 million and total disbursements under the loan aggregated US\$34.4 million. Factors that contributed to the reduction in TPC were: (a) service area reduction (O/F development covered only 22,000 ha instead of an appraised area of 27,000 ha); and (b) a decline in the value of the Thai currency which resulted in a 25% devaluation and which reduced the TPC in US\$ equivalent. Loan disbursements commenced during the second project year (IBRD FY 1982), but lagged behind the appraised disbursement schedule by 55-75%. Upon RID's and MOF's request the Bank cancelled a total of US\$22.6 million from proceeds under the loan (\$19.0 million on June 17, 1987; \$3.0 million on August 9, 1988; \$0.6 million on January 18, 1989).

Agricultural Production

14. The reassessed agricultural potential of the project at loan closure was as follows. Of the 22,000 ha where O/F facilities were provided, cropping

intensities are now expected to reach 172% at full development (178%)¹; however, yields are expected to exceed appraisal estimates². Yield of local transplant wet season rice recorded at appraisal as 1.7 ton/ha, was 2.5 ton/ha in 1987 and is expected to further increase at full development³ by about 30% to 3.3 ton/ha compared to an appraised target yield of 3.0 ton/ha. Yield of HYVs wet season rice⁴ was 3.4 ton/ha in 1987 and is expected to increase at full development to 4.1 ton/ha compared to an appraised target yield of 3.5 ton/ha. Yield of HYVs dry season rice in flooded areas increased from 2.8 ton/ha at appraisal to 3.9 ton/ha in 1987 and is expected to increase to 4.5 ton/ha at full development compared to an appraised target yield of 3.2 ton/ha. Yield of HYVs dry season rice⁵ in non-flooded areas was 3.8 ton/ha in 1987 and is expected to increase at full development to 4.2 ton/ha compared to an appraised target yield of 4.0 ton/ha. Yield of sugar recorded at appraisal as 35.0 ton/ha was 60 ton/ha in 1987 and is expected to increase to 80.0 ton/ha at full development. At appraisal, sugar was not expected to be planted under the project.

Impact

15. The major impact of the project was an increase in rice production (both wet and dry season) and sugar production through increased yield, expanded areas and increased intensities primarily by increasing cropped areas during the dry season. (Table 1, page 7) This led to an increase in farm incomes. At full development, the annual net incremental farm income is expected to be approximately 4,400 Baht per hectare. As a consequence of these developments, labor requirements and wages also increased. Labor and wages are expected to increase at full development by 30 workdays/hectare and between 5' to 10 Baht/workday respectively. The project provided significant improvements in water management and in improved inter-departmental cooperation within RID and in improved contacts with irrigators. Mainly because of MOF's objection to use this loan for studies, no new projects were prepared under this loan. Finally, the increase in the production of exportable commodities (i.e. rice and sugar) also led to an increase in foreign exchange earnings. From 1982-1986 Thailand's rice exports had increased about 14.2%.

16. The appraisal report estimated the project ERR at 23% based on Fall 1981 Commodity Price Forecast data. The Borrower's PCR re-estimated the ERR at 11%, based on Fall 1987 Commodity Price Forecast data (in 1985 constant US

¹ the figure indicates the amount expected at appraisal

² Yield figures for 1987 are based on averages of actual data obtained from field observations and various other sources (RID Mae Klong Project, Agricultural Extension Service); Yield figures for 1988 and beyond are projections.

³ The appraised target yields were to be reached at full development - in the sixth year after completion of project works or in 1994

⁴ introduced with the project

⁵ also introduced with the project

Dollars) and on adjusted costs to September 1987. Major factors contributing to the reduction of ERR from the appraisal estimate are: (a) benefits started accruing only in the sixth year of the project instead of the second year as assumed at appraisal; (b) considerably lower economic prices of paddy; (c) an overestimation of incremental production. (PCR Section 6)

17. The Bank reassessed the ERR as 7.2% based on same production projections as given in the PCR but substituting the latest (September 1988) Commodity Price Forecasts for the earlier (1987) forecast used in the PCR. (table 2, page 8) This substitution, of a yet lower forecast, dropped the ERR from 11% to 7.2%.

Bank Performance

18. The Bank dealt adequately with some issues at appraisal but not with all. Thus: (i) the time estimated for implementation was too short; (ii) the economic assumptions were overly optimistic and thus resulted in overstating the project ERR; (iii) there was a lack of economists during supervision and hence little attention was given during supervision to an actual reduction in economic benefits; (iv) the Bank did not insist that RID obtain farmers' cooperation before the actual construction of O/F system, and as a result delays occurred during implementation.

Lessons Learned

19. R-O-W problem which stemmed from farmers' unwillingness to yield land access for farm ditches and drains was primarily due to a lack of early, effective contacts between RID and future irrigation users. This problem resulted in a delay and a reduction of OFD and delayed derivation of benefits. Attention should therefore be given to involving the benefitting farm population in project preparation allowing them to articulate their legitimate expectations from irrigation. Based on these discussions RID should be able to appropriately plan the project and reach appraised project objectives.

20. With hindsight, it is evident that the appraised implementation schedule of 5 years was far too optimistic. The bank should have anticipated the likelihood of shortcomings common to other projects implemented by RID at appraisal (i.e. delays in awarding contracts, protracted negotiations for R-O-W, etc.). Implementation of similar schemes should be planned for longer periods of time (i.e. 7 to 8 years).

21. Another important lesson learned concerns the water management system and maintenance planning. RID should consider expanding the knowledge gained from the improved water management system (WASAM) and from automated maintenance planning (AMPP) by implementing these systems which already had a positive impact on this project to other similar developments throughout Thailand.

TABLE 1: KEY PRODUCTION ASPECTS OF THE PROJECT

	1981 Situation	Appraisal Estimates ¹	Actual/Anti- cipated at Full Agric. Development	Percent of Appraisal
<u>Cropped Area (ha)</u>				
Paddy	26,000.0	45,500.0	34,600.0	76.0
Sugar	900.0	-	3,300.0	-
<u>Cropping intensities (%)</u>				
	100.0	178.0	172.0	96.6
<u>Yields (ton/ha)</u>				
Local transplant wet season rice	1.7	3.0	3.3	110.0
HYVs wet season rice ²	-	3.5	4.1	117.1
HYVs dry season rice ³	2.8	3.2	4.5	140.6
HYVs dry season rice	-	4.0	4.2	105.0
Sugar	35.0	-	80.0	-

¹ The appraised target yields were to be reached at full development - in the sixth year after completion of project works or in 1994.

² The numbers used here are the average of transplanted and broadcasted HYV wet season rice yields.

³ in flooded area

TABLE 2: PROJECTED PRICES FOR RICE AND SUGAR

(in 1985 constant US Dollars)

Years	RICE		SUGAR	
	Price Forecast		Price Forecast	
	Sept. 1987	Sept. 1988	Sept. 1987	Sept. 1988
	(US Dollars per ton)			
1987	169	177	123	115
1988	175	215	175	240
1989	182	198	210	268
1990	193	165	225	300
1995	212	173	242	224
2000	216	166	242	254

(F.O.B Bangkok, 5% broken, export-quality Thai white rice)

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(TWELFTH IRRIGATION PROJECT)
(LOAN 2022-TH)

BORROWER'S PROJECT COMPLETION REPORT

Introduction

The Mae Klong Irrigation Project - Malaiman Phase I was implemented during the period 1981-1988 and will actually be fully implemented in 1989. It was the second large scale agricultural development project in the Mae Klong Basin following similar agricultural developments on the Right Bank and in the Chao Phya Basin.

Approximately 53.5% of the Project was financed by the Royal Thai Government, while for the other 46.5% a loan from the World Bank (IBRD Loan 2022-TH) was obtained.

The objectives of the Project i.e. increase of the wet-season rice yields, the extension of the dry-season cropped area, the creation of possibilities for agricultural diversification and the improvement of rural employment opportunities, have been fully achieved.

Unlike the Chao Phya Basin, where irrigation water is not sufficient for the dry season irrigation of the entire area, the Greater Mae Klong Irrigation Project in the Mae Klong Basin, of which the Mae Klong Irrigation Project - Malaiman Phase I is a part, to date receives an adequate water supply in the dry season. However, it should be understood that in view of the expansion of the area under irrigation and the fact that water from the two reservoir dams (the Srinagarind dam and Kao Laem dam) is also being diverted to the Chao Phya West Bank and Bangkok Metropolitan, much attention should be paid to improve irrigation efficiencies.

The construction of tertiary irrigation, drainage and road facilities has improved crop-growing conditions to such an extent that broadcasting and transplanting of local rice varieties has been almost entirely replaced by transplanting and nowadays even broadcasting of pre-germinated seed of modern rice varieties. Dry-season cropping in the project area has increased tremendously. As a consequence of these developments, labour requirements increased significantly and labour wages followed suit. Because of the necessity to complete certain farm activities in a short period of time in the double cropping system (harvesting, land preparation and transplanting), the fact that the labour requirements during these periods could not be fully met and the resulting high labour wages, farmers turned to mechanized land preparation and broadcasting of pre-germinated seed.

Note:

This Summary is extracted from the lengthy report prepared by the consultants Ilaco in Association with Empire M. & T. Co. Ltd. for the Royal Irrigation Department. Copies are on file at the Operations Evaluation Department and are available on request.

Project implementation

In the Mae Klong Irrigation Project - Malaiman Phase I the following main components have been implemented (the figures between brackets indicate the amounts at appraisal):

- (i) construction of 18.0 km (19 km) of existing main canals and service roads;
- (ii) construction of 169.0 km (164 km) of lateral and sub lateral canals and service roads;
- (iii) improvement and enlargement of 76.0 km (70 km) of main and secondary drains and construction of 145 km (130 km) of new secondary drains;
- (iv) construction of on-farm works (tertiary canals, drains and roads) covering an irrigable area of 22,000 ha (27,000 ha).

A comparison between the planned implementation schedule at appraisal and the actual implementation schedule is shown in Figure 1.1.

The Project was implemented under the responsibility of the Royal Irrigation Department (RID) of the Ministry of Agriculture and Co-operatives (MOAC). A Project Manager was appointed, who reported to RID's Deputy Director General for Construction. An association of consultants assisted the Project Management in the implementation of the different project components. In actual fact the same Project Manager and Consultants were involved in this Project as in the Mae Klong Right Bank Irrigation Project, which was simultaneously being developed. This made it possible to set up an efficient management team to coordinate activities in both projects.

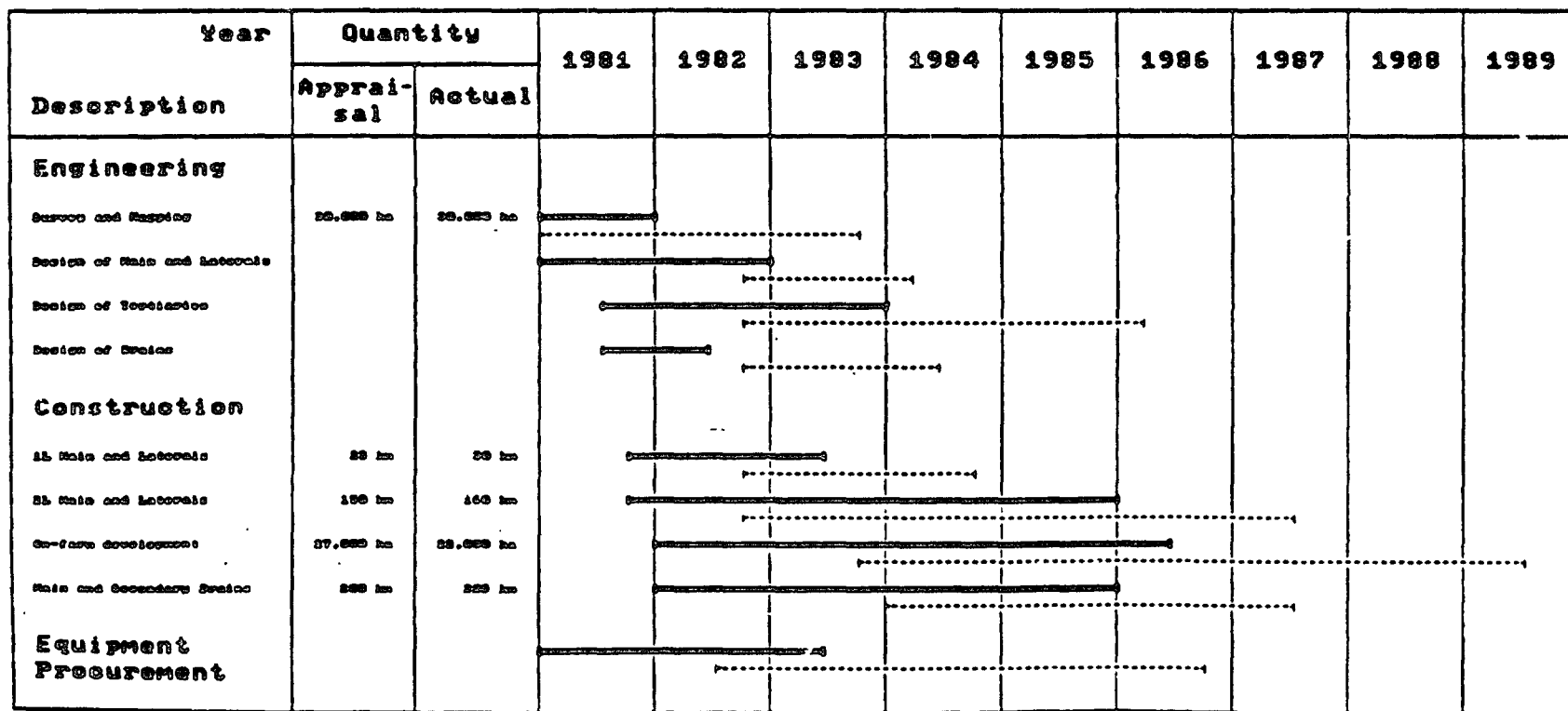
Topographical surveys and cadastral surveys for the design of the tertiary system were based on 1:4,000 scale aerial photographs and executed by respectively RID's Survey Division and the Land Department. Surveys of the new distribution system were carried out by local survey contractors. This was supervised by the Consultants, who were responsible for all design work in this Project.

The design work of the main and secondary irrigation and drainage system was done by Consultants, who used the same Design Office which was established for the Mae Klong Right Bank Irrigation Project for this purpose.

Main features of the design of the supply system were a raise of capacity to 1.6 and 1.5 l/s.ha for main and lateral canals respectively, incorporation of additional structures to raise and control the water levels and allow for full command of the command areas even under low supply conditions and for better operation.

The lay-out and capacity of the drainage system was reviewed, taking into account the need for cross drainage through the project area of drainage water from the western catchment areas. Additional cross drainage structures were

**Implementation schedule of Mae Klong Irrigation Project Malaiman Phase I
(IBRD loan 2022-TH)**



Note
 implementation schedule at appraisal
 actual implementation schedule

Figure 1.1

designed in the 1L main canal for this purpose. Further, a flood protection dike in East Malaiman was constructed so as to protect the on-farm works in that area.

The designed tertiary system is of the so called 'extensive land consolidation' type (Type B) i.e. the ditches, roads and drains follow the existing cadastral boundaries. Hence, no reallocation of plots and no land levelling was allowed for. However, as 100% of the farmers had to be connected to the water supply, drainage and road system, it can still be considered an intensive development. Farmers were involved in an early stage of the design. In total about 22,400 ha were designed by the Consultants Design Office. The on-farm designs for sugarcane areas were somewhat adapted to take care to the specific needs in those areas.

The equipment and materials procured under the Mae Klong Irrigation Project - Malaiman Phase I included Construction and O&M equipment for respectively US\$ 952,470.- and US\$ 902,380.-.

At appraisal, project implementation was estimated to take six years. However, due to time consuming tendering procedures, obstructing farmers, national budget limitations and considerable delays in some civil works and OFD contracts, the civil and on-farm components could not be completed in time. Consequently, the Project and the Loan had to be extended with one year i.e. from June 30, 1987 to June 30, 1988.

The construction of civil works was mostly done by contractors and a minor part by Force Account (some drains). The quality was generally good.

The construction of on-farm facilities was done by Contract, in total 22,000 ha and will be completed in 1989. The progress and quality was at first, disappointing in West Malaiman due to inexperience of project staff with this type of work. Moreover, the short construction time available required accurate planning of work. Consultants extensively trained inspection staff to improve the quality while the Project Management and contractors were assisted in scheduling of the work. In later years the quality improved considerable.

The Consultants time input under the Project was spent on design, assistance to the Project Management in the implementation, assistance to the Regional O&M Office in Operation and Maintenance, and assistance to the Project Planning Division (Economic Branch) in Monitoring and Evaluation of the Project.

Operation and maintenance

A very important part of the project activities included the establishment and implementation of improved O&M practices at farm level and at project level from the very beginning of the Project.

The integrated development approach which was followed, in which a very close co-operation and interaction between design, construction, O&M and economic monitoring and evaluation was strived after, proved to be of great value for the development of the area. An important aspect of this component was the training of RID field staff and the farmers in the proper use of the rehabilitated and newly constructed irrigation and drainage systems. To this end, also mobile training units were developed and equipped with adequate hardware and software, e.g. visual/audio visual aids as training booklets, irrigation calendars, films, slides sound series, etc. Another important step taken, to come to higher irrigation efficiencies, was the development of a Water Allocation Scheduling and Monitoring (WASAM) programme. Maintenance activities were analysed and an Automated Maintenance Planning Process (AMPP) programme, to structure the maintenance process, was developed.

Project expenditures and disbursements

The total project cost will reach at completion in 1989 an estimated amount of Baht 1,887.3 million or US\$ 75.5 million equivalent (1988 conversion rate). This total is some 18% under the estimate made at the time of appraisal (1979) and is mainly due to the fact that the actual total area of on-farm development implemented was 22,000 ha instead of 27,000 ha anticipated at appraisal, even though the unit rate for OFD construction was higher than anticipated. It was also partly caused by the change in exchange rate from B 20 per US\$ in 1981 to B 25 - B 26 per US\$ during the period 1985/1988.

The original Agreement between the Government of Thailand and the International Bank of Reconstruction and Development was based on a Loan of US\$ 57.0 million. This figure was reduced in 1987 to US\$ 38.0 million. The estimated final disbursements will, however, only reach a total of some US\$ 35.1 million. The main reason for the considerably lower loan disbursements is that some construction work has been carried out under force account instead of on contract. For force account work no disbursement was included in the loan. Moreover as mentioned in the previous paragraph less on-farm implementation was carried out and considerable difference in exchange rates have also caused the disbursements to be less than anticipated at appraisal.

Agricultural development

Monitoring of agricultural development, including the establishment of a set of detailed baseline data in the Mae Klong Right Bank Irrigation project area was initially done in close co-operation with the Economic Branch of RID's Project Planning Division. As a result of Consultant's recommendations to establish an in-house Monitoring and Evaluation Unit, all project benefit monitoring and evaluation activities since 1985 have been carried out in co-ordination with RID's Project Monitoring and Evaluation Branch. All M&E activities have been

carried out in close co-operation with project staff and the Consultants. Due to delays in the implementation the first actual monitoring activities, covering initially only small implemented areas, started in 1984.

Cropping intensities in the implemented areas went up in two to three years from 105% to at least 170-180% calculated for the total OFD area (rice and sugarcane). For rice areas in particular, the dry season cropping intensity went up from some 5% to almost 85%. Wet season rice intensities may drop in the near future to 95% because of still existing flooding problems in small parts of East Malaiman.

No information exists on other crops than rice and sugarcane. In case farmers will start to grow more vegetables in the near future, the cropping intensity will increase even further.

To solve the problem with respect to the increase in the demand for farm labour due to increased cropping intensity and strict irrigation schedules, farmers are changing their cultivation practices. Land preparation activities are at present increasingly mechanized with small two-wheel tractors. Besides mechanized land preparation, the introduction of mechanized threshing has also been generally accepted. The same holds true for small motorized spraying equipment. Moreover farmers are changing from the very labour intensive transplanting to broadcasting of rice. Because of the improved water management conditions (proper supply of irrigation water and an adequate drainage system) several farmers switched to broadcasting of pre-germinated seed. It is, however, expected that the majority of the farmers will continue to transplant part of the rice crop because of the severe weed problems in broadcasted rice fields, and because East Malaiman still has a flooding problem in some parts.

Initially the paddy yields increased considerably in the newly implemented OFD areas. However, the rather low paddy prices have not been an incentive to invest in extra labour for proper crop cultivation practices and/or in the application of extra agro-chemicals. Consequently, yields showed a decreasing trend in 1985 and 1986. Recent price increases have shown immediate improvements in the paddy as well as in the sugarcane yields. The projected yield targets, as given in the Appraisal Report, have been reached by the farmers in the project area in a much shorter period than originally foreseen.

Assuming that paddy and cane prices will remain at fair levels, the stage of full development can be reached by 1990. For paddy this means yields for transplanted HYV of 4.3 ton/ha in the wet season and 4.5 ton/ha in the dry season. For broadcasted HYV the expected yields are respectively 3.8 and 4.2 ton/ha.

Monitoring results showed that the yields which can be expected without project implementation would be higher than forecasted in the Appraisal Report. For details on actual recorded and projected yields for paddy and sugarcane reference is made to Table 4.3.

Production costs have been influenced by the changes in cultivation practices but in particular also by the relatively low farmgate prices of paddy and cane. To keep the Net Value of Production (NVP) as high as possible farmers reduced labour costs and the use of agro-chemicals.

Trends in farm gate prices between 1980/81 and 1985/86 have had a negative effect on net farm incomes. Although the projected paddy and cane farmgate prices for 1990-2010 (based on WB commodity price forecasts for the year 2000) are better than the prices in recent years, they cannot be compared with the price projections used in the Appraisal Report. A projected economic paddy price at present and upto the year 2010 of ₦ 3,570/ton, compared with a farmgate price of ₦ 6,900/ton forecasted in 1979 will have an important effect on the viability of the Project as a whole.

Project evaluation

Several important facts have influenced the feasibility of this Project in a rather negative way. The most important one is the delay in the implementation of OFD works. The fact that the first and relatively small areas had been completed only in 1983 and not in 1982 as foreseen during the appraisal and that the total project area can benefit from the new irrigation and drainage infrastructure only in 1990 instead of 1987, has reduced the rate of return considerably.

The Project also appeared to be quite sensitive to the rather low prices of paddy and sugarcane. The economic analyses, however, also indicated that the project has been less sensitive to increases of up to 20% higher investments or changes of plus or minus 10% in yields. Summarizing it can be said that the feasibility of the Project (ERR = 11%), on the basis of conditions of today, is considerably lower than the calculated 23% from the Appraisal Report. Without delays in implementation the ERR would have been 15%, calculated on the basis of prices used in 1979 the result would be 18%. Also important is that the differences between with and without project implementation have proved to be less than expected. However, despite all these facts, the conclusion must be that, under present 1988 conditions, the outcome of the economic analysis is good and probably better than many other and comparable projects, even when the production of high value crops such as vegetables in the project area in the near future is not taken into account.

CONCLUSIONS AND RECOMMENDATIONS

The Mae Klong Irrigation Project - Malaiman Phase I, turned out to be a successful large scale irrigation project. Not only in terms of economics, but also in terms of farmer's co-operation and participation. In an area of about 22,000 ha the physical infra-structure will be such that the conditions for the cultivation of rice or upland crops are optimal and maximum yields can be achieved. The rise in dry season cropping intensities after implementation and the increase in yields are good indicators that the farmers utilize the offered facilities to their full extent.

The ideas developed and experiences gained in the field of engineering, project implementation, water management and monitoring and project evaluation will reflect positively on similar development throughout the Kingdom of Thailand. Local staff have been involved in depth in the preparation of design criteria and designs for civil and OFD works. Local contractors and RID staff have gained considerable experience with the implementation of large scale on-farm development works for which there is still a wide scope in the Kingdom. The development of the Water Allocation Scheduling and Monitoring Programme (WASAM) now already has a positive impact on several projects. RID is considering to implement WASAM on all irrigation projects nation wide. The work done and experiences gained in the economic monitoring and evaluation of the Meklong Irrigation Projects can be of great value for the evaluation of other existing projects.

Within the Mae Klong Irrigation Project - Malaiman Phase I Consultants have recommended that due attention should be paid by the Project Management to the proper completion of the OFD facilities and to the drainage system and the adjacent protection dikes in the flood prone areas of East Malaiman. Due attention should be paid to the Song Phi Nong River, since the capacity of this river is not sufficient and when it cannot discharge the drainage water from the Malaiman areas fast enough severe flooding in East Malaiman may occur, also causing major damage to the distribution system.

The advised discharges by the WASAM programme should be strictly implemented. Actual discharges should be monitored and evaluated. A nucleus of trained staff should be retained for proper operation and for training of staff for other projects, in the background and use of WASAM. The coordination with EGAT should be improved to have more control over reservoir releases to the Vajiralongkorn dam.

The increased efficiency in water use in the Mae Klong Basin will allow for more efficient use of the available water resources, which will enable further agricultural developments, not only in the Mae Klong Basin, but also in the Chao Phya Basin; at present already a considerable amount of water is conveyed to the lower Chao Phya West Bank area for agricultural and domestic use.

Considering the rising trend in commodity prices and the scope for additional developments in the Mae Klong Basin, the Consultants have recommended to continue irrigation development in the Mae Klong Basin. Both in the Stage I and Stage II Left Bank areas there is still an enormous potential for more efficient water use and increases in cropping intensities and yields in case tertiary development is implemented. Especially in the Malaiman sugarcane areas, farmers are very eager for further development and are willing to pay for OFD facilities.

It can be concluded that an integrated approach to irrigation development with attention not only for design and construction but simultaneously for operation, maintenance and water management, leads to satisfying results. The formulation of an irrigation operation plan beforehand and feedback from the field to designers and construction staff are important elements of this approach.

The monitoring of the water distribution and the results of the agro-economic surveys also contribute to the regular, direct feedback of field information to the top level O&M staff.

Results might have been even better, if a consultancy component on agronomic aspects, such as crop diversification, extension, marketing, and credit had also been included in the Project. The latter applies especially to upland crops.

Finally, the results obtained so far have also to be contributed to the diligence of RID's O&M organization, which, understaffed still made the Mae Klong Irrigation Project - Malaiman Phase I an outstanding example for modern Operation and Maintenance of an irrigation project in Thailand. The good cooperation between project construction staff and O&M staff was an essential contribution to this success therefore, it is strongly recommended to follow a similar approach for future developments.

Considering the increasing complexity of the management and further development of the central plain river basins with regards to flood control, irrigation and drainage, water availability and use, reservoir operation etc., and the interrelationship between the Mae Klong and Chao Phya River Basins, Consultants recommend an integrated Chao Phya and Meklong River Basin Development Study. This study should include such fields as water resources development and crop diversification, river basin planning, hydropower, agricultural development, irrigation, drainage, flood plain management, river hydraulics, hydrology, salinity intrusion, water quality, ecology, sociology, navigation and organization.

An important aspect in managing the water supply to the different irrigation projects in the Mae Klong as well as the Chao Phya Basins is the future integration of the existing WASAM and WMS programmes.

COMMENTS FROM THE BORROWER



ROYAL IRRIGATION DEPARTMENT

BANGKOK, THAILAND

CABLE ADDRESS:
RID Bangkok

No. 0311/613

23 November B.E. 2532 (1989)

**Re: Mae Klong Irrigation Project-Malaiman
Phase I - Twelfth Irrigation Project
(Loan 2022-TH)
Project Completion Report**

Dear Mr. Graham Donaldson,

Reference is made to your letter dated September 29, 1989, we are pleased to inform you that the Evaluation Summary and Overview prepared by World Bank staff on the above project is found very complete. Therefore, we have no comment on the said report.

With best regards,

Yours sincerely,

A handwritten signature in black ink, appearing to read "R. Chalajata".

(Roongrueng Chalajata)
Deputy Director General
for Director General

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