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Report No: ICR0000442

IMPLEMENTATION COMPLETION AND RESULTS REPORT

(IBRD-38320 IDA-26720)

ON A

LOAN IBRD-38320 & CREDIT IDA-26720

IN THE AMOUNT OF US$ 26.7 MILLION & SDR 35.7 MILLION
(TOTAL US$ 80.0 MILLION EQUIVALENT)

TO THE

ARAB REPUBLIC OF EGYPT

FOR AN

IRRIGATION IMPROVEMENT PROJECT

June 29, 2007

Sustainable Development Department
Middle East and North Africa Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective March 22, 2007)
Currency Unit = Egyptian Pound
LE 1.00 = US$0.175
US$ 1.00 = LE 5.70

FISCAL YEAR
July 1 – June 30

ABBREVIATIONS AND ACRONYMS

BCWUA	Branch Canal Water Users Association
CAS	Country Assistance Strategy
CD	Central Directorate
CDIAS	Central Department for Irrigation Advisory Services
CF	Continuous Flow
DO	Development Objective
EA	Environmental Assessment
EMP	Environmental Management Plan
ERR	Economic Rate of Return
FAO	Food and Agriculture Organization of the United Nations
fed	Feddan (equivalent to 0.42 hectar)
FY	Financial Year
GDP	Gross Domestic Product
GOE	Government of Egypt
GTZ	German Technical Cooperation
IAS	Irrigation Advisory Service
IBRD	International Bank for Reconstruction and Development
ICB	International Competitive Bidding
ID	Irrigation Department
IDA	International Development Association
IIIMP	Integrated Irrigation Improvement and Management Project
IIP	Irrigation Improvement Project
IIPD	Irrigation Improvement Project Directorate (later changed to IIS)
IIS	Irrigation Improvement Sector (previously IIPD)
IP	Implementation Progress
IPM	Integrated Pest Management
IS	Irrigation Sector
ISR	Implementation Status Report
IWMD	Integrated Water Management District
IWRM	Integrated Water Resource Management
KfW	German Aid Agency
LE	Egyptian Pound
LIB	Limited International Bidding
M&E	Monitoring and Evaluation
MALR	Ministry of Agriculture and Land Reclamation
MED	Mechanical and Electrical Department
MIS	Management Information System
MWRI	Ministry of Water Resources and Irrigation
NGO	Non-Governmental Organization
NPV	Net Present Value

NWRC	National Water Research Centre
O&M	Operation and Maintenance
OFWM	On-Farm Water Management
PAD	Project Appraisal Document
PMU	Project Management Unit
PVC	Polyvinylchloride
SIL	Specific Investment Loan
SWERI	Soils, Water and Environmental Research Institute
SWM	Solid Waste Management
TA	Technical Assistance
TOR	Terms of Reference
TTL	Task Team Leader
UNDP	United Nations Development Program
USAID	United States Agency for International Development
WB	Water Board / World Bank
WBP	Water Boards Project
WQMU	Water Quality Management Unit
WSS	Water Supply and Sanitation
WUA	Water Users Association

Vice President:	Daniela Gressani
Country Director:	Emmanuel Mbi
Sector Manager:	Narasimham Vijay Jagannathan
Project Team Leader:	Jose Simas
ICR Team Leader:	Jose Simas

ARAB REPUBLIC OF EGYPT
IRRIGATION IMPROVEMENT PROJECT
CONTENTS

A. Basic Information

Country:	Egypt	Project Name:	EG Irrigation Improvement
Project ID:	P005173	L/C/TF Number(s):	IBRD-38320,IDA-26720
ICR Date:	06/29/2007	ICR Type:	Core ICR
Lending Instrument:	SIL	Borrower:	MPWR
Original Total Commitment:	USD 80.0M	Disbursed Amount:	USD 71.6M

Environmental Category: B

Implementing Agencies:
Irrigation Improvement Sector

Cofinanciers and Other External Partners:
Kreditanstalt fur Wiederaufbau

B. Key Dates

Process	Date	Process	Original Date	Revised / Actual Date(s)
Concept Review:	11/05/1993	Effectiveness:	08/02/1996	08/02/1996
Appraisal:	09/25/1994	Restructuring(s):		06/30/2006
Approval:	12/22/1994	Mid-term Review:		05/03/2000
		Closing:	12/31/2002	12/31/2006

C. Ratings Summary

C.1 Performance Rating by ICR

Outcomes:	Moderately Satisfactory
Risk to Development Outcome:	Moderate
Bank Performance:	Moderately Satisfactory
Borrower Performance:	Moderately Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)

Bank	Ratings	Borrower	Ratings
Quality at Entry:	Moderately Satisfactory	Government:	Satisfactory
Quality of Supervision:	Satisfactory	Implementing Agency/Agencies:	Moderately Satisfactory
Overall Bank Performance:	Moderately Satisfactory	**Overall Borrower Performance:**	Moderately Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators			
Implementation Performance	Indicators	QAG Assessments (if any)	Rating
Potential Problem Project at any time (Yes/No):	Yes	Quality at Entry (QEA):	None
Problem Project at any time (Yes/No):	Yes	Quality of Supervision (QSA):	Satisfactory
DO rating before Closing/Inactive status:	Satisfactory		

D. Sector and Theme Codes

	Original	Actual
Sector Code (as % of total Bank financing)		
Central government administration	8	8
Irrigation and drainage	92	92
Theme Code (Primary/Secondary)		
Environmental policies and institutions	Primary	Primary
Participation and civic engagement	Primary	Primary
Rural services and infrastructure	Primary	Primary
Water resource management	Primary	Primary

E. Bank Staff

Positions	At ICR	At Approval
Vice President:	Daniela Gressani	caio koch-weiser
Country Director:	Emmanuel Mbi	Sven Burmester
Sector Manager:	Narasimham Vijay Jagannathan	Prem C. Garg
Project Team Leader:	Jose Simas	Aizad Nawaz Khan
ICR Team Leader:	Jose Simas	
ICR Primary Author:	Juan Morelli	
	Michael J. Sandoz	

F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document**)**

The Project Development Objectives are to: (a) increase agricultural production and farmers income by improving the irrigation infrastructure, facilitating a more equitable distribution of water and improving on-farm irrigation management; (b) improve the long-term sustainability through takeover of responsibility for operation and maintenance (O&M) of the tertiary level irrigation system by the farmers and their sharing in the costs

for tertiary level investments; and (c) strengthen the institutional planning and implementation capacity of the Ministry of Water Resources and Irrigation (MWRI) in the irrigation subsector.

Revised Project Development Objectives (as approved by original approving authority)

(a) PDO Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Increased agricultural production and farmers' income. Measured by the value of their farming net revenues (and value of farm land as a proxy).			
Value quantitative or Qualitative)	No baseline value	30%		6-9%
Date achieved	06/30/1996	12/31/2002		12/31/2006
Comments (incl. % achievement)	Target still to be met because of slow adoption of CF. However, the selling and rental values of land in improved areas grew by more than 30%, realizing the net present value of expected increased income derived from improvements.			
Indicator 2 :	Farmers Organizations WUAs taking full responsibility for O&M of tertiary systems (Meskas) under sustainable basis on project improved area			
Value quantitative or Qualitative)	0 WUA'a 0 BCWUA's 0 fed	2650 WUAs (100%) 67 BCWUA's (100%) 248,000 fed (100%)		2906 WUA's (109%) 57 BCWUA's (85%) 205,000 fed (82.7%)
Date achieved	06/30/1996	12/31/2002		12/31/2006
Comments (incl. % achievement)	Users Associations (in 82.7%) of target area) took over the management of tertiary level irrigation systems and are also improtant institutional platforms for exercising user's voice. 100% target to be attaine at IIP2 completion.			
Indicator 3 :	Strengthen MWRI's capacity in the Irrigation subsector. Measured by the Cost Recovery of O&M coss and of improvement costs at Tertiary level.			
Value quantitative or Qualitative)	O&M cost recovery Individually Investment Recovery 0% 0%	O&M cost recovery 100% by WUA's Investment Recovery 100% by land tax		O&M cost recovery 100% by WUA's Investment Recovery 38% by land tax
Date achieved	06/30/1996	12/31/2002		12/31/2006
Comments (incl. % achievement)	Cost recovery started in 2004 with LE76,237, increasing to LE 1.5 millionby end 2005, LE3.2 million by end 2006, and LE6.4million by April 2007.			

(b) Intermediate Outcome Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Structures completed at Delivery and Tertiary System			
Value (quantitative or Qualitative)	zero	2,939 WUAs		
Date achieved	06/30/1996	12/31/2006		
Comments (incl. % achievement)				

G. Ratings of Project Performance in ISRs

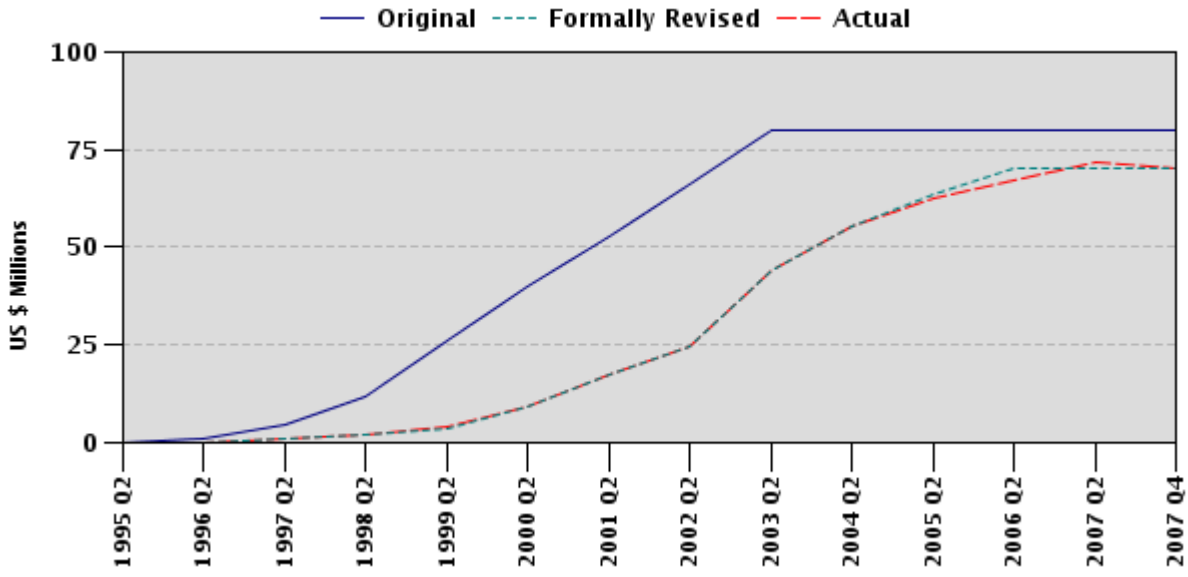
No.	Date ISR Archived	DO	IP	Actual Disbursements (USD millions)
1	03/01/1995	Satisfactory	Satisfactory	0.00
2	06/05/1995	Satisfactory	Satisfactory	0.00
3	07/26/1995	Satisfactory	Satisfactory	0.00
4	02/05/1996	Satisfactory	Satisfactory	0.00
5	05/31/1996	Satisfactory	Satisfactory	0.00
6	08/19/1996	Satisfactory	Satisfactory	0.00
7	09/03/1996	Satisfactory	Satisfactory	0.00
8	04/01/1997	Satisfactory	Satisfactory	1.00
9	10/30/1997	Satisfactory	Satisfactory	1.95
10	03/25/1998	Satisfactory	Satisfactory	2.32
11	11/13/1998	Satisfactory	Unsatisfactory	3.34
12	06/10/1999	Satisfactory	Unsatisfactory	4.44
13	12/27/1999	Satisfactory	Satisfactory	9.40
14	06/13/2000	Satisfactory	Satisfactory	11.39
15	12/08/2000	Satisfactory	Satisfactory	16.89
16	06/20/2001	Satisfactory	Satisfactory	20.78
17	12/12/2001	Satisfactory	Satisfactory	23.65
18	05/14/2002	Satisfactory	Satisfactory	29.08
19	07/24/2002	Satisfactory	Satisfactory	33.72
20	01/10/2003	Satisfactory	Satisfactory	44.28
21	03/11/2003	Satisfactory	Satisfactory	46.52
22	07/22/2003	Satisfactory	Satisfactory	51.04
23	02/27/2004	Satisfactory	Satisfactory	56.67
24	02/27/2004	Satisfactory	Satisfactory	56.67
25	10/12/2004	Satisfactory	Satisfactory	60.43

26	04/27/2005	Satisfactory	Moderately Satisfactory	63.83
27	06/13/2005	Satisfactory	Moderately Satisfactory	63.83
28	09/23/2005	Satisfactory	Moderately Satisfactory	66.19
29	01/18/2006	Satisfactory	Moderately Satisfactory	67.24
30	09/14/2006	Satisfactory	Moderately Satisfactory	70.90

H. Restructuring (if any)

Restructuring Date(s)	Board Approved PDO Change	ISR Ratings at Restructuring		Amount Disbursed at Restructuring in USD millions	Reason for Restructuring & Key Changes Made
		DO	IP		
06/30/2006	N	S	MS	69.02	No major change was done. Last year extension of closing date was to allow: (i) implementation of the pilot W-10 area; and (ii) to test innovative improvements.

I. Disbursement Profile



1. PROJECT CONTEXT, DEVELOPMENT OBJECTIVES AND DESIGN[1]

1.1 Context at Appraisal

Agriculture constitutes an important sector within the Egyptian economy, employing about 23 percent of the labor force and accounting for around 14 percent of GDP and merchandise exports. The agricultural land base is around 8 million feddan (3.3 million hectares). Holdings average less than 1.9 fed (0.8 ha), one of the lowest in the world. The very productive land, particularly in the Delta, is intensively cultivated, and given its agro-climatic conditions and proximity to major markets, Egypt has the potential to attain significant growth in output and income through technology transfer, provision of essential support services to farmers, and the development of post harvest technology and marketing services. The most limiting resource for Egyptian agriculture is irrigation water[A]. Management of its water resources has always been a central feature of the country's development strategy. From a fixed allocation of Nile river water (55.5 billion m^3 a year) Egypt needs to supply water to a rapidly growing population and to newly reclaimed areas, which means that it has to urgently increase water use efficiency as well as crop productivity in both new and existing irrigated areas[B].

The Bank has been in dialogue with GOE on the issue of adoption of a financially sustainable program for managing the irrigation and drainage network, and the IIP became the main evolving instrument for both improvement of on-farm irrigation efficiency and the introduction of cost sharing measures to improve the financial aspects of systems operation and maintenance (O&M). It was estimated that the Irrigation Improvement Project (IIP) would enhance the income of over 654,000 people. At appraisal the project was considered a Poverty-Targeted Intervention (PTI), since 70 percent of project beneficiaries had landholdings of under 1.9 fed (0.8 ha) in size and incomes under the poverty line and close to the ultra poverty line in Egypt. Although employment generation was not specifically mentioned as a higher development objective, the IIP was in line with the key features of the current reform program as it relates to job creation[C].

1.2 Original Project Development Objectives and Key Indicators

SAR PDOs	SAR Monitoring Indicators
(a) to increase agricultural production and farmers income by improving the irrigation infrastructure, facilitating a more equitable distribution of water and improving on-farm irrigation management	Improve main and secondary canals, downstream control structures, distribution control structures, re-use pumping stations. Improve tertiary systems (single-point lifting pumps, lined J section, PVC pipes, efficiency).
(b) to improve the long-term sustainability through takeover of responsibility for O&M of the tertiary-level irrigation system by the farmers and their sharing in the costs of tertiary-level investments	Formation of water user groups and associations, participation, contribution for O&M, acceptability, collection rate/cost sharing of investment, replacement of pumps, adoption of continuous flow.
(c) to strengthen the institutional planning and implementation capacity of the Ministry of Water	Operations of downstream control gates, telemetry system, and use of canal storage; re-use of drainage effluent; irrigation advisory

[1] Main text superscript references numbered A, B, C, etc., refer to endnotes included at the end of the section.

Resources and Irrigation (MWRI) in the irrigation subsector	service; monitoring and evaluation operations; environmental aspects; on-farm demonstrations and training program.

The Project Development Objectives (PDOs) and key monitoring indicators defined in the Staff Appraisal Report (SAR) are summarized in the table above. The project aimed at improvements within three irrigation command areas serving a total net irrigable area of about 248,000 fed (104,200 ha)[D], and key project area, beneficiary and Water User Association (WUA) target values included in the SAR were as in the Table below.

SAR Key Target Values (see Annex 2 for further details)					
Subproject	**Project Area (Fed.)**	**Farmers**	**Population**	**Mesqa WUAs**	**Branch Canal WUAs**
Mahmoudia	131,000	33,500	235,000	1,300	35
Manaifa	42,000	25,800	206,000	520	12
Wasat	75,000	35,500	213,000	830	20
Total	**248,000**	**94,800**	**654,000**	**2,650**	**67**

Source: Staff Appraisal Report, December 1, 1994

1.3 Revised PDO and Key Indicators

None (the original project objectives remained unchanged during project implementation).

1.4 Main Beneficiaries

The direct project beneficiaries were identified in the SAR as being about 95,000 small farmers and their families farming a net arable area of 248,000 fed (104,200 ha). The project was placed in poverty category PTI as indicated at Section 1.1 above. It was estimated that the total of more than 654,000 individual beneficiaries would (i) attain increased incomes resulting from being provided timely and adequate amounts of irrigation water, (ii) avoid a loss in income levels from what would otherwise be a deterioration of soil conditions from usage of drainage water for irrigation, and (iii) save about 34 percent of the costs of pumping irrigation water[E]. Also, the improved efficiency of water use would allow for re-allocation elsewhere of saved water, with benefits accruing to about 100,000 indirect beneficiaries. Health conditions in and around the subproject areas would also be improved, due to reductions in exposure to bilharzia.

1.5 Original Components

The project components as presented and valued in the SAR (including contingency allowances) were as given below[F]. The total estimated project cost was US$ 182.3 million[G]. Financing was to be provided by IBRD (14.7 percent), IDA (29.2 percent), KfW (24.6 percent), the Netherlands Directorate General for International Cooperation (NDGIC, 2 percent) and GOE (29.5 percent).

(a) Irrigation Systems Improvements. This component included (i) Improvement of Main and Secondary Canal Delivery System (US$25.3 million, 13.9 percent of total cost), comprising concrete lining and slope stabilization along about 70 km of main canals and 680 km of secondary canals, replacement of deteriorated old structures including bridges and cross regulators, installation of downstream control gates in secondary (branch and sub-branch) canals and of a telemetry system for centralized remote control of main canal head and cross regulator gates, and installation of pumps at selective locations for controlled reuse of drainage effluent; and (ii) Improvement of Tertiary System (US$126.4 million, 69.3 percent), providing for single-point lifting pumping stations at intakes to about 2,700 tertiary canals (mesqas) and construction

of about 1,000 km of lined and 1,500 km of piped raised mesqas with gated or Alfalfa valve outlets at the heads of quaternary canals (marwas).

(b) Institutional Support (US$13.3 million, 7.3 percent). Support to be provided under this component to MWRI and its implementing agency, the Irrigation Improvement Sector (IIS), was for design and construction supervision and for M&E.

(c) Communication (US$3.6 million, 2 percent). A communication program to achieve general public awareness of water resources scarcity and conservation issues was to be supported under this component at the level of the ministry.

(d) Irrigation Advisory Service (US$10.3 million, 5.6 percent). This component was to provide the IAS with technical support for the organization and strengthening of about 2,650 mesqa-level WUAs and 67 branch canal WUAs (BCWUAs) at the branch canal level, to train WUA members in mesqa O&M, to foster links between BCWUAs and external support agencies, and to assist in the conducting of a communication campaign for farmer awareness of project benefits, issues and training programs.

(e) Environmental Assessment and Management (US$1.4 million, 0.8 percent). This component covered strengthening of MWRI and IIS staff capacity for environmental assessment and management, development of environmental assessment (EA) guidelines covering screening and evaluation of irrigation development projects, and monitoring of water quality particularly in relation to reused drainage effluent and soil water.

(f) On-Farm Irrigation Management Demonstration Program (US$2 million, 1.1 percent). This program was to include provisions and demonstrations on about 50 selected farms of improved irrigation application efficiency and irrigation practices, and of land leveling, selective soil amendments and production inputs and equipment.

1.6 Revised Components

None (the original components were not revised).

1.7 Other Significant Changes

Three important changes to the project as formulated in the SAR were (i) the withdrawal of funding support from the NDGIC, (ii) an increase of 4 years in the project duration, and (iii) the introduction in 2005 of the Wasat W-10 pilot area development to test and demonstrate improved designs[H]. There was also a change in name and structure of the responsible ministry and implementing agency. The client ministry, the Ministry of Public Works and Water Resources, became the MWRI, and the principal implementing agency, the Irrigation Improvement Projects Directorate, was elevated from directorate to sector status within the MWRI and became the IIS. The new names are used throughout this completion report.

2. KEY FACTORS AFFECTING IMPLEMENTATION AND OUTCOMES

2.1 Project Preparation, Design and Quality at Entry

(a) Soundness of Background Analysis

The project was well aligned with both (i) the Bank's Country Assistance Strategy (CAS), which emphasized environmental conservation, sustainability and poverty alleviation through improvement of irrigation infrastructure to enable productivity and income increases, and (ii) the GOE's major priority of conserving water resources, discussed in Section 1.1 above[I]. Lessons from previous Bank projects were built into the IIP design[J]. Project design also drew on experience from previous irrigation sector studies and pilot interventions, including the prior USAID-supported irrigation improvement project[K]. As part of IIP preparation, detailed feasibility studies for irrigation system improvements, supported by a Japanese Policy for Human Resources Development (PHRD) grant, were carried out between October 1994 and July 1995. Loan conditions were adequately complied with before effectiveness.

(b) Assessment of Project Design

Objectives. The three PDOs presented in Section 1.2 above are here assessed as follows:

(i) Objective 1. This first objective emphasized increasing agricultural production and farmer incomes in areas where yields were substantially below national averages, exacerbating poverty conditions in salt-affected drainage-water-dependent areas that were estimated to represent between 60 to 70 percent of the total project area. In addition to reducing water distribution inequities and improving on-farm water management, the proposed irrigation system improvements were expected to result in overall water savings, thus helping towards realization of the GOE's stated water resource management policy, which aims to effect water savings with a view to development of new agricultural areas. The focus on improved water distribution equity and irrigation management, and on increased agricultural production and net income increases for farmers in the project area, was in line with the Bank's lending priorities and strategies, and this on balance is considered to have been a correct and appropriate emphasis[L].

(ii) Objective 2. The second project objective, to form water user organizations to achieve investment cost-sharing and O&M of the tertiary-level irrigation systems by farmers, was considered crucial for long-term sustainability of the projected system improvements. It is clear in retrospect that this project design feature has been instrumental in achieving a degree of local ownership that would not have been possible with a solely-Government institutional design for system management. It is considered that this was a challenging but still realistic objective and one that was again most appropriate.

(iii) Objective 3. The third objective focused on strengthening the institutional planning and implementation capacity of the MWRI in the irrigation subsector. Though the need for this was well-identified, meeting the objective would have been expected to face considerable implementation challenges, given the generally (though not always) poor results of previous similar efforts in the country.

Components. In general the project components were considered to be adequate and conducive to the attainment of the stated objectives. Some specific comments follow:

(i) Improvements of Main and Secondary Canal Delivery System. The project had envisaged extensive application of control systems that were insufficiently developed under the pilot project or untested in the local context. With hindsight, it is thought that a less prescriptive, more flexible and progressive approach to this change would have worked better. Also, CF and downstream control are separate concepts; application of the first of these was and remains a high priority, but introduction of the second represents a further degree of sophistication that arguably should not have been treated as immediately warranted[M].

(ii) Improvements of Tertiary System. This was the project's major component in terms of planned size, cost and level-of-effort. The technical concepts were sound and appropriate, and significant efficiency improvement, operating cost reduction and water distribution equity benefits were expected and achieved. The investment of 70 percent of the project costs into this component is considered to have been well justified[N].

(iii) Irrigation Advisory Service (IAS). This component justifiably and successfully provided for improvement and scaling-up of the prior pilot tertiary-level institutional development efforts through the then recently established IAS. The primary focus given to the mesqa WUAs was pragmatic, making use of the legal framework that had recently been put in place to enable the formation of such organizations. Also of considerable importance for viability and sustainability reasons was the provision for formation of BCWUAs, which were not covered by the existing legal framework. Farmer participation in reviews and agreements relating to the selection of technical options was planned and partially achieved[O].

(iv) Institutional Support. Consultancy input provisions, both local and international, were not enough to cover both the advisory and specialist support functions and the substantial routine liaison and report backstopping tasks that could or would not be undertaken by IIS staff[P].

Organization. The organizational design for project implementation was straightforward and generally adequate. IIS assumed implementation responsibilities, operated from a central headquarters and two field offices, and established a new unit for M&E[Q].

Risks. The major risks identified at appraisal were (i) limited implementation capacity of domestic contractors which could reduce the area improved or could result in delay, and (ii) delay in design of improvement works and procurement processing. These risks were supposed to be minimized by (i) prequalification of contractors and the provision of TA and training of contractors and IIS staff, and (ii) advance actions on procurement and design work using PHRD grants funds. In retrospect it is clear that both risks were underestimated, since in spite of the mitigating measures adopted they both became major causes of delays. Risk assessment did not take into consideration delays in approval of credit agreement by the parliament; thus leading to initial delays in project effectiveness.

2.2 Implementation

The implementation improved substantially with project progress. Positive factors that lead to improved implementation included (i) the support provided by the MWRI minister and the dedication of implementing agency staff, (ii) a good performance by the project implementation consultants in general and their long-term resident manager in particular, (iii) some good contractor performances, generally by the smaller contractors, and (iv) eventual acceptance of the project and recognition of its benefits by a large proportion of the region's farmers and communities both within and outside of the project area. The above indicated major risks identified at appraisal became important factors in delaying project implementation and reducing net benefits. Other factors generating similar negative impacts included (i) the increased costs of system improvements, (ii) insufficient intra- and inter-institutional coordination between implementing agencies, and (iii) underestimation of the difficulties to be encountered in the adoption of CF operations. The withdrawal of Dutch funds from the financing package was partially counteracted by substitute funding from other sources.

Project Duration and Delays. Factors fully or mostly within the control of the GOE and of the MWRI/IIS that resulted in implementation delays included (i) the GOE's long project approval and People's Assembly ratification process (2 years), (ii) a slow build-up in preparation of designs and tender documents, which is attributed in part to uncertainty due to delay in ratification by People's Assembly, (iii) slow tendering of construction contracts, and (iv) slow progress of contracts execution. Board approval occurred in December 1994, but delays in credit agreement approval by the cabinet and ratification by the People's Assembly only allowed effectiveness to occur in November 1996. While there were few designs ready for construction contracts bidding at the start of the project, delay in making necessary decisions lead to initial delays in tendering. Delay in mobilizing the project international consultant has been another cause for delays. The above factors have resulted in late start of disbursements. Preparation of procurement packages ahead of project effectiveness was possible for limited number of packages only because most of the works to be implemented by the project required consultations with WUA's, which were to be formed by the project. However, finalization of these packages and tendering never took place due to lack of decision making by the implementing agency. The progress of planning and design was impeded sometimes by staffing and logistical constraints, and by improper attention to mapping. Procurement processes, which followed GOE general procedures, were sometimes slow and constrictive. Contracts execution progress is discussed separately below. An implementation delay factor largely outside of GOE or MWRI control was farmers' initial skeptical resistance to the proposed improvements[R]. The project was extended twice to allow mainly for re bidding of delayed contracts and completion of the Wasat W-10 pilot. The project was eventually closed on December 31, 2006[S, T].

Performance of Contractors. Prequalification of firms for works contracts was used for most of the project period. The exception was the period 1997-1999, during which open bidding procedures were used. Unsatisfactory outcomes of the open bidding process led to a reversion to prequalification procedures. After generally promising starts, the effects of somewhat low bidding, the use (and misuse) of small subcontractors, and inappropriate management, all of which were then reportedly typical features of the contracting sector in Egypt, became a constraint on progress and performance by the major (mostly large public sector enterprise) contractors. With the devaluation of the local currency from 2001 to 2003 the situation greatly worsened. Later there was a considerable improvement in performance on works contracts let to

small contractors[U]. Overall these circumstances impacted greatly on project duration and had consequent negative effects on costs and benefits. During the latter stage of the project, the implementing agency excluded poorly performing works contractors from bidding.

Cost Escalation. Mesqa systems over-design, and little cost-effectiveness in design and construction solutions in general, led to major cost escalations from the start[V]. These design practices were in line with previous projects. Further substantial cost escalations in more recent years were due to (i) backfilling of old mesqas with large volumes of imported material, (ii) responsiveness to WUAs requests resulted occasionally in cost increases that was aggravated in part by non clarity of cost element in the negotiations process, (iii) the nature of re-tendered mesqa completion contracts, and (iv) high general inflation levels. The higher recent costs gave grounds for concern by both the financing agencies, in relation to the economic feasibility of the investments, and by farmers, in relation to their ability and/or willingness to make payments for capital cost recovery. As a result of these concerns, new improvement concepts and designs were implemented in the W-10 pilot area. These led to significant cost reductions, and, as the pilot area development process advances, more such cost reductions are expected.

Agency Coordination. Inadequate intra- and inter-agency coordination and interaction resulted in a general isolation of project implementers from operation/extension/support agencies and users. There was a fragmented and compartmentalized MWRI setup for implementation with little provision for synergic activities. IIS planners, designers and supervisors had little technical contact and interchange with the system operators and service providers of IS, CD-IAS and MALR, with the farmers, and even with the IIP's own IAS. There was some improvement in this towards the end of the project[W].

Introduction of Continuous Flow Operations. The adoption of CF at peak time demands (May/June) is increasing slowly by slowly and will take more time than anticipated at appraisal. The ex-post analysis of slow adoption of CF in the improved areas shows that it is a result of number different factors: (i) lack of good coordination and better cooperation among the sectors in charge for design/implementation (IIS) and operation and maintenance (IS); (ii) substantial increase of rice cultivation during summer (peak demand time) beyond the capacity of the branch canals; (iii) the prevailing flow restrictions on the main feeder canals due to obsolescence and disrepair; (iv) lack of proper sequencing of implementation of CF of fully completed command area and their relevant feeder canals and branch canals from upstream to downstream of the main systems; and (v) lack of proper training, incentives, and motivation of IS operational staff. The establishment of CF regime operations will require a more complex process than was originally appreciated, and more time and greater effort will be needed to achieve this[X]. The current institutional setup, resources, directives and procedures for systems operation by branch canal rotations will require substantial adjustments to achieve a system-wide conversion to CF operations[Y]. Another requirement, to prevent current and expected future over-demand by farmers and consequent overall water shortage, will be application and observance of mandated or design limits on rice cultivation[Z].

W-10 Pilot Area. The pilot area development was a new initiative, commenced in 2005 to test and demonstrate improved designs. To date it has served to clearly demonstrate the cost effectiveness and benefits of a number of both physical and procedural improvements, including (i) the use of satellite imagery for planning and design, (ii) appropriate reduced or modified pump, pumping station, pipeline and control valve capacities and specifications, and

electrification of pumping stations, for improved mesqa systems, and (iii) the introduction of marwa improvements, primarily pipeline-based, through cooperation between ministries and with water users[AA].

Implementation Consultant. Consulting services for implementation were funded by KfW, and a main consultant joint venture led by an international consulting firm was selected and engaged. Their performance was considered to have been satisfactory in all engineering matters and moderately satisfactory on M&E aspects. The long-term and high-level dedication and effort given to the project by the consultants' resident manager merits special mention.

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

The M&E program was designed to measure a number of indicators directly related to the PDO and outputs of the project. There was no effective baseline study, and use of only indirect data to measure employment generation or poverty alleviation effects was foreseen[BB]. The M&E design, which incorporated a large number of indicators, was too complex and ambitious for the agency involved. In spite of significant TA support efforts, the M&E unit proved to be too weak to manage the overall M&E program and to extract relevant findings. With the exception of two remote sensing studies that were carried out in 2000 and 2006, data collection followed conventional approaches such as sample surveys using questionnaires, while limited or insufficient use was made of methods such as focus groups, case studies, participatory rural assessment, etc. Delays and shortcomings in both M&E designs and system improvements have led to the M&E activities carried out so far being inconclusive and insufficient to enable a proper assessment of the IIP. In any case however, a full impact assessment of the IIP will not be possible until the CF regime is fully operational and its effects can be determined. During the latter stage of the project, the KfW review mission reported that IIS-M&E unit has started to play its expected roles.

Construction Quality. Quality of construction was generally acceptable, at a moderately satisfactory level, for the secondary system improvements (branch canals, bridges, cross regulators, distributors and tail end escapes). For the mesqa (tertiary) system improvements, which represent 70% of the project investment, construction quality was considered satisfactory. In the improved mesqa systems, the pump house finishing and hydraulic fittings were below standard in most of the cases, and the big alfalfa pipeline outlet valves showed short life spans, below the expected 15 years at less than ten years, due to both failures and vandalism. Pump sets, fittings and alfalfa valves will soon need to be replaced[CC].

2.4 Safeguard and Fiduciary Compliance

Environmental Management

The main focus of the environmental management initiatives were (i) setup and staffing of an Environmental Unit (EU), (ii) development and implementation of site specific Environmental Management Plans (EMPs), (iii) environmental screening for any new drainage water reuse pumping stations, (iv) environmental training for senior management staff, (v) procurement of water quality monitoring equipment, (vi) M&E of canal and drain water quality and monitoring of soil quality, (vii) review of water quality guidelines, and (viii) gender activities. The EU was established and carried out the above mentioned activities with support from the project

implementation consultant. EMP development and implementation activities were undertaken to address solid waste and sanitation problems in each of two selected pilot command areas. Environmental training, water and soil quality monitoring, and gender activities were all undertaken to some extent over the course of the IIP. Follow-up environmental management activities are planned and expected to take place under the new IIIMP. Supplementary details are provided in Annex 2. The IIP is seen to have had substantial positive environmental and social impacts, including land and water quantity and quality savings and improvements, reduced exposure to water-borne health hazards (e.g. bilharzia), reductions in carbon emissions (diesel use), improved community management organizations (WUAs), greater equity in access to water resources, and increased net incomes. Potentially negative environmental impacts could occur outside of the project area (e.g. from additional agricultural chemicals), in areas where new agricultural developments could be made possible by project-generated water savings. The credit agreement contained a covenant pertaining to bilharzia (shistosomiasis) snails, and this was complied with.

Financial Management

The IDA credit of XDR 35.7 million was fully disbursed with only XDR 500.34 remaining. The IBRD disbursements amounted to 85% of the signed amount leaving an undisbursed balance of US$ 3.82 million. Occasional deductions were applied by the Bank to withdrawal applications for the amounts of ineligible expenditures claimed as part of the applications, particularly in 2002 and 2003. The project recording and reporting were handled by the IIS, who maintained complete project records and issued periodic reports for the project financial position. More detailed breakdowns at the component and subcomponent level could have helped better track the project's actual performance against planned activities. The project audits were carried out by the Central Auditing Organization and reports have shown some shortcomings with regard to disclosures. The audit reports were generally submitted on time with few exceptions.

Procurement

Procurement of works, goods and services was in general effected satisfactorily by the IIS. In its capacity as project management unit, the IIS was able to nominate and train suitable procurement staff and to develop a procurement section that complied with Bank standards. Concerning the procurement of implementation contracts, the principal features of note during the course of the project had to do with (i) pre-or post-qualification of works contractors, (ii) the failure of large works contractors, and (iii) cancellations and re-tendering of works contracts. Generally, prequalification processes were used. Open bidding processes were carried out in one early period, but they gave poor outcomes and were not used again. Later, after all major works contracts had been let, mostly to large public enterprise contractors, the project began to suffer from non-performance and failure of the larger contractors. The subsequent process of contracts cancellation, re-packaging and re-tendering seems to have been pursued with some effort by MWRI/IIS but hindered by other separate GOE considerations. At the end of the project some such contract issues remained to be resolved by the MWRI as a step towards arranging for completion of outstanding works. For the future, limiting the use of complicated ICB procedures for the simple types of works being executed, and more frequent pre-qualification processes and/or open bidding procedures with well-considered post-qualification processes, together with improved price adjustment, bid evaluation, construction supervision and capacity building measures and arrangements, would seem to be called for. The procurement processes followed

general GoE procedures were time consuming on occasions and focused on occasions on procedures rather than on results. Supplementary details are provided in Annex 2.

2.5 Post-Completion Operation/Next Phase

The IIP project has been moving smoothly into the operational phase, but with a slower than expected changeover of completed canals from rotational flow to CF operations. The IIP transition from implementation to operation overlaps with the on-going W-10 pilot area improvement works[DD] and the current Integrated Irrigation Improvement and Management Project (IIIMP)[EE]. WUAs are dealing with O&M of the tertiary system and BCWUAs are beginning to be involved in the management of some branch canal systems[FF]. Farmers are now overwhelmingly positive about the improvements, and the approved cost recovery scheme - in line with the IIP's original plan - is already being enforced and working smoothly. The changeover to CF operations, although more problematic than expected, is the subject of on-going MWRI efforts to overcome operational constraints. Also, under IIIMP, an approach to implementation and completion is being developed that will follow an upstream-to-downstream full sub-command area sequential development process, since this is perceived as being a main pre-requisite for introduction of CF operations[GG].

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

The relevance of the IIP objectives and design in relation to GOE and Bank policies and strategies at the time of project appraisal was discussed in Section 2.1 above. Over the course of the project development priorities in Egypt essentially remained the same, and so the relevance of IIP continues to be very high. IIP implementation aspects have also been discussed above. The institutional situation in Egypt has not normally been conducive to rapid and efficient implementation of projects in the agriculture and water sectors, or in various other sectors for that matter. Recent indications of improvements in this area, including late IIP and early IIP2 and IIIMP implementation performance, have been encouraging. Certainly the IIP implementation experience has provided relevant and important lessons to help expedite continuing and future similar development efforts.

3.2 Achievement of Project Development Objectives

The project was ambitious in its design and had challenging targets. At project end the IBRD/IDA portion could be considered as more than 95% complete in terms of infrastructure and socio-institutional development targets; remaining items are being completed by GOE with local funding. The outstanding KfW portion, representing almost 20 percent of the project area, is being completed under the KfW-funded IIP2 supplementary operation. At the time of this completion report, agricultural output had not yet shown significant increases, due to delays in the adoption of CF operations, but farmers' incomes had already significantly improved, due primarily to reductions in irrigation costs of around 40%, and there had been a late positive shift in some agency officials' attitudes towards a general recognition of the benefits relating to CF operations. The IIP's water user organizational and managerial sustainability and ownership objective is considered to have been met, with WUAs successfully operating and maintaining their mesqa systems, BCWUAs preparing to co-manage CF in branch canals, and the mesqa

system investment cost recovery mechanism being widely accepted by farmers and increasingly applied through the land tax collection system (see Borrower's Report, Annex 7, page 6). Regarding the MWRI capacity strengthening objective, even though institutional capacity is still limited, MWRI has been gradually undertaking a re-engineering of sector policy and internal institutions to enhance its own capacity and stakeholders involvement in planning, implementing and managing the water systems. The IIP's clearest benefits so far derive from irrigation pumping cost savings and water distribution equity improvements, resulting from the overall physical system improvements, the tertiary system investment co-financing with users, and the strengthening of farmer organization and cooperation through the newly created WUAs[HH]. The overall impact of the project is delayed by the difficulties of application of CF operations[II]. In canals where CF is being applied - even though often only partially and intermittently - all parties, including farmers, MWRI staff and MALR agricultural extension staff, are positive about the experience. In these cases, most of the expected benefits of CF have already been realised, even though they cannot as yet be properly quantified[JJ]. The main reason to rate the DO outcome as moderately satisfactory instead of satisfactory is related to the ERR analysis that came to 15.0% instead of the 25.2% as anticipated at appraisal. This candid result of ERR is linked to the agriculture production and productivity data made available by the implementing sector and presented to the ICR team at the mission time, which was obtained from the Field Survey dated 2005. The evolution of the productivity is likely to increase over the next two to three years as the unfinished parts of the project, mostly financed under the KfW IIP-2, is completed and CF application expands.

3.3 Efficiency

Economic Analysis		
Time of the Analysis	**ERR (%)**	**NPV (in US$ million)**
Staff Appraisal Report (SAR)	25.2	203.5
Implementation Completion and Results Report (ICR)	15.0	165.2

The ICR estimation of the expected ERR considering what has actually been achieved is 15 percent, and the corresponding NPV at 12 percent discount rate is US$165.2 million. Even though these results are positive, they are significantly lower than the ERR of 25.2 percent estimated at appraisal, and are more in line with the Mid-Term Review (MTR) assessment of 16.4 percent. The underlying assumptions for estimating SAR, MTR and ICR costs and benefits are similar and are presented in Annex 3. The reasons for the reduced expected impact are (i) the still limited application of CF in the distribution system, resulting in persistent lack of equity in water availability and delayed yield increases in canal tail-end areas (two thirds of the project area), (ii) low on-farm adoption of improved crop and water management technologies, (iii) unimproved areas not showing the foreseen reduced yields from continued use of low quality drainage water for irrigation to compensate for the shortage of fresh water in downstream reaches of canals, (iv) the increased costs of improvements (see Section 2.2), and (v) an 18 percent reduction in the projected improvement area (205,000 fed improved out of 248,000 fed projected). Compensating positive factors are (i) higher than foreseen irrigation cost reductions, due to higher economic prices for saved diesel fuel, and (ii) higher prices for most of the agricultural products, resulting from significant price increases over the last two years. It is noted that ICR efficiency estimations are considered conservative, since they are based on farmers' surveys carried out until mid 2005, at which time CF operations were impacting only 9% of the sampled farmers. It is expected that, as the extent of CF operations increases, yields will also increase, and hence the ERR should likewise improve.

The project is not expected to have fiscal benefits. Major facilities such as dams, barrages, levees, pumping stations, main canals and drains continue to be funded and maintained through the GOE budget, and farmers have also traditionally maintained their mesqas. The new tertiary system cost recovery scheme being implemented only recovers the investment costs of improved mesqas; farmers, now through their WUAs, continue to be responsible for.mesqa system O&M costs.

3.4 Justification of Overall Outcome Rating

Rating: Moderately Satisfactory

Ratings by component are shown in the following table. The weighted scoring outcome for the overall project would be closer to a rating of satisfactory, but the ICR team considered that the delays in implementation and in the adoption of the CF regime for operations, together with the unbalanced emphasis given to the on-farm component, which has compounded the delay in achieving expected agricultural productivity increases, should warrant an overall rating of marginally satisfactory. Component-by-component rating details are provided in Annex 2.

Project Outcome Ratings by Component

Components	Project Costs (SAR) US$ million	Project Outcome 1/ Rating	Value	Weight over Base %	Contribution to PDO Value
(a) 1. Improvement of main & secondary canals	25.3	MS	4	13.9	0.556
2. Improvement of tertiary system	126.4	S	5	69.3	3.465
(b) Institutional Support	13.3	MU	3	7.3	0.219
(c) Communications	3.6	MS	4	2.0	0.080
(d) Irrigation Advisory Services	10.3	MS	4	5.6	0.224
(e) Environmental Assessment & Management	1.4	MS	4	0.8	0.032
(f) On-Farm Irrigation and Demonstration	2.0	MU	3	1.1	0.033
Physical and Price Contingencies	42.7			-	-
Total Project	182.3	MS		100.0	4.609

1/ Highly Satisfactory (HS) = 6; Satisfactory (S) = 5; Marginally Satisfactory (MS) = 4;
Marginally Unsatisfactory (MU) = 3; Unsatisfactory (U) = 2; and Highly Unsatisfactory (HU) = 1.

3.5 Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development

The project has demonstrated its potential for enhancing agricultural productivity and farmer incomes, and hence for alleviating poverty, through the improving of the physical and operational status and efficiency of irrigation systems. With the further expected adoption of CF operations, the equity disparities affecting small tail-end farmers will continue to reduce. As the IIIMP and other future projects expand the IIP-validated improvements, these benefits will likewise extend to large portions of the overall irrigated area in Egypt where poverty is concentrated. Furthermore, the resulting expected water savings should allow for some significant re-allocations of the country's fixed share of Nile river water to help meet the increased demands of the growing population, and to develop new irrigation areas where mostly high value cropping would occur, generating jobs and income opportunities and hence contributing to social development. Increased rental and land values stemming from the improvements are a clear indicator of real IIP-generated assets being transferred to beneficiaries

that are mostly poor. With regard to gender aspects, the IIP's primary contribution has been facilitation of social and environmental improvement through its support for formation and organization of water user organizations. These have both male and female members, and the organizations serve as vehicles for improving the participatory identification and resolution of a broad range of community issues in the areas of water quality and availability, and related health and sanitation, extending also to education and capacity building both in these areas and in organizational and financial management and administration.

(b) Institutional Change/Strengthening

Mesqa WUAs are generally seen to be functioning well, including the collection and use of fees for mesqa O&M and the annual payments of capital cost recovery installments, as per the amendment of the Irrigation Law of 1984 introduced before appraisal. Also, BCWUAs are established to oversee and integrate O&M of the branch canals and drainage networks, even though they will be unable to properly assume these responsibilities until a corresponding legal framework is put in place. These achievements represent a major accomplishment for MWRI, since institutional reforms of this nature and scale had never before been attempted and carried out in Egypt. Conversely, there were shortfalls in terms of participation by WUAs and system operating agencies in the planning and design of system improvements, and in their subsequent execution, transfer and operational start-up. Also, although WUA establishment objectives were well met by the IIS-IAS, it was not apparent that adequate provisions had been made for continuing suitable post-implementation technical and administrative support for them[KK]. Finally, the IIS has not, to the extent that might have been expected or wished for, developed its capacity and ability to efficiently, transparently and cost-effectively plan, design, contract, supervise and transfer irrigation sector developments in accordance with basic internationally-accepted standards[LL].

(c) Other Unintended Outcomes and Impacts (positive or negative)

The originally unforeseen W-10 pilot area development was commenced under the IIP and is continuing under the IIIMP. It has been successful in implementing and validating IIP design modifications and innovations, leading to further water use efficiency gains and reductions in both investment and recurrent costs. Systems electrification is also generating substantial environmental benefits through the near elimination of carbon emissions from numerous old small diesel pumps.

3.6 Summary of Findings of the M&E Farmer Surveys

M&E surveys began in 2002 and continued until mid 2005. Main findings showed that the IIP provided (i) significant reductions in irrigation costs including mesqa O&M costs and irrigation labor time requirements, (ii) some improvements in the equity of water distribution between mesqa heads and tails, (iii) prevention of tail-end water losses from low-level mesqas to drains, and (iv) enhanced convenience for irrigation. The main reported perceived problems with improved mesqas were (i) some difficulties with pumps maintenance including technical expertise and availability of spare parts, and (ii) insufficient pump discharge capacities. Water shortages and short water availability periods were still common problems facing farmers in both unimproved and improved areas, attributable to delays in introduction of CF operations, but

these problems seemed to be less severe in the improved areas. There was also a general downward trend in the use of low-quality drainage water in tail-end areas[MM].

4. Assessment of Risk to Development Outcome

Rating: Moderate

The risk to development outcome relates primarily to the not yet fully achieved effective application of CF regime operations to branch canals, which is needed to permit the realization of expected benefits. In relation to sustainability of improved tertiary systems, adequate O&M seems to be fully assured, given the achieved operating cost reductions, farmer commitments to investment costs recovery, and the strengthened institutional arrangements provided by the new legally constituted and empowered WUAs. There may be some small risk to WUAs sustainability from the as-yet-inadequate provisions for post-implementation technical and administrative support.

5. Assessment of Bank and Borrower Performance

5.1 Bank Performance

(a) Bank Performance in Ensuring Quality at Entry
Rating: Moderately Satisfactory

The Bank contributed strongly to the design of an improved and evolved project for irrigation improvements, building on previous initiatives as indicated in Section 2.1(a). At loan approval, the state of project preparation was not as required (OMS 2.28[NN]), since there were no detailed designs prepared. This is mainly due to the fact that final designs of most of the works to be implemented under the project require consultations with the WUA's that were to be formed by the project after effectiveness; however, some categories of works and goods packages could have been prepared ahead of project effectiveness. This was not achieved because of lack of decision making on the side of the implementing sector. Also, the procurement capacity was under-estimated, and IIP technical provisions at entry proved to be insufficient to overcome some identified previous project shortcomings. Significant over sizing of pumps and other components, and resulting escalation of costs of the improvements, could perhaps have been avoided if the MWRI staff resistance to adoption of CF, together with other conceptual, technical and institutional shortcomings, had been better identified, assessed and addressed.

(b) Quality of Supervision[OO]
Rating: Satisfactory

During implementation the Bank was proactive and flexible in overcoming the various implementation problems, and diverse actions were suggested and agreed upon with the supervision missions to accelerate implementation and enhance project performance[PP]. Having implementation follow up by staff, stationed in the resident mission has proven to be effective. Bank pressure to overcome design problems, over sizing of works and equipment, and delays in application of CF operations, or to find solutions to implementation and/or cost escalation problems are clearly registered in the missions' aide memoirs. Bank missions in the last years of implementation were most effective in introducing and piloting several design innovations.

(c) Justification of Rating for Overall Bank Performance
Rating: Moderately Satisfactory

5.2 Borrower Performance

(a) Government Performance
Rating: Satisfactory

The government was effective in introducing investment cost sharing practices to improve sustainability of irrigation improvements, thus applying a lesson learned from the prior USAID project evaluation. The minister of MWRI himself was always highly interested in the project, supported its objectives and facilitated its implementation, and this continued for the later W-10 pilot area and IIIMP developments. The implementing agency managed to move forward with large scale implementation of this complex project even though there was number of adverse conditions; such as initial resistance by farmers, devaluation of local currency and institutional fragmentation. There was remarked improvement in the implementing agency performance during the later stage of project implementation. The government was less effective in resolving three further lessons learned from the prior evaluation, relating to (i) shortage of staff to accomplish project goals, (ii) lack of coordination between farmers, IAS and agricultural extension staff for improvement of water conservation and crop yields, and (iii) endemic construction delays due to late starts and lack of experience of contractors. GOE/MOIC resistance to engagement of consultancy support under credit or loan provisions resulted in insufficient project TA and support[QQ]. Also, Budget allocations to the project were sometimes deficient, and IIS management appointments were subject to disruptive rotations.

(b) Implementing Agency or Agencies Performance
Rating: Moderately Satisfactory

The MWRI through its implementing agencies managed to successfully improve the physical distribution system, secure sustainability and ownership through the new mesqa WUAs and BCWUAs, and implement a capital cost recovery mechanism linked to the land tax and widely accepted by the farmers. There has also been a noted positive attitude shift towards a general recognition of the benefits of CF operations, and activities are ongoing aimed at enhancing the integrated involvement of all stakeholders in water system developments. Less positive have been deficiencies in effective implementation and coordination management by IIS, which led to unnecessary disruptions, delays and outcome shortfalls[RR]. Construction supervision, although made harder by poor contractor performances, was generally satisfactory.

(c) Justification of Rating for Overall Borrower Performance
Rating: Moderately Satisfactory

6. LESSONS LEARNED

The present completion report was being prepared during the period of initial implementation of the IIIMP, which provides an opportunity to incorporate IIP lessons learned, particularly in relation to changing from rotational to continuous flow operations. The identified IIP lessons learned are as follows:

(i) Avoiding Initial Delays Arrangements with GoE should be made to avoid initial delays due to delay of approval by the parliament. Procurements should be packaged and be prepared so that the procurement process should be ready to start at effectiveness. In case of works that require consultations of farmers, the process of forming WUA's should start ahead of project effectiveness if possible.

(ii) Taking to Scale of Piloted Innovations and Adoption of Continuous Flow Operation. Piloted innovations that are not fully proven should probably be taken to scale through further progressive piloting; main and branch canal physical and operational measures for implementation of CF regimes should preferably be defined and established in advance of mesqa improvement programs, perhaps best through a separate TA exercise directly with and for the responsible system operating agencies; and a full main canal command area approach to integrated development of irrigation system physical and operational improvements should be adopted, with a strict upstream-to-downstream sequencing, packaging, execution and completion of implementation of improvement works and institutional organizations and arrangements, by fully consolidated sub-command areas served directly from main canal outlets;

(iii) Achieving Cost Effectiveness and Controlling Costs Escalation. Delivery system improvements should be effected in advance of mesqa system improvements, to reduce stakeholder pressures and perceived needs for oversized system components; there should be greater and more effective design intervention, technology transfer and overview by experienced international experts, to ensure technical suitability and cost effectiveness of works designs; greater use should be made of cost-effective prefabricated elements for typical structures required in large quantities; there should be explorations and negotiations with local suppliers during the design process, with regard to future provision of desired but currently unavailable materials and equipment; and there should be an initial participatory planning and preliminary design process to develop technical options and their corresponding costs and benefits, followed by adequate presentation to, discussion with, and consent-securing from, system user organizations and operating agencies, prior to finalizing intervention designs;

(iv) Improving Procurement Processes, Contractors Performance and Reducing Implementation Delays. The use of ICB procedures for works types and sizes implemented under this project are not adequate. Capacity building of procurement staff is essential and frequent procurement training need to be conducted at all levels involved in the different stages of the procurement processes. Future project works should not be entrusted to the generally larger contractors that have previously performed poorly; some smaller contractors have generally developed their experience and performance to the point where they can now deliver satisfactory contract outcomes; contract packages should if possible be small enough for incipient private civil works contractors to manage comfortably; consideration should again be given to open bidding of the improvement contracts, with suitable post-qualification of contractors, to further develop smaller contractors' capacity and accelerate construction progress; and improved construction management and supervision arrangements, for better quality control and reduced disruptions and delays, should be made.

(v) Developing Sustainable O&M Organizations and Arrangements. There should be early presentation, discussion and agreement with WUAs and system operating agencies on development plans and preliminary designs; establishment of WUAs and O&M training should

be effected in parallel and perhaps jointly with similar institutional development and capacity building for system operating agencies; greater emphasis should be given to proper and relevant O&M training for irrigation and drainage system water users; and firm and suitable arrangements should be put in place and activated for continuing technical and administrative support to the WUAs, by CD-IAS and possibly in coordination with a suitable unit within MALR's extension department;

(vi) Ensuring Satisfactory Institutional Priorities, Processes and Coordination. Implementation consultancy quality assurance and support provisions should be increased to better compensate for implementation agency capacity shortfalls; there should be more effective, efficient and rapid processes and procedures for procurement and management of contracts; and there should be more rigorous review and approval processes implemented for specific institutional, O&M, water management, agricultural and training programs; and

(vii) Ensuring Integrated and Complete Irrigation System Improvements. Irrigation system improvement packages should include for and integrally address deficiencies in main and branch canals, mesqa and marwa systems, and on-farm systems[SS]. Limiting improvement packages to mesqa systems without properly attending to provisions for CF operations in the delivery system will limit the corresponding benefits. Similarly, marwa and on-farm improvement packages without needed higher system level interventions will also fail to yield desirable benefits.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

(a) Borrower/implementing agencies

The Borrower's report (included at Annex 7) considers that the objectives of the project were appropriate, reasonable and in line with the government objectives[TT]. Implementing Egypt's policy on cost sharing arrangements, establishing Water Boards, and forming WUAs for mesqa O&M, was considered to be a major step towards irrigation subsector institutional reform, which will serve to help decentralization, free the MWRI from some burdens, and change its role from operational to strategic interventions and supervision. The application of the cost recovery concept ensures sustainability of the irrigation improvement program as the funds recovered would be used in extending improvement works to other irrigated areas. The Borrower considers that the IIS, the IS and the IAS staff, as well as the MALR, have done their best towards letting the IIP achieve its goals and the best possible results. However, it was recognized that the IIP was ambitious, complicated and multi-dimensional. During its preparation it was hard to foresee the constraints and implications of some of the proposed interventions. The delays in the improvement works and in the measures aimed at the introduction of CF operation are seen as being outside the control of the implementing agency[UU]. It was difficult to assess the impact of the IIP on goals such as water savings since it will take some time to complete application of CF operation and for its impact to materialise.

(b) Co-financiers

The KfW report (included in Annex 8) shares largely the main findings of the ICR, mainly the achieved outcomes, implementation problems and the risks. The main deficiencies are incapability of the large public enterprise works contractors to implement their contracts properly

and late involvement of the IS. While the inability of MWRI to merge CD-IAS and IIS-IAS is considered a bottleneck for provision of post-implementation support to WUAs, KfW does not agree that MALR should have a leading role in post implementation support for WUA's. While KfW agrees with ratings for subcomponents, an overall outcome rating of Satisfactory is justified. The main benefit of the IIP is the preparation of small scale farmers for periods of water scarcity, a condition that was not encountered in the past few years, even though highly probable in the project areas. The comparison of yields between project and non-project areas for non-scarce water period will not show significant differences.

(c) Other partners and stakeholders
(e.g. NGOs/private sector/civil society)

Not applicable.

[A] Egypt's irrigation system extends some 1,200 Km. from Aswan to the Mediterranean Sea, and includes two storage dams at Aswan, seven major barrages on the Nile that divert river water into canals, and over 31,000 km of irrigation canals that serve the agricultural lands. The canals deliver water into "mesqas", which are channels serving 100 to 500 fed. Mesqas in turn feed "marwas", which are farm ditches serving 10 to 100 fed. The mesqa and marwa systems are owned, operated and maintained by farmers. Distribution and farm-level delivery of water occurs in accordance with a complex framework of canal-level rotation coupled with rotation between farmers at the mesqa level. Typically, farmers in historically cultivated old lands receive water in the mesqas one-half meter below the elevation of their fields and then pump it into their marwas.

[B] The most pressing problems confronting the irrigation system are the limited control provided by canal structures (many of which are only partially functional), inadequate system operations, and inequitable distribution of water at the tertiary level (where 60 to 70 percent of farmers, at tail-end locations, receive very little water). In this situation, good agricultural water management is considered a key factor in ensuring food security, poverty reduction, and environmental protection. Egypt, after ages of expanding irrigation areas and improving productivity, faces a growing crisis from poorly performing irrigation schemes, slow modernization, declining investment, constrained water availability, and environmental degradation.

[C] At the World Bank MNA Region Conference on Job Creation and Skill Development, Cairo, Egypt, December 2005, H.E. Dr. Mohei El Din, Minister of Investment, indicated that "To ensure the sustainability of job creation, the reform agenda needs to have a lasting impact on building human capital, creating an investment climate and capturing opportunities for equitable growth that can be offered by sound labor, social and economic policies".

[D] The three project irrigation command areas were Mahmoudia in Baheira, and Manaifa and El Wasat in Kafr El-Sheikh governorates. Existing main and secondary delivery system canals were to be improved and provided with control structures, telemetry systems and mixing stations for reuse of drainage effluent. The tertiary systems were to be developed through provision of single-point lifting pumps and lined or PVC pipe tertiary laterals. The Irrigation Advisory Service (IAS) was to be developed to assist with organization of farmers into Water User Groups (WUGs) at the tertiary level, now denoted mesqa Water User Associations (WUAs), and Branch Canal WUAs (BCWUAs) at the secondary level, and to provide corresponding training. Institutional support was to be provided through a communication component at both ministry and project levels, specialized services for monitoring and evaluation (M&E), environmental management and monitoring programs covering water quality and agricultural chemicals, on-farm irrigation management demonstration programs, and a training program both in-country and overseas.

[E] The principal farmer income increases in the improved areas were expected to result from: (i) the continuous flow (CF) canal operation system to be introduced, allowing for on-demand provision of irrigation water to tail-end farmers and reduction of over-irrigation by upstream farmers, leading to improved productivity in the whole command area; and (ii) the improved mesqas and the use of single-point lifting pumps, leading to a significant reduction in pumping costs, better irrigation timings, improved water distribution equity, and reduced farmer time and effort inputs for irrigation allowing for greater concentration on improved crop and cultivation practices. Further project activities aimed at demonstrating better agricultural practices (primarily land leveling) and improved on-farm irrigation management techniques were also expected to help in increasing agricultural productivity. On the first of these, one envisaged consequence of more equitable water distribution was to halt the decline of productivity and/or to improve crop yields in salt-affected downstream areas, by reducing or eliminating the dependence on drainage water for supplementary irrigation that was a feature of about 60 to 70 percent of the project area. CF operations would also provide farmers with greater flexibility and opportunities for diversification into higher value cropping.

[F] Component descriptions with costs from the SAR text are here corrected to be compatible with the project cost summary also presented in the SAR.

[G] The total estimated base cost of the project was US$139.6 million. The addition of physical and price contingency allowances of US$18.4 million and US$24.3 million respectively led to a the total estimated project cost of US$ 182.3 million.

[H] The expected grant financing from the NDGIC for technical assistance (TA) and training, amounting to US$ 3.7 million (2 percent of the total), was withdrawn at an early stage due to their decision to continue targeting drainage rather than irrigation issues with their assistance; this primarily affected the project's communication and environment components which were then largely funded from KfW and GOE sources. The project was planned to have a duration of 8 years and a closing date of 12/31/2002; for reasons described later in this document there were four time extensions, resulting in an implementation period of 11 years and an eventual project closing date of

12/31/2006. Design improvements implemented in the W-10 pilot area included electrification and substitution of diesel by electric motors in the single-point lifting pumping stations, adoption of new design criteria for sizing of piped mesqas, and development and execution of an agreement with the Ministry of Agriculture and Land Reclamation (MALR) to develop a participatory and cost sharing program with farmers for improvement of marwas (quaternary-level systems).

[I] The national strategy to achieve the water policy objective has been to improve the irrigation systems for about 3.5 million fed by the year 2017, to reduce the volume of water lost to the sea, and to promote reuse of wastewater and drainage water.

[J] The Bank/IDA at the time had financed (i) a GOE drainage program totaling US$358 million, covering areas of about 3.26 million fed for open drains and 3.24 million fed for pipe drains, and (ii) a first pumping stations rehabilitation program.

[K] IIP design incorporated, improved upon and scaled up some of the various previously-identified physical infrastructure improvement concepts (branch and sub-branch canal system adaptations for continuous flow (CF) operation, provision of single-point lifting pumps at mesqa intakes, and the piping or raising and lining of mesqas, all new concepts for Egypt at this scale of intervention) and institutional development concepts (establishment of WUAs for O&M at the mesqa system level, also not previously attempted in Egypt on an extensive basis). Additional innovative proposed and adopted IIP interventions included (i) an extension of the institutional development effort to include formation of BCWUAs, and (ii) environmental management provisions, not previously a feature of similar projects. The basic package of physical irrigation improvement measures included (i) improvement of the water control and delivery system to allow for the introduction of CF in the branch canals (in place of the rotational flow system whereby branch canals receive water intermittently in rotations of normally one day in five during the summer irrigation period), and (ii) improvement of the tertiary systems by converting the mesqas to low-pressure buried pipelines and/or high-level J-section lined open channels, serving a number of marwas and supplied by single-point lifting of water from the branch canal through a collective pumping station at the head of each mesqa (replacing the existing system of multi-point lifting from low-level mesqas into individual marwas or fields). The physical improvements were to be accompanied by the establishment of (i) a BCWUA to participate in implementation and management of the improved system at each branch canal level, and (ii) a WUA for O&M of each improved mesqa.

[L] Project area crop yields were significantly lower than the rather high national averages for most crops, and hence some important agricultural production improvements could realistically be expected. Coupling this with large reductions in the costs of production, resulting from cost savings associated with the system improvements, led to a foreseen substantial improvement in net financial benefits for farmers and in good economic returns for Egypt.

[M] The main and secondary delivery system improvement component was to contribute to the first project objective by (i) addressing physical security, reliability and efficiency of the main and secondary system through localized important concrete lining, slope stabilization and structures repair and replacement works, and (ii) attending to important hydraulic and operational regime, control and efficiency aspects of the system; all this in support of the main tertiary system improvement interventions. The former was well conceived, but the latter suffered from some shortcomings in formulation. The concepts and issues relating to CF regimes, operational control based on downstream demands, telemetry-based remote control of gates, and drainage water reuse systems, are complex and multi-dimensional, involving social and institutional as well as technical and managerial aspects. These were not sufficiently appreciated and provided for, and hence the introduction of CF operations could not be completed. The ways and means of achieving a global (Delta-wide) change in irrigation flow regime from rotational to continuous at branch and mesqa levels have yet to be properly identified, tested and applied. High level policy, institutional and management investigations and decisions are needed. While the IIP and follow-on IIIMP provide local command-area level infrastructural and institutional developments to prepare for this change, they do not address the overall system operation constraints to implementation of a CF operating regime. It is thought that a separate multi-disciplinary operational planning and management project directly with and for the MWRI's system operating agencies should be considered, to address and resolve the various related issues. Concerning drainage water re-use developments, two forms were envisaged, namely (i) conventional large re-use pumping stations, and (ii) localized recycling of drainage water from rice paddies. The first of these was not implemented because of the increased risk of drainage water pollution at the tail end of the project area and because of the reduced volumes of fresh water available for mixing in this area. The second form of intervention was considered to require further research and field studies, given the perception that there were practical engineering, agronomic, water quality and sociological issues that needed addressing with much more care than was possible during project preparation and appraisal.

[N] Tertiary system improvements were aimed at, and succeeded in, scaling up the concepts and interventions from the pilot project experience, as well as addressing previous shortcomings (e.g. provision of pumps by the project as opposed to the farmers). Not addressed in its design however was rationalization of mesqa network layouts that would have served to further improve cost effectiveness and operational efficiency.

[O] Given the mandatory investment cost sharing arrangements and farmer responsibilities for subsequent O&M, there could and should have been better interactions between the system designers and WUAs much earlier in the planning stage, for network layouts planning and for discussions of both the technical and cost-benefit implications of alternative interventions. There should also have been some recognition that the participation in reviews and agreements needed to include not only the users but also the system operators responsible for provision and distribution of water down to the mesqa intakes from the branch canals.

[P] The project's institutional support provisions for design and construction supervision, M&E, and all other implementation activities including training, were sizeable but still insufficient, given the limited technical and institutional expertise and capacity within the IIS, and were not always optimally distributed. The single long-term international team leader assignment, while well executed, was insufficient to counterbalance and support the limited capacity of the implementing agency. A second long-term international position, for an assistant team leader, would have alleviated some implementation difficulties and improved project performance. The planned training programs included overseas visits and educational advancement and were not as focused on specific and practical skills relevant to project implementation and follow-on system operations as they could have been.

[Q] Actions for improving on previous implementation performance called for formation of WUAs and preparation of tender documents in advance of project effectiveness. Aspects not addressed in the organizational design were the means of securing needed coordination between farmers, IAS and agricultural extension services, and with other stakeholders including system operating agencies within and outside of the MWRI, not only for the on-farm irrigation management demonstration program but also for all of the technical and institutional improvement activities. In an attempt to secure improvements in contractor performances, a prequalification exercise and minimum contract value were specified for contracts procurement under international competitive bidding (ICB) processes.

[R] As implementation got underway, farmers' resistance towards the shared single-lift mesqa pumping stations to replace their individual mesqa-to-marwa pumping arrangements slowed the process much more than had been expected. Farmers were opposed to relinquishing individual control over use of available water to others via indirect joint control at the head of the mesqa. Acceptance slowly increased as construction progressed and improved mesqa operation and performance demonstrations became possible. This in turn supported and strengthened the IAS in its efforts to mobilize farmers and expand awareness and understanding of IIP interventions.

[S] By the time of the mid-term review (MTR) in May 2000, it was clear that it would not be possible to complete all project area interventions by the original closing date of December 2002. Given the observed good implementation progress over the previous two semesters, it was agreed to set a series of benchmark indicators to be monitored and reviewed before deciding on a closing date extension. Since implementation performance subsequently continued to improve, closing was extended by two years to December 2004. Continued satisfactory performance, and the decision to implement and support the W-10 pilot area development, led to three additional agreed extensions.

[T] Due to project cost increases, available funds permitted improvements to be carried out over an area of only about 205,000 fed. (82% of the originally projected 248,000 fed). This value will reach 210,000 fed (85% of the target value) by the end of 2007, through works undertaken with local funding. To allow for completion of improvements over the remaining area, KfW approved additional funding for improvements for 44,000 fed in the Mahmoudia command area. The new KfW supplementary operation, denoted IIP2, involves a loan of 19.1 million Euros and is scheduled for completion by the end of 2008.

[U] The long delays in works progress and completion led to a growing need for cancellation and re-tendering of large contracts. While MWRI seemed to be willing to cancel the delayed contracts the process seemed to be strongly resisted, in most cases, by the GOE, resulting in several large contracts stalled and corresponding works uncompleted. Cancelled contracts were eventually re-formulated and re-tendered to small contractors. Late IIP and early IIP2 experience showed significantly improved performance being achieved on works contracts by small contractors, including some who had previously also performed well as subcontractors on the larger failed IIP contracts. However, the limited competition between such contractors had resulted in further cost escalation. There had also been issues with the performance on supply of water control gates and pumpsets, for which the number of potential suppliers was also limited.

[V] Over-sizing of mesqa system pumping stations and pipelines resulted in part from a widespread non-belief in the advent of CF, and was due also to no night irrigation assumptions (even though farmers sometimes prefer peak-period night irrigation). Conservative design criteria, and non-acceptance or difficulty of system layouts rationalization, contributed to high project costs. During construction there was often little attempt to minimize intervention times and land areas taken out of cultivation, leading to significant extra costs for temporary works and compensations to farmers.

[W] Insufficient involvement with the project by the main and branch canal system operating agencies, notably the IS, resulted in an inadequate sense of ownership and understanding of the improvements. This led to difficulties and delays in handover of improved canals and acceptance of new operational modes and controls, thus contributing to the delayed adoption of CF operations.

[X] The conceptual and institutional difficulties have led to late and only partial achievements in the planned adoption of the CF regime and hence to a poor result with regard to improved productivity of irrigated cropping in the IIP area.

[Y] The adoption of CF operations would involve new tasks for the IS including (i) allocating and recording water deliveries to individual branch canals in volumetric terms, (ii) communicating and interacting with BCWUAs, (iii) continuous instead of occasional monitoring of canal and control structure operations, and (iv) undertaking or supervising of trash removal and other maintenance activities. The IS districts are generally thought to have adequate numbers of staff for this, but their current qualifications and deployment may not always prove to be suited to such new tasks. Appropriate procedures, training programs, equipment and facilities including necessary transport would all need to be developed and provided.

[Z] Branch canal automatic downstream control gates provided by the project were generally not understood and/or accepted by operators and/or water users, leading to their being disabled or bypassed; trash removal arrangements at these structures were also inadequate and prevented their proper performance. Some distributor structures for upstream control were retrofitted later at these locations and have been better received. Targets for installation of vertical gate remote control systems were not achieved. MWRI is conducting a technical assessment of the approach, used for implementation of the CF.

[AA] More specifically, W-10 pilot area interventions covered (a) gate automation systems with PLC-based local automatic control, (b) use of high resolution IKONOS satellite images for mesqa and marwa layouts planning and design, (c) sizing of pumping stations and pipelines for a water duty of 0.84 l/s/fed (instead of 1.14 l/s/fed) and for pumping times of 20 hours/day (instead of 16 hours/day), (d) use of 2 or 3 pumps per pumping station each sized at 20, 30, 40 and/or 60 l/s, (e) electrification of pumps with pre-paid card system, (f) testing of PVC pipes with pressure rating of 2.5 bars (instead of 4 bars), (g) use of butterfly valves / gate valves (instead of alfalfa valves), (h) testing of marwa improvements (pipelines and lined sections), and (i) cooperation between MWRI/IIS, MALR/SWERI with GTZ, and farmers, for marwa improvements through a participatory and cost- sharing program.

[BB] The M&E package was divided into four components: (i) canal and drain monitoring study (CDMS), covering performance of the delivery system and of drains particularly with regard to tail escape flows; (ii) water quality monitoring study (WQMS), involving both field data and laboratory analysis for a range of defined water quality characteristics in the canals and drains covered by the CDMS; (iii) pump operation study (POS), covering operations at the mesqa level, and focusing on water use at the point of lifting by farmers and related pumping costs; and (iv) farmer surveys (FS), to collect information on crop production and production costs, as well as information concerning farmers' perceptions of the improved system. The M&E program also included other activities carried out by the M&E unit or by other contracted agencies. The M&E unit additional activities were: (i) WUA financial monitoring survey of operational WUAs; (ii) farmer or irrigation service satisfaction survey; and (iii) collection and analysis of secondary data obtained from the MALR. Activities covered by other agencies included: (i) remote sensing studies carried out by WaterWatch on the development of cropping patterns, yields of major crops as well as crop consumptive water use and soil salinity, covering the three IIP sub-project areas, and comparing the years 1995 and 2002 for the summer seasons and 1997/98 and 2002/03 for the winter seasons; and (ii) performance assessment of operational WUAs implemented by the Centre for Rural Development Research and Studies (CRDRS) of the Faculty of Agriculture, Cairo University.

[CC] On improved mesqas, pipelines accounted for 94% of the total installed length while open J-section lined canals accounted for the remaining 6% of the installed length.

[DD] By the end of 2003, it was decided to make use of some surplus funds from the World Bank non disbursed proceeds to complete the last remaining area of about 6,000 fed in Wasat sub-project (the W-10 contract area). Since the parallel preparation for the new IIIMP was advancing during the course of 2004, it was agreed to develop the W-10 area as a pilot improvement area incorporating a number of modifications and strong innovations to the IIP

designs which were being proposed for adoption under the IIIMP. Apart from significant cost reduction measures which brought down average costs to about LE 4,000/fed, the innovations included electrification of mesqa pumping stations and improvement of marwas by converting them to buried pipelines.

[EE] The PDO of the IIIMP is to assist in the implementation of measures aimed at ensuring the efficient and sustainable use of water and land resources, continuing with the IIP type of interventions but advancing in a much more integrated way. The IIIMP would support planned institutional reforms and the improvement and rehabilitation of irrigation and drainage systems and pumping stations, including the removal of system bottlenecks in the main canals in two full main canal command areas: Mahmoudia and Mit Yazid (gross areas of 550,000 feddan) covering about 10% of the irrigated area of the Nile delta. It is noted that the Mahmoudia command area includes the Mahmoudia sub-project area of IIP as well as the area of IIP2, while the Mit Yazid command area includes the Wasat sub-project area of IIP. The IIIMP was conceived as a first phase of a multi-project program with new concepts and approaches serving as a model for subsequent similar full command area schemes. Integrated water management is foreseen with full users' involvement from the planning stage, leading to greater efficiencies in implementation through more coherent construction programmes and clearer responsibilities of all stakeholders.

[FF] The partial involvement of users during both the planning and design stage and the works construction stage helped to develop strong local ownership of the improvements and to achieve sustainable interventions. The establishment of WUAs in the early stages of the improvement process was the target method of obtaining user participation in the IIP. During implementation the WUAs had the role of user representatives, but with the improved systems in operation and the economic advantages demonstrated, direct users' ownership is ensuring full sustainability of the improvements. Suggested mesqa WUA and BCWUA M&E indicators and scorings, for use during the operational phase of the project to monitor sustainability of the WUAs, are included in Annex 5.

[GG] Concerning the CF issue, it is clear that there is a considerable positive shift in the attitudes over the last few years. From an initial position of scepticism, or even opposition, among many members of MWRI staff, there is now a widespread recognition of its benefits. It is recognized also that there is a great reduction of complaints from farmers about water shortages. Other important developments towards CF operations are (i) a growing recognition of the need for regulation of water deliveries by discharge rather than by water level, and (ii) an increasing acceptance that WUAs should have an important role in managing internal water distribution within branch canal command areas.

[HH] Some of the clear project benefit indicators are (i) irrigation costs have been reduced by 35 to 42%, (ii) labor required for irrigation has also been reduced, allowing beneficiaries to give enhanced attention to, and extract greater benefits from, other farming activities, (iii) land values in the improved areas have increased by LE 20,000/fed to LE 80,000/fed (US$3,500/fed to US$13,800/fed), compared with an average project investment cost of LE 4,000/fed (US$700), and (iv) farmers in neighbouring unimproved areas have been expressing strong demands to be included in the new project areas, even while knowing that they will have to pay for the investments through cost recovery arrangements.

[II] Although the farmer surveys show some differences in areas planted and yields of major crops, they confirm that the IIP is far from attaining some of its targets. Yields of major crops in the non-improved areas also increased significantly as a result of various factors. Hence to expect to achieve the relative increases assumed at appraisal might be somewhat unrealistic. The relatively modest changes in yields and crop patterns attributable to IIP interventions would require more time to reflect the impact from the adoption of CF, and to reflect inter-season variations. In the few sample cases where CF operations were occurring, significant yield increases from non-CF improved areas to CF improved areas was evident. The assessment also shows the importance of intermediate outcomes such as improved water reliability, farmer co-operation, financial benefits to farmers from reduced costs, and savings in land and time taken for irrigation.

[JJ] CF operation benefits (not properly quantified) already realized in a few areas include (i) farmers can irrigate according to crop needs instead of rotational system constraints, leading to summer crop yield increases in the order of 10% to 40%, (ii) water distribution equity is improved, complaints from tail-end farmers about water shortages are reduced, and there are fewer disputes between farmers over water distribution, (iii) unofficial re-use of poor quality drainage water for irrigation is reduced, (iv) soil conditions in areas that previously suffered from water shortages and/or relied on re-use of drainage water are improved, and (v) canal water quality is also improved.

[KK] The CD-IAS is the denoted responsible agency for continuing support for WUAs, but it does not seem to be prepared or constituted for this task. Measures to reform the institutional IIS-IAS and CD-IAS set-up have been prepared by MWRI, but strong resistance to these has prevented their implementation.

[LL] There are multiple identified aspects to the shortfall in IIS capacity development. Initial hydraulic design capacity developed and transferred to the irrigation directorates by the international consultants was later mostly lost due to

loss of personnel. Construction supervision control and reporting systems setup and training were also provided, but there was little implementation of this to improve construction quality, quantity, time and cost management. There was also little or no effort to internalize or strengthen capacity for management of internationally-financed projects; the international consultants have been heavily relied on for this. Occasionally, there was strong resistance to adoption and application of improved internationally proven and accepted technical and managerial standards, procedures and practices. Some of the various training programs were ineffective due to inappropriate selection of trainees and insufficient subsequent dissemination of knowledge gained.

[MM] Concerning tail-end drainage water use, the farmer surveys showed that in Manaifa only canal water was being used for irrigation whereas in Wasat and Mahmoudia 10% of the total number of irrigations was still being effected with drainage water.

[NN] As a general rule OPS 2.28 requires that the status of project preparation at the time of Board presentation be such as to allow procurement and other important phases of project implementation to start shortly after loan approval, and that cost estimates be sufficiently reliable to reduce the need for physical contingency allowances to a minimum.

[OO] The IIP had four TTLs during its 11 year implementation period: Mrs. Aizad Khan, Nejdet El Salihi, Usaid I. El-Hanbali and Jose Simas.

[PP] Some important agreements reached as a result of Bank supervision missions related to (i) reviewing project technical approaches and designs, (ii) modification of works contracts bidding aspects including the carrying out of contractor prequalifications, (iii) execution of training programs, (iv) coordinated intervention of central, regional and local implementation agencies for recruitment of staff and contracting of design and supervision tasks, and (v) accelerated establishment of WUAs.

[QQ] Further strong GOE resistance to the needed cancellation and re-tendering of contracts awarded to large non-performing contractors led to large contracts being stalled and corresponding works of some meskas being left uncompleted.

[RR] IIS implementation and coordination management deficiencies included (i) limited in-house technical capacity, due to training and recruitment shortfalls, (ii) often poor attention to design quality and cost effectiveness but excessive and inordinately time-consuming attention to procurements and contracting, (iii) a lack of needed coordination with and between implementing agencies (e.g. MALR/SWERI), operating agencies (e.g. IS), IAS, CD-IAS, agricultural extension services, and farmers, a situation that improved during the last few years of the project, (iv) insufficient attention to post-construction technical and institutional needs and handover processes, and (v) an unbalanced approach to the on-farm irrigation management component.

[SS] Delivery system interventions should reduce water supply constraints, branch canal interventions should deal with conversions for CF regime operations (now seen as the key to increasing water distribution equity, irrigation water use efficiency and economic return per unit of water), and tertiary, quaternary and on-farm system interventions should be implemented fully in conjunction with these to maximize the overall benefits.

[TT] The Borrower considered the project successful to some extent in achieving its goals. M&E results showed evidence that equity of water distribution between the head and the tail of branch canals improved, and that single point lifting at the head of mesqas reduced labour, time and costs for irrigation O&M. The environmental conditions had also improved, decreasing water related diseases due to the piping of mesqas and reducing of drainage water use. Poverty was reduced by increasing beneficiaries' income and agricultural production, land savings, and decreased O&M costs. The average crop yields for the three sub-project areas increased by 4 to 12%.

[UU] The Borrower-indicated factors that caused delays and reduced application of CF operations are changes in world prices affecting the cost of materials and farmers' initial resistance to accept the new IIP concepts. The limited capacity of the contractors was also a factor affecting implementation. Other identified problems related to the control of water distribution in the branch canals through the downstream control gates, stemming from the farmers' tampering and the accumulation of garbage in front of and under the gates. The great increase in the areas cultivated by rice were said to mitigate against CF introduction, since demand exceeded the capacity of the delivery system.

ANNEX 1: PROJECT COSTS AND FINANCING

(a) Project Cost by Component (in US$ million equivalent)

Components	Appraisal cost estimate	Actual cost to closure date of WB loan	Estimate to project completion (IIP 1)		Estimated cost of IIP2
			Cost	% of appraisal	
A. Irrigation Systems Improvements	**115.3**	**130.9**	**146.0**	**126.6**	**33.4**
Main & Secondary Canals	19.1	18.1	20.6	107.9	4.7
Tertiary Development	96.2	112.8	125.4	130.4	28.7
B. Institutional Support	**10.7**	**12.1**	**12.6**	**117.8**	**2.0**
In Cairo	4.5				
In Field Offices	6.2				
C. Communication Support (Ministry level)	**2.8**	**0.0**	**0.0**	**0.0**	
D. Irrigation Advisory Services	**8.2**	**6.7**	**6.8**	**82.9**	**1.0**
E. Environmental Mitigation Plan	**1.1**	**0.5**	**0.5**	**45.5**	
F. On-Farm Irrigation Management Pilot	**1.6**	**1.6**	**1.6**	**100.0**	
Total Baseline Cost	**139.6**	**151.9**	**167.5**	**120.0**	
Physical Contingencies	18.4				
Price Contingencies	24.3				
Total Project Costs	**182.3**	**151.9**	**167.5**	**91.9**	**36.4**

(b) Financing (to Project Completion)

Source of Funds	Type of Financing	Appraisal Estimate (US$ million)	Actual/Latest Estimate (US$ million)	Percentage of Appraisal	Estimate for IIP 2 (US$ million)
Government		53.7	57.5	107.1 (1)	10.0
IBRD		26.7	22.9	85.8	
IDA	35.7 million XDR	53.3 (35.7XDR)	47.1 (35.7 XDR)	88.5 (2) (100%)	
KfW	[Parallel financing]	44.9	40.0	89.1 (3)	26.4
NDGIC (Netherlands)	[Parallel financing]	3.7	0	0	

Notes: (1) GoE financing includes completion of on-going contracts using local investment funds
(2) IDA financing is almost fully disbursed in SDR terms. Only SRD 500 were cancelled.
(3) KfW financing for IIP1 is expected to be fully disbursed in Euro, assuming that balance of KfW loan will be spent on additional works during 2007

ANNEX 2: OUTPUTS BY COMPONENT

Original Project Development Objectives (PDO) and Key Indicators (*as approved*)

The Project Development Objectives were to: (a) increase agricultural production and farmers income by improving the irrigation infrastructure, facilitating a more equitable distribution of water and improving on-farm irrigation management; (b) improve the long-term sustainability through takeover of responsibility for operation and maintenance of the tertiary level irrigation system by the farmers and their sharing in the costs for tertiary level investments; and (c) strengthen the institutional planning and implementation capacity of MWRI in the irrigation subsector. The environmental objectives were: (a) water quality management and monitoring program; and (b) agricultural chemical management program. Proposed target values were stated to be as follows (SAR Annex V Table 3):

Indicator	Unit	Planned (SAR)	IIP 1 (WB/KfW)		Planned under IIP 2 (KfW)
			Completed to end of 2006	Expected to end of 2007	
Physical progress					
Delivery System					
Command area improved	feddan	248,000	205,000	210,000	36,000
D/S control structures completed	Number	200	101	108	(note 2)
Distributor control structures completed	Number	45	34	39	(note 2)
Re-use pumping stations	Number	4	0	0	0
Tertiary System Development					
Meska pumping stations	Number	2,650	2,756	2,935	650
PVC pipeline completed	km	1,500	1,909	2,147	410
J-section lining completed	km	1,000	122	128	0
Institutional Development					
Water Users Associations formed	Number	2,650	2,906	2,935	650
Mesqas handed over to WUA	Number	2,650	2,351	2,935	650
Area of improved mesqas handed over	feddan	248,000	156,000	190,000	34,000
BCWUAs formed	Number	67	57	58	12
Continuous flow applied (note 1)	feddan	248,000	84,000		36,000

Notes: 1. Including area of direct irrigation from main canals (Manaifa and Mit Yazid)
2. Type of control gates to be confirmed

Within the project implementation period water **delivery systems** designs for 68 branch and sub-branch canals (134 km length) serving 210,000 fed were completed, including 116 downstream control gates and 39 discharge control distributors, with associated regulators. Slope stabilization works and bridges were done. Because of serious doubts about the convenience of drainage reuse pumping stations as originally designed, mainly due to excessive contamination of drainage water given that IIP area is at the tail end of the system,

its construction was not done. Telemetry systems were actually in place from previous projects, but not used or kept up and not re-established. Centralized remote gate control targets were not achieved. Downstream control gates were installed but mostly are not in operation due to interferences, blockages, incomplete canal remodelling and/or lack of CF. Some distribution control structures were installed later downstream of control gates for flow limiting purposes, but hydraulic performance is constrained by previous hydraulic design assumptions and/or incomplete branch canal remodelling. In sum, improvements of the delivery systems aimed to maintain the canals and adjust design deliveries and abstraction requirements under the planned CF operation replacing the traditional rotations pattern is considered only as **moderately satisfactory**.

At the **tertiary system** where 70% of the project cost was planned to be invested, the main indicators are: 2,650 mezqas were improved complying with the original target[2]. However, due to shortage of funds, only 199,500 fed could be covered by the IIP investments, 80.4 percent of the original 248,000 fed defined at appraisal[3]. About 2,658 pumping stations were installed by the end of 2006 with more than 5,9300 pumps set installations (about 75% more than the 3,000 target indicated in the SAR).

Although no major mesqa layout rationalizations ware introduced, two main layout improvement concepts were developed: the conversion of large mesqas into smaller mesqas and the replacement of direct off takes from main or branch canals by new parallel mesqas. Generally, old alignments have been maintained regardless of operational suitability and cost effectiveness, without attempts to prepare and discuss options with users, leading to poor distribution of sizes, higher costs, etc. The total length of lined-raised and piped mesqas was also met in 91%, 2,263 km of the 2,500 km targeted at appraisal[4]. Trenching of pipeline mesqas alongside old mesqas, with little or no backfilling (as in the previous project) was changed to placement of pipelines within the old mesqa with full backfilling. The previous project approach had failed in many areas due to the non-provision of pump sets to the WUAs. Overall result of the tertiary system component is considered as **satisfactory**.

Concerning the **institutional and operational** aspects, The MWRI has been working in parallel towards an institutional and management reform process aiming to a shared responsibility of all stakeholders for the use of scarce water resources. The process will still require several years, and will need further activities as those develop under IIP on the ground where the principles are applied, lessons are learned, and which give the reform process the momentum that is required to succeed. The MWRI has already taken several initiatives in the field of institutional reform, integrated water management, system improvement; M&E as well as training that are all contributing to increase the efficiency and

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[2] The value of works completed at the time of the ICR mission is LE 560.4 million and there were still 26 on-going contracts, three of which were almost completed and 8 are more than 90% complete. Some mesqas are still to be finished due to the delayed termination of poor performing contracts that had to be re-procured.

[3] The original project area not covered by IIP due to cost escalation and shortage of funds is being now improved by a complementary IIP-2 KfW financed loan.

[4] The SAR estimated that 60% of the mezqas would be piped and 40% lined. However, farmers overwhelmingly preferred the piped mezqas (94%) rather that the raised-lined ones (6%).

effectiveness of the use of the country's water resources. In-country design-related workshops and training programs developed under IIP had been well attended and are considered fairly successful. International study tours on the other hand are not seen to have been of great benefiting overall. Graduate education provisions were not pursued; cancellation of these is considered to have been a good decision. On-farm program training is said to have not been well distributed to potential beneficiaries. In general, poor or inappropriate control over the training opportunities taken and persons assigned to them is thought to have reduced the overall value of training program benefits. However, the delayed implementation (11 years) and slow adoption of the CF regime determine that the component's outcome is considered as **moderately unsatisfactory**.

Under the IIP **communications** package public awareness campaigns and associated baseline surveys, training programs and goods procurement were carried out. The program had a positive effect in awareness building through TV campaigns. At later stages, the target turned from TV public audience to more specific groups. Staff training activities on photographic documentation and display board preparation were developed. Details for a documentary film on the project's accomplishments were also developed but not materialized due to budget constraints. The results are considered **moderately satisfactory**.

Through the **Irrigation Advisory Services component,** the IIP has been considerably active contributing to one of the most important developments in the water sector in Egypt: the involvement of stakeholders in planning, implementation and management of the water systems. WUAs establishment supported by IAS has been highly effective but perhaps with limited attention to post-construction objectives and needs. The Law 213/94 defined that WUAs were responsible for water management at the level of the privately-owned mesqas in areas under improvement, in particular for the O&M of the collective pumping station at the head of the improved mesqas and for the collection of fees to cover O&M costs. The IIP experience during implementation strongly contributed to the development of the national policy and legal framework for participatory water management.

The project is also showing some positive impact from **environmental management**, resulting from filling-in of old mezqas especially in built-up areas resulting in less quantities of garbage in the canals, and reduced conflicts between farmers. Progress was also achieved in the development of EMPs for pilot low-cost sewage collection systems. Results are considered **moderately satisfactory**.

The **on-farm improvement component** received little attention to the importance of disseminating results from the part of MWRI and an excessive focus by MALR/SWRI on land leveling in the demonstration program, to the detriment of intended interventions for irrigation management improvements. It had failed to achieve the expected on-farm impact. According to the farmer's survey, most farmers are now aware of the importance of land leveling using laser equipment and its effect in less water and time required for irrigation. However, even when they are willing to apply it they are unable because being too expensive, difficult to coordinate among neighboring farmers, and difficult to arrange between crops. Traditional techniques are still dominant in the IIP areas and very few farmers knew about improved irrigation practices, dry planting of berseem and/or other trialed techniques. It has

been a limiting factor that the agriculture extension staff has little knowledge on simple technique for improving on-farm water use. IAS staff, TV & radio have been the main source of information on these aspects but the poor coordination between services is limiting on-farm impact. Results are considered as **moderately unsatisfactory.**

Actual achievements per component and for the overall project are shown in the following table.

Project Outcome Ratings by Component

Components	Project Costs (SAR) US$ million	Project Outcome 1/ Rating	Project Outcome 1/ Value	Weight over Base %	Contribution to PDO Value
(a) 1. Improvement of main & secondary canals	25.3	MS	4	13.9	0.556
2. Improvement of tertiary system	126.4	S	5	69.3	3.465
(b) Institutional Support	13.3	MU	3	7.3	0.219
(c) Communications	3.6	MS	4	2.0	0.080
(d) Irrigation Advisory Services	10.3	MS	4	5.6	0.224
(e) Environmental Assessment & Management	1.4	MS	4	0.8	0.032
(f) On-Farm Irrigation and Demonstration	2.0	MU	3	1.1	0.033
Physical and Price Contingencies	42.7			-	-
Irrigation Improvement Project	182.3	MS		100.0	4.609

1/ Highly Satisfactory (HS) = 6; Satisfactory (S) = 5; Marginally Satisfactory (MS) = 4; Marginally Unsatisfactory (MU) = 3; Unsatisfactory (U) = 2; and Highly Unsatisfactory (HU) = 1.

Supplementary Information

Design Aspects

Progress of design and tender preparation was very slow since start-up because the limited available number of experienced design engineers and even computers for design work in the directorates to the point that drawing was done manually. The lack of up-to-date large scale (1/25,000) survey maps[5], cadastral surveys and water user registries, and too many other basic instruments resulted in poor efficiency and implementation capacity[6].

Many components of the mesqa system physical improvements were systematically over designed with little regard to capital cost. Specified construction sequences and processes including temporary works arrangements also often seem to have been overly elaborate, time consuming and costly in spite of sizeable mandatory capital cost sharing by users. Examples of excesses include pump numbers and sizes[7], pipeline sizes and pressure specifications, pumping house station sizes and materials, and backfilling of old open mesqas. Originally applied normal and reasonable design safety factors were subsequently inflated by implementing agency directives. One reason for over sizing components was a non-belief in the attainment of CF regimes and hence a perceived need to provide large capacity for short duration and infrequent irrigations. Other reasons for conservative design choices included (i) presumed non-availability of materials and equipment on the local market, (ii) presumed farmer opposition to improved layouts and more efficient and cost-effective physical and operational systems and preference for traditional and familiar systems, and (iii) an unwillingness or inability to consider and apply designs based on modern cost-effective materials and technology. A further factor was the compartmentalized nature of the planning and design process and its execution in relative isolation from system operators and users.

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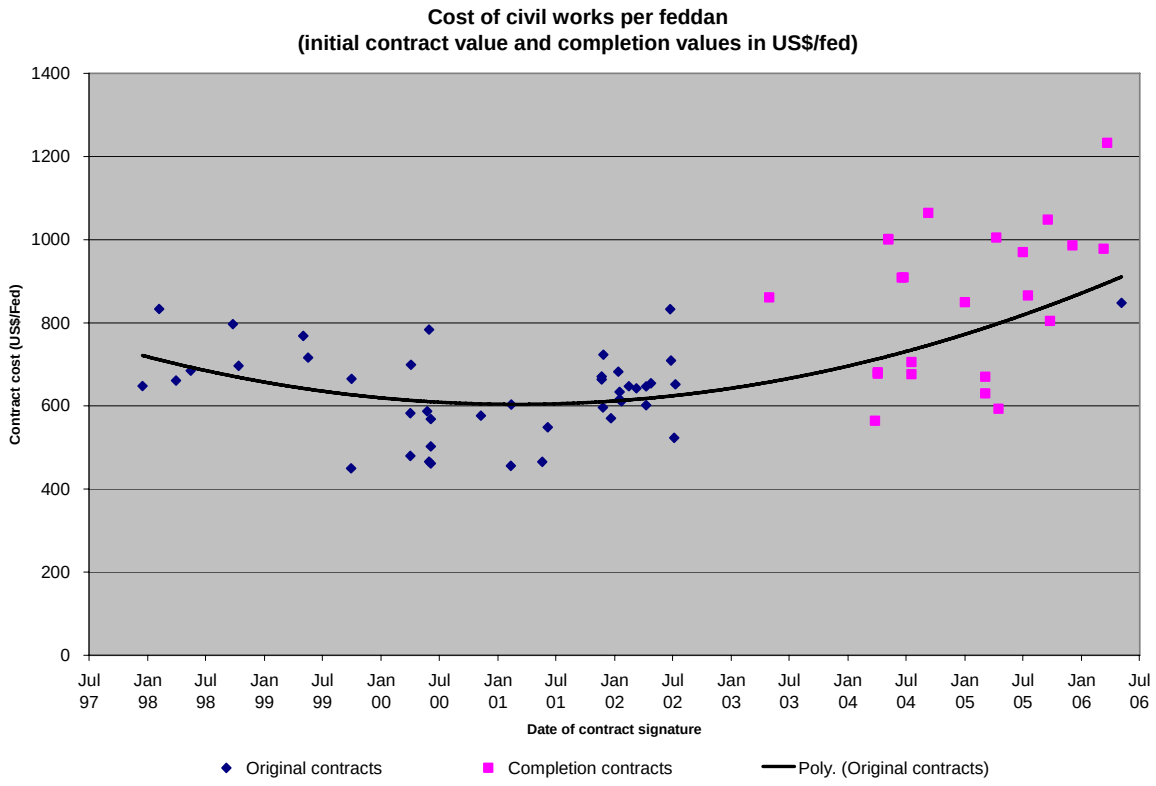
[5] During preparation phase a set of 1/10,000 scale orthophoto maps were procured covering the whole project area but the quality of originals (films) was rather poor which made it difficult to make satisfactory copies.

[6] In 2004, IIS acquired high resolution IKONOS satellite images covering the proposed five IIIMP areas, including the IIP areas. These are now being used for mesqa planning and to produce digitised layout maps of the improved system. With digital format maps, it is possible to develop GIS formats with maps of structures built up in "layers" comprising: spatial layout and physical characteristics of the existing water infrastructure (branch canals, mesqas, marwas), boundaries and areas of all farming units, farmers cadastre (land ownership and water rights), proposed irrigation improvements and other information layers to be added as needed.

[7] Project management insistence on designing every pumping stations including at least 2 diesel pumps with discharge capacity of at least 60 l/s instead of installing also 30 l/s pumps in the smaller mezqas, ended up with almost 70 percent more pumps than planned and an excessive pumping capacity in the IIP areas.

Cost Escalations.

Mesqa systems over-design, and little cost-effectiveness in design and construction solutions, led to major cost escalations. Over-sizing of mesqa system pumping stations and pipelines resulted in part from a widespread non-belief in the advent of CF, and was due also to no night irrigation assumptions (even though farmers sometimes prefer peak-period night irrigation). Conservative design criteria contributed to high project costs, and little if any importance was given to control of implementation costs in general. During construction there was often little attempt to minimize intervention times and land areas taken out of cultivation, leading to significant extra costs for temporary works and compensations to farmers. Backfilling of old mesqas with large volumes of imported material, the nature of re-tendered mesqa completion contracts, and high general inflation levels, led to further substantial cost escalations in more recent years. The average cost of improving mesqas increased from around US$600/fed in mid-2002 to around US$900/fed in mid-2005. Peak costs were around US$1,000/fed in 2004 and 2005 and reached a maximum of over US$1,200/fed in mid-2006 (see Graph below).



The higher recent costs gave grounds for concern, particularly by the financing agencies, in relation to the economic feasibility of the investments. They also raised concern with

farmers, in relation to their ability and/or willingness to make payments for capital cost recovery[8].

Communications

The IIP communication package was sought to be done in two parts: (i) at the ministry level and targeted to the general public, policy makers and the MWRI engineers to build awareness on the scarcity of water resources; and (ii) as an IIP component targeted to the project area farmers. The component was aimed at development of: (i) a communication program for MWRI using various mass media techniques; and (ii) a program for WUAs and BCWUAs with emphasis on water savings, improvement in services, yields, and income as well as potential for cost sharing to reduce future budget burdens.

The MWRI organized the Water Media Unit by ministerial decree in July 1995. Its main targets were to develop and execute a media policy for the MWRI, media research activities aimed at assessing the audiences perception of the water policy, production of media material including a monthly newsletter, raising awareness of the MWRI's engineers with regard to the ministry's plans and achievements, as well as preparation of a training plan aimed at improving capacity for communicating with the farmers.

Main achievement of the communications component's Water Media Unit have been[9]: (a) public awareness campaigns on various water related issues (water scarcity, conservation, importance of farmer-engineer cooperation, etc.); (b) baseline surveys to assess the public audience's nature and level of awareness as well as the ministry's engineers' ability to communicate with farmers; (c) training programs for capacity building of MWRI's communication skills; and (d) various materials for different media types. The program had a positive effect in awareness building through TV campaigns. At later stages, the target turned from TV public audience to more specific groups. Staff training activities on photographic documentation and display board preparation were developed. Details for a documentary film on the project's accomplishments were also developed but not materialized due to budget constraints.

Environmental Management

The project's environment component comprised (i) strengthening of MWRI and IIS staff capacity for environmental assessment and management through specialized on the job training and TA, (ii) development of guidelines for EA screening and evaluation of irrigation development projects in cooperation with EEAA, (iii) monitoring of water quality, particularly of reused agricultural drainage effluent and of soil salinity at the tail-end of each system, and (iv) implementation of a program to train farmers in the proper storage, handling

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[8] As a result of the cost escalation concerns, new improvement concepts and designs were implemented in the W-10 pilot area that reduced unit costs to about US$850/fed (the last point on the graph); this cost included the piping of marwas not previously included.

[9] The unit's main source of funding through its initial phase (1995-1999) came from projects' components support. Since then, the unit has been funded through a dedicated budget allocated by the ministry.

and use of pesticides. The credit agreement also contained a covenant pertaining to bilharzia (shistosomiasis) snails, which were complied with. The total cost of the component was to be US$ 1.43 million; US$0.9 million of this was for TA services to be covered by the NDGIC, and the balance, for goods, was to be provided by the World Bank. Following the withdrawal from the project of NDGIC, some replacement funding was provided by KfW and the World Bank (IDA).

Later, after some progress had been achieved on items (i) and (iii) above, and based on the findings of the MTR and follow-up safeguards and other missions, the environment component was re-formulated to comprise (i) setup and staffing of an Environmental Unit (EU), (ii) development and implementation of site specific Environmental Management Plans (EMPs), focusing on mitigating project area impacts of existing pollution sources rather than of project activities[10], (iii) environmental screening for any new drainage water reuse pumping stations, but no formal EAs, (iv) environmental training for senior management staff, (v) procurement of water quality monitoring equipment, (vi) M&E of canal and drain water quality and monitoring of soil quality, (vii) review of water quality guidelines, and (viii) gender activities.

The EU was established and carried out the above mentioned activities with support from the project implementation consultant. EMP development and implementation activities were aimed at completion of three phases at each of two selected pilot command areas, Besentway and Daqalt, the phases being (i) diagnosis of solid waste and sanitation problems, (ii) selection of winning mitigation options through community participation processes, and (iii) effecting selected mitigation measures in cooperation with pertinent MWRI departments. First and second phase activities were completed for both pilot command areas. In Besentway, the third phase was partly implemented through the Dutch-funded Water Quality Management Unit (WQMU); a low-cost sewage collection system was piloted, but treatment prior to disposal to drains could not be completed due to disproportionately high costs of purchase of needed farm lands. Since there were no drainage water reuse pumping stations constructed under the project (as discussed in Section 2.1(b)[11]), environmental screening activities were not undertaken. Environmental training was effected in accordance with the component reformulation but was at a lower level than was envisaged at appraisal. Water quality monitoring equipment was procured and used for the water quality monitoring study undertaken as part of the M&E component. The soil monitoring study was started at an early stage of the project but was never completed according to plan. Water quality guidelines

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[10] The objective of the EMP was defined as follows: "to identify and where possible, within the financial constraints of the project, implement measures, which will complement the irrigation improvement works to bring about improved environmental conditions within the branch canal command area."

[11] Reuse of agricultural drainage water became national policy during the 1980s. Currently, 5 billion m^3 of drainage water, with an average salinity of 1.8 dS/m, is reused each year and another 3 billion m^3 of drainage water is committed for reuse in the new reclamation areas in the near future. So far this reuse strategy has not caused deterioration of the salt balance in the Nile Delta. This favorable situation was achieved, partially with the help of World Bank funded drainage projects, through a program under which drainage systems were installed for 90 percent of the irrigated land areas. Resulting drainage water is reused after mixing with freshwater that has low salinity content. Tools including functional water volume and quality monitoring systems have been developed for planning and management.

were reviewed, and gender activities with emphasis on environmental issues were incorporated into broader IAS community awareness and mobilization activities.

Follow-up environmental management activities are expected to take place under the new IIIMP, largely in connection with projected sanitation, sewerage and solid waste management initiatives. There would appear to be advantages in planning for demonstration pilots for these in the Daqalt and Besentway command areas, in which relevant diagnosis and mitigation option selection work was carried out under the IIP as outlined above.

It has become clear that project-specific EUs cannot be sustained in the absence of corresponding needed operating resources (funds, equipment and personnel). Also, departments/sectors such as IIS, where EUs are created/hosted, do not usually have mandates for execution of environmental interventions[12]. It would seem that environmental and safeguard components of future water-related projects would achieve better results by mobilizing the capacity of MWRI in-house departments/units that are already mandated to execute EMPs, such as the Drainage Authority and the WQMU.

Procurement

Works

The SAR and/or procurement rules called for procurement of contractors for works using ICB, pre-qualification of contractors. A number of pre-qualification processes were carried out, in 1994 (prior to project effectiveness), 1999 and 2001. During the period 1996-1998, open bidding processes were conducted. These gave poor outcomes, leading to a decision by the implementing agency to revert to prequalification of contractors as the preferred procurement approach.

By about 2001, all of the works packages had been tendered and contracted. However, by 2002, it became evident that several contractors were non-performing and/or failing, perhaps in part as a result of the then prevailing macro-economic conditions in the country. Most of the failing contractors were large public enterprise (parastatal) enterprises. By 2003 a process of cancellation and re-bidding of contracts had started, and this continued during 2004. New biddings to implement remaining works were conducted after splitting the original contracts into smaller ones more suitable for implementation by smaller private sector contractors. Since the project was due to close in late 2004, with no clear indication at the time that there would be a re-extension, a decision was made not to re-conduct the time-consuming pre-qualification process. From early in the re-tendering process it became evident that there would be a low level of response from pre-qualified contractors, attributed to the fact that many of them had been adversely affected by the previously mentioned situation. A reversion to open bidding processes was a possibility, but due to the earlier bad experience with this the IIS decided instead to extend the list of pre-qualified contractors using simplified procedures. Clearances for this were obtained from the Bank.

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[12] An exception would be the coverage of drains passing through residential areas, which can be and is executed directly under the IIS.

Not all of the remaining delayed works contracts were cancelled and re-tendered, and some of the improvement works remain uncompleted to date. The MWRI seems to have been keen to cancel all of the delayed contracts, but other considerations within GOE seem to have prevented the completion of this process. The MWRI had to revert to the difficult process of managing the delayed contracts such that the maximum amount of improvement works could be completed. To this end the IIS tried to reduce the scope of ongoing contracts such that works would not be initiated for any mesqa systems that had not already been handed over to the contractors, and at the same time tried to facilitate advancement in the ones where works has already started. Only limited progress could be achieved due to the fact that contract prices were well below current market prices, due to recent major price hikes. This situation could not be mitigated because of a political decision that contractors could not be fully compensated for price escalation. However, the impact on the project of this constraint was minor because most of the delayed contractors were in default and therefore ineligible for compensation even if price adjustment provisions could have been activated.

The re-tendering that were carried out in 2004 had low numbers of bidders. For the future it is recommended that improvements to the current bidding processes, comprising either more frequent pre-qualification processes or open bidding processes with well-formulated post-qualification criteria and control procedures, be effected. Exclusion of previously non-performing contractors would also be an obvious step to take, as would the incorporation of price adjustment provisions into the contracts. Bid evaluation and construction supervision procedures in particular, and overall procurement capacity in general, also need improvement, possibly best ensured through arranging for the involvement of experienced international consultants.

Goods

No major problems were encountered with goods contracts. A mass procurement of diesel pumps was carried out, without major shortcomings in pumps inventory management being observed. This procurement option could also be suitable in the future for pipes, fittings, etc., but improvement of storage conditions, particularly in Damanhour, would be warranted.

Consultants

Procurement of consultants was managed primarily through KfW.

ANNEX 3: ECONOMIC AND FINANCIAL ANALYSIS

Introduction

The **objectives** of the IIP were to: (i) increase agricultural production and farmers income by improving the irrigation infrastructure, facilitating a more equitable distribution of water, and improved on-farm water management; (ii) improve the long-term sustainability, through takeover of responsibility for the O&M of the tertiary level irrigation system by the new WUAs and their sharing in the costs for the tertiary level investments; and (iii) strengthen the institutional planning and implementation capacity of the Ministry in charge of the irrigation subsector.

The **project area** is located in the northern part of the Delta, where on account of extensive drainage reuse, water quality is extremely poor and limits crop choices by farmers. The existing delivery system of main and secondary canals in the three project irrigation command areas - serving a net irrigable farm area of about 248,000 feddan[13] - was planned to be improved and provided with control structures, telemetry system and mixing stations installed for introduction of continuous flow (CF), and for monitored reuse of drainage effluent. The tertiary systems would be developed with raised lined, or PVC piped tertiary laterals (mezqas) fed by single-point lifting pumps substituting several individual old pumps. The Irrigation Advisory Service (IAS) was to assist with organization and training of farmers into WUAs at tertiary level and at the secondary level BCWUA. The on-farm irrigation management demonstration program would induce the adoption of improved technologies that would enhance: (i) water use efficiency; and (ii) agricultural production through the use of proven technologies.

The IIP expected impact

Table 3.1 Economic Analysis

Time of the Analysis	ERR (%)	NPV (in US$ million)
Staff Appraisal Report (SAR)	25.2	203.5
Mid Term Review (MTR)	16.4	173.4
Implementation Completion and Results Report (ICR)	15.0	165.2

The overall Economic Rate of Return (ERR) was estimated during appraisal (1994) at 25 percent and the project's economic net present value (NPV) at a discount rate of 12 percent at US$126.2 million in constant FY94 prices (US$203.5 million in constant 2006 prices). The SAR economic and financial justification was based on benefits reaching to about 95,000 farm households who would attain increased incomes resulting from: (i) being provided with

[13] Area equivalent to almost 104,200 ha. Because of the existing variation in the water distribution at the tertiary level in project area, it was assumed that only 60 percent of the area would benefit from the project.

timely and adequate amount of irrigation water, (ii) preventing losses in their income levels from what would otherwise be a deterioration of soil conditions; and (iii) saving in about 34 percent in the pumping cost of irrigation water. Also, an efficient use of water at the farm level would result in an overall **saving of water**, but the value these savings was not taken into account for the estimation of the SAR's ERR and NPV.

The **continuous flow** (CF) operation system to be introduced at the mezqas by the IIP would allow on demand availability of irrigation water to farmers, which in turn would: (i) establish a more equitable water distribution system, (ii) progressively eliminate over-irrigation by upstream farmers and, (iii) halt the decline of agricultural productivity as well as improve yields (particularly for summer crops) in the salt affected and thirsty downstream areas, which were estimated to represent about 60 to 70 percent of the total project area. The improved mesqas and the use of single-point lifting pumps would bring about a significant reduction in pumping costs and would allow better irrigation timing. Project activities demonstrating better cultural practices and improved on-farm irrigation management techniques would also help in increasing agricultural productivity.

Cropping patterns were not expected to change dramatically but, as irrigation water became available on-demand, timely crop establishment and irrigations as well as better quality irrigation water would allow for planting more high value crops and increase yields of both winter and summer crops. The increased water availability to tail-end farmers would allow them to cultivate rice as a reclamation crop more frequently, and thereby leach their lands from salts at least once every two years. Hence, the area devoted to rice was expected to increase and cover more than 50 percent of the total summer cropped area while the areas devoted to cotton and maize would decrease accordingly. Lands leached (reclaimed through the rice crop) would support more high value winter crops and broad beans, vegetables and wheat would be increased by about 10 percent.

Crop yields were expected to increase by 8 to 15 percent for winter crops and by 28 to 41 percent for summer crops in 60 percent of the project area (tail end farms) as a result of the planned reliable availability of good quality water, as well as the foreseen improvements in on-farm irrigation management. Increments were expected to be equivalent to the average differences in yields between upstream farms receiving adequate and timely water and tail-end farms suffering from the lack of or timeliness in obtaining their water. The project's annual incremental production at full development would include 109,000 tons of rice, 129,000 tons of winter and summer vegetables, 38,000 tons of citrus, 26,000 tons of wheat, 20,000 tons of sugar beets, and 4,000 tons of broad beans; all valued at US$50 million.

Expected **farm income** increases as result of the project improvements were also analyzed based on three representative farm sizes (small, medium, and large) in each of the three sub-project areas. With the project, differences in yields between the upstream farmers and the tail-end farmers were expected to disappear. Moreover, existing yield levels in the tail ends of the project area were expected to deteriorate significantly over time since the continuous use of saline drainage effluent without mixing with fresh water would cause a severe build-up of salt content in the soil. Without the project improvements yields were expected to fall by 20 percent over the following ten years. The SAR estimated that with the project farm

incomes and the average per capita income would increase about 70 to 83 percent[14] if compared to the without project case.

The Mid Term Review

The expected economic and financial results were re-assessed for the mid term review (MTR) in May 2004. Three scenarios were assessed considering alternative targets given the poor progress achieved up to that time. The option finally accepted was to proceed with the original plan but extending the closing date. The assessment assumed minor changes from the original parameters: (i) cropping patterns were assumed to be similar in both project scenarios; (ii) input and output prices were updated; (iii) savings in irrigation costs were re-evaluated; (iv) a small benefit from land savings and reduced mezqa O&M costs was added; (v) total area to benefit from the project improvements (tail end farms) was increased from 60 to 67 percent; (vi) project costs were updated; and (vii) cost and benefits were re-phased. As in the SAR, the analysis was carried out over a period of 30 years and the new ERR was estimated at 16.4 percent, assuming full implementation of the SAR defined IIP, but extending to December 31, 2004 the project closing date. The expected reduction in ERR compared with the SAR (25%) was mentioned to be due to (i) the fall of world traded commodity prices, and (ii) the effects of the delays in implementation.

The ICR estimated result

The ICR estimation of the expected ERR considering what is actually being achieved so far, and what could reasonably be expected in the future, is 15 percent; and the NPV US$29 million at 12 percent discount rate. Even when these results are satisfactory, they are significantly lower than the ERR estimated at appraisal (25.2 percent) but in line with the MTR assessment (16.4 percent). The main reasons explaining the reduced ERR are: (i) the limited application of CF (9 per cent of the area at the time of the last farmers survey (35 percent at closing date), with variable discharges and still cyclic delivery) in the improved distribution system maintaining considerable lack of equity in water availability and still meager yield increases at the tail end of canals; (ii) low adoption of crop and water management improved technologies; (iii) unimproved areas not showing the reduced yields foreseen at appraisal due to the use of low quality drainage water for irrigation to compensate the insufficient fresh water in canals on the system's tail areas; and (iv) the 18 percent reduction of the improved area (205,000 fed instead of 248,000 fed).

Project costs and benefits were estimated using 1997 to 2006 real market prices inflated into 2006 constant LE. Conversion factors used for valuing costs and benefits for the economic analysis were based mainly on estimations of border prices for tradable inputs and products. These factors included: 3.0 for diesel[15]; 0.9 for phosphate and potassium fertilizers; 0.95 for

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[14] Table 6.1, SAR, December 1, 1994. However, the Working Document C3, Volume II, Annex C, page 17, December 30, 1994 shows expected farm income increases for the representative farm models of about 27.2 to 36.5 percent.

[15] Egypt is a net oil exporter, producing almost 50 percent more oil than its domestic consumption. It refines the majority of its domestic consumption of products. According to IEA statistics, Egypt consumed 21 million tons

wheat; 0.98 for cotton; 0.9 for maize; 1.1 for rice; and 0.7 for meat and milk. For non-traded commodities, such as berseem (alfalfa), and fruits and vegetables, financial prices were assumed to be in line with its economic shadow prices, hence needing no adjustment. Agricultural machinery, pumps, irrigation equipment and other on-farm investment costs were all valued using 0.95 as conversion factor. Prices projections for traded inputs and outputs were assumed to follow the most recent forecasts of international prices prepared by the WB.

Project costs in financial current prices were converted into economic constant 2006 prices, excluding taxes and duties. The following factors were used for adjusting IIP investments: civil works 0.85; equipment 0.95; and specialized consulting services 1.0. Training costs were excluded from the analysis as benefits go beyond the IIP. Economic prices were then estimated in constant 2006 prices by using the GDP deflator for the portion of project costs in local currency; and the Manufacturing Unit Value (MUV) index for the foreign component of the project investment costs. Total project costs in constant 2006 economic prices are summarized in the following Table 3.2.

Table 3.2 Total IIP implementation costs (current financial prices; '000 LE)

Components	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1. Civil works (secondary & tertiary syst)	0	11,455	35,518	60,024	90,928	168,245	92,584	48,453	42,295	23,683	19,223
2. Equipment (secondary & tertiary syst)	279	4,319	705	6,577	4,267	7,314	10,637	8,526	8,266	2,773	3,962
3. Other civil works	0	245	0	319	0	0	0	0	0	0	0
4. Other equipment	2,820	1,059	1,126	561	170	965	794	365	1,371	1,450	0
5. Specialized services	5,653	4,968	5,588	3,156	3,175	4,525	7,871	5,719	4,908	1,650	5,078
5.1 Specialized services – World Bank	67	217	278	76	5	27	19	0	0	0	0
5.2 Engineering support	3,260	2,658	2,823	1,181	1,962	2,651	2,528	1,505	1,817	776	0
5.3 Supplementary measures	2,327	2,093	2,487	1,900	1,208	1,632	3,181	2,827	1,422	219	0
5.4 M&E	0	0	0	0	0	215	2,142	1,387	1,669	655	5,078
6. Recurrent expenditure IIS	1,921	2,776	3,550	4,195	3,745	3,235	3,027	2,530	2,419	2,262	1,077
Total project cost IIP	10,672	24,822	46,487	74,832	102,285	184,284	114,912	65,593	59,257	31,818	29,341

IIP benefits were derived from aggregate incremental farm net income (comparing *with* versus *without* project scenarios) resulting from representative crop and farm models representing each of the three project's improved sub-areas. Crop budgets are based on real data obtained through interviews with farmers and from the M&E farmers survey (FS) conducted between 2002 and 2005 by the WMRI. Average yields and cropping patterns in improved and unimproved areas were computed as if they represented the *with* and *without* scenarios taking also into account Waterwatch studies based on remote sensing approaches

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of petroleum products in 2003 of which diesel accounted for about 39 percent. In September 2004, diesel prices were raised for the first time in a decade by 50 percent, but this still left the price at LE 0.60 (US$0.10) per liter. The government estimated at the time that the diesel subsidy cost some 5 billion Egyptian pounds (US$800 million) a year. In fiscal year 2005–06, the petroleum subsidy (which includes natural gas and all oil products) was made explicit for the first time at LE 22 billion (US$3.8 billion); and in February 2006 revised the subsidy cost to LE 41 billion (US$7.1 billion). The structure of subsidies encourages the use of diesel pumps and higher levels of waste, discourages substitution towards electricity and has a significant impact on the state budget.

applied over 1997/98, 2002/03[16] images. Table 3.3 below summarizes yield increases considered for the main crops *with* project as compared to the *without* project scenario[17]. Incremental yields are highly coherent with the result of 2005 farmers' surveys but probably is a conservative estimation of impact since yields have continued to improve further as the establishment of CF in IIP branch canals and mezqas allows for the expression of the on-demand water availability at the tail end farms at least in about 35 per cent of the area today with partial CF.

Table 3.3 Yield improvement factors of major crops with project versus without project

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007-2015
Wheat	1.005	1.01	1.02	1.03	1.035	1.04	1.045	1.05	1.05	1.05
Rice	1.015	1.03	1.045	1.06	1.065	1.07	1.075	1.08	1.08	1.08
Maize	1.005	1.01	1.02	1.03	1.035	1.04	1.045	1.05	1.05	1.05
berseem, LS	1.005	1.01	1.015	1.02	1.025	1.03	1.03	1.03	1.03	1.03
berseem, SS	1.005	1.01	1.015	1.02	1.025	1.03	1.03	1.03	1.03	1.03
broad beans	1.005	1.01	1.02	1.03	1.035	1.04	1.045	1.05	1.05	1.05
sugar beet	1.005	1.01	1.02	1.03	1.035	1.04	1.045	1.05	1.05	1.05
winter vegetables	1.01	1.02	1.03	1.04	1.05	1.05	1.05	1.05	1.05	1.05
summer vegetables	1.01	1.02	1.03	1.04	1.05	1.05	1.05	1.05	1.05	1.05
Cotton	1.005	1.01	1.02	1.03	1.035	1.04	1.045	1.05	1.05	1.05
Citrus	1.01	1.02	1.03	1.04	1.05	1.05	1.05	1.05	1.05	1.05
water melon seeds	1.01	1.02	1.03	1.04	1.05	1.05	1.05	1.05	1.05	1.05

As in the previous evaluations, cropping intensities were considered to be 200 % for both *with* and *without* project situations and cropping patterns showed only minor differences between scenarios. For each of the three regions three farm models were built representing the following percentage of farms per size brackets: (i) about 24 per cent of farms being smaller than one fed (average size 0.75 fed); (ii) about 40 per cent between 1 and 3 fed (average size 1.5 fed); and (iii) about 36 per cent larger than 3 fed (average size 4 fed).

Irrigation cost reductions constitute a significant source of benefits resulting in the overwhelming farmers' acceptance of the improvements with cost recovery agreements being achieved by the IIP. Improved mesqas allow for reductions in the farms' pumping cost of irrigation estimated in about 35 to 42 percent in financial terms (42 percent weighted average in economic terms). The improved efficiency of water conveyance and the corresponding water savings being obtained *with* project was estimated based on the piped mezqa conveyance efficiency been improved from 80 to 95 percent. IIP investments at the secondary delivery systems were assumed to have no significant impact on the overall

[16] The farmer surveys comprised 5 summer seasons (2001 to 2005) and 4 winter seasons (2001/02 to 2004/05). It is difficult to identify a clear trend in cropping patterns for unimproved or improved areas, or to obtain statistically significant differences between areas. Shares of the main crops in total planted area show important inter annual variations in both the summer and winter seasons. This could be attributed to changes in relative crop revenues, for example as a result of producer price changes for crops that can easily substitute each other.

[17] The yield increases estimates are based on the results from in-depth statistical analyses, including multiple regression analysis, carried out on the yield data sets of the farmer surveys by the IIP international M&E specialist. For the improved areas yields appeared to be 3 % higher for berseem; 5 % for wheat, maize, broad beans, sugar beet, winter and summer vegetables, cotton as well as citrus (as perennial crop); and 8% for rice.

system efficiency so far. Additionally, the more efficient single-point lifting pump sets reduce considerably the O&M costs of pumping and the labor requirements for irrigation.

Assumptions on theoretical crop water requirements, in terms of conjunctive use, were based on the results of a recent "matching study" and are shown in the following table 3.4 for Mahmoudia sub-project area (Western Delta Region), and Wasat and Manaifa (Northern Delta Region)[18]. As far as data is available, the table also shows the estimated consumptive use as published in the National Water Resources Plan in 2001 for Lower Egypt. For broad beans, no estimate was found for the Northern Delta Region, so the same values as for Western Delta were used.

Table 3.4 Consumptive use by crops and IIP intervention areas

Crops	Northern Delta	Western Delta	difference	NWRP lower Egypt
	Manaifa/Wasat	Mahmoudia	%	
Winter				
Wheat	1,606	1,885	17,4	1,828
Berseem LS	2,266	2,654	17,1	2,345
Berseem SS	1,471	1,725	17,3	n.a.
Beans	1,895	1,895		n.a.
sugar beets	2,171	n.a.		n.a.
vegetables /	1,363	1,574	15,5	n.a.
Summer				
Rice	4,467	4,869	9,0	4,248
Cotton	2,886	3,320	15,0	3,881
Maize	2,128	2,424	13,9	2,474
vegetables	3,698	4,228	14,3	n.a.

Based on the theoretical requirements and on the overall irrigation efficiency improvement as presented above, the crop water requirements per feddan for the *without* and *with* project situation were calculated for Mahmoudia and Manaifa/Wasat areas respectively[19]. Potential water savings resulting from these assumptions were estimated to be up to 27.8 % in the with project situation. Such would be the case if *with* the improved mezqas the water use index (WUI), defined as overall irrigation water supply over crop theoretical requirements, would improve from 140 percent (*without*) to 120 percent (*with*) as a result of farmers having higher security about timely water availability, reducing their over flooding of crops when water is available.

For the calculation of irrigation costs, the standard approach used in the SAR and in the MTR was used and values updated following these criteria: (i) the 1999 financial values used in the MTR report as initial investment costs of pump sets updated by using the composite "equipment/machinery" of the wholesale price index (WPI); (ii) fuel prices inflated to 2006 values by using the "fuel and fuel-related products" price index of the WPI; (iii) operator

[18] The estimates of crop consumptive water use shown in Table 3.3 are based on the assumption that the average overall conveyance efficiency is 85 percent.

[19] IIP. Preparation of the Implementation Completion Report. Ex-post financial and economic analysis. Draft Report (March 2007). Jurgen Blanken, Consultant.

costs & labor wages determined by applying the average annual price increases as used for the agricultural labor wage rates (from the average increase of labor costs in agricultural production from MALR statistics). As for the SAR and MTR reports, the following models were distinguished:

- ***without* project** two sizes were considered: (i) farmers' individual pump sets with 5 HP and a discharge of 110 l/sec, or (ii) with 7.5 HP and a discharge of 200 l/sec. An efficiency of 100 % was used for all computations. The assumptions made in the MTR as regards technical parameters such as the working life time, total lifetime maintenance costs (50 % of initial investment), fuel consumption per hour, costs of lubricants as a fixed percentage of fuel costs (10 %), as well as maintenance costs being a function of annual pumping hours were adopted without any change. For the analysis of irrigation costs in the without project situation, the average pumping costs of the 2 models described above have been used (see Table 3.5 below).

Table 3.5: Pumping costs per m^3 (LE/m^3**) in financial current prices – without project**

	1999	2000	2001	2002	2003	2004	2005	2006
5 HP; 110l/sec discharge								
Annual use 375 hours	0.0273	0.0273	0.0277	0.0287	0.0311	0.0342	0.0374	0.0396
Annual use 500 hours	0.0254	0.0255	0.0259	0.0268	0.0290	0.0319	0.0349	0.0370
7.5 HP 200 l/sec discharge								
Annual use 375 hours	0.0231	0.0229	0.0232	0.0239	0.0258	0.0285	0.0309	0.0328
Annual use 500 hours	0.0211	0.0210	0.0212	0.0219	0.0236	0.0261	0.0283	0.0301
Average both pump sets								
Annual use 375 hours	0.0252	0.0251	0.0255	0.0263	0.0285	0.0314	0.0342	0.0362
Annual use 500 hours	0.0233	0.0232	0.0235	0.0243	0.0263	0.0290	0.0316	0.0336
Average	0.0242	0.0242	0.0245	0.0253	0.0274	0.0302	0.0329	0.0349

- **with project,** three pump sets size possibilities were analyzed: (i) small meska (up to 50 feddan) with 2 pump sets of 60 l/sec each, and a discharge capacity of 432 m^3/hour; (ii) medium meska (100 feddan) with 2 pump sets of 60 and 90 l/sec, and a discharge capacity of 540 m^3/hour; and (iii) large meska (200 feddan and more), 2 pumps of 90 and 150 l/sec, and a total discharge capacity of 864 m^3/hour. All technical pump parameters and cost items were supposed to be the same as for the MTR report, except for the cost estimate for the lifetime maintenance costs which was increased from 33 to 75 percent of the initial investment, as proposed by IIS. Based on the data obtained from IIS on the total improvement area and the meskas handed over to users by the end of 2006[20], the average pumping costs obtained for the small and medium size meskas for the improved IIP area as shown in table 3.6 below.

[20] The average command area per meska for the 3 sub-project areas is as follows: (i) Mahmoudia 70.4 feddan; (ii) Manaifa 62.2 feddan; and (iii) Wasat 63.2 feddan.

Table 3.6: Pumping costs per m^3 (LE/m^3) in financial current prices – with project

	1999	2000	2001	2002	2003	2004	2005	2006
Small meska (50 feddan)	0.0196	0.0195	0.0197	0.0204	0.0221	0.0245	0.0265	0.0280
Medium meska (100 feddan)	0.0147	0.0146	0.0147	0.0152	0.0165	0.0182	0.0197	0.0208
Large meska (200 feddan)	0.0121	0.0119	0.0121	0.0124	0.0134	0.0149	0.0160	0.0170
Average all 3 sizes	0.0155	0.0153	0.0155	0.0160	0.0173	0.0192	0.0207	0.0219
Average small & medium size	0.0171	0.0170	0.0172	0.0178	0.0193	0.0213	0.0231	0.0244

Financial Analysis: Farm Models. FARMOD software allowed for the assessment of the IIP impact at the beneficiaries' family income level. Family labor availability was introduced to the farm models to determine seasonal requirements for hired labor. Self consumed farm production and off-farm employment was also estimated as well as relevant family expenses, to analyze social aspects related to poverty alleviation and the impact of improvements on income. Full cost recovery of investments was also introduced (assuming 3 years for repayment of pumps and 20 years for mezqa investments) in order to verify the payment capacity of small farmers and the net income after cost recovery. Table 3.7 below shows the farm budget for a 1.5 feddan model for the Mahmoudia improved area.

Table 3.7: New Areas Farm Model (1.5 feddan) Financial Budget (In LE)

	Without			With Project		
	Project	1	2	3	4	5 – 20
Main Production						
Winter Crops	3,460	3,460	3,585	3,570	3,647	3,645
Summer Crops	3,240	3,240	3,319	3,388	3,371	3,750
Fruits and Vegetables	2,515	2,515	2,708	2,753	2,942	2,432
Animal products	9,000	9,000	9,000	9,000	9,000	9,000
Sub-total Main Production	18,215	18,215	18,612	18,711	18,960	18,827
Sub-total Byproducts	305	305	337	361	397	474
Gross Value Of Production	18,520	18,520	18,949	19,072	19,357	19,301
Sub-Total On-Farm Use	2,805	2,805	2,850	2,766	2,671	2,410
Sub-Total On-Farm Consumption	3,121	3,121	3,164	3,115	3,109	3,303
Net Value Of Production	12,593	12,593	12,934	13,192	13,577	13,588
Off Farm Employment	3,835	3,835	3,736	4,082	3,945	4,152
Purchased Consumption	300	300	300	300	300	300
INFLOWS	16,128	16,128	16,370	16,974	17,222	17,440
Production Cost: Investment		5,670	-	-	-	-
Operating Costs	3,703	3,643	3,650	3,594	3,623	4,141
Sub-Total Production Cost	3,703	3,703	3,650	3,594	3,623	4,141
OUTFLOWS	3,703	9,313	3,650	3,594	3,623	4,141
Cash Flow Before Financing		6,815	12,720	13,380	13,598	13,299
Farm Family Benefits Before Financing	12,354	9,936	15,884	16,494	16,707	16,602
Net Financing (Cost Recovery)		8,948	-400	-408	-407	-265
Cash Flow After Financing	12,354	15,763	12,320	12,971	13,191	13,034
Family Benefits After Financing	15,546	15,616	15,484	16,086	16,300	16,337
Returns per Family-Day of Labor	85	85	84	87	86	90
1.1 NPV = LE 3,636.						

Annual benefits in this Mahmoudia 1.5 feddan farm model allowed for an increase in family household income (after cost recovery) by 5%, from US$2,726 to US$2,866 equivalent, representing a daily net per capita income of US$1.24 and US$1.31 respectively (hence still under poverty line) using an average family size of six members. Similar to the model

presented above, nine farm models were built to represent the universe of IIP beneficiaries from the three sub areas, considering three farm sizes (average size of 0.75 feddan, 1.5 feddan and 4 feddan). Table 3.8 below shows the area covered by each type of farm, the assumed number of farms represented in the improved areas and the expected family income increases in the sixth year, after full cost recovery of pump costs. It also shows in the last column the NPV of the incremental benefits to be attained by farmers as a result of the project improvements.

Table 3.8. Farm Models and Expected Income Increases

	Area per type of Model (feddan)	No. of farms	Farmers Net Income Increase	
			Year 6 (%)	NPV LE
Mahmoudia Model 0.75 feddan (38% of area)	2,900	3,800	104	2,036
Model 1.5 feddan (32% of area)	15,100	10,100	106	3,950
Model 4 feddan (30% of area)	76,300	19100	109	10,674
Manaifa Model 0.75 feddan (38% of area)	6,800	9,100	102	835
Model 1.5 feddan (32% of area)	18,500	12,300	103	1,931
Model 4 feddan (30% of area)	12,500	3,100	106	8,267
Wasat Model 0.75 feddan (38% of area)	6,300	8,300	103	2,144
Model 1.5 feddan (32% of area)	18,700	12,500	104	3,912
Model 4 feddan (30% of area)	37,300	9,400	107	11,149

Farm models confirmed the positive impact of the IIP investments over beneficiaries' family income even after cost recovery of the investments involved, but at a lower level than foreseen at appraisal due to the fact that CF is still to be enforced in most of the project areas. In spite of that shortcoming, the financial attractiveness of the proposed improvements, and its impact on incomes was confirmed by the models as income increases by 2 - 4 percent in the smaller farms averaging 0.75 feddan, and up to 7 – 9 percent for the larger farms averaging 4 feddan in the improved areas.

1.2 **Economic Results.** The evaluation exercise with FARMOD software allowed for an analysis at the crop/activity, representative farm models, sub project region, and farm size levels. Water savings are expected to reach about 15% of the volume being used, equivalent to 360 million m^3 of water saved per year at project maturity. Based on the above mentioned assumptions and assigning no economic value for the water saved, the project would still have an ERR of 15%. The NPV at a discount rate of 12% (representing the opportunity cost of capital) was estimated at LE 165 million (about US$29 million equivalent) as shown in Table 3.9. An additional non-quantified benefit of the project will be greenhouse gas (GHG) emissions reductions (ERs). A 15% reduction in the volume of water pumped, the single-point (collective) pumping sets at the mesqa's head, and the more efficient pump sets would all contribute to reduce carbon emissions.

1.3

1.4

Table 3.9 Project Summary **ECONOMIC BUDGET (In LE '000)**

	IIP Investments	Present	Future Without	Future With	Percentage Change
Main Production					
Winter Crops		479,827	519,807	541,201	4
Summer Crops		460,347	504,912	560,540	11
Fruits and Vegetables		232,472	237,530	244,661	3
Animal products		669,841	669,841	669,841	-
By Products		45,477	57,815	62,300	8
Gross Value Of Production		1,887,965	1,989,905	2,078,543	4
Sub-Total On-Farm Use		301,814	274,683	280,557	2
Sub-Total On-Farm Consumption		246,147	261,113	259,290	-1
Net Value Of Production		1,340,004	1,454,108	1,538,696	6
Sub-Total Purchased Consumption		16,712	16,469	17,882	9
INFLOWS		1,323,293	1,437,640	1,520,814	6
Production Cost					
Investment Mezca Improvements & Pump sets	666,779				
Operating: Winter Crops		92,953	123,927	117,925	-5
Planting materials		40,553	58,815	59,629	1
Summer Crops		10	78	406	422
By Products		5,050	5,035	4,835	-4
Fertilizers		80,907	108,654	111,934	3
Agrochemicals		78,203	79,477	78,361	-1
Irrigation costs		108,495	107,995	62,718	-42
Other production costs		86,268	79,315	73,293	-8
Labor		275,206	298,931	299,227	-
Sub-total Operating Costs		767,644	862,227	808,328	-6
Sub-Total Production Cost		767,644	862,227	808,328	-6
Other IIP Investment Costs	74,524	-	-	1,900	-
OUTFLOWS		767,644	862,227	810,228	-6
Cash Flow		555,649	575,413	710,586	23
Net Economic Benefits		801,796	836,526	969,876	16

IRR = 15.0%, NPV = 165,182.00

ANNEX 4: BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION PROCESSES

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Aizad Nawaez Khan	Task Team Leader	MN2AG	
Nejdet Al-Sahili	Principal Irrigation Engineer	MN2AG	
Supervision/ICR			
Usaid El-Hanbali	Sr. Irrigation Engineer	MNSRE	TTL
Arbi Ben-Achour	Social Scientist	MNSRE	
Ashok Subramanian	Lead Water Inst. Dev. Specialist	MNSRE	
Ayat Soliman	Environmental Specialist	MNSRE	
Mohamad Usman	Agricultural Economist, Consultant		
Jose Simas	Lead Water Resources Expert	MNSRE	TTL/ICR
Mohamed Safwat Youssef Abdel-Dayem	Consultant	MNSRE	
Maiada Mahmoud Abdel Fatt Kassem	Consultant	MNAFM	
Hani Abdel-Kader El Sadani Salem	Sr. Water Resources Engineer	MNSSD	
Maher Abu-Taleb	Sr. Water Resource Specialist	MNSSD	
Zakia Chummun	Language Program Assistant	MNSSD	
Nejdet Al-Sahili	Irrigation Engineer Consultant	MNSRE	
Juan Morelli	Ag. Economist. Consultant	FAO-CP	ICR
Michael Sandoz	Irrigation Eng., Consultant	FAO-CP	ICR

(b) Staff Time and Cost

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	No. of staff weeks	USD Thousands (including travel and consultant costs)
Lending		
FY94		139.16
FY95		180.26
FY96		0.79
FY98		3.22
Total:		323.43
Supervision/ICR		
FY95		44.84
FY96		36.16
FY97		52.70
FY98		77.80
FY99		102.12
FY00	24	113.37
FY01	16	82.80
FY02	15	64.63

FY03	13	56.38
FY04	19	91.87
FY05	19	80.77
FY06	22	124.07
FY07	11	59.20
Total:	139	986.71

ANNEX 5: BENEFICIARY SURVEYS AND PROPOSED WUAS PERFORMANCE INDICATORS

1. Farmers' perception of the irrigation improvement[21]

Continuous flow Assessment. The effective introduction of continuous flow (CF) is still significantly lagging behind schedule (35 percent). CF was effectively applied to only 9 percent of the sample farmers in Mahmoudia when the last survey was conducted in 2005. The assessment of farmer's acceptance of CF showed that all sample farmers in IIP areas preferred continuous flow. The most important reasons were: (i) more convenient for irrigation; (ii) improves equity between head and tail of branch canal; (iii) overcoming water shortage problem; (iv) saving of time and labour for irrigation.

Crop yield comparison with and without continues flow. To asses the impact of applying CF in improved areas on crop productivity, the yields per feddan of main summer crops were compared to the areas with and without CF in Mahmoudia sub-project for summer 2005 season. Yields of wheat varieties were higher with CF than those without CF except for Sakha 69 variety. Yields of summer crops on farms with CF were higher than those without CF. The yield increases on summer crops ranged between 11-38 percent. Further analysis is required since only 9 percent of the sample in Mahmoudia sub-project was having CF.

Preferred type of meska improvement: When farmers were asked about the type of meska improvement they prefer most of them (91%) in the three sub-projects answered they prefer pipelined meskas. Farmers who preferred raised lined meskas (7.5%) were located in Wasat and Mahmoudia sub-projects. Farmers preferred piped meskas improvement for the following main reasons: (i) ease of operation; (ii) easier to ensure that water reaches the tail of the meska; (iii) it takes less land; (iv) it has less seepage/water losses from meskas; (v) it’s easier to divide water between farmers for irrigation at the same time.

Improved Mekas. The study assessed also the awareness and perception of the IIP among farmers with improved meskas in-operation. The most important benefits representing about 73.9% of all IIP benefits appreciated from the farmer's point of view were: (i) reduces pumping costs; (ii) reduces irrigation time; (iii) improves equity between head and tail of meska; and (iv) prevents tail losses from low-level meskas to drains.

Operation and Maintenances (O&M). The survey also analyzed farmers' perception toward O&M problems of improved meskas. About half (48 percent) of the farmers in Mahmoudia reported some problems associated with the IIP. However, only 10 percent of farmers in Manaifa complained from these problems against only 3.6% of those in Wasat. The main reported problems of improved meskas were: (i) spare parts for pumps not being available; (ii) difficulties in maintaining pumps; (iii) pump repair technicians not being available; (iv) discharge from mezqa pumps not being sufficient; (v) problems with levels along meska; and (vi) stand by pump not being available.

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[21] Farmer Survey Study, Report No. 5, (Winter 2004/05 and summer 2005)

Following are the main results from the farmers' perspective:

- Regarding effects of IIP improvements on **cropping patterns**: (i) for the winter 2004/05 season there was an increase of long season berseem (LSB) in all three sub areas and of wheat in Manaifa and Mahmoudia; and (ii) an increase of rice at the expense cotton and maize in Wasat while at the expense of cotton, maize and perennial summer crops in Manaifa and Mahmoudia.
- Crop patterns varied slightly different with relative location in head, medium or tail. There was an increase in LSB and wheat in the medium and tail areas in Wasat and Mahmoudia. Rice expanded in medium areas of the improved area but decreased at the tail areas. Cotton and maize increased in the tail areas in both Wasat and Manaifa.
- There is a general slightly higher trend in **yields** obtained on improved mesqas: the average rice yield for the three areas increased by 8.8% from 2.85 to 3.1 tons/fed; for Sakha 61 and 93 wheat in Wasat yields were 1.8% and 1.2% higher than in unimproved areas respectively. In Manaifa, short season berseem (SSB) and Sakha 61 wheat yield differences were 0.6% 2.5% respectively.
- To asses the impact on crop productivity of CF regime in improved areas, yields of main crops were compared with areas without CF in Mahmoudia. Wheat yields were higher with CF except with Sakha 69 variety and yield of all summer crops on farms with CF were higher than those without it. The increase in yield of summer crops ranged between 11-38%. Further analysis is needed since only 9 percent of the 2005 study sample was under the CF regime.
- In improved areas, there is a general downward trend in the use of low water quality as only canal water was used for irrigation in Manaifa. However, in Wasat and Mahmoudia canal water was also the main source used but still 10% of total number of irrigations depended on drainage water.
- Water shortage and length of irrigation period are still common problems facing farmers in both unimproved and improved areas because of the delays in introducing of CF especially in Mahmoudia. However, these problems seem to be less severe in improved areas.
- Awareness and perception of the IIP was also analyzed. The main benefits from the farmer's perspective were: (i) reduction of pumping costs; (ii) reduction of irrigation labor time; (iii) equity improvement between head and tail of mesqas; (iv) prevention of tail losses from low-level mesqas to drains; (v) convenience for irrigation; and (vi) reduction of masqa maintenance cost. Annex 5 summarizes some other farmers' perceptions of improvements according to the survey.
- The main problems of improved mesqas were from their perspective some difficulties to maintain pumps: repair guys and pumps spare parts unavailable and insufficient pumps discharge capacity.
- Most farmers (91%) prefer pipelined mesqas for the following reasons: ease of operation, higher security that water reaches the tail of mesqas, and less land and seepage / water losses from mesqas.

Scoring for Water Users' Association Performance Indicators

The proposed WUA Performance Indicators shall be used to assess the performances of each WUA on an annual basis, whereby the WUA can score 0, 1 or 2 points on each performance indicator. The overall score as well as the total scores for institutional, financial and technical performance indicators are an indication of the level of performance of the WUA with regard to the O&M of the irrigation and drainage infrastructure and its own functioning.

No	Performance Indicator	Calculation	Scoring
	Institutional		
1	WUA membership ratio	WUA members as % of total number of water users in command area (CA)	2 = > 50% 1 = 25 – 50% 0 = < 25%
2	Female WUA membership ratio	Female WUA members as % of total number of female water users in CA	2 = > 50% 1 = 25 – 50% 0 = < 25%
3	Representation of tail-end water users in Board of Management in irrigation scheme	Number of members of Board of Management from tail-end of CA as % of total number of members of Board of Management	2 = ≥ 33% 1 = < 33% 0 = not represented
4	Annual General Meetings of General Body	Number of AGM held in last financial year	2 = one every 2 months 1 = only one per year 0 = no
5	Regular meetings of Board of Management	Number of meetings held during last financial year	2 = one every 2 months 1 = < one each 2 months 0 =
6	Preparation of minutes of meetings of General Body and Board of Management	Minutes of meetings made	2 = always 1 = irregularly 0 = never
7	Elections of members of Board of Management	Elections for members of Board of Management timely	2 = yes 0 = no
8	Written set of Internal Rules & Regulations	Internal Rules & Regulations prepared and approved by General Body	2 = approved 1 = non-approved 0 = none
9	Communication between WUA and water users	WUA uses board and notices to inform water users	2 = yes 0 = no
10	Enforcement of sanctions	Sanctions are enforced by WUA	2 = yes wthout RA assistance 1 = yes with RA assistance 0 = no
11	Resolution of internal water-related conflicts	Number of resolved internal conflicts as % of number of reported internal conflicts	2 = > 75% 1 = 50 – 75% 0 = < 50%
12	Level of facilities	Fully equipped office and adequate transport	2 = yes 1 = only equipped office 0 = none
13	Employment of Water Masters	Duration of employment of Water Masters during last financial year	2 = > __ months/year 1 = < __ months/year 0 = none
Sub-Total Score			
	Financial		

	Performance Indicator	Calculation	Scoring
14	Full payment of Water charges	Number of water users having paid Water charges before end of financial year as % total number of water users due to pay	2 = > 90% 1 = 50 – 90% 0 = < 50%
15	Water charge collection performance	Collected Water charges as % total amount of Water charges assessed	2 = > 80% 1 = 50 – 80% 0 = < 50%
16	Cost of Water charges collection	Cost of Water charges collection as % of amount of Water charges collected	2 = < 15% 1 = 15 – 30% 0 = > 30%
17	Emergency and Reserve Fund	Amount deposited in Emergency & Reserve Fund divided by CA	2 = ≥ 10% of paid W charges 1 = 10% of paid W charges 0 = < 10% of paid Wcharges
18	Approval of WUA Business Plan	WUA Business Plan has been prepared and approved by General Body	2 = prepared and approved 1 = prepared / not approved 0 = not prepared
19	Approval of Annual Balance Sheet	Annual Balance Sheet prepared and approved by General Body	2 = prepared and approved 1 = prepared / not approved 0 = not prepared
20	Financial Audit of WUA	WUA account approved by auditors	2 = unconditional approval 1 = conditional approval 0 = no audit conducted/approv.
21	Submission of WUA account to RA	Accounts are submitted to RA in time by WUA	2 = submitted in time 1 = submitted but not in time 0 = not submitted
Sub-Total Score			
	Technical		
22	Preparation and publication of water distribution and irrigation schedule	Water distribution/rotation plans are prepared and published by WUA	2 = prepared and published 1 = prepared but not published 0 = not prepared
23	Irrigated area as proportion of assessed/cropped CA	Irrigated area as % of total assessed/ cropped CA	2 = > 90% 1 = 80 – 90% 0 = < 80%
24	Efficiency of water supply per acre of irrigated/cropped CA	Supplied volume of irrigation water per irrigated/cropped acre CA as % of allocated water volume	2 = > 90% 1 = 80% - 90% 0 = < 80%
25	Equitable supply of irrigation water within CA	Irrigated area in tail-end of CA as % of irrigated area in head-end of CA	2 = > 90% 1 = 70 – 90% 0 = < 70%
26	Implementation of annual maintenance inspection	Annual maintenance inspection is conducted during last financial year	2 = yes 0 = no
27	Preparation and approval of annual maintenance plan	Annual maintenance plan prepared and approved by General Body	2 = prepared and approved 1 = prepared but not approved 0 = not prepared
28	Maintenance expenditures as ration of maintenance budget	Maintenance expenditures per acre CA as % of maintenance budget	2 = > 90% 1 = 75% - 90% 0 = < 75%
29	Maintenance cost to revenue ratio	Maintenance expenditures as % of collected revenue collected	2 = > 80% 1 = 70 – 80% 0 = < 70%
30	Operational capacity of distribution system in irrigation scheme	Actual conveyance capacity as % of designed conveyance capacity	2 = > 90% 1 = 80 – 90% 0 = < 80%

	Performance Indicator	Calculation	Scoring
31	Capital works executed according to approved WUA	Actual capital expenditures as % of planned capital expenditures specified in WUA Business Plan	2 = > 80% 1 = 60% - 80% 0 = < 60%
Sub-Total Score			
TOTAL SCORE			

ANNEX 6: STAKEHOLDER WORKSHOP REPORT AND RESULTS

No Stakeholder workshop was held.

ANNEX 7: SUMMARY OF BORROWER'S ICR AND/OR COMMENTS ON DRAFT ICR

Introduction

Egypt is one of the developing countries that expect facing a serious water crisis very soon. This is due to its limited water resources represented mainly by its fixed allocation of the Nile River water (about 55.5 milliards cubic meter per year according to the 1959 Water Agreement with Sudan), and in view of the increase of water demand as a result of the rapid growth of population, social changes, and the agricultural & industrial growth.

Egypt had no other opportunities but to have the initiative in formulating water resources strategies and policies due to its geographic location as the most downstream country in the Nile Basin and because of its limited rainfall resources. The policy's overall objective is to utilize the available conventional and non-conventional water resources to meet the socio-economic and environmental needs of the country and bridge the gap between supply and demand. The formulated policy focuses on the following major aspects:

1- Demand management by achieving the optimal use of available water resources through minimization of water losses, irrigation improvement projects, cost recovery, cropping pattern reform, groundwater development strategies, reuse of agricultural drainage water,

2. Water Resources development through increasing the Egypt's share of the Nile water (Upper Nile projects such as Jongli Canal), distillation of ground water and harvesting rainfall,

3. Environmental conservation through Separating domestic and industrial sewage from agricultural drainage, treatment of domestic sewage, enforcement of water quality law to industrial facilities, reducing fertilizer and pesticide usage in cultivation, and monitoring surface water and groundwater quality,

Irrigation Management Improvement Stages

To bridge the gap between the limited water supply and the increasing demand, through the efficient use of the available water resources, the EWUP Project conducted and financed by USAID as a research project took place during the period between 1977 until 1983. According to the projects' results, the Egyptian government represented by the Ministry of Water Resources & Irrigation (MWRI) has started a national program for improving irrigation management in the old areas located within the valley and the Delta. This national program constitutes a well- identified framework including the major project requirements and specific components for implementing improvement of the system management covering an area of 3.5 million feddans by year 2017. A physical system commenced in 1984 through USAID financed improvement project covering an area of 65,000 feddans including the branch canal level and the tertiary level. It was finished by year 1996.

The second stage began physically in the year 1997. It is a $182 million investment to improve the existing irrigation system in 248,000 feddans of land in the northern part of the Nile Delta in Behira and Kafr El-Sheikh Governorates, with co-financing provided by the World Bank for reconstruction and development, International Development Association (IDA) as well as the German Kredetanstall Fur Wiederaufban (KFW). It was planned to complete the physical works by the end of year 2005.

The third stage of the national program for improvement began in 2003/2004 and still within the preparation phase. According to the lessons learnt and the cumulative experiences, it was found that the improvement should consider the integration for different components of irrigation infrastructure (irrigation, drainage, IIP and ground water resources for irrigation management).

Hence the 3rd stage is called Integrated Irrigation Improvement Project (IIIMP) as it would conduct the project considering the integration of water management understanding to cover 500,000 feddans in five command areas with an objective of completing what had been begun in WB, IDA, KFW financed stage. It is planned that the IIIMP would build on the IIP but will adjust broad and integrated actions to reduce the distribution inequities and water losses, decrease the supply reliability and increase the operational flexibility, reduce the overall demands and increase the crop yields and farmers' incomes.

IIP Main Activities

The Irrigation Improvement Project (IIP) as one of the means of achieving optimal use of water resources in cultivation and the maximum agricultural productivity per feddan would also overcome the water distribution problems among farmers. The project main activities constitute of the following:

1. Improvement of the water delivery system in main & branch canals through installing new regulating structures (DS control gates) on branch canals, together with the applying the continuous flow instead of rotations, channel protection, telemetry system to allow centralized remote control of regulators on main canals.

2. Modernization of irrigation infrastructure at tertiary or mesqa level through installation of a collective pumping station at the head of each mesqa (single point lifting), high level mesqas (raised, or low pressure buried pipelines).

3. The Establishment of the Irrigation advisory services (IAS) in project area to provide technical support & training for the WUAs at mesqa and branch canal level in operation and maintenance of improved mesqas.

4. Formulation of an environmental program to evaluate the project environmental impacts.

5. An On-farm irrigation management program to improve farmers' irrigation practices and water use efficiency.

6. Institutional support to IIP for project implementation including staff training, consultancy services, facilities and equipment.

Figure (1) A layout of the project area under the different stages of implementation:

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IIP Main Objectives

The main objectives of the irrigation improvement project are listed in the following points:

Increase the agricultural production and the farm income by improving the irrigation infrastructure, a more equitable distribution of water, and improving on-farm water management.

1. Improve the long-term sustainability of irrigation through the assumption of responsibility for operation and maintenance at the tertiary level by farmers, cost sharing arrangement for tertiary level investment costs.

2. Strengthen the institutional planning and implementation capacity of MWRI within the irrigation Sector.

Some of the Project Achievements

Improvement of delivery system for main & secondary canals:

Within the project life, delivery designs for 68 branch and sub-branch canals (134 km length) serving 210,000 feddans were completed. This included 116 downstream control gates and 39 discharge control distributors, with associated regulators that require about 56,000 m3 of R.C., 39,000 m3 for masonry pitching, and 190,000 m3 of earth works for canal modeling**.**

Mesqa Improvement

A design of About 2,263 km of mesqas (91 % of the SAR) is made. At start, estimations were such that 60% of the mesqas to be pipelines, and 40% for lined. Such distribution did not agree with the farmers' preference of the pipelines. Therefore, the final designs were made for 2127 km (94 %) for pipelines (2,785 mesqas) and 136 km (6%) for elevated (150 mesqas). Instead of installment of single pump in each, IIS prefer installing multiple pumps with various sizes to meet changes in seasonal water requirements and cropping pattern, therefore the number of pump-sets became 5906 pump-sets (twice envisaged at SAR)

Irrigation Advisory Services

It was established as one of the IIP components to provide technical assistance & training for the WUAs at mesqa and branch canal level in the field of operation and maintenance of improved mesqas. The main objective of the IAS is to facilitate the WUA's participation at the different levels of work (before, during and after construction) in addition to solving conflicts among farmers. IAS with the WUAs succeeded to operate more than 3500 improved meskas. IAS formulates about 65 Bc WUAs covering all the improved branch canals.

The irrigation and drainage law number 12/1984 was amended to include the establishment of meskas improvement and maintenance monetary fund to be responsible for cost recovery program. This program is considered as a vital issue for the IIP sustainability since part of the cost required for extending the irrigation improvement works in the Delta and the Valley will be provided through the cost recovery of the already improved meskas by the WUAs contribution. A Ministerial decree has determined the basis of estimating and repaying work costs of improved meskas, besides the method of presenting it to beneficiaries, the opposing procedures and respective administrations that will collect the money and deposit it in the meskas improvement and maintenance account fund, in both old and new lands. It was estimated that the construction costs of improved irrigation network will be paid either in cash or on annual installments not exceeding twenty years according to farmers' repaying abilities, whereas the repayment costs of pump-set supply and installation will be over the first three years.

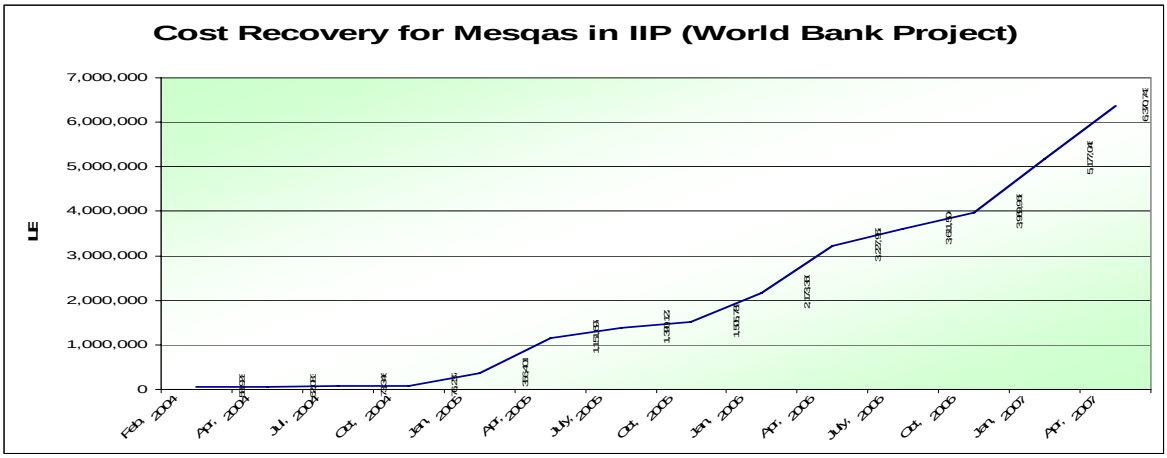
After implementing the developed irrigation works in the area, the respective irrigation department will determine the total costs of establishing a developed irrigation network, the costs for each WUA, the cost per feddan, and the cost for each beneficiary. A list of cost shares per beneficiary will be displayed for at least two weeks (after being announced in Elwakae Elmasrya newspaper) at the agricultural co-operatives mayor offices, local police stations, mosques, and WUAs headquarters. Concerned beneficiaries will have the right to oppose the estimated costs within 30 days following the display.

Beneficiaries' oppositions will be summated to the Public Irrigation Administration where a judgment will be made by a committee chaired by the general director/his deputy, representatives of the agricultural administration, survey department, agricultural Co-operative, irrigation engineer, and WUAs as member, consequently, the committee decision is final. The Irrigation Improvement Administration will deliver a statement to all respective entities to collect land tax, including areas and basins covered by irrigation networks, implemented by the Ministry, and the amount per feddan to be paid within the dates determined to collect land tax, and deposited in the account of irrigation canals development and maintenance fund.

The Cost recovery program has started by the end of the year 2003 with very low rates of collecting money due to the lack of communication between the land tax departments and the Irrigation Improvement department. But at the beginning of 2005, the Minister of finance and the Minister of water resources approved offering the people of land Tax departments an incentive of 2.5% form the total amount of money collected. This made a significant change and increased the figures of the collected money. It is expected to have a great increase in the rates of collecting money during the coming period due to the approval of the Minster of Water Resources and Irrigation in last February to increase the incentive of the land tax to 3% of the collected money.

The following table presents the estimated amount of money to be collected and the actual amount collected in the IIP project area in Middle and West Delta until the end of April 2007. It shows that we are still far from the targeted amounts but according to the attached chart, it is clear that the trend is going up and the rate of collection is increasing which means that the program will have better performance in the following years.

Directorate	Estimated amount to be collected till April 2007	Actual amount collected till April 2007	Percentage (%)
West Delta	9,229,871.89	3,586914.19	38.86%
Middle Delta	7,574,687.73	2,783,828.99	36.75%



Design changes

As the cost of improvement works increased and reached L.E 6,000 per feddan, a new design criteria was taken into consideration. A command area at the tail-end reach of Meet Yazid canal (W10-area) was selected as pilot to test the effect of several recommended technical and managerial changes on the application of the continuous flow, irrigation cost & time, agricultural productivity, and farmer's income with a main objective of decreasing the cost of irrigation improvement per feddan. These changes include using automated sluice gates regulators instead of DS control regulators, smaller pipe diameters & pump capacity, more pump operation time per day, marwas improvement and using electric pumps instead of diesel pumps. It is intended to adopt those mentioned changes related to delivery, mesqa and marwa, design, control and operation in IIP2 and the IIIMP project**.**

Evaluation of the borrower's own performance

The IIS staff in cooperation with the IS staff, the IAS, and the MALR have done their best during the different stages of the project to let the IIP1 perform well, achieve its goals with the best results. But the IIP1 is an ambitious project related to the Egyptian irrigation system which is very complicated and is considered to be a multi-dimensional system that involves social, institutional, technical and managerial aspects. Therefore, the project faced some problems during its preparation stage as it was very hard to forecast the constraints and implications of some of the proposed interventions such as the continuous flow regimes.

During the implementation stage, there was somewhat a delay in implementing some contracts concerning the improvement measures aiming at the introduction of continuous flow at branch canal level. Part of this delay was outside the implementing agency control due to the change in the world prices leading to the increase of the cost of materials used in the implementation of IIP works, or due to the farmers' initial resistance to accept the new IIP concepts and interventions. Some of the delay was due to the limited capacity of the contractors themselves towards the size of the contract and the huge amount of its included works.

During the operation stage, there were some problems concerning the means of controlling of water distribution in the branch canals through the downstream control gates due to the farmers' tampering and the accumulation of garbage in front of and under the gates impeding their free operation and reducing the passing flow. The great increase in the areas cultivated by rice was one of the problems faced by the government and participated in preventing applying the continuous flow efficiently as it is still controlled in a manner similar to rotational supply according to the beneficiaries' demand. Hence, it is difficult to assess the impact of IIP on achieving its goals such as the possible water savings as it should be assessed at the sub-project level not at the branch canal level, in addition, it will take some time after complete application of the continuous flow in the whole sub-project before the impacts materialise and become tangible. It was obvious that the role of WUOs at branch canal level is equally important in organising and enforcing pump operation schedules. Anyhow, the economic and the financial analysis of the IIP1 showed that it was feasible with an internal rate of return of about 18 % as mentioned page 29 in the ex-post financial and economic analysis report prepared by the agriculture economic consultant.

Regarding the objectives of the project which were defined at the beginning, they were appropriate, reasonable and in line with the government objectives. It can be noticed that the project was successful to some extent in achieving its goals as it improved the irrigation and drainage services. From the results of the monitoring and evaluation program, there is good evidence that equity of water distribution between the head and the tail of branch canals improves. There is also good evidence that having single lifting point at the head of meska, reduced labour, time and cost for irrigation purposes in improved areas and also reduced the maintenance cost. Having less number of pumps also reduced the carbon emissions leading to have a positive environmental effect.

The project participated in improving the environmental conditions in the improved areas and decreasing the water related diseases due to moving to pipelines meskas instead of open uncovered ones and as a result of reducing the informal reuse of drainage water for irrigation.

The project helped to reduce poverty in beneficiary population by increasing the farmers' income. This was achieved through increasing the agricultural production, land saving and decreasing the cost of irrigation and maintenance. There is a difference in yields between improved and unimproved areas of between 6-40 % depending on crop and variety. There is also evidence of increase in rice, berseem areas in improved areas. The yield for all summer crops was higher in improved areas compared to unimproved areas. For example the average rice yield for the three sub-projects increased with 8.8 % from 2.85 to 3.1 ton/feddan, and the cotton yield increased with 4.5% from 6.6 to 6.9 qintar/feddan. Also, the yield for all winter crops except berseem was higher in improved areas compared to unimproved areas. The average crop yield for the three sub-projects increased with 4 to 12%.

Egypt’s policy on cost sharing arrangements, establishing Water Boards, and promotion of mesqa-level management in the field of operation and maintenance works done by Water Users' Groups is considered to be a major step forward in the institutional reform field. It helps achieving the decentralization concept which lets the MWRI gets rid of some of its burdens and changes its role from the operational role to the strategic and supervision one

represented in planning for national policy. Applying the cost recovery concept will ensure the sustainability of the IIP as the money collected would be used in extending the irrigation improvement works in other areas in the Delta and the Valley

The MWRI being interested in testing the technical and managerial changes related to delivery, mesqa and marwa, design, control and operation in W10 area as a pilot area, it financed the study from its local budget.

A proposal about assessing flow characteristics of main canals in improved command areas is currently studied to get a complete description of the flow distribution in main canals which would help understanding different factors that adversely affect the implementation of the continuous flow and determining water consumption in improved and unimproved areas separately

Evaluation of the bank performance to the borrower

■ The consultants worked in close collaboration with the IIS staff and provided them with all possible technical assistance in the different fields concerning planning, designing and implementing the different activities of the irrigation improvement project.

■ The bank stopped bidding new contracts for implementing IIP1 works for one year which caused somewhat a delay in the implementation of the IIP1

■ There was a great cooperation between the IIS staff and the World Bank staff but changing the World Bank staff from time to time caused somewhat a delay in the procedures of obtaining the no-objection for some of the disbursements.

■ The German Financial Cooperation with Egypt is appreciated. It has provided additional funds to measure the impact of IIP on a grant basis with a view of complementing funds mobilized by MWRI.

■ There was a quick response from the KfW side to the IIS request to raise its contribution in the co-financing of the cost of the M&E additional services from 57 % to 70 %. This was very helpful to implement the M&E components.

■ The donor facilitated the procedures of purchasing all the necessary equipment required for implementing and evaluating the Irrigation Improvement Project.

■ Mid-term missions of consultants took place to help reviewing and integrating the results of the different components of the M&E IIP program and assist in preparing M&E workshop for IIP workshop presentations

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■ The KfW was interested in disseminating the results of the monitoring & evaluation IIP impact among decision makers and all concerned people who were invited to workshops financed by the KfW.

Lessons learnt & action taken towards them

- **With regard to the continuous flow and innovations**

It is essential to study carefully the alternatives of the down stream control gates (Avio-Avis) as a control mean of water distribution system in branch canals. Those alternatives are applied in W10 area in Kafr Elshiekh governorate as a pilot area. The first one is the automation system where the discharges are measured automatically by ultrasonic equipment installed at the vertical gates. The second one is to control the water levels downstream the main gates automatically and controlling the discharges by weirs or distributors.

Main and branch canal physical and operational arrangements for implementing the continuous flow regimes are preferable to be established in parallel with or in advance of meska improvement programs as applied now in w10 area in Sefsafa branch canal using the new design criteria.

- **For achieving cost effectiveness and controlling costs escalation**

Training was given in the different fields (design, implementation, irrigation advisory services,…..etc…..) to get effective design intervention, technology transfer, A great attention was paid to benefit from the private consulting offices, institutes of the national water research centre and foreign experts specialized in the improvement works to apply the modern technology .

Negotiations with local suppliers for provision of desired materials and equipment for the design process and improvement works took place in the preparation stage of the preliminary contracts and regular visits are made to factories that produce the materials and equipment required by the project (pumps, gates, valves and pipes) to ensure both technical suitability and cost effectiveness

Participation of the WUAs in the planning, preliminary design process is very important prior to finalizing intervention designs to develop technical options, more benefits and less cost

All the design works were done during the period 1997 till 2000, but according to the world bank request many modifications and were made to the original design to have the new design criteria to be applied in w10 area. This consumed a long period of time.

- **Concerning the improvement of the contractor performance and reducing the implementation delays**

A prequalification list of contractors was prepared and updated regularly. Companies names whose performance was poor were excluded according to certain evaluation principles and regulations agreed upon by the funding agencies.

Contract packages are made small enough for the private sector contractors to manage comfortably

- **With regard to developing sustainable O&M and organizational arrangements**

Training programs were prepared by the IAS and the MALR to train the farmers and the WUAs on the operation and maintenance works and the on-farm component. Irrigation schedule between marwas is currently prepared by the MALR.

- **Concerning the coordination, priorities for implementation, O&M, extension and production**

Procurement processes are standardized, time-effective and transparent, according to the World Bank rules.

May 30, 2007

ANNEX 8: COMMENTS OF CO-FINANCIERS AND OTHER PARTNERS/STAKEHOLDERS

KfW shares largely the main findings and conclusions of the ICR. This pertains to the assessment of the achieved outcomes, the implementation problems and the major risks. We regard the incapability of the big state owned civil works contractors to execute their contracts properly and the insufficient and late involvement of the Irrigation Sector (IS) of MWRI by the Irrigation Improvement Sector (IIS) as the main deficiencies of IIP. Concerning the institutional weaknesses of MWRI we would like to point out that the lack to merge CD-IAS and IIS-IAS led (and continues to lead) to substantial problems with respect to post-implementation assistance and support to WUA. In this same context, we are skeptical as regards the recommendation developed in the section Developing Sustainable O&M Organizations and Arrangements "to put in place and activate firm and suitable arrangements for continuing technical and administrative support to the WUAs, either by CD-IAS or by a suitable entity or unit within MALR's extension department." We agree that there is a need to improve the existing institutional setup for WUA, but we believe that this would best be done through CD-IAS. CD-IAS has a clear mandate for providing such support to WUA, and the various problems encountered so far are first of all "in-house" in the MWRI and should thus be solved by this Ministry. There is a high risk that transferring this task to another ministry (MALR) might contribute to further inter-ministerial coordination problems.

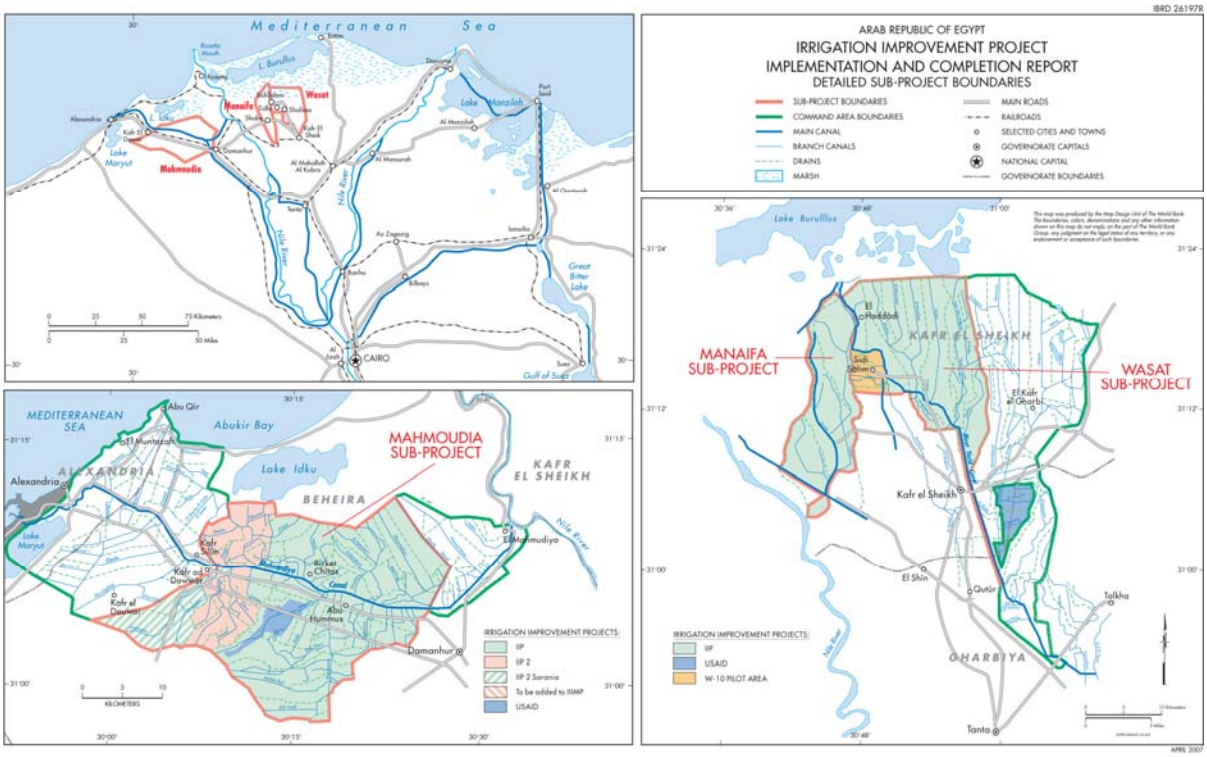
The overall outcome rating as "moderately satisfactory" seems to us very critical. We fully agree with the detailed ratings for the different project components, but we like to point out the fact that the main project component aiming at tertiary irrigation canal development and meska improvement has been very successful and has rightly been rated by the World Bank as "satisfactory". Since this component absorbed almost 70 % of total project costs, and scored some 75 % of the total contribution to the project's development objectives, a generally higher rating of the project outcomes as "satisfactory" seems to be justified.

In addition we believe that the main benefit of the IIP was the creation of an infrastructure which allows securing the irrigation agriculture in the Nile Delta mainly for small scale farmers also in years of short water supply. Luckily there were no years of extremely short water supply during the recent past. That is why the comparison of yields of areas with IIP improvements and without such improvement could not show the full benefit of the Project at the moment.

ANNEX 9: LIST OF SUPPORTING DOCUMENTS

- Staff Appraisal Report (Report Number 13454-EGT). Irrigation Improvement Project, December 1, 1994
- Development Credit Agreement (Credit number 2672 EGT). Irrigation Improvement Project, November 27, 1995
- Loan Agreement (Loan number 3832 EGT). Irrigation Improvement Project, November 27, 1995
- Supervision Missions' Aide Memoirs from 1995 to 2006
- Mid Term Review Report. Irrigation Improvement Project, April, 2000
- Project Appraisal Document. Integrated Irrigation Improvement and Management Project, April 7, 2005
- Integrated Water Resources Management Plan, MWRI, June 2005
- Irrigation Improvement Project 2, March, 2006
- Farmers Surveys. M&E of the IIP (Several Reports)
- Pumps Operation Studies (POS). M&E of the IIP (Several Reports)
- Canal and Drain Monitoring Studies (CDMS) (Several Reports)
- Water Quality Studies (May 2002 to March 2005) (Several Reports)
- Report on Assessment of Automatic Gates and Continuous Flow. Irrigation Improvement Project. Mott MacDonald / Sabbour Associates, June 2006
- Financial Monitoring and Irrigation Service. Satisfaction of Water User Associations (WUAs), Gamal M. Ayad. October 2004
- Supply of Satellite Images for the Purpose of Land Use Mapping. WaterWatch. Draft Final Report, December 2006.
- Preparation of the Implementation Completion Report. Ex post financial and Economic Analysis. Irrigation Improvement Project. Jurgen Blanken. March 2007..
- Preliminary Findings of Monitoring Farmers' Perceptions in the IIIMP Pilot Area (W10). Dalia Gouda, February 2007
- Country Assistance Strategy for The Arab Republic of Egypt for the Period FY06-FY09 IBRD and IFC, May 20, 2005, Middle East and North Africa Region
- Detailed Note regarding the IIP. June 2007.

MAPS


IBRD 261978
ARAB REPUBLIC OF EGYPT
IRRIGATION IMPROVEMENT PROJECT
IMPLEMENTATION AND COMPLETION REPORT
DETAILED SUB-PROJECT BOUNDARIES
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COMMAND AREA BOUNDARIES
MAIN CANAL
BRANCH CANALS
DRAINS
MARSH
MAIN ROADS
RAILROADS
SELECTED CITIES AND TOWNS
GOVERNORATE CAPITALS
NATIONAL CAPITAL
GOVERNORATE BOUNDARIES
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Lake Manzalah
Great Bitter Lake
Gulf of Suez
CAIRO
Nile River
Mahmoudia
Manaifa
Wasat
MEDITERRANEAN SEA
Abukir Bay
Lake Idku
ALEXANDRIA
BEHEIRA
KAFR EL SHEIKH
MAHMOUDIA SUB-PROJECT
Alexandria
Damanhur
IRRIGATION IMPROVEMENT PROJECTS:
IP
IP 2
IP 2 Sarania
To be added to IWMP
USAID
KILOMETERS
Lake Burullus
MANAIFA SUB-PROJECT
WASAT SUB-PROJECT
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GHARBIYA
Tanta
W-10 PILOT AREA
APRIL 2007

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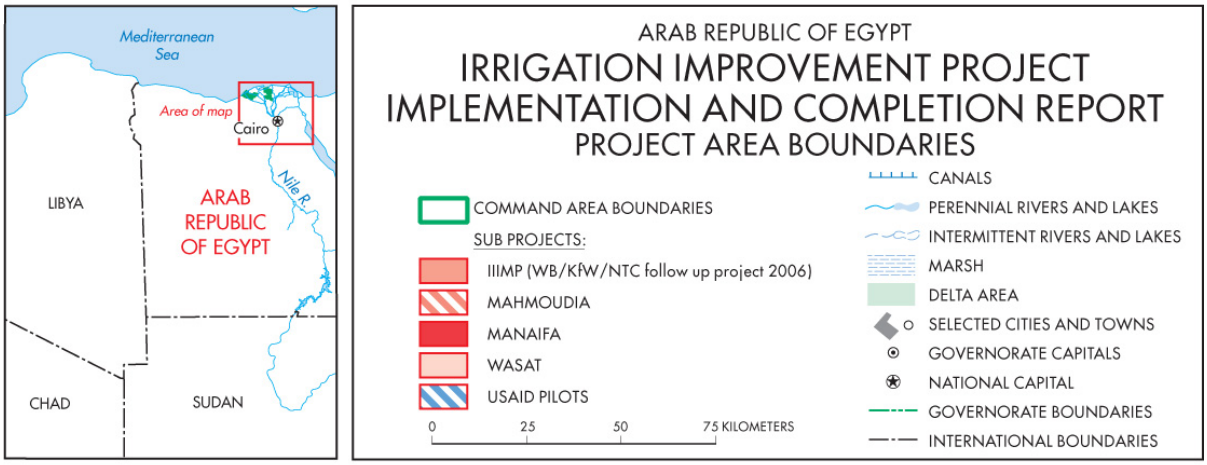

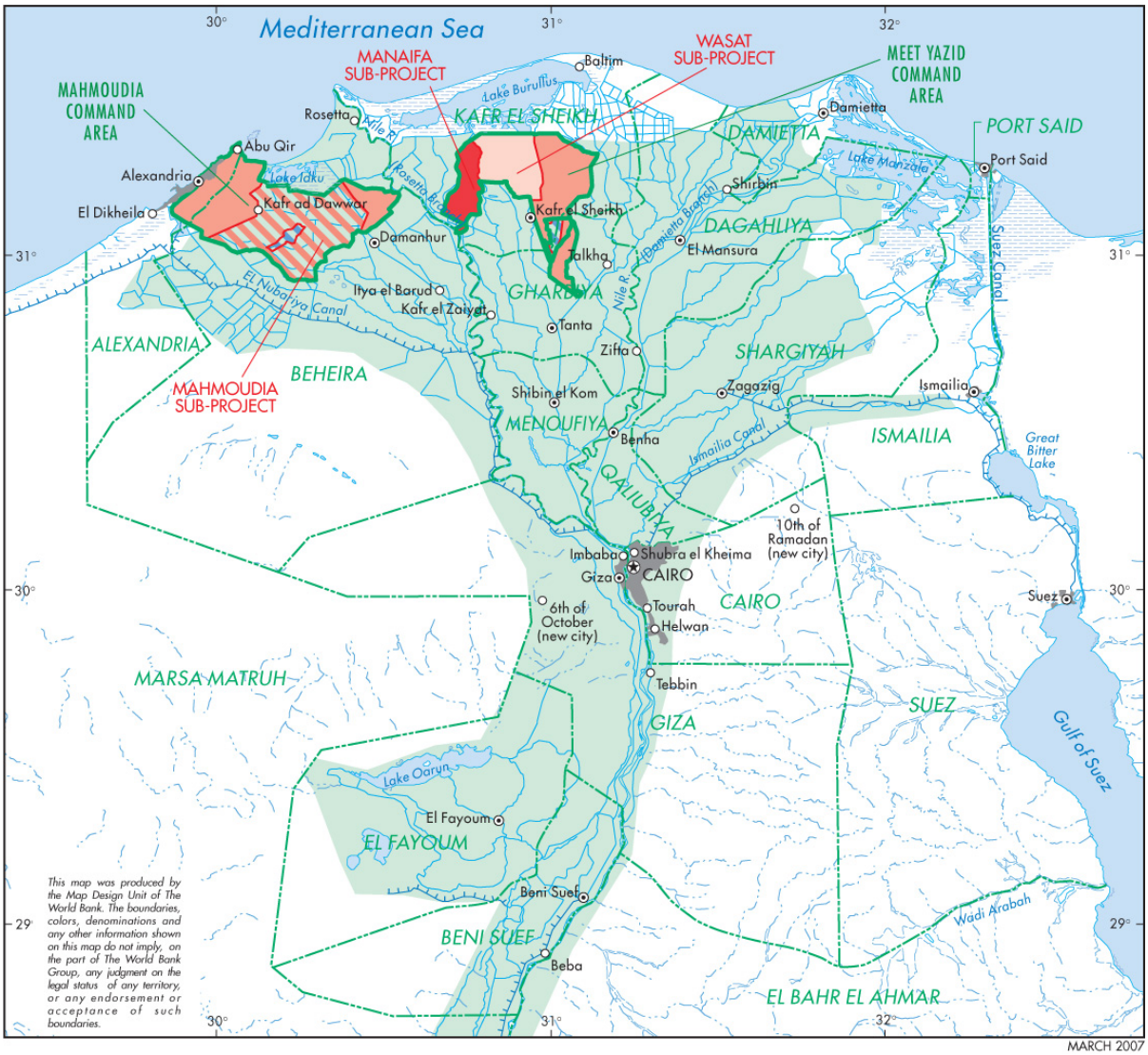

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MARCH 2007