The World Bank

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Report No: ICR00004249

IMPLEMENTATION COMPLETION AND RESULTS REPORT

Loan No. 7984-EG

ON A

LOAN

IN THE AMOUNT OF

US$100 MILLION EQUIVALENT

TO THE

Government of Egypt, Ministry of International Cooperation

FOR THE

EGYPT-FARM-LEVEL IRRIGATION MODERNIZATION (P117745)

JUNE 12, 2018

Water Global Practice
Middle East And North Africa Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective March 13, 2018)

Currency Unit = Egyptian Pounds (EGP)	
EGP 16,7=	US$1
US$ =	SDR 1

FISCAL YEAR
January 1 – December 31

Regional Vice President:	Hafez Ghanem
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ABBREVIATIONS AND ACRONYMS

AFD	French Agency for Development
ARC	Agricultural Research Centre of MALR
AWMP	Agricultural Water Management Project (implemented by GIZ)
BCR	Borrower's Completion Report
EALIP	Executive Authority for Land Improvement Projects
EGP	Egyptian Pound
EMP	Environmental Management Plan
ESMP	Environmental and Social Management Plan
EUR	Euro
FAO	Food and Agricultural Organization
Feddan	0.42 hectare
FFS	Farmer Field School
FIMP	Farm-level Irrigation Modernization Project
GIZ	*Gesellschaft für Internationale Zusammenarbeit*
GoE	Government of Egypt
I & D	Irrigation and Drainage
IBRD	International Bank of Reconstruction and Development
ICB	International Competitive Bidding
ICR	Implementation Completion and Results Report
IFAD	International Fund for Agricultural Development
IFR	Interim Financial Reports
IIIMP	Integrated Irrigation Improvement and Management Project
IIP	Irrigation Improvement Project
ISM	Implementation Support Mission
JSDF	Japanese Social Development Fund
KfW	*Kreditanstallt für Wiederaufbau*
MC	Marwa Committee
M&E	Monitoring & Evaluation
MALR	Ministry of Agriculture and Land Reclamation
Marwa	Quaternary irrigation channel/field channel
Mesqa	Tertiary irrigation channel
MIS	Management Information System
MoF	Ministry of Finance
MoIC	Ministry of International Cooperation
MWRI	Ministry of Water Resources and Irrigation
PAD	Project Appraisal Document
PAP	Project Affected Person
PDO	Project Development Objective
PMU	Project Management Unit for FIMP within MALR
QCBS	Quality and Cost Based Selection
RF	Results Framework
RPF	Resettlement Policy Framework
SSS	Single Source Selection
SWERI	Soil and Water Research Institute of MALR

TA	Technical Assistance
TTL	Task Team Leader of World Bank
USD	United States Dollar
WB	World Bank
WUA	Water User Association

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DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P117745	EGYPT-Farm-level Irrigation Modernization
Country	**Financing Instrument**
Egypt, Arab Republic of	Investment Project Financing
Original EA Category	**Revised EA Category**
Partial Assessment (B)	Partial Assessment (B)

Organizations

Borrower	Implementing Agency
Government of Egypt, Ministry of International Cooperation	Ministry of Agriculture and Land Reclamation

Project Development Objective (PDO)

Original PDO

The project development objective is to increase agricultural profitability and improve equity in access to higher-quality water for up to 140,000 small-scale farmers on up to 200,000 feddans (80,000 hectares) in the command areas of Mahmoudia, Manaifa and Meet Yazid located in the Nile Delta. This would be conducted specifically in areas where upstream irrigation improvement interventions, both physical and institutional, have occurred and are fully functional. These objectives would be achieved through both structural improvements and a strengthening of farmer support services.

Revised PDO

The revised project development objective is to increase access to improved irrigation systems in the project areas of Mahmoudia, Manaifa and Meet Yazid located in the Nile Delta, in an equitable manner.

FINANCING

	Original Amount (US$)	Revised Amount (US$)	Actual Disbursed (US$)
World Bank Financing			
IBRD-79840	100,000,000	100,000,000	100,000,000
TF-13794	3,875,410	0	0
Total	**103,875,410**	**100,000,000**	**100,000,000**
Non-World Bank Financing			
Borrower	30,000,000	0	14,600,000
FRANCE: French Agency for Development	50,000,000	0	42,000,000
Total	**80,000,000**	**0**	**0**
Total Project Cost	**183,875,410**	**100,000,000**	**156,600,000***

*Amounts expected to reach $173.7 million by June 30, 2018 once the FIMP closes (AfD loan and GOE funds will continue to be disbursed until then).

KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
14-Dec-2010	10-Jul-2012	9-Jun-2015	30-Jun-2016	31-Dec-2017

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US$M)	Key Revisions
21-Jun-2016	40.62	Change in Project Development Objectives Change in Results Framework Change in Loan Closing Date(s) Reallocation between Disbursement Categories Change in Safeguard Policies Triggered Change in Implementation Schedule
31-May-2017	58.59	Reallocation between Disbursement Categories

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Moderately Satisfactory	Moderately Satisfactory	Modest

RATINGS OF PROJECT PERFORMANCE IN ISRs

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US$M)
01	08-Feb-2011	Satisfactory	Satisfactory	0
02	10-Dec-2011	Satisfactory	Satisfactory	0
03	30-Jun-2012	Moderately Satisfactory	Moderately Satisfactory	0
04	29-Dec-2012	Moderately Satisfactory	Moderately Satisfactory	.25
05	29-Jun-2013	Moderately Satisfactory	Moderately Satisfactory	.75
06	28-Dec-2013	Moderately Unsatisfactory	Moderately Unsatisfactory	.75
07	29-Mar-2014	Moderately Unsatisfactory	Moderately Unsatisfactory	1.81
08	23-May-2014	Moderately Satisfactory	Moderately Satisfactory	3.19
09	10-Dec-2014	Moderately Satisfactory	Moderately Satisfactory	4.69
10	22-Jun-2015	Moderately Satisfactory	Moderately Satisfactory	9.63
11	18-Dec-2015	Moderately Unsatisfactory	Moderately Unsatisfactory	25.77
12	14-Mar-2016	Moderately Unsatisfactory	Moderately Unsatisfactory	31.64
13	13-Oct-2016	Moderately Unsatisfactory	Moderately Unsatisfactory	45.62
14	30-Jan-2017	Moderately Unsatisfactory	Moderately Unsatisfactory	48.91
15	24-Jul-2017	Moderately Unsatisfactory	Moderately Satisfactory	60.42
16	20-Dec-2017	Moderately Satisfactory	Moderately Satisfactory	75.17

SECTORS AND THEMES

Sectors

Major Sector/Sector	(%)
Agriculture, Fishing and Forestry	**100**
Irrigation and Drainage	100

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3)	(%)
Urban and Rural Development	**98**
Rural Development	98
Rural Infrastructure and service delivery	97
Land Administration and Management	1
Environment and Natural Resource Management	**29**
Climate change	27
Mitigation	27
Renewable Natural Resources Asset Management	2
Biodiversity	1
Landscape Management	1

ADM STAFF

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I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

Context

1. At the time of appraisal, the agriculture sector constituted a critical part of the Egyptian economy. Although its share of GDP was 14 percent in 2008, agriculture remained vital for economic growth and rural incomes as the sector employed 30 percent of the workforce and provided livelihoods for 55 percent of the population. Many of these people depended on agriculture as the primary source of income and employment, particularly the poor. Rural poverty was relatively high compared to urban poverty (15 and 5 percent respectively in Lower Egypt, comprising mostly the Nile Delta). Farms were and still are typically small, with an average of about 1 feddan or 0.42 hectare (90 percent are less than 3 feddans) and characterized by high yields for most food crops (rice, sugar cane, wheat, maize, cotton, and sorghum). For non-traditional high-value crops, yields remained below potential and the margin for improvement was quite high.

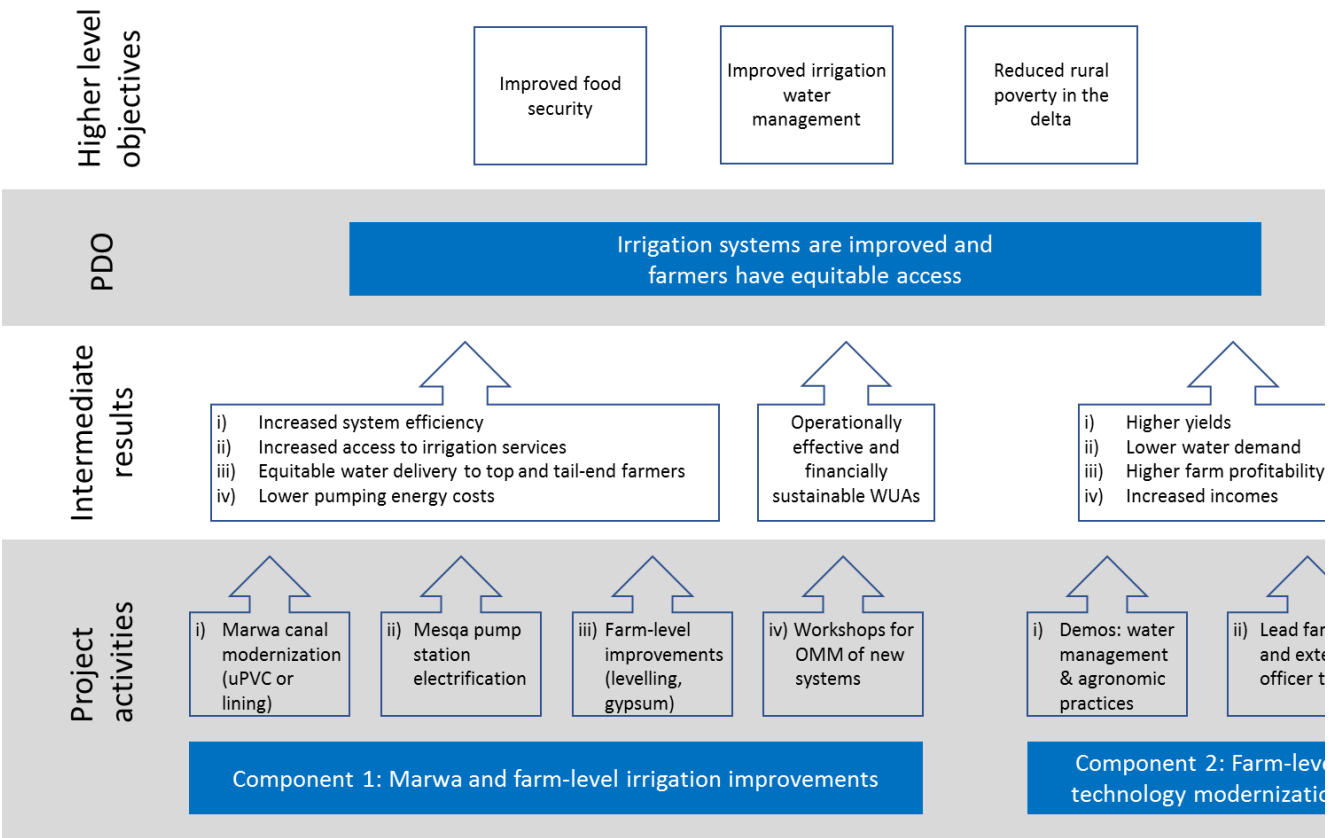
2. Long-term challenges put pressure on Egypt to increase agricultural productivity further. One challenge was *water scarcity.* Egypt relies on the Nile for a vast majority of its freshwater resources but while supply stayed constant, the demand for water had increased substantially over the years and was expected to continue to do so in the future, fueled by rapid population growth, agricultural expansion, and industrial development. Another challenge was the need to improve *food security*. Egypt is one of the main importers of grain in the world and projections of the country's food balance indicated that dependence on grain imports would more than double over the next twenty years. Given limited land and water resources, a further increase in agricultural productivity was necessary to enhance supply. A third challenge was *climate change*, which put further strain on scarce water resources and food security. Climate change models projected an increasing probability of severe weather events that would increase yield volatility and decrease global production of key crops. This would aggravate agricultural commodity market instability and increase Egypt's risk of food shortages.

3. Irrigation was and still is a critical input for domestic agricultural production. Virtually all of Egypt's agricultural lands are irrigated from the Nile River and roughly 90 percent of the country's population is concentrated in and around the Nile Delta and its Valley. In most of the "Old Lands" (land in the Nile Valley and Delta claimed from the desert many generations ago that has been intensively cultivated since and are typically deep, flat and extremely fertile), irrigation was based on long-standing, yet inefficient flood irrigation. Canals delivered water below field elevation, and farmers typically lifted water into quaternary canals (marwas) to their fields through diesel-operated mobile pumps. The drainage system consisted of open gravity drains, with drainage water re-use facilitated by pumps for direct use, or to mix drainage water with other irrigation water. Re-use of drainage water was often done by tail-end farmers, who lacked access to sufficient freshwater from the irrigation system and who also tended to be poor farmers. This practice was of concern as drainage water quality was declining, particularly in the Delta. The Government had demonstrated a strong commitment to the modernization of irrigation systems during the previous decades. Good progress had been made in the main, branch and mesqa canals, which were rehabilitated under the Irrigation Improvement Project (IIP; Project ID: P005173) and the Integrated Irrigation Improvement Project (IIIMP; Project ID: P073977) among other initiatives. What remained to be done was on-farm irrigation modernization, which became the focus of Farm-level Irrigation Modernization Project (FIMP), and which had the potential to maximize returns from the previous heavy investments in the upstream systems.

4. In this context of relatively high poverty, increasing water scarcity, inefficient on-farm irrigation systems, and poor-quality drainage water, FIMP focused on modernizing the marwas and farm-level distribution networks and increasing access to agronomic and land management services. The expected benefits included: a more equitable water distribution between farmers at the head and tail end of the canals; ensuring that water would be available at the time and in the quantity needed particularly for growing more high-value crops; and generating labor and energy cost savings. At the same time, farmers needed greater awareness and enhanced knowledge to make the most of the modernized irrigation systems, therefore capacity building activities, support to extension services, and enhanced extension/research links had to be provided. During the IIIMP, the Government of Egypt had piloted marwa modernization in the W-10 pilot on 5,600 feddans, coordinated by EALIP using Government equipment, community-based construction and small-scale contractors. This was called the 'force-account approach'. Given its success at a small scale in IIIMP, marwa modernization using the force-account implementation approach was tested within FIMP at a larger scale, with more conventional contracting options available if this was not successful, as proved to be the case. Figure 1 illustrates the theory of change as envisaged at appraisal.

Theory of Change (Results Chain)

Figure 1: Theory of change for the Farm-level Irrigation Modernization Project



5. The premise of the project – as defined in the Project Appraisal Document (PAD) – was that the increased efficiency of the water conveyance system would lower labor and pumping costs and improve equity of water

supply. Farm profitability would be increased through a set of infrastructure modernization and on-farm agricultural support interventions. A significant reduction in energy pumping costs was expected to follow the switch from diesel to electric power. As part of the modernization design, organizational sustainability of irrigation system operations and maintenance were also addressed.

6. At the time of restructuring in June 2016, the overall logic and structure of the theory of change was not changed from the original intention, although changes were made to the activities and results targets. Under Component 1, the project originally envisaged to achieve land improvements (iii above) which were low cost interventions to be financed primarily by the Government. The restructuring paper noted these totaled an insignificant fraction of the funding, and indicators were removed because of weak farmer-demand and government capacity. Under Component 2, the demonstration of water management and agronomic practices, and uptake of high-value crops was reduced, because adoption requires not only water availability, but also other farmer incentives such as access to markets and finance, as well as behavioral change. These factors were outside of the scope of the project and required longer timelines.

Project Development Objectives (PDOs)

7. The original PDO was "to increase agricultural profitability and to improve equity in access to higher-quality water for up to 140,000 small-scale farmers on up to 200,000 feddans (80,000 hectares[1]) in the command areas of the Mahmoudia, Manaifa and Meet Yazid canals located in the Nile Delta". This objective was expected to be achieved through both structural improvements to the irrigation network and farmer support services, focusing on areas where upstream irrigation improvements, both physical and institutional, had occurred and were fully functional, thanks to previous Bank-financed projects (see the "Context" section above).

Key Expected Outcomes and Outcome Indicators

8. The project's success was to be measured against:

(a) 5 PDO indicators: (i) agricultural output from the main irrigated crops, in LE per feddan, increased by 10%; (ii) irrigation operating costs, in LE per feddan, reduced by 30%; (iii) difference in yields between farmers at the tail-end and head-reach of quaternary canals reduced by 20%; (iv) reduced drainage water re-use by farmers, especially those at the tail-end of quaternary canals, by 50% (all these increase/decrease being measured against baseline and non-project neighboring comparison areas); and (v) approximately 20,000 active marwa committees established.

(b) 16 Intermediate Results (IR) indicators: (i) <u>Component 1</u>: a) electric pumps installed on mesqas; b) farmers' costs for pumping water into mesqas as a result of switch from diesel to electric pumps reduced by 30%; c) marwa modernization adopted for about 180,000 feddan; d) farmers' time for applying water to fields, in hours per irrigation, as a result of marwa modernization, reduced by 30%; e) laser land leveling applied on 105,000 feddan; f) deep ploughing applied on 50,000 feddan; g) gypsum applied on 70,000 feddan; h) alternative contracting approaches for marwa improvement adopted in 30% of contracts; and i) 80% of marwa committees with alternative contracting approaches satisfied with contracting and implementation; (b) <u>Component 2</u>: a) 100% of farmers in project area familiarized with marwa modernization program, including cost recovery; b) visit of extension agents to farmer communities increased by 75,000 field days; c) training in technical and agronomic skills received by 7,500 key farmers; d) women account for at least 25 percent of people trained; e) improved irrigation technologies, such as low head bubblers, adopted by farmers on an additional 10,000

[1] There appears to have been a mistake in the PAD, as in fact 80,000 ha equals to 190,476 feddans (not 200,000).

feddan; f) higher value horticultural crops grown on an additional 12,000 feddan; and g) monitoring and evaluation system established and applied.

Components

9. The project was designed around two main components: (i) Marwa and Farm-Level Irrigation Improvements, and (ii) Farm-level Technology Modernization.

10. **Component 1: Marwa and Farm-Level Irrigation Improvements** (US$139.4 million excluding contingencies). This component was intended to support irrigation modernization on about 200,000 feddans in three irrigation command areas in the Old Lands. In these locations, main and branch canal and mesqa improvements had been carried out under previous Bank-funded projects, and mesqa Water User Associations (WUAs) had been formed to ensure sustainable operations and maintenance (O&M) and irrigation management. The component was meant to finance the following: (i) marwa and on-farm improvements comprising transformation of open marwa canals to a low-pressure distribution system composed of buried uPVC pipes and hydrants as well as a few lined open marwa channels with small gated outlets, with options designed and implemented in accordance with farmer needs and agreement. As needed, mesqa pump stations and associated fittings would be upgraded, and new butterfly valves provided for off-takes to marwas; (ii) change of approximately 75 percent of the mesqa pump stations from diesel pumps to electric ones and installation of dedicated rural electric-power grids (LV and MV networks); (iii) farm-level improvements such as laser land-leveling, deep ploughing, gypsum application, reshaping of field drains, and flexible hose systems; (iv) capacity building for appropriate use and maintenance of mesqa and marwa-level works and land improvement activities; and (v) field surveys, designs, and construction supervision and management.

11. **Component 2: Farm-level Technology Modernization**. (US$14.1 million excluding contingencies). This component aimed to enhance farmer knowledge and uptake of improved irrigation and associated land improvement and crop production technologies, in parallel with and in support of the marwa and on-farm-level irrigation modernization carried out under Component 1. The following activities were envisaged at appraisal: (i) increasing farmer awareness of marwa improvements through farmers' meetings and exchange visits; (ii) demonstrations of improved marwa and farm-level irrigation systems, improved on-farm water management, and associated land improvement and agronomic practices for both field crops and horticultural crops; (iii) training of lead farmers and extension staff in irrigation management and associated practices, private sector service providers such as workshops in installation and repair of irrigation infrastructure, project implementation and administration staff, and senior management and policy level officials; (iv) improved extension delivery through publications and mass media broadcasting, increased outreach through the MALR's interactive web-based extension information networks, facility improvement, and provision of transportation and field allowances; (v) implementation support, including pilots and studies to support the development of future field-level irrigation improvements and Monitoring and Evaluation (M&E) activities; and (vi) environmental monitoring and mainstreaming.

12. The Executive Authority for Land Improvement Projects (EALIP) was designated as the primary implementing agency for supervising the marwa modernization works and implementing farm-level improvements (laser land leveling, soil improvements, and deep ploughing), which were crucial for obtaining higher irrigation efficiency and yields. The Agricultural Research Centre (ARC) was proposed to be responsible for quality control and system testing for all the marwa modernization works as well as overseeing the implementation of the M&E system.

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION

Revised PDOs and Outcome Targets

13. In June 2016, the project was restructured (Level 1) to extend the closing date by 18 months, from June 30,2016 to December 31, 2017 and to revise the PDO, among other changes. The original PDO focused mostly on the long-term impacts of the project, notably an increase in agricultural profitability. The increase in agricultural output value per feddan indicator included in the original Results Framework (RF) was considered (at the time of restructuring) to be attainable only after project completion, when the civil and electricity works had been completed and the farmers had time to switch to higher-value crops. To ensure that project outcomes could be achieved and measured by the closing date, the PDO was changed as follows: "to increase access to modern irrigation systems in the project areas of Mahmoudia, Manaifa and Meet Yazid canals located in the Nile Delta, in an equitable manner". At the time of restructuring, 38 percent of the loan had been disbursed. However, there was no change in the project scope, intervention area or total project budget. Table 1 below shows the changes made at the 2016 restructuring.

Revised PDO Indicators

14. At restructuring in 2016, the PDO indicators were revised to align with the revised PDO, measure outcomes that were directly attributable to FIMP interventions, and to align to the World Bank's core sector indicators for irrigation projects.

Table 1: Original and Revised PDO Indicators and Targets

Original PDO Indicators	New/Revised PDO Indicators	Original Target	Revised Target
Not in original	**PO-1** (new): Water users provided with improved irrigation and drainage services (number)	n/a	140,000
Not in original	**PO-2** (new): Water users provided with irrigation and drainage services – female (no.)	n/a	14,000
PO-1: Agricultural output from the main irrigated crops, in LE per feddan increased by 10% (relative to baseline and non-project neighboring comparison areas)	*Deleted*	10%	n/a
PO-2: Irrigation operating costs in LE per feddan reduced by 30% (relative to baseline and non-project neighboring comparison areas)	**PO-3** (revised): Irrigation operating and maintenance cost reduced (%)	30%	30%
PO-3: Difference in yields between farmers at the tail end and head reach of quaternary canals reduced by 20% (relative to baseline and non-project neighboring comparison areas)	**PO-4** (revised): Ratio of water availability (in cubic meters/hour) measured at tail and head ends	20%	75%
PO-4: Drainage water re-use by farmers, especially those at the tail end of quaternary canals reduced by 50% (relative to baseline and non-project neighboring comparison areas)	*Deleted*	50%	n/a
PO-5: Approximately 20,000 marwa (Quaternary canal) committees established.	**PO-5** (revised): Operational water user associations created and/or strengthened (number)	20,000	1,000
PO-6: Direct project beneficiaries	Moved as IO 1 *and replaced* with PO-1 and PO-2	140,000	140,000

Revised Components

15. There were no major changes in components or activities either during the Level I restructuring in June 2016 or the Level II restructuring in May 2017. Only the scope of some activities – whose targets at appraisal were anyhow indicative – were reduced as follows:

16. **Component 1**. The overall target area to be improved was initially expressed as 80,000 ha, or 200,000 feddans in the PAD and the Legal Agreement. During the June 2016 restructuring, the target of 80,000 ha was retained, but the conversion to feddans was expressed as 170,000 feddans, which is actually equivalent to 71,428 ha. In fact, 80,000 ha equals to 190,476 feddans (not 200,000 or 170,000 feddans). The restructuring therefore added confusion to the exact target area to be developed. Another change was that the area of land improvements (land levelling, gypsum and deep ploughing) was reduced, as these low-cost interventions were being implemented by EALIP to facilitate technology demonstration and encourage adoption by farmers. The original aim of catalyzing new-technology uptake was maintained and reflected in a revised results indicator.

17. **Component 2**. Originally, the project aimed to introduce modern irrigation technologies such as low-head bubblers on 10,000 ha. These technologies were expected to catalyze a shift to higher value crops on about 12,000 ha. These targets were found to be unrealistic, as the shift in both technology and crop type depended on factors external to the project (farmer attitudes, local financing for irrigation equipment, markets and production knowledge). The strategy shifted to the establishment of 'lead farmers' on 200 feddans for demonstration purposes, linked to the Farmer Field School (FFS) approach. The changes did not affect the project's financial and economic viability because these targets had not been part of the original financial and economic analysis undertaken to justify project feasibility.

Other Changes

18. The other main changes included:

(i) **The switch from 'force account' and participatory contracts (small-scale contracting and community based contracts) under a JSDF grant to clustered medium-scale contracts with national contractors after June 2015**. Participatory contracting was initially adopted to implement civil works and was to be supervised by EALIP. The community-based contracting approach proved to be inappropriate for FIMP because the capacity of the PMU and of MALR Governorate-level staff was insufficient to monitor several small contracts. The MALR had no experience in the awarding and supervision of multiple small construction contracts and the PMU did not have the resources for contract supervision including the need for quality control of implemented works. In addition, this approach required high levels of community coordination and construction skills to lay uPVC pipes properly, which were simply not available. It was also difficult to mobilize the right equipment in a timely way using the force-account mechanism.

(ii) **Triggering the Resettlement Safeguards Policy in the June 2016 restructuring** to cover the loss of land value for landholder farmers due to the installation of electric poles on their land. The triggering of the policy implied the preparation of a Resettlement Policy Framework (RPF), a Resettlement Action Plan (RAP) and eventually led to effective compensation of only 1,033 farmers (but for a marginal amount of about US$13 per installed pole).

(iii) **Level II restructuring in May 2017 to deal with the effects of the depreciation of the Egyptian currency**: The depreciation increased the cost of project inputs (particularly imported inputs) and slowed down progress on physical works, as contractors could no longer cover their costs or make a profit. In response to the devaluation, the restructuring allowed IBRD to increase the share of its financing from 60 percent to 90 percent for physical works and from 60 percent to 100 percent for consulting services. This increase enabled French Agency Development (AFD) to cover the cost of variation orders on affected contracts, which the World Bank

had not been authorized to do because the contractual clauses did not include provisions for currency depreciation.

Rationale for Changes and Their Implication on the Original Theory of Change

19. The main rationale for the first restructuring in 2016 was a number of core and intermediate indicators were dependent on other, non-project, factors. These were deleted or replaced with indicators more directly linked to the activities and investments. There was, for example, a problem with attribution of results in relation to agricultural profitability as a number of exogenous factors potentially impacted on this more than the FIMP irrigation investments themselves. The restructuring took place late in the project cycle (year 5) and should have been done earlier. A major part of the reason for the late response to the poor piloting progress was the Arab Spring which significantly limited the progress of the 'force-account' pilot within FIMP in the first three years. This context was the main rationalization for the extension of the pilot beyond the two years set out in the PAD, combined with a firm Government belief that the force-account approach was more cost-effective, and construction benefits would be more widely distributed to beneficiaries. Further, given the long-term Government targets for marwa modernization of five million feddan (two million ha), FIMP as a whole, was a large-scale test of marwa modernization, and the Government's intention was to build a cadre of small-scale contractors for the massive upscaling that was intended in the future. The activities in Component 2 that were significantly reduced either had limited causal linkages to the PDO indicators, or as in the case of promoting a shift to high-value horticultural crops, required completion of the marwa modernization first, needing much longer timelines than the project period. These agricultural activities comprised an insignificant fraction of the investment, and were therefore removed from the PDO at restructuring. However, the original theory of change remained logically intact.

II. OUTCOME

A. RELEVANCE OF PDOs

20. The FIMP PDO is still in alignment with the current Country Programming Framework (CPF) 2015-2019 (report no: 94554-EG) which notably states that "agricultural productivity and off-farm employment could be enhanced by policy reforms, better connective infrastructure, more efficient water allocation systems, and improved agricultural and agro-industrial logistics." The FIMP intervention of modernizing earth canals with low-pressure pipelines anticipated a 10 to 20 percent increase in conveyance efficiencies, with an additional similar increment from improved infield water-application, technological changes and management practices. FIMP was also aimed to reduce operational costs and increase profitability through the switch from diesel to electric pumps, which required the installation of dedicated medium and low voltage networks with electric transformers sufficient to pumps electrical loads. On this point, the farm-level financial and higher-level economic rationale remains valid. The PDO of increased access to improved irrigation services through a set of FIMP modernization activities, was, and is still therefore highly relevant to the Bank's agenda and priorities.

21. FIMP was and still is in line with the GoE's Strategy for Sustainable Agricultural Development 2030 and was considered as a first phase to one of the strategy's main pillar, a national irrigation modernization program to gradually improve the efficiency of water conveyance and distribution systems and the efficiency of on-farm irrigation systems, targeting five million feddans of Old Lands, and aiming at increasing farm-level efficiencies from 50 percent to 80 percent by 2030.

Assessment of Relevance of PDOs and Rating

22. Based on the above analysis and justification, the relevance of the PDO is considered High.

B. ACHIEVEMENT OF PDOs (EFFICACY)

Assessment of Achievement of Each Objective/Outcome

Pre-restructuring – (Modest)

23. The original PDO was to 'increase agricultural profitability and improve equity in access to higher-quality water for up to 140,000 small-scale farmers on 200,000 feddans (80,000 hectares[2]) in the command areas of Mahmoudia, Manaifa and Meet Yazid canals located in the Nile Delta'. The results in relation to the two PDO elements of agricultural profitability and equity were positive, all exceeding the set targets, as described below.

24. **i) Increase in agricultural profitability**: The results in relation to agricultural profitability exceeded the original PDO targets by project closure as follows:

- **PO-1: Agricultural output** (in LE per feddan) from the main irrigated crops increased by 30.9%, approximately three times the original target of 10%. The result was derived from annual yield measurements in 2015, 2016 and 2017 for each of the five main crops. The results were adjusted for local inflation and averaged, yielding the positive result.
- **PO-2: Irrigation operating costs** (in LE per feddan) were reduced by 46.2% mainly due to the switch from diesel to electrical power. This result was much higher than the target of a 30% reduction relative to baseline and non-project neighboring comparison areas.

25. **ii) To improve equity in access to higher-quality water:** The original indicator in relation to equity of supply was based on crop yield. This was not reliably linked to the project activities alone. Crop productivity depends on a number of extraneous factors, not least fertilizer application and seed choice. Nonetheless, the results exceeded the targets:

- **PO-3: Difference in yields** between farmers at the tail end and head reach of quaternary canals was reduced by 59% which is a significantly better outcome than the target reduction of 20%.
- **PO-4: Drainage water re-use** by farmers, especially those at the tail end of quaternary canals, reduced by 95% against a target reduction of 50%.

26. The positive numerical results of the original PDO indicators need to be tempered with the reality that as stated in the restructuring paper, targets were unrealistic. At restructuring, two of the four indicators (PO-1 and 3) were deleted as they did not measure the impact of FIMP activities alone, but were influenced by other factors not attributable to the project activities themselves and therefore should not heavily influence the rating. While the numerical scores would imply a high rating, construction of the pipelines using communities and small-scale contractors were not conducted with formal construction supervision and later engineering audits identified concerns with pipeline backfilling and joint-integrity of on-site welded uPVC T-pieces and u-bends. These issues were resolved in the second half of implementation, through a switch to larger-scale contractors and professional supervision. Moreover, some small workshops were constructed for manufacturing valves and concrete pipes in the project areas in 2011-2012 under the PMU's local fund. However, the reported issues leave uncertainties in the pre-restructuring efficacy. The combination of inappropriate original indicators, unrealistically low targets, and questions around pipeline integrity, given the limited supervision in the first stage

[2] There appears to have been a mistake in the PAD, as in fact 80,000 ha equals to 190,476 feddans (not 200,000).

of FIMP, lead to a rating of **Modest**.

Post-restructuring – (Substantial)

27. The revised PDO was "to increase access to modern irrigation systems in the project areas of Mahmoudia, Manaifa and Meet Yazid canals located in the Nile Delta, in an equitable manner".

28. The project aimed to increase water-users' access to new or improved irrigation and drainage services through modernization of the irrigation system and improved equity of supply. The replacement of diesel pump stations with electrical pumps - and the construction of the necessary medium and low voltage networks - and earth canals with uPVC pipelines aimed to reduce O&M costs and narrow the supply differential between upstream and downstream farmers on the marwas. In addition, the capacity of WUAs and farmers to use water more efficiently was to be strengthened. The results should be viewed in the context of these main outcomes which cut across the spatial scales of the mesqa, marwa and farm levels of the system. Achievements against the PDO indicators are discussed in Table 2 in the same order as they were set out in the RF. More details on achievement of IR indicators are provided in Annex 1.

Table 2. Achievements of revised PDO indicators

Indicators	Discussion of results and achievement
PDO Indicators	
PDO Indicator 1. Water users provided with improved irrigation and drainage services *Achievement: 142%* *Rating: High*	A total of 197,633 water users (landholders and tenants) accessed improved irrigation and drainage (I&D) services, which is 141.2% of the target of 140,000 - a significant achievement. The activities that led to this achievement include: replacing approximately 97% of the marwas with buried uPVC pipelines and lining of approximately 3% of the open earth canals (i.e. marwas) to reduce transmission losses; switching from diesel to electric pumps to improve the reliability and reach of water delivery; and training farmers in the use of the improved pumps and on-field system.
of which female water users provided with improved I&D *Achievement: 113%* *Rating: High*	Gender-disaggregated data was obtained from sample surveys undertaken by the extension focal point officers, of females owning and leasing land. On 31 December 2017, the number of female water users was estimated at 15,813 corresponding to 113% of the end target of 14,000 female water users. A note on the positive impact of modernization efforts, such as FIMP, on female farmers is presented in Section E.
PDO Indicator 2. Irrigation operating and maintenance cost reduced *Achievement: 104%* *Rating: High*	The irrigation operating and maintenance (O&M) cost pertains to energy, operation time and maintenance costs. The energy cost is a dominant contributor to the total O&M cost and savings were achieved by replacing diesel pumps with electric pumps (electricity is less expensive than diesel). The diesel versus electrical system O&M cost was EGP 12.61 vs EGP 8.67/hour/Feddan equivalent to a cost reduction of 31.3% as compared to a target of 30%. A technical audit confirmed the cost savings resulting from this switch in energy source, thus providing confidence to the PMU's own measurement. The reduction in the time spent in irrigation was the result of higher flows at the point of release into the fields. The reduction in operating and maintenance costs arose from the change from diesel to electric pumps, and from earth-canal to modernized marwas.
PDO Indicator 3. Ratio of water availability measured at tail and head ends	This indicator measures the difference between top-end and bottom-end hydrant flows and is the main indicator for equity between water users. Typically, on canal systems, top-end users have access to more water than tail-enders. FIMP aimed to reduce this difference on the modernized marwas to 75% versus a baseline of 50%. The modernized marwa hydraulic system

Achievement: 113% *Rating: High*	(pipelines or lined-canals) combined with improved operational procedures (systematic rotations) contributes to improved equity.
PDO Indicator 4. Operational mesqa level water user associations created and/or strengthened *Achievement: 244.3% numerically but training scope had minor shortfalls.* *Rating: Substantial*	The strengthening of operational WUAs focused mainly on operator training and operational procedures based on the technical requirements of the new electrical pump stations. Data was obtained from the electrical consultant's reports. Discussions during the ICR confirmed that training was conducted by contractors, and the primary focus was on mechanical and electrical operations. The pump station designs included backup diesel pumpsets and the training thus covered both electrical and diesel O&M activities. FIMP also introduced the formation of marwa committees to coordinate farmer-input to design and address marwa maintenance in future. Remarkable progress was thus achieved in regard to operator training and in the distribution of O&M information beyond the targets. The minor shortfalls in relation to the scope of operator training (limited attention to operational schedules) and to the distribution of detailed O&M manuals lead to a rating of *substantial* achievement.

Justification of Overall Efficacy Rating

29. The overall efficacy rating of Component 1, the most important one in terms of both cost and contribution to the PDO and Intermediary Results, relates mainly to the engineering modernization effort. The project achieved remarkable results across all the indicators and the pre-restructuring results indicate that the 18-month extension of the original implementation period was indeed necessary to ensure stronger benefits. Most of the results were better than the expected targets. Moreover, all the expected targets were achieved for the original PDO indicators by the end of the project period. It should be noted that in addition to a high IBRD loan disbursement rate (75 percent by project closure, updated to 99 percent by the end of the grace period), AFD had disbursed 100 percent of its loan by December 2017, and expects 100 percent utilization of disbursed funds by the end of July 2018, when its loan will close. Although the project experienced a good turnaround in the second half of its implementation, EALIP's lack of performance in the first half led to significant delays. Further, slow implementation was compounded by a lack of institutional coordination between MOWRI and MALR and the limited capacity of the PMU (and MALR by extension) due to insufficient technical staff in the first phase of project implementation.

30. FIMP's achievements are remarkable in light of the recovery from the multiple challenges of the first three years, mainly the unstable country context (the Arab Spring, political upheaval, curfews curtailing access to project sites) and the unsuccessful 'force-account' implementation approach. The rapid acceleration in the second half of the project shows the PMU and Task Team's ability to assess challenges and successfully change strategy, which explains the positive results. In summary, FIMP has achieved better than expected results for many of the targets, but with a shortfall in implementation speed that required an 18-month extension of time, and slightly less than the targeted total coverage of the modernized marwas as shown in the intermediate results. The efficacy for the pre-restructuring period (38% of disbursement) is rated as **Modest** while the efficacy for the post-restructuring (62 percentage of disbursement) is rated as **Substantial**.

C. EFFICIENCY

Assessment of Efficiency and Rating

31. The Economic Rate of Return (ERR) was estimated at appraisal at 29 percent, and the Net Present Value (NPV) at a 10 percent discount rate, at Egyptian Pound (EGP) 1.15 billion (US$209 million). The quantified benefits included mostly private gains (increased value of production and reduced irrigation costs) accrued by participating farmers. Expected public benefits (irrigation water savings for diversion to other uses and environmental benefits such as the reduction of greenhouse gas (GHG) emissions) could not be valued, but all FIMP costs were considered in the cost-benefit analysis. The assessment done at appraisal expected crop yields to increase by 11 to 20 percent while net incomes per feddan would rise by 17 to 32 percent. Farm models showed that farmers would be supportive of the proposed improvements as they would get water savings (15-18 percent) and a significant increase in income (12 to 29 percent). These savings could theoretically translate into a reduction in the overall water use in the project area by 18 percent (from 1.45 to 1.19 million m^3 per year), but equity improvements would offset part of the efficiency gains from the improved marwas. Exact quantification would require detailed field measurements. In addition, a reduction in non-recoverable losses through deep percolation and savings due to reduced tail-end water losses were expected.

32. Observed field results from project interventions during the ICR mission confirmed the attainment of significant increases in productivity, equity of water distribution among farmers at the head and tail end of the systems, reduced irrigation costs, and water savings. Crop and farm models combining different farm sizes and cropping patterns developed at appraisal and representing the typical farms in the project area were adapted considering the evolution in cropping patterns, productivity, production costs (including reduced irrigation costs) and input/output prices since appraisal. This took into account the findings of field surveys carried out by the Economic Affairs Sector of MALR and of evaluations of an earlier pilot in an area known as W10. All cost and benefit streams were transformed from financial to economic values using conversion factors as necessary and constant February 2018 prices. Benefits derived from increased value of agricultural production and reduced irrigation costs were aggregated following the actual schedule of mesqa and marwa modernization and project costs disbursement. All project costs were considered in the analysis as done at appraisal. Based on these assumptions, the ERR at project completion is estimated at 22 percent and the NPV at EGP 2.29 billion (US$137 million), a highly positive result, although slightly below the estimate made at appraisal because of implementation delays (see details in Annex 4). The economic viability of FIMP would be higher if valuing other economic benefits such as: (i) the water saved for its use in other areas or sectors; and (ii) the environmental benefits (reduction of GHG emissions, improved health of residents in the project areas thanks to reduced exposure to noxious fumes from diesel pumps).

33. Regarding aspects of design and implementation, the slow start and delays due to the social unrest during the first three year of implementation were the determinant factors (beyond the GOE or the implementing agency's control) for reducing the anticipated economic impact. The FIMP improved 83 per cent of the target area at appraisal (155,300 feddans out of 190,746 feddans or 80,000 ha at project closure) despite the extension of 1.5 years as a large share of the civil works were done in the last two years, delaying the accrual of net benefits which negatively impacted the ERR. Likewise, irrigation improvement costs have been higher than estimated[3], and the funds used for implementation from the different sources (IBRD, AFD, JSDF, GIZ and GoE) were reduced by about 3.5 percent in current US dollars[4]. Some activities under component 2 had to be reduced at restructuring in June 2016 (i.e. the number of field crop demonstration sites, area treated with land improvements such as laser land levelling, deep ploughing, gypsum application, etc.) but increases in yields were satisfactory and in line with those expected at appraisal (see above). These factors explain the lower-than-expected ERR, which is nonetheless still very high and well above the social discount rate (6%).

34. With the FIMP, water use in the project improved area was reduced by about 20 percent (from 1.36 million to 1.07 million m^3 per annum) mainly due to reduced water conveyance losses. This result is slightly higher than the appraisal estimate. The gross value of production increased by 17 percent, and its net value by 40 percent. Combined with the reduced irrigation water use above, this translates into a water productivity increase of about 78 percent (from EGP 1,760 to 3,138 per thousand m^3). In conclusion, FIMP demonstrated that investments in mesqa, marwa and on-farm improvements result in significant incremental benefits both from the point of view of the beneficiary farmers and of the country's economy. The efficiency of FIMP is therefore rated as **Substantial**.

D. JUSTIFICATION OF OVERALL OUTCOME RATING

35. As explained above, the Relevance of the PDO was rated as **High**. Efficacy was subject to a split assessment with the pre-restructuring efficacy rated as Modest and the post-restructuring efficacy rated as Substantial. Efficiency was evaluated as Substantial. The outcome rating for the pre-restructuring period (38 percent expenditure) was determined to be **Moderately Unsatisfactory**, while the outcome rating for the post-restructuring period (68 percent expenditure) was derived to be **Satisfactory**. While significant progress was made in the final implementation period – and in particular the last six months, as evidenced by the upgraded ISR rating in December 2017, the project's performance must be assessed throughout its duration, not only at the tail end. As a result, and due to the split assessment based on a weighted rating of the pre- and post- restructuring sub-outcomes, an overall Outcome rating of **Moderately Satisfactory** is justified, as shown in Table 3.

Table 3. Split Assessment of Outcome Ratings

	Pre-restructuring	**Post-restructuring**
Relevance of Objectives	*High*	*High*
Efficacy	*Modest*	*Substantial*
Efficiency	*Substantial*	*Substantial*
Overall rating	*Moderately Unsatisfactory*	*Satisfactory*
% disbursed	*38%*	*62%*
Overall rating	*MU (3)*0.38+ S(5)*0.62 = 4.2 ~Moderately Satisfactory*	

E. OTHER OUTCOMES AND IMPACTS (IF ANY)

Gender

36. Irrigation modernization under FIMP had a direct and enabling benefit for women: irrigation activity in the modernized marwas became possible for women for the first time. It is considerably easier, reportedly, for women to simply open alfalfa hydrants (or in the case of the few lined marwas, opening of steel slide gates) compared with the prior situation of earth marwa canals where work was physically heavier. Less time is also needed in the field

[3] At project appraisal improvement costs for mesqas, marwas and on-farm were estimated at US$112.5 million for 180,000 fed. Actual costs for these sub-components ended up being also US$112.5 million but for 155,300 fed improved. The average cost of these improvements per fed was US$625 and US$709 respectively, about 13.5 percent higher than the appraisal budget.

[4] Estimated total project costs would reach to US$ 173.7 million by June 30, 2018 once AfD loan closes. This is amount is 96.5 percent of the appraisal estimate (US$180 million including physical and price contingencies). See details in Annex 3 (Project Costs by Components) and Annex 4 (Efficiency Analysis).

due to increased discharges from the hydrants compared with flows from the original earth marwa canals. Discussions with female FFS facilitators from the PMU, and with a group of women farmers in the project area during the ICR mission confirmed the importance of the FIMP technical transformations in facilitating meaningful access to irrigation farming for women in the project areas. Some FFS were mixed gender and there were also male-only FFS. Support to female FFS under parallel funding (supported by GIZ), though on a limited scale (100 FFS by 2018) also proved to be empowering for the women. Not only did it allow women to improve their irrigation and agricultural skills, but also other topics such as nutrition, health, empowerment and income generating activities such as keeping small livestock, etc.

Institutional Strengthening and Capacity Building

37. Institutional and organizational development benefits derived during FIMP are as follows: (i) farmers and WUA representatives were directly involved in the marwa modernization planning, in construction progress monitoring, and in approving payments. In the process, local farmer groups, government representatives and the construction companies gained substantial new experience in the technical and administrative aspects of marwa modernization; (ii) the project invested directly in pump operator training for all mesqas including pump activation, operational butterfly valve-settings, and electric and diesel-motor maintenance. The pump stations are now operated effectively, albeit in a semi-formalized way and fee-collections for O&M are reportedly close to an exceptional 100 percent; (iii) Governorate technical personnel were actively involved in construction supervision activities in support of the quality and cost control consultants, with gains in technical and construction supervision knowledge, including from PMU facilitated training courses conducted by short-term consultants; (iv) the FFS activities included topics of on-farm water management aimed at increasing field-level efficiency gains, and facilitated female farmers' participation in irrigation activities using more easily managed alfalfa hydrants for releases; and (v) throughout the project, the PMU procurement, financial management, technical supervision and overall coordination capacities were greatly enhanced and improved over time (see for example analysis on fiduciary aspects below).

Poverty Reduction and Shared Prosperity

38. **Poverty reduction**. The project did not track poverty reduction per se but closely followed the increases in farm productivity and farmers' incomes through regular surveys and monitoring by the Governorates' extension and FIMP technical teams under the overall supervision of EAS. Financial benefits at crop/farm level estimated by the ICR mission showed a 12 to 18 percent increase in family incomes and a 13 to 25 percent increase in net income per cropped feddan, as the combined result of increased productivity and reduced irrigation costs. These results are quite significant. The increased agricultural production and income per feddan of improved farms after the FIMP was immediately reflected in the land market. On average the market value of the improved lands increased by about 50 percent, from LE 20,000 to LE 30,000 per kirat (about US$28,000 to US$42,000 per fed). The original reluctance of farmers to accept the proposed improvements was followed by high satisfaction levels with these improvements (as concluded by the qualitative impact assessment conducted end 2017, see Annex 1) and by the increased demand of farmers from adjacent areas to extend the FIMP modernization to their farms. Moreover, some farmers who initially rejected the construction of the buried marwas later came to entreat the PMU to install them.

39. **Shared prosperity**. The main FIMP effects with regards to shared prosperity were the equity gains between head and tail end farmers which were substantial and higher than targeted. As indicated earlier, results of measurements made on sampled marwas showed that tail enders received on average 85% of the water flow at the marwa head as compared to 50 percent at baseline, a significant improvement. This result was mainly due to the switch from diesel operated pumps to electrical ones. Reduced time and labor for irrigation and easier irrigation from buried pipes connected to hydrants at each plot after FIMP improvements, as compared to heavy

and dirty work to divert water from open marwas, also allowed women to easily participate in irrigation, which had not been the case before FIMP.

Other Unintended Outcomes and Impacts

40. There is now an experienced private market for on-farm irrigation modernization civil works, which barely existed before FIMP. Contractors have gained significant technical and social knowledge as well as contract management experience (a challenge in Egypt generally speaking) and are now well-positioned to carry out further works. In addition, at least one of the contractors is considering opening a workshop for post-project services and repairs to farmers. Lastly, considering the good results and impacts of the irrigation modernization coupled with improvements in agriculture extension service delivery, the Governor of Beheira requested the FIMP to be scaled up in her governorate to cover other districts and areas.

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

41. **Simple design**. The design of FIMP activities built on the extensive experience of similar prior irrigation improvement projects. The Irrigation Improvement Project (IIP) rehabilitated upstream canals and installed diesel pumps to serve mesqa groups, but did not improve marwas. IIIMP took modernization a step further and introduced electric pumps and mesqa pipelines, with a trial of the marwa improvements under the W-10 pilot in 2005-2006. The design of the FIMP took into account the country context, lessons learned from previous projects, financial and economic impacts and benefits, and risks – which were all well analyzed and documented.

42. **Risk and mitigation**. Seven risks were identified, of which three were rated high (low capacity in EALIP, poor quality of materials and workmanship and delays in procurement) and four were medium (tendering of bulk pipes, insufficient reduction of consumptive water use, lack coordination between MWRI, MALR and local user organizations and farmer resistance to participating in marwa improvements). Of these identified risks, almost all materialized except tendering of bulk pipes and insufficient reduction of consumptive use, which turned out not to be so challenging. There were probably insufficient mitigation measures against EALIPs' low capacity and the poor coordination between MWRI and MALR but the measures proposed for quality control, delays in procurement and farmer objections to marwa-level works proved to be effective.

43. **Readiness for implementation**. As for FIMP, the design was in hindsight not fully satisfactory. While there were some positive aspects, more detailed design studies during preparation (and funded through an advance on the loan or other source) would have greatly accelerated the rapid take off of civil works and enhanced quality of works, including optimization of pumping for each marwa. Moreover, PMU and EALIP's capability might have been overestimated during design along with the adequacy of the 'force account' modalities to address the much larger scale of FIMP, as compared to the earlier W-10 pilot under IIIMP. Further, the results framework included agricultural indicators that could not directly be attributed to FIMP activities, and the Component 2 targets in particular were over-ambitious. Readiness for implementation would have been stronger if engineering feasibility studies had been completed during preparation.

B. KEY FACTORS DURING IMPLEMENTATION

44. **Political instability**. The project commenced at a time of serious political instability in Egypt and the region. The Arab Spring started right at the beginning of the project (January-February 2011). After the Mubarak regime was overthrown, there followed periods of military and civilian rule. During this unstable time, there were frequent changes within the implementing agency (MALR), including the turnover of 10 Ministers from the beginning of the

project until closure. Due to poor security and curfews, some project sites became inaccessible, rendering project implementation very difficult. Institutional uncertainty, social unrest and security issues were thus a challenging backdrop to the first half of the project life-cycle and impacted negatively on implementation.

45. **Civil works implementation modalities**. Initially, FIMP tested the 'force-account' approach (funded by the Japan Social Development Fund, or JSDF) from October 2011 to March 2014. The progress in this first half of the project was extremely slow with less than five percent expenditure recorded by the end of the pilot in March 2014. The JSDF pilot was planned for 18 months, but it took more than 30 months for MALR/PMU to realize and agree that using the 'force account' approach had not been very effective and would not lead to the expected results in time. An internal assessment of the participatory contracting/ force account approach led to a change of strategy in the second quarter of 2014 to the 'turn-key' approach, with clustered works contracts (marwa modernization and pump station works combined) involving larger, more capable contractors. The contract award process followed standard construction principles, with the bidding process based on the World Bank (WB) standard guidelines. To facilitate this shift in implementation approach, some technical support was extended to the PMU in the form of professional engineering design, quality and cost control expertise provided by consulting firms. These changes led to a rapid increase in construction activity and project progress.

46. **Insufficient collaboration between MALR and MWRI**. The lack of effective collaboration reportedly originated from MWRI's previous lead role in modernizing mesqas (under IIIMP) and its concerns that FIMP would be perceived by farmers as a project required to repair or complete what MWRI had not done correctly. While a de-facto lack of cooperation existed at higher levels in the ministries and had a negative impact on progress and on the marwa improvement works component, there was good cooperation between the IIIMP and FIMP PMU directors at the working level. In the end, FIMP agreed to support mesqa level WUAs through operator training (WUAs are the purview of MWRI) and coordinated its field activities with IIIMP.

47. **Egyptian pound devaluation**. Another implementation factor was the Government of Egypts decision on November 3, 2016 to remove currency controls, leading to a major devaluation of the Egyptian Pound (from EGP 8.8 to 16 per US$). This caused the steel price to triple, among other cost increases such as for fuel and uPVC pipes but variation orders were not permitted under the IBRD loan as none of the contracts included clauses for price adjustment due to currency depreciation. The process of resolving this issue led to payment and construction delays from Dec 2016 until May 2017 and reduced the rate of work progress. The PMU (with the assistance of its electricity and civil consultants) and Bank Task Team worked together to find a solution that began with the PMU and its consultants evaluating the escalation payments which would have been due to the contractors under standard escalation procedures. On this basis, the PMU reached agreement with the contractors on acceptable escalation or compensation payments. It was then agreed with AFD that these compensation payments would be paid out of the AFD loan. However, because the AFD loan of US$50 Million had also been affected by a weakened Euro over the project period, its financing envelope was reduced by about US$11 Million to US$39 Million. Consequently, the level II restructuring of May 2017 tried to respond to both challenges by increasing the share of the IBRD financing for civil works and consulting services, thus freeing up AFD's loan to cover the variation orders.

48. **Obtaining irrigators' agreement on works final design**. During implementation of the electricity component, numerous objections were received from farmers in relation to overhead electrical transmission lines that passed over their property, or where farmers had illegally built structures on agricultural land. In most cases, this issue could be resolved by re-routing transmission lines or switching to underground cables. Farmers also caused delays for technical reasons – demanding greater diameter marwa pipes, relocation or additional outlets, extensions to marwas etc. These demands required a negotiation process with farmers as well as technical and contractual adjustments. Implementation was also delayed initially by some farmers' objections to the civil works, as they were skeptical about

the benefits of the buried marwas, but once they started observing the results in improved areas, they quickly came around.

49. **Inadequate technical assistance**. At project preparation and even at restructuring, the Government of Egypt was reticent to borrow for TA and would only accept TA support if it was grant funded. This led to ad hoc, but nonetheless valuable, support such as the implementation of pressure testing measures put in place after the mission by Société Canal de Provence paid for by AFD Headquarter funds. The lack of structured TA was thus more of a systemic issue and the TA component was only included during the restructuring because the 'force-account' approach had so obviously failed to achieve the expected results and further support without TA and a different contracting approach was not warranted.

50. Fortunately, close World Bank implementation support and advice to the PMU, restructuring, a very dedicated and engaged PMU Director and staff (both at central and Governorate level), openness to change and adaptability all helped to overcome most of the above-mentioned implementation hurdles, and eventually led to the achievement of most of the expected results and targets, although with some delay.

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

A. QUALITY OF MONITORING AND EVALUATION (M&E)

M&E Design

51. At design, it was envisaged that ARC and EALIP, as the main implementing agencies, would have a key role in the M&E system design, operationalization and implementation. Some of the proposed M&E tools included preparation of survey instruments and establishment of scorecards to measure beneficiaries' satisfaction with project activities and civil works implementation methods. The solicitation and integration of farmers' feedback to test and compare different methods, and carry out day-to-day M&E activities was a key feature of the M&E approach. The Project Operational Manual (POM) prepared in 2011 did not cover M&E procedures. A detailed M&E manual, in Arabic, including many operational tools, was prepared by an international consultant in May 2013 but was never cleared by the World Bank.

52. While the design was generally sound, the respective roles and boundaries of responsibilities between ARC and EALIP and overall M&E arrangements could have been defined more explicitly. Moreover, some of the indicators in the results framework could have been better defined to make it clear exactly how they were to be measured. For instance, the terms "water users", "clients" and "project beneficiaries" were used in different parts of the results framework but without clear definitions in the PAD or the Legal Agreement. The terms are drawn from core sector indicators, though, so the vague terminology may be reflective of broader weakness in the irrigation sector rather than a particular shortcoming of FIMP.

M&E Implementation

53. A framework agreement was signed between the PMU and the EAS/MALR to undertake all M&E surveys, namely at baseline (in 2014-15), at mid-term (2016) and at project closure (December 31, 2017). The surveys were carried out in the same areas, with the same sample of farms/households (including with tail-end farmers at marwas). They covered seven major food and cash crops (wheat, sugar beet, rice, cotton, maize, berseem, for about 8 percent of the total cropped area), yields, quantity of inputs, input and output prices and so on, which allowed to generate valuable and verifiable information for the ex post economic and financial analysis. Extension and economic sector staff from the two Governorates actively participated in data gathering and were trained accordingly by EAS staff.

During the first three years of implementation, no permanent staff within the PMU was assigned to M&E although EAS provided some support. Part of the reason for the delay in hiring an M&E officer was that a US$4.3 million Trust Fund from the Australian Agency for International Development (AusAid), that was signed in June 2013 and was meant to cover M&E staff in part, was cancelled in January 2014 due to a change in the Australian government's priorities. Eventually, an Officer was hired in mid-2015 to undertake both FIMP (40%) and OFIDO[5] (60 percent) M&E activities.

54. After the initial hurdles in M&E implementation were cleared, important progress was made: between August and December 2015, the results framework was revised, the M&E system was operationalized (with issuance of data collection forms for field staff), the performance indicators were reviewed, a M&E plan was prepared and local M&E focal points (one in each Governorate) were appointed and trained. Since then, monthly and quarterly M&E reports have been regularly produced, using data compiled by field staff and sourced from the consultants supervising electricity and civil works, and from other units within the PMU (namely finance and procurement). The M&E activities concentrated on reporting on the results indicators as per the various versions of the RF, contributing to the organization and review of the above-described M&E surveys (at mid-term and project end) and of the final impact evaluation surveys, as well as the preparation of the Resettlement Policy Framework and Resettlement Action Plan after the 2016 restructuring. Lastly, end-project documentation – namely a socioeconomic survey and a Borrower's Completion Report – were prepared in a timely and satisfactory way.

M&E Utilization

55. M&E has mainly been utilized as a reporting tool to MALR and the World Bank to inform on the attainment of the PDO and intermediate results and to some extent as a project implementation tool that could alert PMU and the Bank Task Team to areas where progress was lagging. However, the M&E system could have integrated implementation, procurement or disbursement progress rather than focusing narrowly on results indicators. Such a key role for M&E should have been better reflected during design and could be implemented in follow up projects. After the 2016 restructuring, all original indicators (yield increases, changes in cropping patterns/areas, farm size, input/output prices, production costs) continued to be monitored, along with revised ones: this was a very good practice as it allowed to generate data for the ICR, notably the efficiency analysis. Without this data, conducting the ex post economic and financial analysis (EFA) at completion would have been very difficult and likely of lower representability and quality.

Justification of Overall Rating of Quality of M&E

56. While M&E system was correctly implemented and produced most of its expected results and deliverables, the weaknesses in the design undermined its full effectiveness. In conclusion, the overall M&E quality is rated **Modest**.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

Environmental Compliance

57. During the design preparation of the project, an Environmental Impact Assessment (EIA) and an Environmental Management Plan (EMP) were prepared. OPs/BPs 4.01 (Environmental Assessment), 4.09 (Pest Management) and 7.50 (Project on International Waterways) were triggered. FIMP was classified as category B considering that no significant irreversible or long-term adverse environmental impacts were anticipated and that any adverse impacts could be effectively addressed through appropriate preventive actions and mitigation measures. Overall environmental impacts were expected to be very positive, particularly on improving water management in the Delta. The 2016 Restructuring recommended the preparation of an Environmental and Social Management Plan (ESMP). The Borrower revised the ESMP by including an action plan to mitigate social impacts on project affected persons

[5] IFAD-funded project (OFIDO) for irrigation development in the Old Lands also implemented by the PMU.

(PAPs) in April 2015, which the Bank reviewed and cleared. The ESMP has been implemented satisfactorily since, notably environmental monitoring, capacity building, public awareness and minimizing impacts during marwa improvement activities. An appropriate method for safely disposing of asbestos ceilings on the old pump stations was integrated in the ESMP. In total, 25 asbestos roofs from old pump houses were removed and replaced with less harmful ones.

58. Samples of irrigation water, groundwater, drainage water and soils were collected by SWERI and tested before and after the project intervention. The results were as follows: (i) before marwa improvement: all water samples were polluted with NO^3 ions, parasites and pesticides; macro and micro nutrients and heavy metals were below critical limits; and soils were considered non-saline and sufficiently fertile for plant nutrition; (ii) after improvement: 92 percent and 98 percent respectively of water samples were free from parasites and pesticides while assessments of nutrients and heavy metals and soil compatibility for cropping remained unchanged. It can be concluded that the installation of piped marwas had a positive effect on reducing irrigation water pollution from pathogenic indicators. It is also reasonable to infer that the replacement of diesel pumps with electric pumps reduced greenhouse gas emissions, although the exact impact was not measured due to inadequate resources. Compliance with environmental safeguards is deemed to be **satisfactory**.

Social Compliance

59. Although no resettlement issues were anticipated at appraisal, given that the project's interventions were not expected to displace people, OP/BP 4.12 (Involuntary Resettlement) was triggered during the 2016 Restructuring, mainly because of the potential loss of private agricultural land after the installation of poles for connecting the mesqa pumping stations to electricity. The triggering of the Resettlement policy in hindsight carried high transaction costs that were not necessarily offset by any tangible benefits. On the cost side, a firm was recruited to help the PMU develop a Resettlement Policy Framework (RPF) and a Resettlement Action Plan (RAP) acceptable to the Bank, a workshop was held in each Governorate and agreement had to be reached with the GoE on compensation for lost land as this category of compensation created a precedent[6], and field work was undertaken to duly register PAPs and effectively compensate them. Eventually, only 1,033 project beneficiary farmers were compensated and received a minimal amount (US$13 per person). In reality, the land that each farmer gained thanks to the buried marwas (which replaced the wider earth canals) far exceeded the land lost from the installation of the electricity poles (each pole took up about 1m2 of space on the farmer's land). Ultimately, the direct costs, implementation delays and administrative burden created after the policy was triggered far outweigh the benefits of the policy.

60. On another note, a Health and Safety Plan for construction workers, PMU staff and extension staff was prepared by the PMU in 2016 and cleared by the Bank. The Plan was distributed to all contractors and to MALR managers at Governorate and PMU level. Safety kits, jackets and helmets for extension driving motorcycles were procured and distributed using GoE counterpart funding. Field visits during implementation support missions and the ICR mission confirmed that this safety equipment is being used. Moreover, the project did not have any labor influx issues. In summary, compliance with social safeguards was **Satisfactory**.

Procurement

61. The FIMP procurement performance progressively improved throughout implementation, notably thanks to the close involvement and guidance provided by the Bank Task Team to the PMU staff. Given that the PMU had no prior experience with the World Bank's procurement guidelines, the Task Team provided training to PMU staff on procurement requirements. Moreover, as a mitigation measure against procurement capacity issues within the implementing agency, all contracts were subject to prior review. While the PMU managed to file procurement

[6] Egyptian law allows for compensation for lost private land after installation of electric poles only for high voltage grids, not for low and medium voltage grids.

documents relatively well, significant exchanges were often needed between the Task Team and the PMU to bring the documents up to the Bank's standards. An important failing of the procurement arrangements was the lack of contractual provisions for a change in exchange rate. From 2016, following the rejection of community and small-scale contracting, civil works were procured through NCB with a waiver for ICB. As the EGP had been stable for many years, its devaluation was not foreseen and works contracts (all of short duration, less than 18 months) did not include price adjustment clauses. When costs sharply increased after the devaluation of the Egyptian currency in November 2016, and given there was no provision for escalation under the IBRD loan, all contractors stopped work except for the few activities unaffected by the price increases. The inability to issue variation orders significantly delayed construction progress. The challenge was eventually resolved when the PMU, working with its electricity and civil works consultants conducted both analytical and market studies that helped to reach a relatively fair settlement accepted by contractors and funded by AFD, which had more funding flexibility. Overall, procurement partially met the Bank's procurement requirements.

Financial Management

62. From the Financial Management (FM) perspective, and throughout the life of the project, the PMU maintained an acceptable level of fiduciary arrangements. With regards to *Staffing*: the project FM team remained stable throughout the life of the project. This prevented the loss of cumulative knowledge which was built through on-the-job training, several training sessions and workshops held be the Bank's FM team. The PMU FM team was consistently comprised of an experienced financial officer supported by a team of several fresh graduate staff (three for FIMP only). All of the appointed staff showed adequate skills to carry out the tasks required under the Loan Agreement. Concerning *Accounting and Record Keeping*: at an early stage of implementation, the PMU operationalized an automated accounting system (i.e. Comsys) for the purpose of recording and reporting on the project's financial transactions. Although the system can generate the required reports under the Loan Agreement, its full capabilities were not utilized, particularly the deviation analysis. Better budget planning and reporting on this matter would have helped to detect and resolve delays in contractors' performance and overall project disbursement.

63. Concerning *Flow of Funds and Internal Controls*, the Borrower opened a US$ Designated Account (DA) at the Central Bank of Egypt to handle disbursements. Hence, and after the technical and financial reviews within the PMU, the involvement of the Ministry of Finance Representative (i.e. Financial Controller positioned within MALR) became imperative. This representative added an additional level of review which was beneficial but also cumbersome to the chain of transactions. Finally, with regards to *Auditing*, an independent external auditor was appointed to review the Interim Financial Reports (IFRs) and audit the project's annual financial statements. All the audit reports and IFRs were received, reviewed and found acceptable. In conclusion, the project is considered to have followed the Bank's financial requirements, although there was scope for improvement in record keeping and liaising with the Ministry of Finance on payments.

C. BANK PERFORMANCE

Quality at Entry

64. The project design relied heavily on the previous irrigation modernization projects in Egypt (IIP and IIIMP). These provided a wealth of detailed knowledge and experience that informed the FIMP approach and scope, which differed from the previous projects as it focused on the 'last mile' of on-farm irrigation modernization. However, there were no feasibility designs carried out at preparation and appraisal for modernized systems which would have identified the level of hydraulic design sophistication that was necessary to achieve acceptable pump energy efficiency, and sufficient equity in hydrant flows across the system. These are well-known challenges in relation to pumped pressurized irrigation systems with variable demands. In regard to implementation modalities, a more detailed assessment should have been carried out concerning the capacity of the small contractors or EALIP to undertake the works which required substantial technical inputs to achieve adequate quality for long term

sustainability.

65. The original results framework included numerous indicators that were not directly linked to FIMP activities and could therefore not provide a measure of FIMP-financed progress. The RF was accordingly revised during restructuring to a relevant set of indicators, although many indicators remained not clearly defined, which necessitated further iterative clarifications during the implementation support missions.

66. Given that the majority of the investment was in infrastructure at the level of the mesqa WUA, a greater emphasis on WUA development would have been justified to optimize irrigation and drainage water management and increase overall project benefits. This would have entailed a more formal partnership with MWRI, which is responsible at the tertiary level where the WUAs operate. Here is it necessary to reflect on the World Bank's own internal limitations in project design. FIMP was led by the agriculture sector of the Bank, working directly with the MALR, with little involvement from the water sector team which had Irrigation and Drainage (I&D) technical experts and a longer history of engagement with MWRI (in the prior IIP and IIIMP projects). MWRI was responsible for the mesqa level WUA institutional setup but MALR militated for a separate institutional setup comprising marwa level committees. These two levels of I&D management were not well-integrated given the higher-level institutional issues and weak cooperation between MWRI and MALR. If the project preparation team had prioritized the mesqa level WUA development from the start, then FIMP and IIIMP activities would have been better aligned and coordinated.

67. The internal Government tensions tended to undermine the chances of success regarding strengthening the important WUA setup noting this was originally supported by the Bank under the IIIMP but was not consistently extended to FIMP. While experience suggests that such a partnership would have been challenging to establish, it would have been worth exploring the appropriate institutional arrangements that could have enhanced project implementation. At the same time, it should be noted that the coordination with other authorities such as electricity, roads, municipalities, etc was required before electricity works could be carried out and the level of cooperation with these entities was much more successful.

Quality of Supervision

68. A total of 31 implementation support missions were fielded diligently and regularly to support the project over its implementation period, repeatedly comprised of high-level engineering and irrigation expertise, agronomy, extension and social expertise, and perhaps less so with M&E expertise, although this subject was systematically tackled by successive mission leaders. From the point of view of the borrower (MoIC), the project suffered from frequent changes in Task Team Leaders (TTL), with seven TTLs over eight years from design to project completion. At the same time, one can argue that these changes in TTL made it possible to critically reflect on past experiences and achievements at each change and to take action to reorient the project as needed, which eventually led to an accelerated implementation as of 2016. Thereafter, there were fewer changes to the Task Team members, which proved to be adept at supporting the PMU over the course of the project, for instance in procurement and financial management.

Justification of Overall Rating of Bank Performance

69. In summary, although quality at entry could have been improved, the quality of supervision was exemplary. The Bank supported the Borrower and the implementation agency (MALR and its PMU) as much as it could to constantly adapt to the difficult socio-economic context and encountered difficulties and to improve the PMU's performance in many domains over the years. The Bank's constant support significantly contributed to eventually achieving most of the expected project results after a sharp acceleration in implementation in the last 18 months (which incidentally put a lot of pressure on both the PMU, MALR, Governorates and Bank staff). However, given that the quality at entry generated many of the challenges encountered during implementation, the overall Bank

performance is rated as **Moderately Satisfactory**.

D. RISK TO DEVELOPMENT OUTCOME

70. The main risks to the development outcome (i.e. increased access to modern irrigation systems in the project areas, in an equitable manner) are related to the sustainability of the modernized mesqas and marwas. By nature, the civil works to improve the performance of mesqa and marwa systems were not complicated and did not require high level operational skills from contractors. The quality of civil works was ensured through: (i) redirecting irrigation civil works to medium-scale contractors; (ii) hiring specialized quality control and construction supervision consultants (as of mid-2016, after which most of the modernization was implemented); and (iii) the very close involvement of beneficiary farmers in the detailed design of marwa improvements, supervision and co-certification of the delivery of equipment/works at the field level. The institutional innovation of the FIMP – the marwa committees – could prove to be effective structures for discussing and resolving any O&M issues among beneficiaries in the future, while the training provided to pump operators (WUA representatives) could also help ensure the smooth supply of water to the marwas and the farms. While there is a risk that the Government could reduce or eliminate subsidies for electricity used in agriculture, thereby undercutting the cost savings from electric pumps, alternative power sources, such as solar power, might be able to fill the gap.

V. LESSONS AND RECOMMENDATIONS

71. The main lesson learned from the FIMP is that on-farm irrigation modernization through improvement of pumping stations and of quaternary canals, coupled with enhanced advisory services to farmers to improve water use and productivity, is feasible at a large scale and beneficial, both to end users and the economy. FIMP showed that marwa modernization can bring financial benefits to farmers (mainly through the reduction in pumping costs and increased yields and incomes) as well as a range of economic and social benefits (reduction in water use, more equity between water users, easier involvement of women in irrigation, et c.).

72. ***For the areas targeted by FIMP***, the_main recommendations for follow up are: (i): expand the FFS approach to enhance the agricultural gains from improved irrigation modernization; (ii) develop or organize markets with smallholders (and their associations), traders and large commercial farms and support associated infrastructure and capacity building to enable a shift to higher value crops and access to markets; (iii) further improve soils and test other on-farm irrigation methods (bubblers, drip, etc.) that may save more water and be more suitable to fruit and vegetables and other high value crops; and (iv) broaden the role of WUAs – in partnership with MWRI - notably by training WUAs in governance, simple accounting and management in order to make them even more sustainable.

73. ***For the remaining areas to be covered under GoE's 5 million feddan program of irrigation modernization in the Old Lands***, the main take away lessons and recommendations deriving from FIMP are: (i) support for on farm irrigation modernization along the lines of what FIMP implemented was successful, but technical design, construction and contract management inefficiencies need to be better addressed (summarized below and detailed in Annex 6); (ii) explore ways to possibly reduce investment costs[7] and speed up/facilitate civil works on a much wider scale, for example through the use of trenchless machines for burying uPVC pipes (which would necessitate larger contracts to absorb amortization costs of such equipment by contractors) and reducing standards of uPVC pipes (from 4 to 2.5

[7] Actual irrigation modernization costs -including the technology transfer and capacity building component costs- ended up at US$1,095 per feddan as compared to US$900 per feddan at appraisal. To date about 250,000 feddans have been improved through the FIMP and other donor-funded projects (IFAD, OFID) implemented by the PMU. For the 5 million feddans that are proposed to be improved until 2030 under the Government's national on-farm modernization programme, that would represent a total cost of US$ 5.2 billion over the remaining 12 years. Reduction in costs are needed to make this target more achievable.

bar) if cost-savings can be achieved in doing so; (iv) there is need for a comprehensive approach to modernizing the irrigation system—starting from main canals and ending with on-farm modernization. Both on-farm and off-farm irrigation modernization are important, and implementing them in close coordination is critical for the success of the overall program and the achievement of higher-level objectives, notably poverty reduction, maximizing food security and improving water resources management.

Project design, coordination and implementation

74. **Works contracts of significant size (minimum US$5 to 10 Million) executed by competent commercial contractors can achieve rapid positive results**. The initial approach was prompted by an earlier pilot (W-10) which entailed the 'force-account approach', piloted with community and small contractors on 5,600 feddans. However, this approach proved inadequate for meeting the demands of the large scale of work (originally 180,000 feddans). The final approach adopted in early 2016 involved larger packaged contracts attractive to larger contracting firms. While marwa specific contracting experience was limited, rapid progress was achieved: 60 percent of the works was completed in the last 25 percent of the project duration; and 37 percent was achieved in the last seven months (8 percent of the project duration). This important finding was also noted in the ICR of the IIIMP (2016) but the finding did not inform FIMP, which was planned in 2010. The fact of rapid acceleration achieved in the last third of the project after the support of construction supervision and quality control consultants was mobilized, alongside the strategy of packaged works (civil and pump stations), reflects the high suitability of the construction and TA supervision approach that finally evolved in FIMP.

75. **Physical works need to be sequenced to start with electricity infrastructure first and then marwa/ mesqa improvements**. As the farms where modernization took place were privately owned, every farmer had to agree to have works done on their land prior to construction activities commencing. A planning approach that aims to work first with smaller, technically manageable and socially cohesive mesqas, will achieve faster progress in construction activity. These mesqas can act as working examples for planning and construction-engagement with more complex larger mesqas. Another key lesson is that it is better to construct the electricity transmission lines up to the pump station before commencing work on the marwas as the provision of a reliable and inexpensive energy supply enhances farmer's trust in the benefits of the project. Moreover, to minimize farmers' objections to installing overhead electricity lines in their lands, the use of underground cables should be considered, especially as the cost difference between overhead and underground cables is minimal.

Technical design of irrigation schemes with social considerations

76. **Farmer and WUA involvement in final design and supervision leads to ownership**. The project was highly attentive to farmers' involvement in implementation and was responsive to their preferences such as number of hydrants per plot and minimum pipe sizes (the PMU changed the hydraulic design of the marwa pipes from 160mm to 180 mm on farmers' request). Farmers, through their marwa committees, mesqa WUAs and agricultural cooperatives, were involved in key stages of final design, checking progress, and co-signing construction payment approvals. Accommodating farmers' design preferences and including them in the construction process was essential as the infrastructure is owned by the mesqa WUA with signed agreements to be repaid by individual farmers over 15 years, with no interest as per GoE policy. Ownership resulting from the process is evidently strong.

77. **Design of smaller rather than larger mesqas has technical and social advantages**: Mesqas included in FIMP averaged 60 Feddan (25 ha) in size, but ranged from 13 to 193 Feddan (5.5 to 81 ha). In smaller mesqas, it was substantially easier to mobilize farmers, undertake construction and resolve issues. This was attributed to the strength of family or local relationships, which tends to diminish with increased mesqa size. Dividing larger mesqas into two (with a minimum size of approximately 50 feddan per mesqa) will improve technical and social outcomes.

78. **Use hydraulic models for mesqa network design for optimum pumping energy utilization**. The FIMP design process was based on a simplified design guideline that was pragmatic in its ease of application, but the results suggest that while pumping costs were reduced significantly, the energy use of pump stations and delivery equity were moderate. A more sophisticated hydraulic and pump-duty design approach addressing variable demand, with attention to hydrant differential flows, possible use of flow-regulators, and to optimizing operational rotational schedules, would achieve better system performance and I&D service outcomes.

Contracts and construction supervision

79. **Technical support from civil and electricity engineering firms was central** to the achievement of construction supervision standards, and cost and quality control. The PMU was highly committed but was significantly under-resourced. The necessary TA to the PMU and engineering support concomitant with a major civil works construction program such as FIMP was added very late during implementation (after 3.5 years, and in month 68 as far as engineering works supervision). TA should be included in future projects and activated from the project start.

80. **Contracts need to make provisions for price adjustment due to currency fluctuations**. The currency devaluation (EGP 8.8 to 16 on 3 Nov 2016) caused a severe increase in the prices of inputs for the modernization works. The inability to issue variation orders on the IBRD loan stalled work progress and complicated administration until an appropriate methodology for variation payments was developed and AFD covered the cost. Inclusion in contracts of price-adjustment provisions along with detail on the method of setting and approving price-adjustment factors is recommended for future projects.

81. **Pipeline pressure testing method must be explicit in the construction contract specifications**: The hydraulic integrity of the as-constructed uPVC pipelines (4 bar: 180-225mm diameter) was not initially specified and pipeline construction quality could not be properly assured. An appropriate method was established during the project and applied throughout, but must be explicit in method and be included in future contracts.

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Objective/Outcome: To increase access to improved irrigation systems in the project areas of Mahmoudia, Manaifa and Meet Yazid located in the Nile Delta.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Water users provided with new/improved irrigation and drainage services (number)	Number	0.00 01-Feb-2015	140000.00 21-Jun-2016	140000.00 21-Jun-2016	197663.00 31-Dec-2017
Water users provided with irrigation and drainage services - female (number)	Number	0.00 01-Feb-2015	14000.00 21-Jun-2016	14000.00 21-Jun-2016	15813.00 31-Dec-2017

Comments (achievements against targets): Achievement ratio is 141.2%
Data sources: Agricultural Cooperative Associations for number of owners. For tenants, the number is estimated because it varies from one season to another. The estimation is done through a random selection of stations.
-Land owners number: 121,172 (Beheira: 74,131 and KES: 47,041)
-Tenants number: 76,491 farmers (Beheira: 59,294 and KES: 17,197)
Accordingly, total FIMP beneficiaries 197,663

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion

Irrigation operating and maintenance cost reduced	Percentage	0.00 05-Jan-2011	30.00 23-Sep-2011	30.00 21-Jun-2016	31.30 31-Dec-2017

Comments (achievements against targets): Achievement Ratio is: 104%.
The respective electric vs. diesel pumps operation and maintenance (O&M) costs for a typical marwa of 60 feddans were calculated using the following parameters: energy costs (fuel and oil or electricity); pumps maintenance; maintenance of buried PVC pipes; cost recovery of installed equipment and pump operator fees. The diesel versus electrical system O&M cost establishes at EGP 12.62 vs EGP 8.66 /hour/feddan, equivalent to a cost reduction of 31.3%, as compared to the set target of 30%.
Source of information: PMU calculations and ICR mission verifications.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Operational water user associations created and/or strengthened (number)	Number	0.00 01-May-2011	10000.00 23-Sep-2011	1000.00 21-Jun-2016	2433.00 31-Dec-2017

Comments (achievements against targets): Achievement Ratio is: 244%
The FIMP did not establish new WUAs (these were formed under previous projects such as the IIP and IIIMP) but rather strengthened the capacities of existing WUAs and assisted the establishment on informal marwa committees (composed of members of each WUA) to improve irrigation operation, water use at farm level and water efficiency and equity in distribution.
The number of WUAs that were strengthened under FIMP amounts to 2,433 (1,515 in Beheira and 928 in Kafr El-Sheikh). Each mesqa WUA operates one pumping station composed (after FIMP improvement) of one renewed diesel pump and two electric pumps. Each WUAs station covers around 60 feddans in average.
Source of data: Under-Secretary of Agriculture 24 March 2018

Objective/Outcome: In an equitable manner.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Ratio of water availability (in cubic meters/hour) measured at tail and head ends	Percentage	50.00 01-Feb-2015	75.00 21-Jun-2016	75.00 21-Jun-2016	84.50 31-Dec-2017

Comments (achievements against targets): Achievement Ratio is: 113%
This indicator measures the difference between top-end and bottom-end hydrant flows and is the main indicator for equity between water users. Typically, on canal systems, top-end users have access to more water than tail-enders. FIMP aimed to reduce this difference on the modernized marwas to 75% versus a baseline of 50%. The modernized marwa hydraulic system (pipelines or lined-canals) combined with improved operational procedures (systematic rotations) contributes to improved equity.

A.2 Intermediate Results Indicators

Component: Marwa and Farm-Level Irrigation Improvements

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Direct project beneficiaries	Number	0.00 01-May-2011	140000.00 21-Jun-2016		207663.00 31-Dec-2017
Female beneficiaries	Percentage	0.00 01-May-2011	10.00 21-Jun-2016		13.10 31-Dec-2017

Comments (achievements against targets): Achievement Ratio is: 148% (total direct beneficiaries); and 131% (female direct beneficiaries)
Direct project beneficiaries include water users provided with improved irrigation & drainage services (197,663 water users as calculated above –see PDO indicator 1), workers that were employed to undertake electricity and civil works, and farmers that benefited from extension and capacity building

activities for an additional estimated 10,000 people. Direct female beneficiaries include 15,813 female water users and 2,491 female farmers who received extension services.
Source of data: see above for water users; Extension focal point in each Governorate; and electricity and civil works contractors.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Area provided with new/improved irrigation or drainage services	Hectare(Ha)	0.00 01-May-2011	80000.00 21-Jun-2016		65252.00 31-Dec-2017
Area provided with new irrigation or drainage services	Hectare(Ha)	0.00 01-May-2011	80000.00 21-Jun-2016		65252.00 31-Dec-2017

Comments (achievements against targets): Achievement Ratio is: 82 %
This indicator was introduced during the 2016 restructuring. The target area was set at 80,000 ha (with a conversion of 1 Ha = 2.38 feddans / 1 feddan = 0.42 Ha) but the comments section of the results table mistakenly converted this number revised to 170,000 feddans (71,428 Ha). The ICR mission took 80,000 ha as the target. As of 31 December 2017, the total area that benefited from improvements (switching from diesel to electric pumps, buried uPVC pipeline and associated distribution system, lined marwas) under on-going or completed contracts was estimated at 65,528 Ha (155,300 feddans), of which 104,834 feddans was in Beheira and 50,466 feddans in Kafr El-Sheikh.
Source of data: Consultant reports; Technical team reports; and PMU data.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Electric pump installed on mesquas	Number	0.00 05-Jan-2011	130000.00 23-Sep-2011	150000.00 21-Jun-2016	155300.00 31-Dec-2017

Comments (achievements against targets): Achievement Ratio is: 104%
a/ It should be noted that the original target value and unit of measurement was not the total number of electric pumps installed but rather the area (in feddans) that would benefit from electricity supply through dedicated (low and medium voltage) grids installed by the FIMP.
As of 31 December 2017, the area benefiting from electric pumps amounted to 155,300 feddans (104,834 feddans in Beheira and 50,466 feddans in Kafr El-Sheikh). Exact value will be known after due verification by the construction supervision and quality control consultant (Saleh and Hegab).
Source of data: Saleh and Hegab reports and PMU data.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Water pumping costs reduced	Percentage	0.00 05-Jan-2011	30.00 23-Sep-2011		46.00 31-Dec-2017

Comments (achievements against targets): Achievements Ratio is: 154%
It should be noted that no definition of water pumping costs was provided in the original results framework presented in the PAD and the Loan Agreement. After discussion between the PMU and the Bank's Task Team during successive implementation support missions, it was agreed that water pumping costs should embed only the direct pumping costs e.g. energy costs, excluding maintenance costs of the pumps and of the existing and improved mesqa and marwas system after FIMP improvement. Total fuel & oil cost for a diesel pump was estimated at 4.85 EGP/fed.hr against an energy cost of 2.61 EGP /fd.hr for an electric pump, resulting in a reduced pumping cost by 46% (switching from diesel to electricity).
Source of information: PMU calculations and ICR mission verifications.
NB: Prices in 2017 values, after the EGP devaluation in November 2016.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Labor time savings for farmers	Percentage	0.00 05-Jan-2011	30.00 23-Sep-2011		37.00 31-Dec-2017

Comments (achievements against targets): a/ 37% for time savings; 49.5% for labor savings. These values were calculated during the final impact assessment survey carried out by EAS at the end of 2017.
Achievements Ratio is : 123% for time savings; and 165% for labor savings
Source of data: Economic Affairs Sector (EAS) final impact assessment.

Component: Farm-level Technology Modernization

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Targeted clients satisfied with agricultural services (percentage)	Percentage	0.00 01-May-2014	70.00 21-Jun-2016		85.00 31-Dec-2017
Targeted clients satisfied with agricultural services - male (number)	Number	0.00 01-May-2014	700.00 21-Jun-2016		58369.00 31-Dec-2017
Targeted clients satisfied with agricultural services - female (number)	Number	0.00 01-May-2014	700.00 21-Jun-2016		7961.00 31-Dec-2017
Targeted clients- male (number)	Number	0.00 01-May-2014	1000.00 21-Jun-2016		3260.00 31-Dec-2017
Targeted clients – female (number)	Number	0.00 01-May-2014	1000.00 21-Jun-2016		1152.00 31-Dec-2017

Comments (achievements against targets): Achievement Ratio is: 121 %
The results from the final survey carried out by the Economic Agricultural Sector of MALR are summarized below:
- High quality of works and contractor performance (92% satisfied)
- Duration of development work (90%)
- Appropriate time for project implementation (95%)
- Appropriate PMU improvement cost (87%)
- Using the community for the implementation works (86%)
- Farmers involvement before starting the implementation works (86%)
- Farmers involvement in delivery of improved mesqas (91%)
- Services provided to farmers in general (57%)
- Providing training for all beneficiaries (87%)

Overall, the farmers satisfaction's is quite high (85%) and largely over the 70% target.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Client days of training provided	Number	0.00 01-Jan-2015	7500.00 21-Jun-2016		7534.00 31-Dec-2017

Comments (achievements against targets): Achievement. Ratio is: 101%
Client days of training provided are comprised of training sessions, field visits, workshops, field technical assistance and contractors' training that benefited pump operators and farmers.
Source of data: Extension Focal Point & Technical team in each Governorate.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Technologies demonstrated in the project areas (number)	Number	0.00 01-May-2011	15.00 23-Sep-2011		15.00 31-Dec-2017

Comments (achievements against targets): Achievement Ratio is: 100%
The 15 demonstrated technologies are the following: (i) community composting; (ii) silage; (iii) fodder from rice straw; (iv) on-farm irrigation improvements by buried pipe ; (v) on-farm irrigation improvements by lined marwas; (vi) use of an electronic complaint system; (vii) regular transplant of rice by rope; (viii) System of Rice Intensification (SRI); (ix) land laser-leveling; (x) deep ploughing; (xi) adding gypsum to soil; (xii) use of different rice varieties in Farmer Field Schools (FFS); (xiii) use of card payment for electricity supply; (xiv) raised beds ; and (xv) modern irrigation for horticulture in the Old Land.
Source of information : Extension Focal Point & Technical team in each Governorate

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Area with higher-value horticultural crops grown (number of feddan)	Number	0.00 05-Jan-2011	12000.00 23-Sep-2011	100.00 21-Jun-2016	1218.00 31-Dec-2017

Comments (achievements against targets): Achievement. Ratio is: 1,218%
By the end of the project, 1,218 feddans were planted with higher-value horticultural crops (out of which 20 feddans of demonstration plots were in progress with application of modern irrigation technologies). The original target (10,000 feddans) was considered not realistic at restructuring in June 2016, and reduced to100 feddans.
Source of information : Extension Focal Point & Technical team in each Governorate

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Monitoring and evaluation system established and applied	Percentage	0.00 05-Jan-2011	100.00 23-Sep-2011		100.00 31-Dec-2017

Comments (achievements against targets): Design & establishment of and effective M&E system started in 2011 and was further upgraded in December

2015 when a part-time M&E specialist (shared with IFAD-funded OFIDO project) was assigned to follow FIMP's M&E issues within the PMU. Activities included: (i) carrying out the baseline survey; (ii) Selecting and training the field M&E specialists and designing the exchange information mechanism; (ii) updating the Results Framework (RF) in 2016 in view of restructuring then regularly informing it; (iv) preparing monthly M&E reports compiling data and due analysis from information received from FIMP technical and extension team at governorate level, Quality Control and Cost consultants for electricity and civil works; (v) providing the required data, reviewing and improving the different studies , such as: Brower's Completion Report (BCR), Economics Affairs Sector surveys, Resettlement Policy Framework (RPF) , Resettlement Action Plan (RAP), impact assessments , economics analyses and Implementation Completion Report (ICR).

B. KEY OUTPUTS BY COMPONENT

PRE-RESTRUCTURING Objective/Outcome: The project development objective is to increase agricultural profitability and improve equity in access to higher-quality water for up to 140,000 small-scale farmers on up to 200,000 feddans (80,000 hectares) in the command areas of Mahmoudia, Manaifa and Meet Yazid located in the Nile Delta.	
Outcome Indicators	1. PO-1: Agricultural output from the main irrigated crops, in LE per feddan increased by 10% (relative to baseline and non-project neighboring comparison areas) 2. PO-2: Irrigation operating costs in LE per feddan reduced by 30% (relative to baseline and non-project neighboring comparison areas) 3. PO-3: Difference in yields between farmers at the tail end and head reach of quaternary canals reduced by 20% (relative to baseline and non-project neighboring comparison areas) 4. PO-4: Drainage water re-use by farmers, especially those at the tail end of quaternary canals reduced by 50% (relative to baseline and non-project neighboring comparison areas)
Intermediate Results Indicators for Component 1: Marwa and Farm-Level Irrigation Improvements	(i) Installation of electric grid and replacement of diesel with electric pumps on tertiary (mesqa) canals. (ii) Modernization of marwas with PVC pipes and hydrants, including piloting more participatory contracting and implementation approaches (iii) Farm-level land improvements
Intermediate Results Indicators for Component 2: Component 2: Farm-level Technology Modernization	(iv) Support for farmer awareness and knowledge (farmer meetings and exchange visits), and improved extension delivery (v) Training of lead farmers, extension staff, EALIP staff, private sector operators, and senior management officials (vi) Demonstrations of on-farm irrigation and cropping practices (vii) Implementation support and studies
Key Outputs by Component 1: Marwa and Farm-Level Irrigation Improvements	• Electric pumps were installed on mesqas serving 155,300 feddans • Reduction in farmers operating costs (LE per feddan) was 46.2% • Marwa modernization as adopted for 155,300 feddans • Reduction in time spent irrigating was reduced by 37% due to marwa modernization

	• Alternative contracting approaches for marwa improvement were adopted and tested (force-account approach)
Key Outputs by Component 2: Farm-level Technology Modernization	• 100% of farmers in the project area were aware of the marwa modernization program (including cost recovery) • Extension agents visits to farmer communities were increased. • Training in technical and agronomic skills were received by 58,369 farmers • Women accounted for more than 13.6% of people trained • Improved irrigation technologies were demonstrated on 155,300 feddans • Higher value horticultural crops were grown on an additional 1218 feddans • The monitoring and evaluation system was established and applied

POST-RESTRUCTURING Objective/Outcome 1: To increase access to improved irrigation systems in the project areas of Mahmoudia, Manaifa and Meet Yazid located in the Nile Delta, in an equitable manner.	
Outcome Indicators	1. Water users provided with new/improved irrigation and drainage services (number) (Water users provided with irrigation and drainage services - female (number)) 2. Irrigation operating and maintenance cost reduced (percentage) 3. Ratio of water availability (in cubic meters/hour) measured at tail and head ends (percentage) 4. Operational water user associations created and/or strengthened (number)
Intermediate Results Indicators for Component 1: Marwa and Farm-Level Irrigation Improvements	1. Direct project beneficiaries (Number) 2. Female beneficiaries ((percentage) 3. Area provided with new/improved irrigation or drainage services (Hectare) 4. Electric pump installed on mesquas (number) 5. Water pumping costs reduced (percentage) 6. Labor time savings for farmers (percentage)

Intermediate Results Indicators for Component 2: Component 2: Farm-level Technology Modernization	7. Targeted clients satisfied with agricultural services (percentage) 8. Targeted clients satisfied with agricultural services - male (number) 9. Targeted clients satisfied with agricultural services - female (number) 10. Targeted clients- male (number) 11. Targeted clients – female (number) 12. Client days of training provided (number) 13. Technologies demonstrated in the project areas (number) 14. Area with higher-value horticultural crops grown (number of feddan) 15. Monitoring and evaluation system established and applied
Key Outputs by Component 1: Marwa and Farm-Level Irrigation Improvements	The activities under Component 1 resulted in the following outputs: • 197,663 water users (landholders and tenants) accessed improved irrigation and drainage (I&D) services. • 15,813 women accessed improved irrigation and drainage (I&D) services. • Irrigation operating and maintenance costs were reduced by 31.3% • Equity of distribution (tail and head ends) was increased from 50% to 84% • 207,663 people directly benefitted from the project • 18,304 women directly benefitted from the project • A total of area of 65,252 Ha of irrigation infrastructure was modernized • Electric pumps (and power distribution network) were installed on 65,252 Ha • Energy costs for pumping were reduced by 46% • The time required for field-level irrigation activities was reduced by 37%
Key Outputs by Component 2: Farm-level Technology Modernization	The activities under Component 2 resulted in the following outputs. • A total of 58 369 farmers were provided with satisfactory agricultural services • Training was provided for 7,534 farmers and operators • Fifteen different technologies were demonstrated • Higher-value horticultural crops grown on 1218 Feddan (512 Ha) • A monitoring and evaluation system established and applied

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Preparation	
Supervision/ICR	
Dambudzo Josephine Muzenda	Task Team Leader(s)
Basheer Ahmad Fahem Sadeq Jaber	Procurement Specialist(s)
Wael Ahmed Elshabrawy	Financial Management Specialist
Claudine Kader	Team Member
Abdulhamid Azad	Team Member
Silvia Mauri	Team Member
Mariana T. Felicio	Social Safeguards Specialist
Enas Shaaban Mahmoud	Team Member
Mohammad Farouk Ibrahim Kandeel	Environmental Safeguards Specialist
Ibrahim Ismail Mohammed Basalamah	Team Member
Marc Fantinet	FAO Team leader (ICR)
Jonathan Denison	FAO Irrigation Specialist (ICR)
Juan Morelli	FAO Economist and finnacial Analyst (ICR)

B. STAFF TIME AND COST

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US$ (including travel and consultant costs)
Preparation		
FY10	56.554	349,804.97
FY11	29.298	151,260.77

FY12	0	20,258.25
FY13	0	1,146.07
FY14	0	-1,110.00
FY16	0	0.00
Total	**85.85**	**521,360.06**
Supervision/ICR		
FY11	2.400	6,834.54
FY12	13.056	182,326.95
FY13	14.825	306,536.23
FY14	16.550	125,412.80
FY15	48.232	444,587.30
FY16	64.040	498,848.94
FY17	29.948	184,430.22
FY18	19.309	143,760.18
Total	**208.36**	**1,892,737.16**

ANNEX 3. PROJECT COST BY COMPONENT

Components	Amount at Approval (US$M)	Actual at Project Closing (US$M)	Percentage of Approval (US$M)
Component 1: Marwa and Farm-Level Irrigation Improvements (approximately US$139.3 million excluding contingencies).	139.3	139.30	100%
Component 2: Farm-level Technology Modernization (approximately US$ 14.1 million excluding contingencies).	14.1	14.10	100%
Total	**0.00**	**153.40**	**100.00**

ANNEX 4. EFFICIENCY ANALYSIS

Original Economic and Financial Analysis (EFA)

The Economic Rate of Return (ERR) for the FIMP investments was estimated at appraisal at 28.9 percent while the Net Present Value (NPV) with a 10 percent discount rate, at LE 1,152 million (US$209 million). Most of the quantified benefits were private goods benefiting the participating farmers. Results did not quantify the value of expected benefits in public goods such as: (i) irrigation water savings and its diversion to other users, or needs[8]; and (ii) the environmental benefits, as the reduction of greenhouse gas (GHG) emissions and related enhanced public health conditions. All FIMP costs were considered for the project's cost benefit analysis[9].

Quantified benefits included: (i) production and productivity increases (due to enhanced water distribution, timely irrigation, equity for tail end farms, improved water quality and quantity, improved drainage, reduced water table and water and soil salinity, etc.); (ii) land gains for production (due to the covering of marwas); (iii) reduced irrigation costs (depreciation and O&M costs of pumps, energy costs, labor for irrigating, etc.), input savings, reduction of weed control costs, reduced marwa maintenance costs, etc.; (iv) change in cropping pattern (due to improved reliability and timely access to water, lower risks, and technical assistance providing support for using improved practices and diversification to higher value crops); and (v) enhanced water productivity (as conveyance speed increases, water loses are reduced, drainage improves, land leveling is applied, yields increase, and irrigation costs are achieved).

Yields were expected to increase by 11 to 20 percent, while net incomes per feddan would grow between 17 to 32 percent as a result of the combined effects of increased production and reduced costs. Farm models representing the typical rural household beneficiaries including the most important production activities and sources of income, off-farm employment, production costs, cost recovery of the system improvements, and other relevant parameters, allowed for estimating the family net incomes "without" and "with the project". The models showed that farmers would be supportive of the proposed improvements as they would result in about 15 to 18 percent of water savings, obtaining a significant increase in income ranging from 12 to 29 percent; and with some diversification to higher value crops, their net income could easily be doubled in a few years.

Aggregating results throughout the proposed project area after all costs were matched with the quantified benefits to be obtained by beneficiaries, allowing for the assessment of the expected results: water use in the project area could be reduced by 18 percent from 1.45 million to 1.19 million m^3 per annum as a result of the improvement package to be implemented including enhanced water management (piped marwas, reduction of water duties, equity in its distribution, irrigation cost reductions, land leveling, technical assistance, etc.). Estimates of savings without detailed field measurements must be taken as indicative. Some of the water saved by the top end farmers would in effect be used by the tail end farmers who often suffer water shortages and benefited from improved equity as a result of the buried marwas. The tail end farmers no longer need to rely on pumping poor quality drain water. As the net value of production was expected to increase by 50 percent while saving water, the resulting productivity of irrigation water would

[8] The project was expected to save water mainly through improvements of the water conveyance to the fields: field-to-field flooding loses considerable water to drains, evaporation, and evapotranspiration of weeds. Most of these losses are permanent as they cannot be recovered because of the proximity of the project area to the sea, and given that saline intrusion had salinized the aquifer below the coastal area. Thus, most of the wastage of water in these areas are true water losses, and if mitigated (avoided or reduced) it could be allocated and conveyed elsewhere.

[9] About 25 percent of the project costs were to install new electrical grids in the project areas for the substitution of diesel pump-sets. Electrification of pumps at the mesqa level besides reducing O&M costs including energy and labor, enhances convenience, reduce noise, air pollution and other ambient pollution from oil spills. Alongside electrification, the single-point pumping at the mesqa's head, the marwa/on-farm improvements, and the timely irrigation could also reduce pump sizes, minimizing the at-source GHG emissions from the thermal electric plants.

be increased by 83 percent (from US$82.5 to US$151.4 per thousand m^3).

The Economic and Financial Analysis (EFA) after FIMP Closing

The project improved area expected at appraisal ended up being reduced by about 20 percent due to several factors discussed in this ICR. Likewise, improvement costs ended up being higher than estimated at appraisal, and the funds made available and spent for project implementation from the different sources (IBRD, AFD, JSDF, GIZ and GoE) were also reduced by about 3.5 percent in current US dollars. Similarly, other targets were revised at restructuring, and the levels performed and/or achieved are lower than planned (i.e. the number of field crop demonstration sites developed; FFS groups formed; areas applying laser land levelling, areas treated with deep plowing and/or amended with gypsum, etc.)

In order to re-estimate the project impact at project closing, a new EFA was prepared adjusting the main determinant parameters including area improved, project support interventions, and the overall actual project costs. Also, all original assumptions used for estimating the expected benefits were revised and updated based on mission observations and estimations on what is being attained at closing, including what could be expected in the project area, the farmers' involvement, and the production technologies changes being adopted (on average) in the field.

Project Costs and Benefits in Constant 2017 Values

The updated EFA at project closing was prepared valuing all costs and benefits at February 2016 constant LE values[10]. No costs expended before the project, including those from the IIP improvements stretching back to 1995, were considered since they were treated as sunk costs. The cost of all improved marwas and mesqas during FIMP were valued based on the latest contracts awarded under the project at EGP 6,400 and EGP 9,600 per fed respectively. Other FIMP costs were valued based on actual disbursements in current US$, using the average exchange rate of the year in which they were expended, and transformed into LE of February 2018 (using LE 16.7 per US$ as exchange rate). Table A4.1 presents the total project costs in current US$ and in constant 2018 EGP values.

Project benefits were estimated based on one or several of the effects induced by the project interventions including: (i) production and productivity increases (due to enhanced water management, distribution efficiency, timely availability, gained equity for tail end farms, improved water quality and quantity reaching farms, better agronomic practices, etc.); (ii) land gains for production (about 4 percent due to the covering of marwas); (iii) reduced irrigation costs (depreciation and O&M costs of pumps due to switching to electric pumps, time savings for irrigation, reduction of marwa maintenance costs); (iv) minor changes in cropping patterns (due to improved reliability and timely access to water, reduced risks, and project technical assistance providing advice for using improved production practices and switching to higher value crops); and (v) increased water productivity (due to the increase in water conveyance speed, reduction in water losses, application of land leveling, higher yields and lower costs of production, etc.).

Benefits were also estimated at February 2018 constant values by updating all market prices and costs used for the crop and activity models with those prevailing at closing date. Table A4.2 presents these values with minor adjustments based on the World Bank Commodities Price Forecast (constant US dollars) from October 26, 2017 which were assumed to be representative for the 20 years period (2014 – 2033) assumed as the life of the project investments.

[10] The FIMP went through huge exchange rate fluctuation during implementation. The Euro weakened as compared to the dollar from $1.43 in 2010 to $1.12 in December 2017. The EGP was devaluated in November 2016 against the euro from EGP 9.70 to EGP 19.42 and against the dollar from EGP 8.86 to EGP 17.58. The devaluation of the Euro against the US dollar affected the value of the AFD loan. The devaluation of the pound has created difficulties for the contractors, who were not in a position to absorb the resulting price increases of materials and labor.

Table A4.1 Project Costs in Current US dollars and in 2018 LE constant values

Year	Actual Disbursements (in current '000 US$)					
Project Component By Year Including Contingencies	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**TOTAL**
A. Marwa and Farm Level Irrigation Improvements						
1.System Improvements						
Design snd Supervision	422	432	442	452	904	**2652**
New Electricity Grid Low & Medium Voltage	0	1590	10780	6200	14920	**33490**
Mesqa Adaptation / Marwa Improvements / Land Improvements	0	3,545	31,675	24,800	49,835	**109,855**
SubtotalSystem Improvements	**422**	**5,567**	**42,897**	**31,452**	**65,659**	**145,997**
2. Machinery for System and Land Improvements						
Tractors for Land Improvements Laser Units (scrappers & laser units)Trenchers (Canal Digging)Gypsum Distributors	2,174	3,477	-	-	-	**5,651**
Subtotal Machinery for System and Land Improvements	**2,174**	**3,477**	**-**	**-**	**-**	**5,651**
Subtotal Marwa and Farm Level Irrigation Improvements	**2,596**	**9,044**	**42,897**	**31,452**	**65,659**	**151,648**
B. Farm Level Technology Development and Dissemination						
1. Training / Farmer Awareness / Demonstration/	1530	1350	2875	2545	3090	**11390**
2. Implementation Support	2666	3036	1889	796	2275	**10662**
Subtotal Farm Level Technology Development and Dissemination .	**4,196**	**4,386**	**4,764**	**3,341**	**5,365**	**22,052**
Total	**6,792**	**13,430**	**47,661**	**34,793**	**71,024**	**173,700**

Year	Actual Disbursements (in constant 2018 million LE)					
Project Component By Year Including Contingencies	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**TOTAL**
A. Marwa and Farm Level Irrigation Improvements						
1.System Improvements						
Design snd Supervision	7,047.40	7,214.40	7,381.40	7,548.40	15,096.80	**44,288.40**
New Electricity Grid Low & Medium Voltage	0.00	26,553.00	180,026.00	103,540.00	249,164.00	**559,283.00**
Mesqa Adaptation / Marwa Improvements / Land Improvements	0.00	59,201.50	528,972.50	414,160.00	832,244.50	**1,834,578.50**
SubtotalSystem Improvements	**7,047.40**	**92,968.90**	**716,379.90**	**525,248.40**	**1,096,505.30**	**2,438,149.90**
2. Machinery for System and Land Improvements						
Tractors for Land Improvements Laser Units (scrappers & laser units)Trenchers (Canal Digging)Gypsum Distributors	36,305.80	58,065.90	**-**	**-**	**-**	**94,371.70**
Subtotal Machinery for System and Land Improvements	**43,353.20**	**151,034.80**	**716,379.90**	**525,248.40**	**1,096,505.30**	**2,532,521.60**
Subtotal Marwa and Farm Level Irrigation Improvements						
B. Farm Level Technology Development and Dissemination						
1. Training / Farmer Awareness / Demonstration/	25,551.00	22,545.00	48,012.50	42,505.68	51,603.00	**190,217.18**
2. Implementation Support	44,522.20	50,701.20	31,546.30	13,293.20	37,992.50	**178,055.40**
Subtotal Farm Level Technology Development and Dissemination .	**70,073.20**	**73,246.20**	**79,558.80**	**55,798.88**	**89,595.50**	**368,272.58**
Total	**113,426.40**	**224,281.00**	**795,938.70**	**581,047.28**	**1,186,100.80**	**2,900,794.18**

Table A4.2 Prices Used for the EFA

FINANCIAL PRICES					
(In LE)	Unit	2018		Unit	2018
Outputs			**Inputs**		
Winter Crops /a			**Planting materials**		
Wheat	ton	3,567	Rice seed	kg	6.
Berseen	ton	361	Maize seed	kg	30
Broad beans	ton	7,340	Wheat seed	kg	20
Sugar Beet	ton	750	Berseen seed	kg	20
Summer Crops			Cotton seed	kg	12
Rice	ton	3,600	Broad beans seed	kg	11
Maize	ton	2,900	**Fertilizers**		
Maize Green Foder	ton	400	Urea (45%)	50 kg	125
Cotton	ton	19,000	Phosphoros	50 kg	80
By Products			Potasium	50 kg	250
Wheat straw	ton	800	Manure	cu. m.	24
Broad beans Straw	ton	500	**Irrigation costs**		
Sugar Beet Leaves	load	30	Pumpset Depreciation (diesel)	hr	7.75
Rice straw	ton	300	Pumpset Depreciation (electric)	hr	6
Stalks (maize)	ton	500	Diesel	lt	3.65
Stalks (cotton)	ton	500	Electricity	KWH	0.35
Fruits and Vegetables			Soil Preparation Tractor	hr	200
Citrus	ton	3,500	Mechanic harvesting	hr	100
Guava	ton	5,000	Land Levelling	lumpsum	200
Grapes	ton	5,500	**Project Investments**	LS/FED	3,145
Tomato	ton	1,800	Mezca Improvements	fed	6,400
Potato	ton	2,000	Marwa Improvements	fed	9,600
Animal products			**Labor**		
Milk	lt	5.	Labor (Jan & Sept to Oct)	man days	60
Meat	kg	42.5	Labor (Feb to May, Nov & Dec)	man days	50
			Labor (Jun to Aug)	man days	75

Financial Results

The production parameters and improvements mentioned above and the expected results were estimated and introduced in crop and farm representative models with FARMOD[11] to represent the "with" and "without" project situations as was done at the appraisal EFA. Models facilitated the quantification of most of the above mentioned incremental benefits that the project is inducing, and the beneficiaries' capacity to pay for cost recovering the financed investments.

Estimated benefits were quantified based on the findings of field surveys and evaluations of the W-10 pilot area and of the FIMP areas being completed earlier during implementation. The team also worked closely with officers of the Center of Agricultural Economics and Statistics of the MALR and with the data collected during field visits for the modeling of the representative crop budgets and cropping patterns, typifying the situation before and after the works completion. Data from the project's M&E system based on information collected were also used. Benefits from the on-going dissemination of improved practices through the existing 100 FFS groups and from those being created (100 new ones in 2018) were estimated.

Crop models for the most important field crops being produced in the project area, including wheat, berseem clover, broad beans, sugar beets, winter and summer vegetables, rice, cotton and maize were prepared. As representative of the orchard and vegetables crops, models for citrus, guava, grapes, tomato and potatoes were also developed. Table A4.3 summarizes the assumed yields and resulting net income being obtained both before and after the project improvements. Even though in cases where FFS groups are already in place yields increases reach 30 to 40 percent, it was assumed that on average beneficiaries would reach about 10 - 13 percent productivity increases.

[11] FARMOD is a software developed by FAO and the World Bank for the evaluation of agricultural projects.

Table A4.3 Average Incremental Yields and Incomes by Crop

Crop/Activity	Crop Yields (kg/fed)			Net revenues after labor costs (LE/fed)		
	Without Project	With Project	Increase %	Without Project	With Project	Increase %
Wheat	2,600	2,860	10%	6,110	7,558	24%
Berseem Long Season	28,000	30,800	10%	6,049	7,307	21%
Berseem Short Season	20,000	22,000	10%	3,681	4,610	25%
Broad Beans	1,125	1,275	13%	5,524	6,568	19%
Sugar Beat	21,000	23,100	10%	10,333	12,065	17%
Winter Vegetable	15,000	16,500	10%	19,924	22,811	15%
Rice	3,400	3,740	10%	7,281	8,888	22%
Cotton	840	924	10%	7,888	9,861	25%
Maize	3,670	4,037	11%	7,589	9,107	20%
Summer Vegetables	22,000	24,200	10%	16,507	20,381	23%
Citrus	11,800	13,000	10%	26,933	30,954	15%
Guava	11,400	12,540	10%	37,358	42,479	14%
Grapes	10,000	11,000	10%	41,690	47,113	13%

The productivity gains and incomes detailed in Table A4.3 show that yields increased by 10 to 13 percent while net incomes per cultivated feddan rose by between 13 to 25 percent as the combined effects of increased productivity and reduced irrigation costs. Vegetables, guava, citrus and grapes as higher value crops are providing more than three times the net revenues provided by most of the field crops. However, yields and net revenues are assumed to be increasing less than was expected at appraisal due to the significant delays that affected the implementation pace of the mesqa and marwa physical improvements and the electrification works, as well as the FFS activities which advanced slower than expected at project preparation.

Farm models combine different farm sizes and cropping patterns for representing the typical benefitted household production systems including the prevailing crops, activities and sources of income, the production costs, the off-farm employment, and the repayment of the cost of the improvements (installments paid in 3 or 10 years for the mesqa and marwa respectively). Seven farm models representing small, medium and large farms - with 0.6, 1.25 and 2.5 fed sizes - were prepared. A summary of these models' parameters, budgets and results are shown in Table A4.4.

Table A4.4 Farm Models: Estimated Parameters and Income Increases (in LE/farm)

	Income Increases (%)	Model size (in fed)	FIMP Area per model (fed)	Number of Farms	Farmers net Income	
					Without Project	With Project
Traditional Field Crop Areas			**156,300**	**198,500**		
Model 1: Small Farm (29% of area)	**14%**	0.6	45,000	75,000	24,262	27,737
Model 2 Small Farm (29% of area)	**13%**	0.6	45,000	75,000	25,246	28,566
Model 3 Small Farm (4% of area)	**12%**	0.6	6,300	10,500	28,394	31,813
Model 4: Medium Farm (11%of area)	**16%**	1.25	17,500	14,000	48,909	56,604
Model 5: Medium Farm (11%of area)	16%	1.25	17,500	14,000	43,103	50,134
Model 6: Larger Farm (10%of area)	18%	2.5	15,000	6,000	91,268	107,818
Model 7: Larger Farm (6% of area)	17%	2.5	10,000	4,000	111,387	130,658

The farm modelling results confirm that the FIMP is having a positive impact on beneficiaries' net income even when cropping patterns would be maintained almost the same as they were previously. The project interventions allowed for about 20 percent of water savings and a significant increase in beneficiaries' income, ranging from 12 to 18 percent. The repayment of the FIMP capital investments (about 3,103 LE per fed per year over 3 years and LE 965 per fed-year from years 4 to 10) would represent about 50

percent of the expected increases of annual net family income being induced by the project interventions for the first 3 years, and only 17 percent of years 4 to 10 increments. If conversion to higher value crops would occur with the improved systems, beneficiaries' incomes could easily be doubled in only 8 years' time.

The increased capacity of the improved farms for agricultural production and income generation after the FIMP interventions is clearly perceived by farmers and by the local land markets. The original reluctance of farmers to accept the FIMP proposed improvements was followed by high satisfaction levels of farmers and an increasing demand of other farmers from adjacent areas for extending the program to their farms. On average, the market value of land increased about 50 percent, from LE 20,000 to LE 30,000 per Keratt (US$28,000 to US$42,000 per fed). The agricultural land value is in general an accurate reflection of its expected net benefit stream/income-generating capacity (and also aligns with its net impact to real national income).

Economic Analysis

Conversion factors (CFs) for shadow pricing[12] were applied for some products and inputs. Wheat[13] and livestock products market prices, and fertilizers and energy costs were adjusted based on recent estimations, given the levels of existing subsidies in Egypt. A CF of 0.79 was applied for wheat, 0.85 for milk and meat, 1.5 for fertilizers, and a CF of four in the case of diesel and electricity costs. Market prices for most the other inputs and outputs are well aligned with their export or import parity levels. Prices used for these products and inputs are not expected to show major variations in the coming years according to the most recent forecasts of commodity prices prepared by the World Bank (Outlook Pink Sheets from October 2017).

The economic value of water was also estimated based on the residual imputed value approach (average net economic value generated from irrigated agriculture in the project area). The average value for the project area given the existing cropping pattern is LE 1,760 per m^3 of water. Over time water is having an increasing opportunity cost as it becomes increasingly scarcer, its productivity increases, the horizontal expansion of irrigated areas continues, and higher value crops become more relevant. However, as in the case of the appraisal analysis the economic value of water being saved was not included as part of the benefits for this assessment.

The aggregation of benefits being obtained by beneficiaries through their production activities within the FIMP areas confronted with all investment costs allows for the valuation of the project results. Table A4.5 below shows the pace of incorporation of farms and cropped areas to the improved scenario following the actual completion of areas improved.

[12] Since the mid-1980s the GOE has moved from an emphasis on state planning and high level of protection towards a reliance on private economic activity and trade openness. Since the late 1990s GOE has been committed to macroeconomic stability and private sector development; it has privatized several state-owned firms, and made legal reforms to spur private investment. It has also pursued a policy of trade liberalization, the elimination of quantitative restrictions on imports, and the reduction in tariffs overall. However, huge energy subsidies considerably distort market prices by creating additional advantages to some sectors relative to others. Energy subsidies distort the incentive framework and represent a high fiscal cost as they are estimated to cost more than US$7 billion per year. Currently, the GOE faces problems with high unemployment, and an unstable currency, with its main foreign exchange earning industry, tourism, suffering a sharp fall in revenues.

[13] Egypt is the world's biggest importer of wheat and runs a national system to keep its population supplied with subsidized bread. However, the sharp economic downturn has hit its currency and added urgency to the need to reform the existing bread subsidies. The country's farming is efficient, but the availability of fertile land is limited in comparison to its fast-growing population.

Table A4.5 Number of Farms and Areas Improved (in thousand feddan)

	Unit	Without Project	With Project					
		1 to 20	1	2	3	4	5	6 to 20
Cropping Intensity	Percent	178.85	178.85	178.85	179.01	180.19	182.32	186.85
Cropping Pattern								
Existing Technology								
Wheat in Improved Areas Incorporating Electricity & Piped Marwas	fed	55.25	55.25	54.145	45.968	31.272	-	-
Berseen (LONG) in Improved Areas Incorporating Electricity & Piped Marwas	fed	50.38	50.38	49.373	41.916	28.515	-	-
Rice in Improved Areas Incorporating Electricity & Piped Marwas	fed	73.4	73.4	71.932	61.069	41.544	-	-
Maize in Improved Areas Incorporating Electricity & Piped Marwas	fed	17.98	17.98	17.621	14.96	10.177	-	-
Summer Vegetables - Tomatos	fed	5.46	5.46	5.351	4.543	3.091	-	-
Winter Vegetables Potatoes	fed	10.825	10.825	10.609	9.007	6.128	-	-
Sugar Beat	fed	8.615	8.615	8.443	7.168	4.876	-	-
Cotton in Improved Areas Incorporating Electricity & Piped Marwas	fed	28.23	28.23	27.666	23.488	15.979	-	-
Citrus in Improved Areas Incorporating Electricity & Piped Marwas	fed	19.84	19.84	19.444	16.507	11.23	-	-
Guava Incorporating Piped Marwas	fed	7.	7.	6.86	5.824	3.962	-	-
Grapes Incorporating Piped Marwas & Bubble Irrigation	fed	6.69	6.69	6.557	5.567	3.788	-	-
Sub-total Existing Technology		283.67	283.67	277.998	236.015	160.562	-	-
New Technology								
Wheat in Improved Areas Incorporating Electricity & Piped Marwas	fed	-	-	1.105	9.282	23.979	55.25	55.25
Berseen (LONG) in Improved Areas Incorporating Electricity & Piped Marwas	fed	-	-	1.008	8.464	21.865	50.38	50.38
Rice in Improved Areas Incorporating Electricity & Piped Marwas	fed	-	-	1.468	12.331	31.856	73.4	73.4
Maize in Improved Areas Incorporating Electricity & Piped Marwas	fed	-	-	0.36	3.021	7.803	17.98	17.98
Summer Vegetables - Tomatos	fed	-	-	0.109	1.044	3.435	8.213	11.804
Winter Vegetables Potatoes	fed	-	-	0.216	1.945	5.763	13.578	17.169
Sugar Beat	fed	-	-	0.172	1.447	3.739	8.615	8.615
Cotton in Improved Areas Incorporating Electricity & Piped Marwas	fed	-	-	0.565	4.743	12.252	28.23	28.23
Citrus in Improved Areas Incorporating Electricity & Piped Marwas	fed	-	-	0.397	3.333	8.61	19.84	19.84
Guava Incorporating Piped Marwas	fed	-	-	0.14	1.176	3.038	7.	7.
Grapes Incorporating Piped Marwas & Bubble Irrigation	fed	-	-	0.134	1.124	2.903	6.69	6.69
Sub-total New Technology		-	-	5.672	47.908	125.24	289.176	296.358
Total Cropped Area		283.67	283.67	283.67	283.924	285.801	289.176	296.358

Table A4.6 shows the aggregate volume of production based on the main agricultural activities, as well as the inputs used by the 155,300 feddans improved under the project[14]. Production was estimated to be increased by about 18 percent (about 10 percent in most of the products with the exception of winter and summer vegetables that were assumed to increase from 282 to 569 tons). Most of the area gained from buried marwas was assumed to be used for vegetable production, given an average increase of four percent in the cropped area, and the enhanced reliability of water reaching the improved farms through the buried piped marwas and hydrants. Water use in the FIMP area was reduced by about 20 percent, from 1.36 million to 1.07 million m^3 per annum as a result of the project interventions, mainly due to reduced water losses.

[14] Area improved reached 155,300 fed by December 2017 and additional 3,300 fed are being completed with the AFD support under the FIMP.

Table A4.6 Aggregated Production and Inputs in the Project Areas

		Without Project	With Project							
	Unit	1 to 20	1	2	3	4	5	6	7	8 to 20
Main Production		**3,637**	**3,637**	**3,637**	**3,645**	**3,712**	**3,853**	**4,144**	**4,256**	**4,260**
Wheat	ton	144	144	144	144	145	148	154	158	158
Berseen	ton	1,411	1,411	1,411	1,412	1,424	1,453	1,512	1,552	1,552
Sugar Beet	ton	181	181	181	181	183	186	194	199	199
Rice	ton	250	250	250	250	252	257	267	275	275
Maize	ton	66	66	66	66	67	68	71	73	73
Maize Green Foder	ton	67	67	67	67	67	69	71	73	73
Cotton	ton	24	24	24	24	24	24	25	26	26
Citrus	ton	234	234	234	234	236	241	251	258	258
Guava	ton	80	80	80	80	81	82	86	88	88
Grapes	ton	67	67	67	67	68	69	72	74	74
Tomato	ton	120	120	120	123	145	186	274	282	286
Potatoes	ton	162	162	162	164	180	211	274	282	283
Animal products	ton	363	363	363	364	367	374	390	400	400
By Products	ton	469	469	469	469	474	484	504	517	517
On-Farm Use	ton	1,573	1,573	1,573	1,581	1,603	1,649	1,744	1,806	1,806
On-Farm Consumption	ton	506	506	506	509	535	586	693	716	721
Sales		**1,567**	**1,567**	**1,567**	**1,570**	**1,591**	**1,633**	**1,720**	**1,742**	**1,742**
Wheat	ton	27	27	27	27	27	27	28	29	29
Berseen	ton	175	175	175	175	171	161	142	129	129
Sugar Beet	ton	181	181	181	181	183	186	194	199	199
Rice	ton	20	20	20	20	20	21	23	24	24
Maize	ton	50	50	50	50	50	51	53	54	54
Maize Green Foder	ton	31	31	31	31	31	31	31	30	30
Cotton	ton	24	24	24	24	24	24	25	26	26
By Products	ton	159	159	159	159	160	162	166	169	169
Citrus	ton	234	234	234	234	236	241	251	258	258
Guava	ton	80	80	80	80	81	82	86	88	88
Grapes	ton	67	67	67	67	68	69	72	74	74
Tomato	ton	120	120	120	121	131	150	189	194	195
Potatoes	ton	156	156	156	157	163	176	202	206	204
Animal products	unit	244	244	244	244	246	250	259	265	265
Operating										
Purchased Inputs										
Berseen	ton	226	226	226	226	228	233	242	249	249
Planting materials	kg	19,567	19,567	19,567	19,665	20,388	21,687	24,452	24,452	24,452
Maize Green Foder	ton	37	37	37	37	37	39	43	45	45
By Products	ton	94	94	94	94	95	97	101	104	104
Fertilizers	50 kg	142,785	142,785	142,785	142,950	144,229	146,841	152,264	153,852	153,862
Irrigation costs	hr	33,102	33,102	33,102	32,931	31,475	27,772	20,345	14,830	14,726
Water	000 m3	1,361	1,361	1,361	1,358	1,337	1,280	1,166	1,072	1,071
Electricity	hr	-	-	-	1,057	9,963	32,038	76,492	107,341	107,981
Labor										
Labor	man days	26,776	26,776	26,776	26,793	26,911	27,105	27,524	27,426	27,421
Productivity of Water	LE/m3	1.760								3.138

Table A4.7 presents the overall FIMP results valuing costs and benefits at economic prices. The value of production increased by 16.7 percent from LE 7.25 billion to LE 8.46 billion (US$434 million to US$506 million). As the net value of production increased from LE 2.39 billion to LE 3.36 billion (40 percent, from US$143.4 million to US$201.2 million), using about 20 percent less water, the resulting productivity of water increased by about 78 percent from LE 1,760 to LE 3,138 per thousand m3 (equivalent to US$105.5 and US$187.9).

The ERR for the FIMP investments was estimated at 22.4 percent and the NPV with 10 percent discount rate at LE 2.29 billion (US$137 million). The results are highly positive but below the originally estimated ERR (28.9 percent). The impact is even more positive if value would be assigned to the significant benefits in public goods including: (i) the water saved for its potential use in other sectors or areas; and (ii) the environmental benefits (reduction of GHG emissions, etc.) and potential health benefits (local population no longer inhaling noxious fumes from diesel pumps).

Table A4.7 Overall FIMP Results

ECONOMIC BUDGET (AGGREGATED) (In LE Million)	Without Project	With Project							
	1 to 20	1	2	3	4	5	6	7	8 to 20
Main Production									
Wheat	403	403	403	403	406	415	432	443	443
Berseen	509	509	509	510	514	525	546	560	560
Sugar Beet	136	136	136	136	137	140	146	149	149
Rice	898	898	898	899	907	925	963	988	988
Maize	191	191	191	192	193	197	205	210	210
Maize Green Foder	27	27	27	27	27	27	29	29	29
Cotton	451	451	451	451	455	464	483	496	496
Citrus	819	819	819	820	827	844	879	903	903
Guava	399	399	399	399	403	411	428	439	439
Grapes	368	368	368	368	371	379	394	405	405
Tomato	216	216	216	221	261	335	492	508	514
Potatoes	325	325	325	329	361	421	549	564	567
Animal products	2,279	2,279	2,279	2,281	2,300	2,347	2,442	2,507	2,507
Sub-total Main Production	7,021	7,021	7,021	7,037	7,163	7,431	7,987	8,201	8,210
By Products									
By Products	228	228	228	228	230	235	245	252	252
Gross Value Of Production	7,248	7,248	7,248	7,264	7,393	7,667	8,232	8,453	8,462
Sub-Total On-Farm Use	627	627	627	628	636	654	692	718	718
Sub-Total On-Farm Consumption	1,776	1,776	1,776	1,783	1,839	1,953	2,191	2,260	2,270
Net Value Of Production	4,845	4,845	4,845	4,853	4,918	5,059	5,349	5,475	5,475
Production Cost									
Investment									
Design & Supervision	-	7	7	7	8	15	-	-	-
Mezca Improvements	-	-	20	150	270	575	-	-	-
Marwa Improvements	-	-	30	225	405	862	-	-	-
Electrification Grid	-	-	27	180	104	249	-	-	-
Machinery for System & Land Improvemen	-	36	58	-	-	-	-	-	-
Training / Farmer Awareness / Demonstra	-	26	23	48	43	52	-	-	-
Implementation Support	-	45	51	32	13	38	-	-	-
Sub-total Investment Costs	-	113	216	643	842	1,790	-	-	-
Operating									
Purchased Inputs									
Berseen	82	82	82	82	82	84	87	90	90
Planting materials	242	242	242	244	253	269	304	304	304
Maize Green Foder	15	15	15	15	15	16	17	18	18
By Products	52	52	52	52	52	53	56	57	57
Fertilizers	542	542	542	542	547	557	577	583	584
Agrochemicals	72	72	72	73	74	76	80	81	81
Irrigation costs	385	385	385	382	359	299	178	91	89
Electricity	-	-	-	1	14	45	107	150	151
Other production costs	125	125	125	126	133	145	172	175	176
Sub-Total Purchased Inputs	2,655	2,655	2,654	2,652	2,666	2,687	2,778	2,777	2,778
Labor									
Labor	1,571	1,571	1,571	1,572	1,579	1,590	1,614	1,607	1,606
Sub-total Operating Costs	4,226	4,226	4,226	4,224	4,245	4,277	4,391	4,384	4,384
Sub-Total Production Cost	4,226	4,340	4,441	4,867	5,087	6,067	4,391	4,384	4,384
OUTFLOWS	4,226	4,340	4,441	4,867	5,087	6,067	4,391	4,384	4,384
Cash Flow	619	505	403	-14	-169	-1,008	957	1,091	1,090
Net Economic Benefits	2,395	2,281	2,180	1,770	1,670	945	3,149	3,351	3,360

IRR = 22.4%, NPV = 2,288.3

Sensitivity Analysis

The project impact was also estimated assuming that (i) the current prices for the main products would not maintain the levels prevailing in 2017/18, and (ii) the average yield increments (10 – 13 percent approximately) and irrigation costs reduction (diesel/electricity/labor by 40 percent) would take longer than 3 years after the project interventions. This sensitivity analysis measured the project results in case that the product prices would fall by about 20 percent in the immediate future; and that the yield increase and irrigation costs reductions would take five years instead of the assumed three years in being attained. As shown in Table A4.8, in the first case, the ERR would drop to 16.9 percent while in the second, it would fall to 19.4 percent. In the most adverse case of both events occurring simultaneously, the ERR would then become 14.6 percent. These results allow concluding that the project impact is both, positive and robust against the most likely risks.

Table A4.8 Sensitivity Analysis

Risk	Event	ERR (%)	NPV (in LE million)
a. Base scenario	As described	22.4	2,288
b. Product prices down	20% lower prices	16.9	1,199
c. Yields & cost improvements	delayed 5 years instead of 3	19.4	1,852
d. Both (b) & (c) situation	jointly	14.6	845

Conclusion

This EFA and overall assessment lead to the conclusion that despite the several difficulties affecting implementation, the FIMP attained a strong positive impact both from the financial and economic perspectives. These results confirm that the benefits from mesqa, marwa and on-farm improvements in the Old Land areas in Egypt resulted in significant incremental benefits for the targeted farmers (net family income increasing 12 to 18 percent) as well as for the economy (ERR of 22.4 percent). The results are strongly positive even if unlikely adverse events occur as would be the case for the general reduction of the prices for the agricultural products and/or some delayed achievement of the modest outcomes: yield increases and irrigation cost reduction.

The quantified result with which these impact indicators were estimated did not include significant benefits in public goods which add to the quantified project benefits, making these investments even more attractive. The non-quantified benefits include: (i) 20 percent of water saved, which can potentially be diverted to other sector needs or areas, in a context where water scarcity endangers the country's economic and social stability; and (ii) the environmental benefits (reduction of GHG emissions and improved water quality), and the public health benefits, as local population is no longer inhaling noxious fumes from hundreds of malfunctioning old diesel pumps.

Despite the normally expected and the unforeseen difficulties in implementing the innovative FIMP improvements (mainly the massive piloting of electrification of mesqa pumps, the piping marwas; and under the unexpected adverse political economy and budget constraints), about 200,000 mostly poor farmers improved their livelihood while the GOE is recovering the investment costs involved. Water productivity was increased by 78 percent, and water savings reached about 20 percent, as mentioned above. The proof of this positive impact is expressed in the value of the improved land, which increased by about 50% in response to the improved productive capacity of this critical and scarce production factor. If these improvements are expanded to cover the five million feddan in the irrigated old lands following GOE plans, water savings could reach about nine billion m^3 per year and if reallocated prudently, could help address Egypt's alarming water insecurity. These water savings would represent more than 12 percent of the water currently being used in the country.

ANNEX 5. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS

To: Dambudzo Josephine Muzenda, Water resources Specialist and Project TTL.
Email: dmuzenda@worldbank.org

From: Prof. Dr. Hesham Allam, Supervisor of the Central Administration Foreign Agriculture Relations, MALR**.**

Dear Ms. Dambudzo,

This is to refer to Farm-Level Irrigation Modernization Project (FIMP) co-financed by the World Bank, the AFD and the Government of Egypt. Also we refer to the draft of the Implementation Completion and Results Report (ICR 00004249) conducted by a high caliber team of the World Bank.

Please allow to us as the Ministry of Agriculture and its FIMP Project Management Unit to seize this opportunity to comment on the abovementioned ICR draft report.

We agree with the Project outcomes, results and overall rating, however we noticed that "Moderate Satisfactory" rating in ISR no.16, is unexpected because the implementation progress made during that specific period was remarkable, as most of the total project objectives achieved.

On the other hand, I would like to mention that during FIMP implementation course (2012-2017), the Bank Team Leaders were changed many times, we have found all of them very supportive and their responses were most of the time very fast.

Accordingly, regular supervision and review missions by the Bank helped in guidance and hand-holding to achieve the project objectives as the mission members have always been very cooperative, and the wrap–up discussion with the topmost Government-level functionaries aided in resolving implementation issues very promptly. Also, field visits by the Mission members and the Aide Memoires have provided objective and useful feedback to track the project progress and for initiating corrective actions.

In addition to the foregoing, it was very much appreciated the restructuring done by the Bank, in cooperation with AFD and GOE, in response to the devaluation of the Egyptian Pound in November 2016. Through the restructuring, the Bank has increased its financing share from 60% to 90% for physical works and from 60 to 100% for consulting services, thus permitting works to resume promptly, and ensuring the maximum achievement of the project objectives.

Looking forward to a future partnership with the World Bank group in the support of new agricultural projects covering water savings, and improve equity in access to higher quality of water.

EXECUTIVE SUMMARY OF BORROWER'S COMPLETION REPORT

This Borrower Completion Report (covers the implementation of the Farm-level Irrigation Modernization Project (FIMP) until 31 December 2017 at the Closure of the International Bank for Reconstruction and Development (IBRD) loan. The project activities will continue up to 30 June 2018, when Agence Française de Développement (AFD) and the local also funds finish. An update of this completion report will be issued in June 2018.

FIMP has been implemented in the command areas of the Mahmoudia canal (Beheira Governorate) and the Meet Yazid & Manaifa canals (Kafr El Sheikh Governorate) with an area of 170,000 feddan, located in

the north of the West and Middle Delta (see maps in annex D). The objective of FIMP is to increase access to modern on-farm irrigation systems in the project areas in an equitable manner.

The FIMP was also designed as a pilot project to support implementation of the Government's on-farm irrigation modernization program and to support significant learning and capacity building initiatives to develop a delivery mechanism for the broader governmental strategy of 5 million feddan in the old lands for 2030.

FIMP is financed by an IBRD Loan in the amount of USD 100 million (IBRD79840), which was approved on 14 December 2010, but only became effective 20 months later. The FIMP is co-financed by AFD with EUR 35 million (CEG1004-01Y), and with a Government of Egypt (GOE) contribution of EGP 400 million, the equivalent of USD 39 million. In addition, a Japanese Social Development Fund (JSDF) grant of USD 2.75 million (TF098199) administered by the World Bank together with IBRD79840 has been made available to finance the capacity building programs for beneficiaries and the extension team activities, including farmer awareness, media and extension publications; until its closure on 30 June 2016, the JSDF grant financed also the consultancy services.
Even with improved security on the ground under the current government and improved capacity to implement the project, more time was needed to compensate for the early implementation delays and to complete some of the large contracts. To deepen the ongoing institutional reform and scale up capacity building of various farmer organizations and extension agents, consistent support over a longer period appeared to be necessary. Therefore, the original closing date of the loan was extended at Restructuring from 30 June 2016 to 31 December 2017.

Beside the governmental team, the PMU hired specialists including a firm responsible for project construction supervision and quality control, an electricity consultant, a Monitoring and Evaluation (M&E) consultant, and a full time Project Administration Coordinator (PAC), to ensure that overall project objectives are met and project benefits are measured for progress review and to serve as a lesson for future project development plans. Moreover, the Bank has carried out 31 Implementation Support Missions, welcomed by the Borrower to review progress and to find solutions for unforeseen problems. After each mission, an Aide Memoire was prepared, summarizing the agreed actions.

At IBRD-Loan Closure, FIMP has achieved on-farm irrigation modernization, replacing open marwas with buried pipes, on 155,300 feddan (91.4% of the targeted area), benefitting 121,172 landowners, 76,491 tenants. In addition, 10,000 laborers have been engaged during construction. Thus, the project achieved a total of 207,663 direct beneficiaries with more than 720,000 temporary work opportunities.

Before loan closure, the PMU realized that the remaining undisbursed IBRD loan will not suffice the achievement of marwa improvement works of the project targeted area, thus, it took the initiative to add an additional area of 10,000 feddan of marwa improvement, under the OPEC Fund for International Development (OFID) in the Kafr El Sheikh and Beheira FIMP area, where electricity and pump house works were completed under FIMP.

The closing date of the AFD Loan (CEG1004-01Y) is June 2018 and it is expected that by that time, the undisbursed part of this loan, as well as the local contribution by GOE, will be fully exhausted, maximizing the complete project target by an approximate area of 4,000 feddan.

The quality control on the electricity contracts is well managed through the electrical consultant who ensures: (i) material compliance by witnessing factory tests; (ii) site delivery compliance; (iii) installation compliance including works on concrete bases, alignment, steel power erection, stringing of conductors

and erection of ground and pole- mounted transformers.

At the start of the project, electricity works faced objections from farmers, refusing using their private land as passage for the overhead or even for underground cables, which required attention from the FIMP electrical consultant and social team to resolve this issue. Most of farmers' objections have been solved by proposing an appropriate technical solution.

The percentage of mesqas with medium and low voltage network has reached 79%, and the quality of electrical installation has been checked and controlled for both technical and financial aspect till handing over the responsibility to the Distribution Company. Additionally, the sustainability of the project has been granted through contracting, under local fund, the Distribution Company for a period of 15 years with operating and replacing whenever necessary.

During project implementation, it has been ensured that Project Affected Persons (PAPs) were adequately and fairly compensated under the electricity contracts that involved installation of medium and low voltage electric poles in private farms. As Operation and Maintenance (O&M) is vital to ensure the sustainability of the FIMP project, the technical team has therefore provided them with spare parts and materials, equipment and maintenance manuals.

Starting in 2015, the WMRP programme, under German Development Cooperation, implemented by GIZ, provided technical assistance to the FIMP project in the context of on-farm irrigation improvement. Assistance was provided on capacity building for the direct project beneficiaries (60,000 farmers) including (O&M) trainings, organizing more than 200 Farmer Field Schools (FFS) and establishing 2 effective complaint centers.

Farmers have been very much satisfied with the improvements made by FIMP on their land, because the O&M costs of irrigation have decreased by 31.3% and their agricultural outputs have increased by 30.9%, their cultivable land has increased by 5%, and their water pumping cost has decreased by 46.2%. Moreover, before FIMP intervention, farmers at the tail end used 50% of the water quantity used by farmers at the head of marwas. After the on-farm irrigation improvement, farmers at tail ends are using 85% of water, with an increase of 35%, as per indicator for equity of water distribution between farmers at the tail and head. Their un-served neighbors lobbied at district and governorate level to extend this approach to their land as well.

Famers have been so satisfied with the improvements made by FIMP on their lands that their unserved neighbors lobbied at district and governorate level to extend this approach to their lands as well. The Governor of Beheira has now indeed taken this request to the Prime Minister, who has decided to adopt the FIMP-approach for all the Old Lands of Beheira governorate, plus some New Lands. The project could not have been more successful.
Another sign of FIMP's success is that the IBRD loan was fully disbursed before 31 December 2017, leaving some sites in the project areas (Kafr El Sheikh and Beheira) where the electrical works are completed without completing the marwa improvement works and in some other sites missing the completion of electrical works. In order to have all the civil and electrical works in the whole project sites completed, the Ministry of Investment and International Cooperation (MIIC), along with Ministry of Agriculture and Land Reclamation (MALR) is in the process of studying the "FIMP phase 2" request, to complete FIMP remaining targeted area under the AFD fund.

AFD

Mrs. Dambuzdo Muzenda
Task Team Leader – FIMP Project; Water Resources Expert
The World Bank

May 31st, 2018

Subject : AFD Comments on Implementation Completion Report for FIMP

Dear Mrs. Muzenda,

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Thank you for your email dated May 13th 2018 by which you shared with *Agence Francaise de Developpement* (AFD) the Implementation Completion Report (ICR) prepared by the World Bank for the Farm-level Irrigation Modernization (FIMP) Project. The ICR has provided AFD with a first opportunity for critical reflection as it contemplates extending additional financing to the Government of Egypt to complete areas that could not be finished under the original FIMP financing package. AFD has carefully reviewed the ICR and approves of the contents of the report. We would however like to seize this opportunity to make the following general comments:

- The table on page 2 notes the original estimated amount of USD 50,000,000 of AFD co-financing (AFD co-financed the project for an amount of EUR 35,000,000). The table shows only the evolution in World Bank financing and makes no mention of the revised amount or disbursement rate of the co-financing by the Government of Egypt or AFD. AFD had disbursed 100% of its loan by December 2017, and expects 100% utilization of disbursed funds by the end of July 2018.
- We thank you for noting AFD's flexibility regarding the financing of variation orders linked to the devaluation. It would indeed have been important to include price adjustment clauses in all contracts, even though the level of price fluctuation was difficult to anticipate given the short nature of many contracts. It is unclear to the AFD team currently working on FIMP why these were removed as we understand they are usually standard in Bank contract templates for suppliers.
- AFD takes note of the high transaction costs (administrative burden and delays) and low impact (little compensation disbursed) of the Resettlement Policy Framework put into place after the 2016 restructuring to compensate farmers for land lost due to the erecting of electric poles, when farmers were simultaneously gaining land thanks to the buried marwas.
- In section III.D, the ICR notes of some quality control issues that were identified during Bank supervision missions and that were resolved in 2016 with the hiring of the quality control supervisor consultants and the implementation of certain additional testing measures (put in place after the mission by Société Canal de Provence paid for by AFD HQ funds). AFD would like to highlight the importance of having a highly-capable and fully-staffed quality control supervisor (potentially acting as a type of project engineer) at the beginning of all future irrigation improvement projects and that this entity should be fully empowered to act upon its technical recommendations with regards to contract management.
- The ICR touches upon the parallel funding provided by GIZ *via* its Water Management Reform Programme. AFD would like to acknowledge that the FIMP project indeed benefited from this parallel support which notably strengthened extension capacity at the level of the Ministry as well as farmer organizations, operations and maintenance modalities and others. It is difficult to ascertain the full impact of this support on FIMP, but it is clear that this capacity building benefited the project and that the work done by the PMU and MALR with the support of GIZ should be considered in future project phases.
- Annex IV of the ICR ("Efficiency Analysis") highlights the huge financial impact and return on investment of Component 2 activities (including training, awareness, demonstration) as a critical complement to the infrastructure modernization activities noting that with "conversion to higher value crops with the improved systems, beneficiaries incomes could be doubled in only 8 years' time". Given these impacts, future projects should perhaps give greater weight to Component 2-type activities.

Looking forward to our continued collaboration, please accept my best regards.

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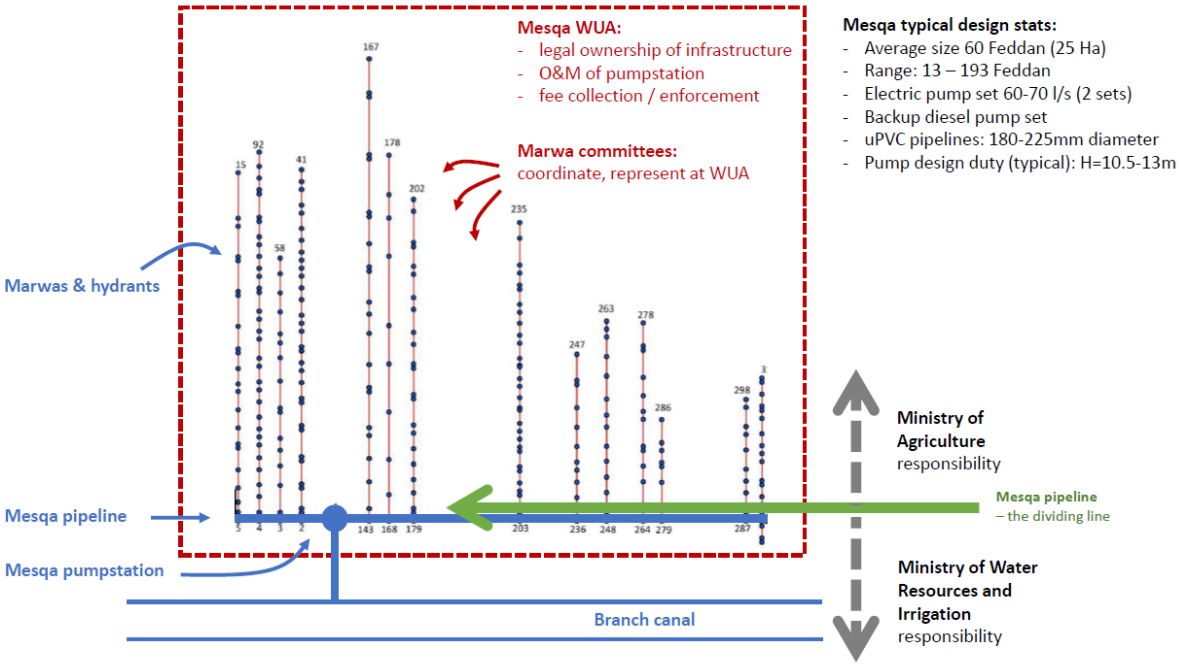
1. Framing the discussion

The purpose of this annex is draw on the experiences of the FIMP project as documented in multi-agency and consulting reports, and informed by discussions during the ICR fact-finding process. A retrospective view of the project synthesizes key factors that are aligned to turning points in the FIMP implementation process. These provide substance to the results assessment and can inform similar future modernization investments in Egypt.

1.1 FIMP hydraulic, institutional and operational authority boundaries

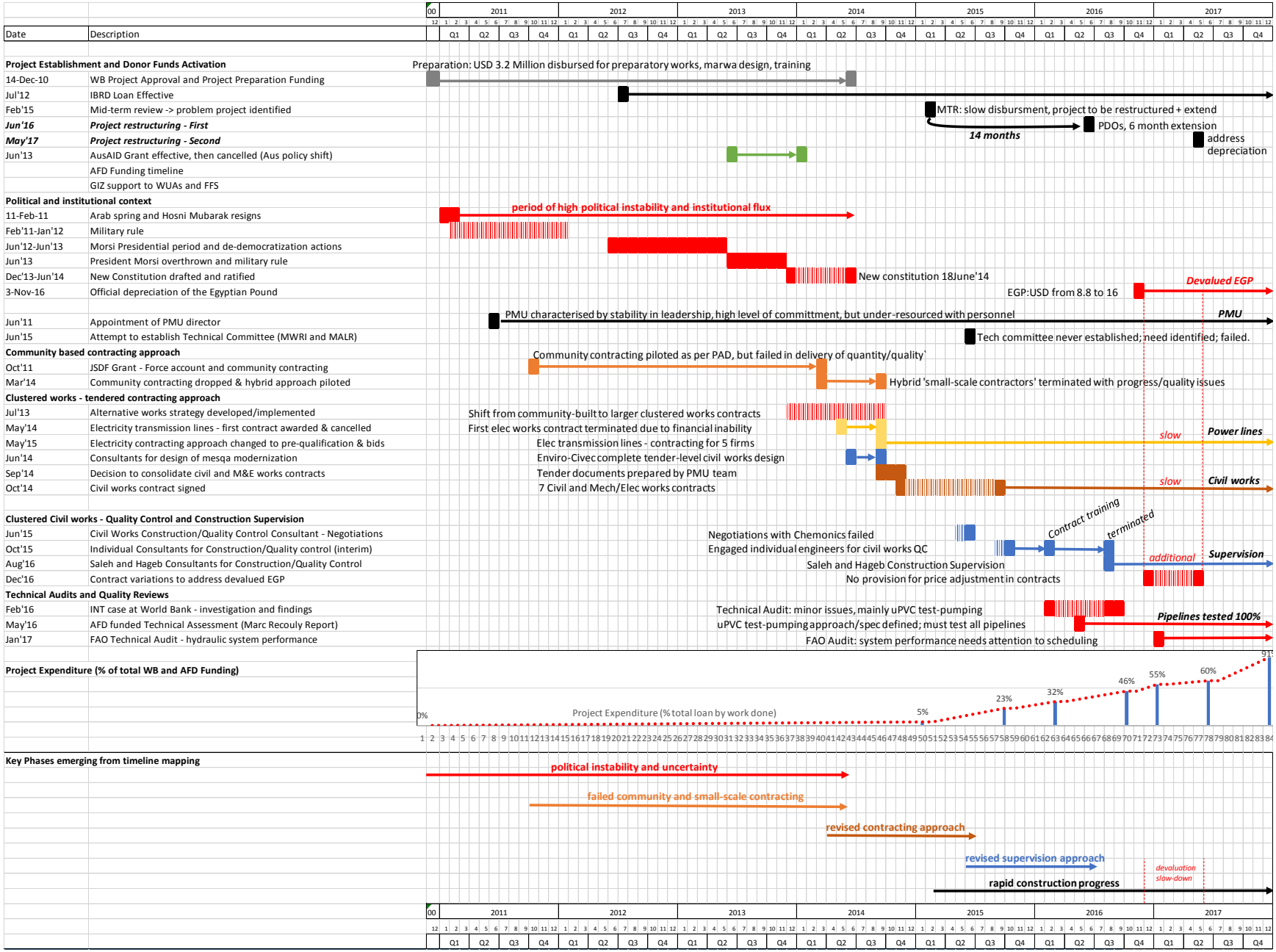
The FIMP program for marwa improvement was carried out by the Ministry of Agriculture and Land Resources (MALR) and followed from prior irrigation improvement projects carried out by the Ministry of Water Resources and Irrigation (MWRI). These two ministries have clearly demarcated boundaries of engagement; both involving irrigators as annotated in Figure A6.1. The main and branch irrigation canals – Mahmoudiya and Meet Yazid – and a number of their off-taking branch canals were upgraded in the original MWRI Irrigation Improvement Program (IIP). In the subsequent IIIMP, in addition to further improvement works on the two main canals and many off-taking branch canals, many small individual-pumps drawing from branch canals and serving a single mesqa hydraulic unit were replaced by a single shared diesel pump station serving the unit. The pump station was designed to feed existing earthen quartenary canals (marwas) of typical length 200-650m, though occasionally longer than 1km. The operational unit for scheduling was, and remains, 1 Feddan (0.42 Ha) in size. Typical features of the modernized mesqa are shown in Figure A6.1 while Figure A6.2 shows the overall project timeline.

Figure A6.1 Schematic of a FIMP modernized scheme with hydraulic and organizational boundaries



NB: the shared pump station is owned by a Mesqa WUA, instituted under legal decree. The mandate of water supply investment and management in the branch canals and mesqas (involving the Mesqa WUA) is with the MWRI. Marwa modernization involves the marwa committees and falls under the MALR.

Figure A6.2 FIMP Milestones, 2011-2017



2. Key lessons learned

Technical Hydraulic Design and Materials Selection

a) The pipeline pressure testing method needs to be explicit in the contract specifications: One important technical issue that emerged in FIMP was the testing method to check the hydraulic integrity of the as-constructed uPVC pipelines (four bars for pipes of 180 - 225mm diameter). The specification for testing was initially not defined, and the PMU required contractors to pressure-check the system using the installed pumps. A technical study supported by AFD in May 2016, which was subsequently validated by a separate WB audit (Dec 2016), established the need for comprehensive testing of all constructed pipelines and identified an appropriate method. The new protocol required a 30-minute pressure test with less than 10 percent pressure drop in order to pass. Contractors subsequently agreed and the project pipelines were all tested comprehensively after construction and prior to payment. Less than 2 percent of the total number of 1489 marwas failed the tests and were subjected to contractor remediation before payment was made.

b) Injection-molded uPVC fittings and not contractor-made fittings should be used: Early in the contract, injection molded fittings (u-bends; riser T-pieces) were unavailable in Egypt for the diameters used (180, 200, 225 mm diameter). Contractors initially manufactured these using plastic-welding technology on site. The quality of these fittings, though cased in concrete thrust blocks, were questionable and was identified as an issue in the technical audits. Manufacturers responded and suitable fittings were subsequently produced and used throughout.

c) 'No-sand bedding' for uPVC marwa pipelines is a locally-suitable cost-saving innovation: uPVC pipes are routinely laid with a sand bedding to avoid point-loads to the pipe-base, and then embedded with graded material containing a coarse fraction before backfilling. The bedding and embedment provides structural strength against deflection from surface and side-wall loads. In previous similar projects in the delta[15], however, the loads in marwas were assessed as low (shallow trench=0.8-1.0m; limited farm machinery) and local silty-clay soils were found to be suitable for bedding, embedment and backfill (with some grading). This has led to construction-cost savings and reduced machinery damage in the fields and was replicated in FIMP. The no-sand approach was subject to further review during the WB technical audit (December 2016) and was found to be adequate. A formal specification and method statement derived from this experience would aid wider replication and cost-saving. The specification would need to address suitable particle size distribution and the appropriate sequencing of construction methods, including puddling of in-situ material around the pipe base, as evidently practiced by the contractors**.**

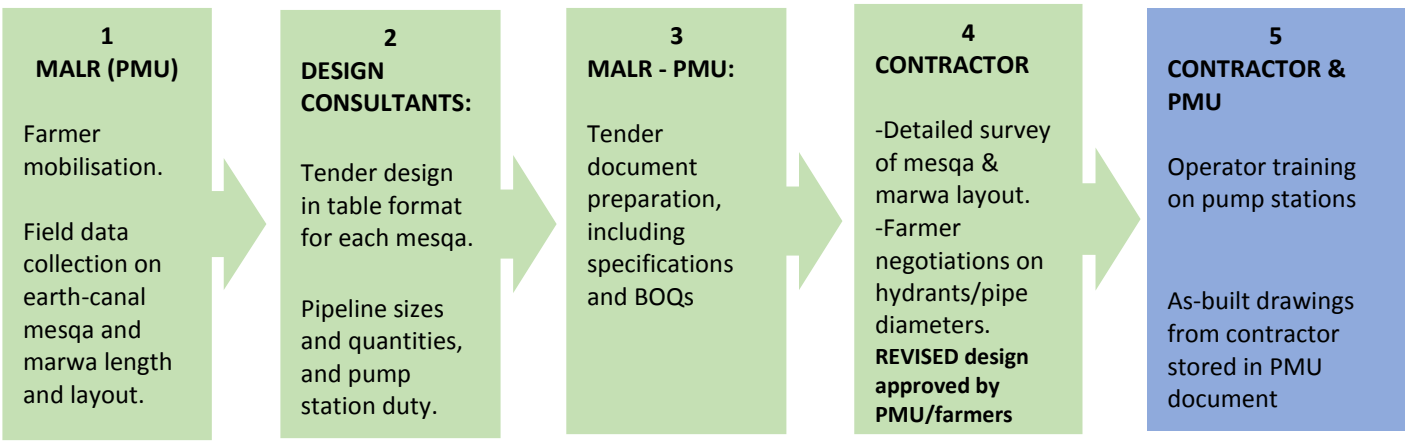
d) Greater sophistication in the technical design of the pump station and low-pressure pipe network is needed for optimum pumping-energy utilization: The FIMP design process followed the sequence (Figure A6.3): basic field survey (step 1), basic tender design (step 2) prepared on simplified hydraulic parameters16; tender document preparation and contracting (step 3). The contractor then undertook detailed site surveys and engaged in final negotiations on exact hydrant positions with farmers, marwa

[15] AENRI Report, undated. Dr Essam Wasif (AENRI Director) and Prof. Dr. Mohamed Al Ansary (Head of Technical Committee). Technical Evaluation Report: Standards for installation of pipes without sand bedding. ; conditionally accepted by the WB; FIMP TTL PMU e-mail: Wed, January 7, 2015: 3:03 PM.

[16] Elfiky Maged. 2008. Hydraulic Design of Buried-piped mesqa and marwa network. MALR and GTZ.

pipeline alignments, and pipe sizes (see social-design comment over the page) (step 4). Once approved by the PMU and farmers, construction proceeded. On completion, as-built drawings were produced and operator training was conducted (Step 5).

Figure 3: Engineering survey, design and construction sequence



This process was successful in achieving a hydraulic system that was:

- Comparatively superior to the diesel-pumped earth-marwa system in regard to operational cost and delivery equity (see result details).
- Acceptable to farmers (pipe sizes and hydrant spacing/positions).

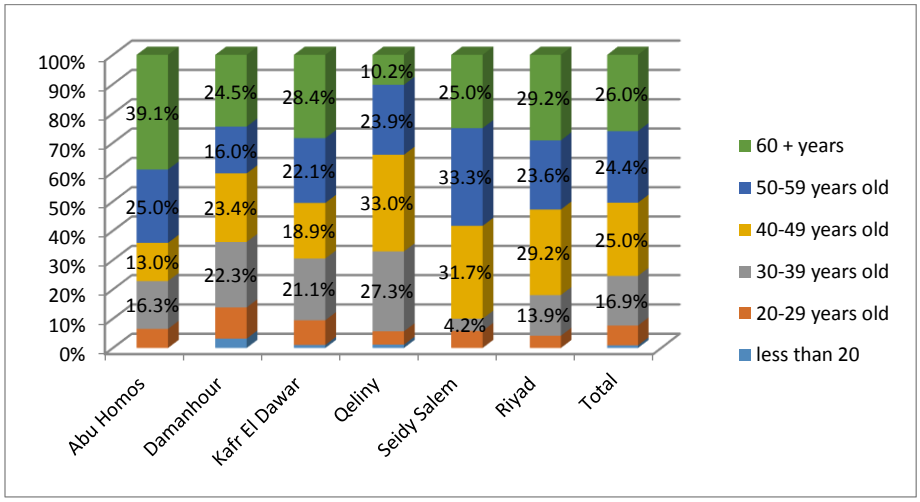
Questions have been raised about the hydraulic performance, particularly in regard to pumping energy (FAO, 2018)[17] and a potentially significant reduction on impellor life due to cavitation when operating out of the reasonable pump-efficiency range. A sample of electric pumps in FIMP were assessed to be operating outside of acceptable efficiency ranges (FAO, 2018). This was due to high variability in hydraulic demands across the network and sub-optimal pump selection rationale. Technical solutions to this and other challenges were described in the FIMP operational manual based on W-10 Pilot experiences and included: setting of pump-capacity combinations for multiple-pump installations to achieve incremental flow ratings of 10 l/s as a maximum; use of flow control regulators; consideration of the applicability of variable-flow motors (variable speed drives); attention to hydrant seal quality; and installation of pressure and flow-measurement devices on all pump stations. The pump-duty range on each mesqa need to be set with greater levels of sophistication in regard to network hydraulic behaviour, and in consideration of optimum operational schedules and the possible use of flow regulators in the system.

[17] Food and Agriculture Organization (FAO), 2018. Farm-level irrigation modernization Project (FIMP): Technical Audit. FAO. Rome.

ANNEX 7. RESULTS OF BENEFICIARY SURVEY

A beneficiary survey was commissioned towards the end of the project. It covered a sample of 561 beneficiaries (280 in Kafr el Sheikh and 280 in Beheira) to assess their experience with: (a) access to information, (b) awareness raising activities, (c) the grievance redress system, (d) compensation for land loss and crop damage, (d) access to service delivery, and (e) quality of service delivery. Figure A7.1 shows the distribution of the respondents by age and gender.

Figure A7.1 Sample Distribution by Age and Gender



Note: Abu Homos, Damanhour and Kafr El Dawar are districts in Beheira. Qeliny, Seidy Salem and Riyad are in Kafr el Sheikh.

Some of the notable results are as follows:

- 45.8 percent of the total sample surveyed received information about the project, varying among the districts (57.5 percent in Seidy Salem and 33 percent in Damanhour).
  - 48.3 percent received their information from agricultural associations/ cooperatives, 17.5 percent from agriculture advisors (extension workers), 12.3 percent from neighbors and 9.4 percent from the engineers in the project.
  - 94.2 percent reported saving water as the main shared information, followed by labor savings with 48.8 percent, and saving time mentioned by 24.4 percent of respondents.

- The grievance mechanism was reported to be a crucial process for solving project-related complaints.
  - 1,233 complaints were received until December 2017, out of which 1,201 were solved (97 percent).
  - 94 percent of the complaints were related to technical issues such as damages to hydrants, pipelines, machines, etc. Two percent of the complaints were related to compensation and 3 percent to production materials
  - Submitted complaints were dealt with in relatively quick way (in 24 hours, according to the GRM staff). However, some problems by nature could not be solved, i.e. lack of water in the main canals and installation of electricity, and others (i.e. regarding to installation of poles) are not easily to solve.

- The assessment considered that the project managed to introduce proper communication channels in the project areas, including individual and group meetings, site visits, and project information documents (posters and flyers).
  - 48.3 percent reported attending meetings in the agriculture association; 39.2 percent attending seminars prepared by the extension agents, and 15 percent attending other meetings. Few farmers (3.3 percent reported participating in the Farmer Field School groups.

Compensation: The survey results highlighted that one of the main barriers to disbursing compensation to affected farmers was the lack of official documents certifying ownership: 80.2 percent of the surveyed farmers have official land tenure (tenancy/ownership), and 34.3 percent have official ownership contract. Almost all sampled farms had official contracts. Farmers were informed about the value of compensations but most reported the amount as too small. Disbursing the money was delayed due to many reasons, including that the census took some time to compile and share with the PMU; and the Ministry of Finance required that each farmer should have a Visa card to receive his compensation (costing about LE 100), rendering the compensation more cumbersome to collect. Eventually, the PMU convinced the Ministry of Finance to disburse compensations without the bank card, and the funds are expected to be disbursed during the first quarter of 2018.

Project benefits: About 74 percent of the sample has benefited from irrigation rehabilitation and 51.3 percent benefited from **electrification** of irrigation machines. This indicator varied among project areas exceeded 90 percent in Seidy Salem, and 52.2 percent for irrigation rehabilitation and 32.6% for electrification in Abu Homos. As the marwas were buried, land was gained by some farmers: about 9.0% gained a portion of land varying between 2.88 Qirate in Riyad to 5.3 Qirate in Qeliny.

About 368 farmers reported a decrease in **irrigation time** while 83 reported the contrary. The average decrease was 2.3 hours while the increase was 4.69 hours, the latter mainly attributed to water availability in the main canals. Similarly, 232 farmers reported a decrease in irrigation costs with an average reduction of 124.2 EGP, while 142 farmers reported increases in the irrigation cost due to fuel and labor cost increases after the Egyptian pound was floated in November 2017.

Changes in **crops yields** were declared by: (i) 131 farmers with an increase estimated at 0.33 ton/fed, while (ii) 47 farmers reported a decrease of about 0.08 ton/fed. Also, about 22.8% of farmers claim having higher incomes after modernization (25.9 percent of the sample located at the head of marwas and 23.3 percent at the tail). These improvements are attributed to the enhanced availability of water which enables farmers to irrigate their fields in the proper time and using less labor, which them up to take care of their other farm duties. Saved time was also reported as being used for taking care of their livestock or doing other business to increase in their income, as well as for socialization with family and friends. Cleanliness of water also contributed to increased crop yields.

Significant benefits are also resulting from farmers participating in the FFS activities. Information about irrigation methods was mentioned as FFS main benefit by 50 percent, agriculture guidance by 45 percent, information about pesticides and spraying by 20%, gaining information about diseases and treatments by 15percent, and information about harvesting methods and modernization of irrigation benefits by five percent. However, few farmers reported participating in FFSs: in Seidy Salem they were 12.5 percent,

while in Damanhour only 1.1 percent while in other districts they did not exceed seven percent of the farmers.