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IMPLEMENTATION COMPLETION AND RESULTS REPORT

TF099074

ON A

GRANT

IN THE AMOUNT OF US\$ 70 MILLION

TO THE

ISLAMIC REPUBLIC OF AFGHANISTAN

FOR THE

ON-FARM WATER MANAGEMENT PROJECT (OFWMP)

July 31, 2020

Agriculture And Food Global Practice
South Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective December 31, 2019)

Currency Unit = AFGHANI (AFS)

AFS 77.07 = US\$1

US\$ 1.40 = SDR 1

FISCAL YEAR

December 21 - December 20

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ABBREVIATIONS AND ACRONYMS

AF	Additional Financing
AREDP	Afghanistan Rural Enterprise Development Program
ARTF	Afghanistan Reconstruction Trust Fund
BRAC	Building Resources Across Communities
CBA	Cost Benefit Analysis
CBR	Capacity Building for Results Facility
CDC	Community Development Council
CHA	Coordination of Humanitarian Assistance
CIT	Component Implementation Team
CPF	Country Partnership Framework
DD	Difference-in-differences
DGAED	Directorate General of Agriculture Extension and Development
E&S	Environmental and Social
EFA	Economic and Financial Analysis
EIRP	Emergency Irrigation Rehabilitation Project
ENPV	Economic Net Present Value
ERR	Economic Rate of Return
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
FAO	Food and Agriculture Organization
FCC	Farmer Call Center
FCV	Fragility, Conflict, and Violence
FFS	Farmer Field School
FM	Financial Management
GIE	Geospatial Impact Evaluation
GIS	Geographic Information System
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
HEIS	High Efficiency Irrigation System
IA	Irrigation Association
ICR	Implementation Completion and Results Report
ICRR	Implementation Completion Report Review
ICS	Inclusive Consultancy Services
ICST	International Consultant Support Team
ID	Irrigation Directorate
IDS	Irrigation Demonstration Site
IMP	Integrated Pest Management
IP	Implementing Partner
IRD	International Relief Development
IRDP	Irrigation Restoration and Development Project
IRR	Internal Rate of Return

ISN	Interim Strategy Note
ISR	Implementation Status and Results Report
LD	Liquidated Damages
LLL	Laser Land Leveling
M&E	Monitoring and Evaluation
MAIL	Ministry of Agriculture, Irrigation, and Livestock
MEW	Ministry of Energy and Water
MIS	Management Information System
MRRD	Ministry of Rural Rehabilitation and Development
MSI	MSI Worldwide
MTR	Midterm Review
NADF	National Agriculture Development Framework
NDVI	Normalized Difference Vegetation Index
NESPAK	National Engineering Services Pakistan
NHLP	National Horticulture and Livestock Project
NIDP	National Irrigation Development Program
NSP III	National Solidarity Program III
O&M	Operation and Maintenance
OFWM	On-Farm Water Management
OFWMP	On-Farm Water Management Project
OHS	Occupational Health and Safety
PAMC	Proposal to the ARTF Management Committee
PCPL	Precast Parabolic Concrete Lining
PCR	Project Completion Report
PD	Project Director
PDO	Project Development Objective
PIP	Project Implementation Plan
PIU	Project Implementation Unit
PLR	Performance and Learning Review
RF	Results Framework
RP	Restructuring Paper
TA	Technical Assistance
TPM	Third-Party Monitoring
VWO	Village Women Organizer
WMTI	Water Management Training Institute
WOP	Without Project
WP	With Project

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DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P120398	AF On-Farm Water Management (OFWM)
Country	Financing Instrument
Afghanistan	Investment Project Financing
Original EA Category	Revised EA Category
Partial Assessment (B)	Partial Assessment (B)

Organizations

Borrower	Implementing Agency
Islamic Republic of Afghanistan, MAIL	Ministry of Agriculture, Irrigation and Livestock (MAIL)

Project Development Objective (PDO)

Original PDO

The PDO of the project is to improve agricultural productivity in project areas by enhancing the efficiency of water used.



FINANCING

	Original Amount (US\$)	Revised Amount (US\$)	Actual Disbursed (US\$)
World Bank Financing			
TF-99074	41,000,000	70,000,000	66,508,616
Total	41,000,000	70,000,000	66,508,616
Non-World Bank Financing			
Borrower/Recipient	0	0	0
Total	0	0	0
Total Project Cost	41,000,000	70,000,000	66,508,616

KEY DATES

Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
16-Feb-2011	16-Mar-2011	06-Feb-2013	30-Jun-2014	31-Dec-2019

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US\$M)	Key Revisions
01-May-2013	6.86	Change in Results Framework Change in Components and Cost Cancellation of Financing
01-May-2014	14.22	Change in Loan Closing Date(s)
08-Nov-2015	25.00	Change in Loan Closing Date(s)
16-Dec-2015	25.00	Additional Financing Change in Results Framework Change in Components and Cost

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Satisfactory	Moderately Satisfactory	Modest

**RATINGS OF PROJECT PERFORMANCE IN ISRs**

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US\$M)
01	23-Aug-2011	Satisfactory	Satisfactory	5.33
02	11-Feb-2012	Moderately Satisfactory	Moderately Unsatisfactory	5.33
03	29-Aug-2012	Moderately Unsatisfactory	Unsatisfactory	6.01
04	01-Mar-2013	Moderately Unsatisfactory	Unsatisfactory	7.69
05	03-Sep-2013	Moderately Satisfactory	Moderately Unsatisfactory	9.57
06	04-Jan-2014	Moderately Satisfactory	Moderately Satisfactory	13.74
07	08-Sep-2014	Moderately Satisfactory	Moderately Satisfactory	20.42
08	02-Feb-2015	Satisfactory	Satisfactory	23.77
09	08-Sep-2015	Satisfactory	Satisfactory	25.83
10	22-Apr-2016	Satisfactory	Satisfactory	30.13
11	10-Nov-2016	Satisfactory	Satisfactory	31.89
12	25-May-2017	Satisfactory	Satisfactory	38.24
13	22-Dec-2017	Satisfactory	Satisfactory	46.72
14	02-May-2018	Satisfactory	Satisfactory	50.07
15	08-Nov-2018	Satisfactory	Satisfactory	61.90
16	06-Feb-2019	Satisfactory	Satisfactory	61.90
17	01-Aug-2019	Satisfactory	Satisfactory	64.33
18	19-Dec-2019	Satisfactory	Satisfactory	66.48

**SECTORS AND THEMES****Sectors**

Major Sector/Sector (%)

Agriculture, Fishing and Forestry 100

Irrigation and Drainage 71

Public Administration - Agriculture, Fishing & Forestry 29

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3) (%)

Urban and Rural Development 0

Rural Development 100

Rural Infrastructure and service delivery 100

ADM STAFF

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I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

Context

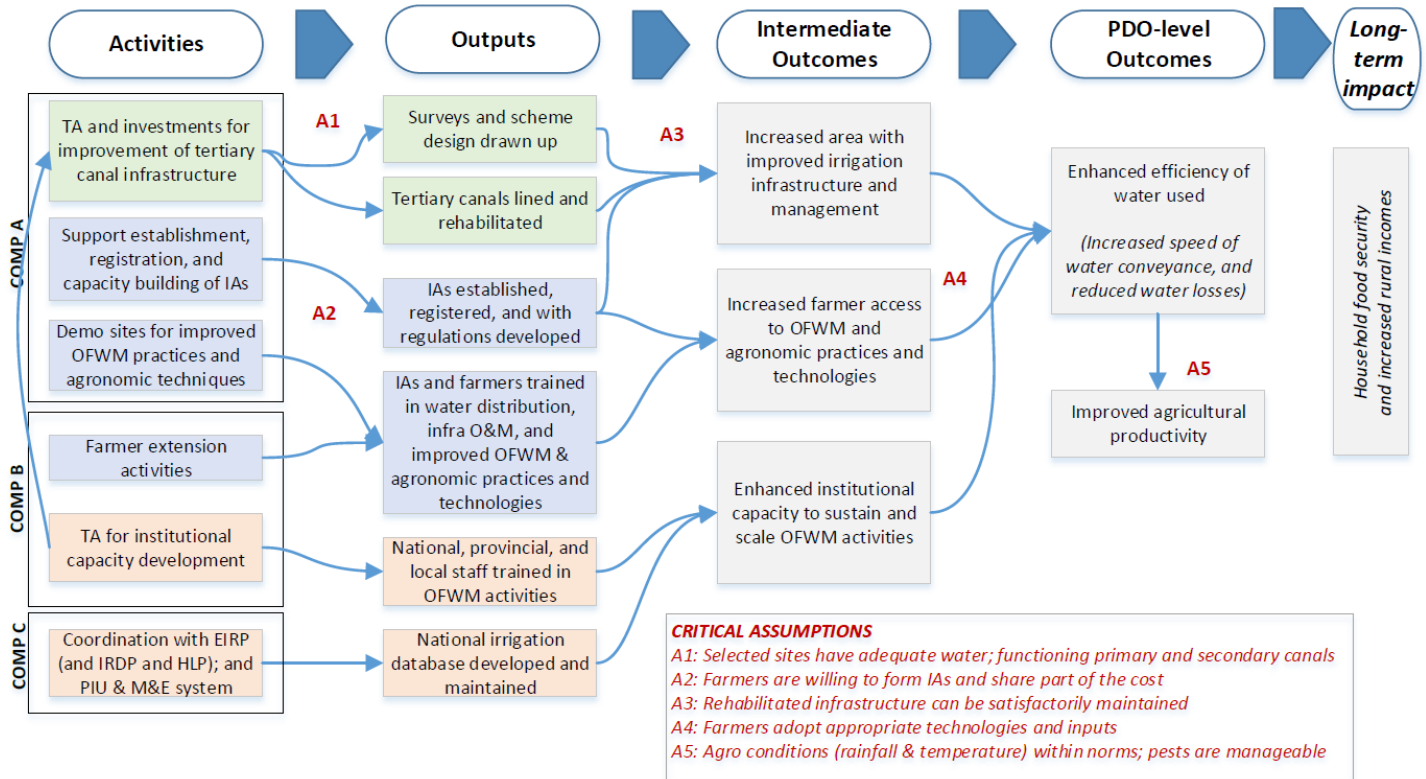
- 1. Economic growth had accelerated, but this growth was volatile and unevenly distributed.** Between 2003/04 to 2010/11 real GDP growth was on average 9.1 percent per year, in contrast to a significant decline in growth between 1978 to 2001. Growth, however, was highly volatile and it fluctuated based on the volatility in agriculture sector growth which is subject to annual weather conditions. While growth had improved, the poverty rate remained high at 36 percent in 2007/08, with many other households just right above the poverty line, and thus vulnerable to falling into poverty. Alongside poverty, nutrition outcomes were dire, with 55 percent of children under five years of age considered chronically undernourished. Poverty in the country is seasonal. In 2007/08, poverty was highest in the summer during the lean season (44 percent) and lowest in the fall during harvest (23 percent), it was also higher in rural areas (36 percent) than in urban areas (28 percent).
- 2. Concurrently, security was deteriorating and trust in leadership and governance had weakened.** A sense of insecurity had then grown in even otherwise peaceful areas. The Presidential election in 2009 was embroiled in controversy, and the succeeding 2010 Parliamentary elections revealed problems with the democratic process, where it took one year to seat parliamentarians. Political stability, the rule of law, control of fraud and corruption, and government effectiveness were considered key challenges. Institutions were fractured and weak, particularly at the province and district levels.
- 3. The agriculture sector continued to be a key driver of growth, but agricultural productivity was low.** Next to the services sector, agriculture had the largest share of GDP. In 2010, the agriculture share of GDP was 26 percent and its share of employment was 49 percent, employing 67 percent of all women and 40 percent of all men. Most were engaged in subsistence agriculture primarily in the production of cereals, particularly wheat, to meet gaps in household food security. Of the 4 million ha cultivated, wheat covered 2.5 million ha. Leading up to 2010, significant progress had been made with cereal yields growing by 13 percent each year on average between 2001 to 2010. But crop productivity was still low, since it had previously declined to less than 50 percent of the pre-war levels.
- 4. Low agricultural productivity was in large part driven by the lack and inefficiency of irrigation.** Over the three decades of conflict, irrigated crop area declined by 70 percent resulting from the decimation of irrigation infrastructure. Of the area covered by irrigation schemes only a tenth used properly engineered systems and a third was not cultivated due to water constraints. Low-quality hydraulic structures, poorly functioning tertiary canals (even when primary and secondary canals have been rehabilitated), and traditional management methods were leading to high losses of water, with considerable shortages for those at the tail end of schemes. In the context of social disruption, traditional systems for Operation and Maintenance (O&M) had weakened. This led to conflict among water users and further degradation of the already few and poor functioning irrigation schemes. In Afghanistan, while irrigated wheat yields of 2.7 tons/ha were higher than rainfed yields of 1.8 tons/ha, they were lower than irrigated wheat yields in neighboring Pakistan, Uzbekistan, and Iran, where yields ranged from 3 to 5 tons/ha. Inefficiency in irrigation schemes led to high water losses and constrained agricultural productivity.
- 5. Against this background, the Government sought support for improving on-farm water management.** The National Agriculture Development Framework (NADF) included the Agriculture Production and Productivity Program as one of its four pillars. Under this pillar irrigation, seeds, and fertilizers were key inputs. The On-Farm Water Management



Project (OFWMP) was a pilot to address productivity constraining inefficiencies in water use, particularly at the level of tertiary canals. This approach was new to the country and did not exist in other irrigation projects, such as the Emergency Irrigation Rehabilitation Project (EIRP, P078936) or its follow-up Irrigation Restoration and Development Project (IRDP, P122235) which were both focused on primary and secondary canal rehabilitation. OFWMP aligned well with the country’s priorities and Bank’s strategic objectives (See Section IIA).

Theory of Change (Results Chain)

Figure 1. Reconstructed Results Chain for OFWMP



Source: ICR author’s reconstruction using the 2011 PAMC. The project activities included infrastructure rehabilitation investments (in green), farmer-centered technical assistance (TA) (in blue), and institutional strengthening and coordination (in yellow).

Project Development Objectives (PDOs)

- 6. **The PDO was to improve agricultural productivity in the project areas by enhancing the efficiency of water used.** The PDO was consistent between the original grant agreement and Proposal to the ARTF Management Committee (PAMC). The PDO was not changed and remained valid through the life of the project.

Key Expected Outcomes and Outcome Indicators

- 7. **The first expected outcome was to improve agricultural productivity and the second expected outcome was to enhance the efficiency of water used.** While the second outcome on water use efficiency was the key channel through which the first outcome would be achieved, it is in and of itself a key outcome given the key challenges on water availability and water losses. The outcome indicators to measure the two outcomes are summarized in Table 1. The original indicator to measure the achievement in expected outcome 1 was PDO indicator #1, and those to



measure outcome 2 were PDO indicators #2 and #3. At additional financing (AF) approved in December 2015, PDO indicator #6 was added (as an indicator for outcome 1) and PDO indicator #3 was reworded.

8. **In addition to the two expected outcomes, the project also expected to meet a third objective on outreach and scale targets**, particularly with regards to the number of irrigation associations established and strengthened, the number of beneficiaries, and their satisfaction with key project activities. These are measured with PDO indicators #4, #5, and #7, which were added as (or upgraded to) PDO indicators with the AF (see Table 1).

Table 1. Expected Outcomes and Evolution of PDO Indicators and Targets

Outcomes	PDO Indicators	Target at closing set at 2011 <i>Closing: June 30, 2014</i>	Target at closing set at 2013 <i>Closing: December 31, 2015</i>	Target at closing set at 2015 <i>Closing: December 31, 2019</i>
Outcome 1: To improve agricultural productivity	#1. Land productivity of wheat (kg/ha)	+15% relative to baseline	+15% relative to baseline	+20% relative to baseline
	#6. Improved agricultural productivity due to the higher value crop due to improved irrigation services	--	--	+15% relative to AF 2015
Outcome 2: To enhance the efficiency of water used	#2. Water productivity of wheat (kg/m ³)	+15% relative to baseline	+15% relative to baseline	+20% relative to baseline
	#3. Irrigated area (ha)	+10% relative to baseline	+10% relative to baseline	+64,000 ha relative to baseline
Objective 3: Outreach and scale	#4. Number of operational IAs established and strengthened	--	--	325 from baseline
	#5. Number of beneficiaries (gender disaggregated)	--	--	120,000 total, 60,000 women
	#7. Percentage of IAs expressing satisfaction with the project activities.	--	--	85%

Components

9. **Component A: On-Farm Water Management** (*original estimate: US\$29.0m, estimate after 2013 restructuring: US\$13.0m, estimate with AF: US\$42.9m, final actual: US\$43.1m*). This component included three subcomponents, to be implemented in their order: A1) the establishment and strengthening of irrigation associations (IAs) for improved O&M; A2) the improvement of on-farm physical irrigation infrastructure (tertiary networks or watercourses) in schemes already rehabilitated by EIRP; and would involve initial surveys, design activities, and contracting out works for concrete structures and lining; and A3) the establishment of Irrigation Demonstration Sites (IDS) to demonstrate improved water saving techniques.



10. **Component B. Institutional Capacity Building** (*original estimate: US\$4.7m, estimate after restructuring: US\$4.7m, estimate with AF: US\$8.2m, final actual: US\$5.4m*). The objective of this component was to enable MAIL staff to plan, design, implement, and monitor OFWMP programs throughout the country. This component included strengthening and building capacity of the General Directorate of Irrigation (ID) of MAIL at the national, provincial, and district levels. The ID had only been recently established in 2009. This would be implemented following a government-to-government program with the Government of the Punjab Province in Pakistan whereby project and MAIL staff would be trained in the Water Management Training Institute (WMTI) in Lahore. The trainings would include: a) a 45-day flagship training program at WMTI on applied OFWM, b) a training-of-trainers (TOT) for graduates of the flagship training program, and c) specialized training on more advanced subjects of OFWM. In addition, this component included irrigation extension by project staff to farmers (a 1-week training course for farmers in IDS and a 2-day training course for other farmers), and the initiation of a database of irrigation infrastructure in the country.
11. **Component C. Project Management, Coordination, Monitoring and Evaluation** (*original estimate: US\$7.3m, estimate after restructuring: US\$7.3m, estimate with AF: US\$13.0m, final actual: US\$15.1m*). This component included establishing a Project Implementation Unit (PIU) in Kabul and in five proposed areas, project management on fiduciary and safeguard aspects, coordination with other projects, such as IRDP (P122235) and the National Horticulture and Livelihood Project (NHLP, P157997), and donors, and establishing an efficient monitoring and evaluation (M&E) system.
12. **Component D. Support for Productivity Enhancement** (*original estimate: US\$0m, estimate after restructuring: US\$0m, estimate with AF: US\$5.9m, final actual: US\$2.9m*). This component was added with the AF in 2015. It is a reframed and scaled-up version of the original subcomponent A3 and its related pilot activities. This component aimed at realizing the potential of improved irrigation systems. Activities included promotion of laser land leveling (LLL) and high efficiency irrigation systems (HEIS), training and capacity building for IAs and farmers in various agronomic practices and integrated pest management (IPM), demonstration sites to disseminate the range of improved water management and agronomic practices, and establishment of a farmers' information service center.

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION

Revised PDOs and Outcome Targets

13. **The project scale was reduced via a restructuring in 2013, and then later increased via an AF in 2015.** Due to significant delays in implementation, the Project was restructured in May 2013 with a cancellation of \$16m, revising the grant from \$41m to \$25m. During restructuring, the PDO, indicators, targets, and closing date remained the same, but the scale of scheme rehabilitation was reduced from a target of 52,500 ha (175 schemes) to 10,000 ha (50 schemes). The following year, in May 2014, the closing date was extended by 18 months, from the original closing of June 30, 2014 to December 31, 2015. As a result of significant momentum post-restructuring, an AF for \$45m was approved in December 2015, increasing the grant from \$25m to a total of \$70m, and extending the closing date to December 31, 2019. The scale of scheme rehabilitation was increased to an additional 45,000 ha on top of the then already achieved 19,000 ha (already exceeding the revised 10,000 ha target at the 2013 restructuring).
14. **While the PDO was never revised, the PDO indicators and targets were revised with the 2015 AF.** The PDO indicators and outcome targets were revised with the AF to streamline them and better align them with the PDO, and to include targets on gender-disaggregated beneficiaries. The original three PDO indicators, land productivity, water productivity, and irrigated area remained unchanged, and their targets were slightly revised upwards.¹ A notable

¹ This ICR evaluates the project against a 20% end target, as mentioned in the AF project paper



inconsistency is that land and productivity targets should have been measured for wheat and other crops, but only wheat was reported. The target for irrigated area was revised from a percentage increase to number of hectares rehabilitated, and the revised target reflected the scale-up. Per Table 1 above, four new PDO indicators were added.

15. **The intermediate results indicators (IRIs) were revised in 2013 and 2015.** In 2013, the IRI “Decrease in number of water theft cases between July-October” was dropped, leaving out a key IRI which would stem from functioning IAs. Four new IRIs were added in 2013, but all four were dropped in 2015: “Number of training sessions provided to each IA each year (including content of such sessions)”, “Associated command area covered”, “Number and type of water-saving measures demonstrated”, and “Number of farmers adopting the demonstrated measures”. Dropping the last IRI meant that the Project would not track any adoption rates. In 2015, other IRIs were added, including “Annual on farm job created”, “Number of farmer’s information center built and operational”, “Preparation of a draft Law on Irrigation and Drainage”, and “Recruitment of CBR based staff in the ID”. The new IRIs reflected outputs which would enable farmer extension services, address coordination in the irrigation sector, and promote project sustainability.

Revised Components

16. **The activities in Component A were scaled down in the 2013 restructuring and then scaled up in the 2015 AF.** The cancellation of \$16m applied entirely to a scaling down of on-farm physical irrigation infrastructure (subcomponent A2), without impacting the planned activities for IAs (subcomponent A1) or IDS (subcomponent A3). In 2013, Component B was revised to include the construction of five regional office buildings to house ID and OFWMP staff, financed out of cost savings from Component B. The 2015 AF increased the total target for rehabilitation to 64,000 ha, of which 19,000 ha (100 schemes) had been completed pre-AF. The AF would cover the remaining 75 schemes which were identified pre-AF and for which IAs had already been established, and it would cover other schemes not initially identified pre-AF.
17. **The 2015 AF added a policy agenda under Component B and a new stand-alone Component D for productivity enhancement support, reflecting an effort towards inter-ministry and intra-ministry coordination.** Under *Component B*, the AF added a policy instrument to support the irrigation subsector and the overall management of water resources. Activities included providing support to MAIL in developing the National Irrigation Development Program (NIDP) with the Ministry of Energy and Water (MEW)² and Ministry of Rural Rehabilitation and Development (MRRD), coordinating irrigation investments across MAIL, MEW, and MRRD via enhanced inter-ministerial and donor coordination, and refining the underlying legal framework to delineate responsibilities (i.e. amending the Water Law and developing the Irrigation and Drainage Law). *Component D* was added to further the support to water and agricultural productivity. This component would be managed separately by the Directorate General of Agriculture Extension and Development (DGAED) of MAIL. However, fully staffing the DGAED Component Implementation Team (CIT) was delayed, and only completed by May 2017.

Other Changes

18. **Under Component A, the guidelines on site selection and lining technology were revised in the 2013 restructuring.** As identified in the MTR (February 2013) and then implemented via the restructuring in May 2013, the rules on site selection and the use of lining technology were revised, as follows: first, schemes could be selected if the headwork, primary, and secondary canals are in good operating condition, regardless of whether EIRP had rehabilitated the scheme. The MTR noted that some EIRP rehabilitated schemes had inadequate water flow. Second, the schemes need not be equally distributed across the five regions. Third, other forms of canal lining (i.e. In situ or brick-lining) could be used if appropriate for the specific scheme and if it improves the rehabilitation completion time for contractors.

² This has recently been restructured to the National Water Affairs Regulation Authority (NWARA).



The MTR noted the constraints with precast parabolic concrete lining (PCPL) technology, which while successful in other places (i.e. Pakistan) was not as effective in Afghanistan. Contractors lacked the capacity to manufacture PCPL and the Project had no capacity to test PCPL quality. Only a few testing labs were available under IRDP.

19. **Under Component B, a detailed staff training plan was completed in 2013.** As discussed in the MTR, a detailed plan for implementing Component B was absent, so it had been managed ad-hoc. A capacity building and training needs assessment had never been done to identify the key areas of intervention needed. The training plan later developed expanded training locations not only to Pakistan, but also to India, Thailand, and Italy.
20. **Under Component C, in 2013 the project management team underwent a significant revamp and more effective monitoring and management was introduced.** The Project Director (PD) was replaced in June 2012, then considered a crucial step forward. This replaced PD was promoted as the first Director of the ID in 2014. The MTR noted the need for an HR reorganization, as it lacked an organizational chart with clear reporting lines or responsibilities, with salary anomalies in almost all categories. A new monitoring and management system was introduced to better track outputs and aid in planning.
21. **Other significant changes revolved around implementation arrangements, including: i) inclusion of the Food and Agriculture Organization Technical Assistance (FAO-TA) facility, ii) upgrading of the PMU to a central program office, iii) more explicit collaboration between MAIL and MEW, and iv) an increased reliance on third party monitoring (TPM):**
 - In AF 2015, an FAO-TA facility was added to support the policy agenda under Component B. This FAO-TA facility was to be launched in 2016, but the signing of the agreement was delayed to 2017.
 - In 2017, to streamline implementation of irrigation projects, it was announced that the PMU was to become a Central Program Office (CPO) which would manage seven donor-funded irrigation projects. However, by January 2019, there was still some delay in transition, as the ID still did not have a Director.
 - In 2017, five explicit sites were included for collaboration between OFWMP (under MAIL) and IRDP (under MEW), with IRDP rehabilitating the upper canals and OFWMP the lower canals. MRRD was, however, not involved. Overall concern on the coordination with MRRD and the Citizen's Charter persisted.
 - By 2016, due to escalating security concerns, there was a heavier focus on TPM (See Section IIIB).

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

22. **Key changes to implementation arrangements were intended to strengthen the links between institutional capacity and the expected outcomes. There was an added focus to facilitate inter-ministry and intra-ministry coordination.** The inclusion of a policy agenda in *Component B* was intended to strengthen the inter-ministry collaboration among MAIL, MEW, and MRRD. The inclusion of a stand-alone *Component D* with DGAED as the CIT was intended to pull together agronomic interventions with irrigation and water efficiency interventions together under one project and to incentivize intra-ministry collaboration between the PMU (and ID) and the DGAED. This stand-alone Component D was also intended to expand on the provision of improved technologies and practices for farmers. The inclusion of the FAO-TA facility, the planned upgrading of the PMU facility, and the collaboration sites between OFWMP and IRDP were intended to facilitate inter- and intra-ministry coordination.
23. **Other changes were meant to correct some constraints at design and bottlenecks in implementation, without alterations to the theory of change.** The added flexibility on site selection and use of lining technology for Component A and the detailing of the training plan for Component B addressed areas where the PAMC was either too restrictive or too vague. The revamp of project management (and HR) and the later inclusion of TPM were meant to address implementation bottlenecks.



II. OUTCOME

A. RELEVANCE OF PDOs

Assessment of Relevance of PDOs and Rating

24. **At appraisal, throughout implementation, and by closing, OFWMP remained aligned with the Bank’s overall strategy documents for Afghanistan.** The Project which spanned nine calendar years (January 2011 to December 2019) and 10 fiscal years (FY11-FY20) overlapped with three Bank strategy documents for Afghanistan³: i) ISN FY09-11, ii) ISN 2012-14 (extended to FY16), and iii) CPF FY17-20 (extended past FY20 as per the PLR). At closing, OFWMP aligned with CPF FY17-20, directly to Pillar 2 and Objective 2.4 (Increased agricultural productivity) (See Table 2). The Project also indirectly aligned to various calibrations of Pillar 1 in ISN FY09-11 (building the capacity of the state and its accountability to citizens), in ISN FY12-14 (building the legitimacy and capacity of institutions), and in CPF FY17-20 (building strong and accountable institutions).
25. **The Relevance of the PDO is rated HIGH.** There were no shortcomings in the relevance to the WBG CPF at project closing.

Table 2. Consistency of PDO with WBG Strategies for Afghanistan

WBG Strategy	Project Relevant Strategic Pillar	Project Relevant Results, Outcomes, Objectives, or Indicators under Strategic Pillar
Interim Strategy Note FY09-FY11	Pillar 2. Promoting growth of the rural economy and improving rural livelihoods	<ul style="list-style-type: none"> ➤ Result 2: Increased proportion of rural land brought back into productive use ➤ Result 3: Increased agricultural productivity ➤ Result 4: Progress towards achieving food security ➤ Result 6: Progress in reducing rural household poverty rates
Interim Strategy Note FY12-FY14	Pillar 2. Equitable service delivery	<ul style="list-style-type: none"> ➤ Outcome 1. Improved rural and community services <ul style="list-style-type: none"> ○ Indicator 3: Increase in irrigated area ○ Indicator 4: Increase in crop yields in rehabilitated areas
	Pillar 3. Inclusive growth and jobs	<ul style="list-style-type: none"> ➤ Outcome 1. Agriculture growth <ul style="list-style-type: none"> ○ Indicator 1: Increase in irrigated area under agricultural production ○ Indicator 2: Increase in crop yields in rehabilitated areas
Country Partnership Framework FY17-FY20	Pillar 2. Supporting inclusive growth	<ul style="list-style-type: none"> ➤ Objective 2.4 Increased agricultural productivity <ul style="list-style-type: none"> ○ Indicator 2.4.1. Increase in agriculture productivity (irrigated wheat yields) ○ Indicator 2.4.2. Increase in number of farmers with regular access to extension workers and/or irrigation services (and percent female) ○ Indicator 2.4.3. Area provided with irrigation and drainage services (hectares)

³ Including the full preparation period, the project spanned 10 fiscal years, FY10 to FY20.



B. ACHIEVEMENT OF PDOs (EFFICACY)

Assessment of Achievement of Each Objective/Outcome

26. **The assessment of achievement of each objective is based primarily on a *reanalysis* of project data on outcomes and guided by a *reassembly* of data for the results framework (RF).** This ICR is evaluating achievement of outcomes against the targets established at AF in December 2015. Because data on the RF was sparse, it was reassembled using various sources. The RF serves as an indication of the trajectory of outputs (See Annex 1) and is the primary basis for evaluating achievement for the *scale objective*. However, the reliability of the RF is limited in assessing achievements of the two *expected outcomes*. First, several of the defined indicators, baseline values, and set targets were kept vague or inconsistent after appraisal. Second, the reported periodic achievements were inconsistent across various sources and their data sources unclear. Third, the analysis of outcomes in the RF does not allow for a strong case for attribution.
27. Considering these limitations, raw data on outcomes were reanalyzed including a triangulation and harmonization of different databases. The reanalysis constitutes the basis for evaluation of achievement of the two expected outcomes. The reanalysis largely focuses on scheme rehabilitation and presents three estimations: i) a pre-post comparison (for the treatment group), ii) a treatment vs control group comparison (at closing), and iii) a difference-in-differences (DD) comparison, which calculates treatment group improvements over time relative to control group improvements. The DD estimate makes the strongest case for attribution. *Refer to Annex 6 for a full discussion of the reanalysis.*
28. **The achievement of outcome 1 ‘improved agriculture productivity’ is rated as SUBSTANTIAL.** Table 3 summarizes four sources of estimated project impacts on wheat yields: i) the RF, ii) the project completion report (PCR) and impact evaluation, iii) the reanalysis of impacts, and iv) a much earlier geospatial impact evaluation (GIE) conducted by AidData at the College of William & Mary. The estimated impact from these different sources ranges from a 0.5 t/ha to 1.1 t/ha increase in absolute terms, and an 18 to 49 percent increase in relative terms. The most reliable estimate is the reanalysis of impacts, which estimates a **34 percent increase in wheat yields, well exceeding the 20 percent targeted increase**. Both the reanalysis and the GIE find that the yield gains are larger at areas near the head or start of the canal where water flow would be greatest. However, these differences in gains between head and tail are not large. The positive gains for those even at the tail indicate that scheme rehabilitation reduced water losses through the canal. The reanalysis indicates that IDS and FFS interventions would have contributed an additional 10 and 15 percent increase in yields, respectively (additional to the impact of the scheme rehabilitation itself). However, these interventions reached far fewer farmers than scheme rehabilitation, so the additional impacts of these interventions do not apply broadly.
29. The reanalysis of impacts is considered the most reliable for a few reasons. First, unlike the PCR or impact evaluation, the reanalysis uses the baseline data from 2013 as opposed to pre-rehabilitation recall data fraught with biases. Second, unlike the RF, PCR/impact evaluation, or the GIE, the reanalysis includes control schemes as a counterfactual. Third, unlike the GIE, the reanalysis estimates the impact directly on yields as opposed to NDVI which is a proxy for yields. Fourth, unlike the GIE, the reanalysis estimates impact by grant closing in 2019, as opposed to using data much prior to closing. Nevertheless, the GIE serves as an independent verification of the positive direction of impacts, well before closing. Comparing the reanalysis of impacts to external FAOSTAT data further strengthens its validity. The DD estimate from the reanalysis accounts for a control group increase in yields between 2013 to 2019 of 27 percent, equivalent to a compound annual growth rate of 4 percent over the six-year



period. This is close to data from FAOSTAT where the national annual average growth rate in wheat yields was 5.8 percent.⁴

30. Besides yields, another potential indicator for outcome 1 was improved agricultural productivity (due to higher value crop). This vague indicator was interpreted by the PIU as the increase in income due to crop conversion. However, it was poorly and incorrectly measured (See Annex 6), and as such the ICR considers the reported impacts on income as unreliable.⁵ While the impact on wheat yields well exceeded its target, the lack of reliable information on other indicators such as other crop yields or income gains through crop conversion warrants a substantial rating, as opposed to a high rating for outcome 1.

Table 3. Project Impact on Wheat Yields from Various Sources

Source	Baseline (tons/ha)	Endline (tons/ha)	Methodology	Estimated Impact
Results Framework <i>By PMU and WB Task Team</i>	2.29 (in 2013)	3.4 (in 2019)	Before and after, no control group	1.11 t/ha or 49% (relative to baseline)
Project Completion Report and Impact Evaluation 2019 <i>By PMU and FAO</i>	2.9 (post-rehab recall at 2019)	3.4 (in 2019)	Before and after, no control group	0.50 t/ha or 18% (relative to baseline)
Reanalysis of Impacts <i>By ICR authors</i>	Treat: 2.27 Control: 2.08 (in 2013)	Treat: 3.44 Control: 2.63 (in 2019)	Difference-in-differences, with control group	0.65 t/ha or 34% (relative to baseline for control group)
Geospatial Impact Evaluation <i>By College of William & Mary</i>	0.194 median NDVI (pre-rehab)	0.233 median NDVI (post-rehab)	Panel regression with season, year, and cell fixed effects, but no control group	0.95 t/ha (0.037 NDVI) Or 19% (relative to median NDVI pre-treatment)

Source: ICR author's compilation from reassembled RF, PCR/impact evaluation, reanalysis, and GIE. The baseline value in RF varied at different points, it was 2.5 at appraisal and 2.0 at AF, and later revised to 2.29. The estimated impact reported for reanalysis is derived from regression estimates in Annex 6, not from simple comparison of the means above. Additional data analysis was shared by authors of the GIE to complete this table. The GIE estimated impact reported here is the impact at peak greenness of NDVI (or at time of harvest). The assumptions on converting NDVI to yield is detailed in the GIE report.

31. **The achievement of outcome 2 'enhanced efficiency of water used' is rated as SUBSTANTIAL.** The reanalysis estimates an increase in **water productivity of 17 percent, which is a substantial achievement against a 20**

⁴ This is for the most recent six-year period 2011 to 2017, for which data was available at FAOSTAT.

⁵ As discussed in Annex 6, the data collection for this indicator missed several important reference points or denominators against which to evaluate increases in income, including: income from land which was not converted, income for those who did not convert, and income for those in non-rehabilitated areas



- percent target** in a context of worsening insecurity and increasingly scarce water resources in the country.⁶ The reanalysis estimate is lower and more conservative than the RF and PCR estimate of 29 percent, because the reanalysis accounts for necessary adjustments to the baseline and endline values to make an accurate comparison. For the baseline, the RF estimate had an unknown source, and hence the reanalysis constructed the variable using baseline survey data in 2013. For the endline, the RF estimate was based on data collected from IDS, and not from beneficiary farms. As such, the reanalysis downscales the RF value following some assumptions (see Annex 6).
32. To corroborate the evidence on substantial gains in water productivity, this ICR notes that key outputs were met. According to the RF, total irrigated hectares reached 75,787 ha by 2019 which exceeded the target of 64,000 ha, and rehabilitated watercourses reached 743 km which well exceeded the 138 km target.⁷ These indicators are quite reliable given that TPM would have focused on such outputs. The RF also reports on achievements on conveyance efficiency, conveyance duration, and time taken to divert water. However, it is unclear how and when these indicators were evaluated. The reanalysis provides a DD comparison indicating that the time needed to irrigate one jerib of land (or 0.2 ha) decreased by 157 percent, alluding to significant reductions in water wastage through the canal.
33. **The achievement of objective 3 ‘outreach and scale’ is rated as HIGH.** The reassembled RF indicates that the project had established 631 IAs, well above the target of 325. OFWMP supported IAs with registration and capacity building. Of the established IAs, 97 percent expressed satisfaction with project activities, above the target of 85 percent. By 2019, the project had reached 382,700 beneficiaries (of which 187,500 women), well above the target of 120,000 beneficiaries (of which 60,000 women).
34. **Overall, the achievement in outcomes and objectives described above are largely driven by Component A, and much less likely to have been driven by Components B or D.** Component A was a much larger share of the total investments, and outputs under this component were exceeded. While staff training targets in Component B were achieved, other outputs under policy engagement and coordination (which straddle Components B and C) were either unachieved (such as the IRI on CBR-based staff recruited) or its achievement unclear given the lack of IRIs for other goals under policy engagement. It is also unlikely that Component D drove the outcome achievements since the scale targets for this component were very low (relative to the overall scale of the project) and the outputs were achieved late in the life of the project (See Figure 2).
35. Following the Theory of Change (Figure 1), the core activities under Component A (TA and investments for canal improvement and support for the establishment of IAs) led to an increase in area with improved irrigation infrastructure and management. This then led to the observed enhanced water use efficiency driven by reduced water losses (see Paragraphs 31 and 32), and this significantly drove improvements in agricultural productivity (See Paragraph 28). It is unlikely that the activities from the other components (Components B and D) had driven the changes in key outcomes across the project beneficiaries (See Paragraph 34).

Justification of Overall Efficacy Rating

36. **The overall efficacy rating is SUBSTANTIAL.** This accounts for the substantial rating for the agriculture productivity outcome, the substantial rating for the water efficiency outcome, and the high rating for the scale objective.

⁶ Unlike for wheat yields for which control group data was collected at endline, control group data was unavailable for water productivity. As such, the estimated impact on water productivity is a pre-post measure, not a DD comparison. Evidence from other indicators is used to further corroborate the gains in water productivity.

⁷ The reanalysis also provides a farm-level analysis of irrigated area. The DD estimate suggests an average increase in irrigated area of 14 percent.

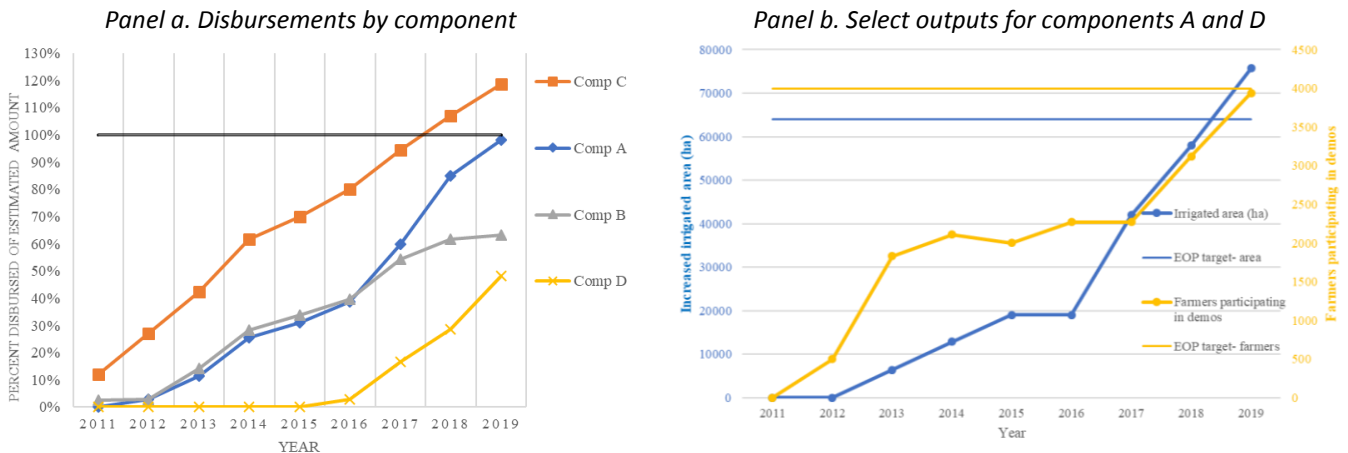


C. EFFICIENCY

Assessment of Efficiency and Rating

- 37. **The ex-post efficiency analysis at project completion uses a two-scenario cost-benefit analysis (CBA).** The quantified benefits focus on agricultural production gains (and reductions in cost of production) which result from higher crop yields and more land under cultivation (including an increase in irrigated area). These benefits result from activities, outputs, and outcomes in Component A. Other benefits from Components B and D are excluded. First, a less conservative scenario accounts only for costs under Components A and C. These are the components from which quantified benefits are calculated from. Second, a conservative scenario accounts for costs across all components. Total project costs totaled US\$ 65.646 million in financial value nominal terms⁸, US\$ 84.360 million in financial value current terms, and US\$ 77.9 million in economic value. The CBA was conducted over a 20-year period, with a discount rate of 12 percent. Refer to Annex 4 for a full discussion of the EFA.
- 38. **Under the less conservative scenario, at completion the economic net present value (ENPV) was \$56.9 million and the economic rate of return (ERR) was 21.9 percent.** Under the more conservative scenario, accounting for all costs, the ENPV was \$51.8 million and the ERR was 20.7 percent. In both scenarios, the ERR is well above a 12 percent opportunity cost. A sensitivity analysis, which shows a decrease in benefits of 10 percent, leaves the less conservative ERR at 20.4 percent and the conservative ERR at 19.1 percent, showing that the results are robust to benefit reductions. The switching value is 42 percent for the less conservative scenario and 38 percent for the conservative scenario. The ERR is comparable to efficiency estimates of other irrigation projects in Afghanistan. For example, the ex-ante ERR for irrigation under the National Solidarity Program III (NSP III) was 22 percent.⁹

Figure 2. Trajectory of Disbursements and Outputs



Source: ICR author’s calculations using project expenditure data and reassembled RF (from Aide Memoires/ISRs)

⁸ The EFA was conducted after closing, but before all expenditures were registered. The final project expenditures will be only slightly larger, and it is not expected to impact the EFA, its results, and the evaluation on efficiency.

⁹ The NSP III ICR reports a 61 percent ERR for irrigation (ICR3688). However, the ICR Review (ICRR) for NSP III indicates that the ICR does not provide sufficient information for the 61 percent ex-post ERR, and that such a return is out of step with other ERR estimates for irrigation in both stable and unstable environments.



39. **The ERR at completion was significant, but lower than the 28 percent ERR at AF (in 2015). While costs were assumed to be higher at AF due to worsening implementation challenges in this FCV context, OFWMP exceeded cost-effectiveness expectations.** The AF and completion CBAs follow similar methodologies, converting financial into economic values and assuming a 20-year period of cash flows.¹⁰ The increase in time and finance was disproportionately higher than the increase in scale granted at AF. Financing increased by 70 percent (from \$41m to \$70m) while scale increased by only 22 percent (from 52,500 ha to 64,000 ha). This indicates that turning OFWMP around while insecurity was worsening was a costly endeavor. Nevertheless, the project then exceeded scale targets. Despite FCV challenges to rural access and weak field capacity, the annual average cost per ha (the sum of costs for Components A and C) decreased from \$919 between 2013-2015 to \$553 between 2017-2019. This can be attributed to proactive efforts to improve efficiency, such as combining multiple schemes into one contract.
40. **Despite investment delays in Component A and investment gaps in Components B and D, the significant benefits realized, outputs achieved, and moderate administrative costs translate to a substantially efficient project.** Target spending on *Component A* was met, but much of this spending occurred towards closing (Figure 2, Panel a). As a result, there were delays in meeting targeted irrigated area (Figure 2, Panel b). These delays are, however, not atypical in the context of Afghanistan's difficult operating environment. In contrast to Component A, the project fell below the estimated spending on *Components B and D* (Figure 2, Panel a). However, these components were much smaller shares of the investment, and hence would have a smaller impact on overall return. For example, for Component D, while OFWMP barely met the target on number of farmers participating in demonstrations (Figure 2, Panel b), the target of 4,000 farmers is a small share of the overall target of 120,000 beneficiaries (and an even smaller share of the actual 382,700 beneficiaries). The only component to exceed its spending target is project management (*Component C*), yet this was 23.5 percent of total disbursements and is lower than administrative costs for other projects in this FCV context.¹¹ Moreover, Component C includes staff time cost for surveying and design of schemes, so that 23.5 percent can be considered an upper bound of administrative costs.
41. **The overall efficiency rating is SUBSTANTIAL.** This rating accounts for the significant ERR and relatively low administrative costs despite the implementation and administrative challenges in an FCV context.

D. JUSTIFICATION OF OVERALL OUTCOME RATING

42. **The overall outcome rating for OFWMP is SATISFACTORY.** This accounts for the *high* rating for relevance of the PDO, the *substantial* rating for efficacy, and the *substantial* rating for efficiency.

¹⁰ Although the ex-ante CBA at appraisal (in 2010/11) and at restructuring (in 2013) are not comparable to the AF or completion CBAs, the 2010 and 2013 CBAs are comparable to each other. These earlier CBAs conducted at appraisal and restructuring did not differentiate between financial and economic values, used a shorter 10-year period of cash flows, and had less available data from completed schemes to build assumptions. The internal rate of return (IRR) declined from 34 percent in 2011 to 18 percent in 2013.

¹¹ See, for example, the ICR for Afghanistan Rural Enterprise Development Program (AREDP) (ICR4556), which cites and discusses high operational costs both for AREDP and for NHLP.



E. OTHER OUTCOMES AND IMPACTS

Gender

43. **The Project proactively included the hiring of women in its staff and successfully used a complementary cadre of village women organizers (VWOs). Anti-harassment training was conducted in each region for all staff.** The project included 23 female staff (out of total 190 staff), including five female dedicated gender officers. In addition, the project leveraged a cadre of 352 VWOs, women who came directly from the communities and were paid a stipend to support gender officers in mobilization of women. VWOs were deemed a cost-effective and sustainable means of engaging women in communities. Anti-harassment training was conducted in each region and for all staff, with the goal of mitigating and responding to Gender Based Violence (GBV).
44. **While the Project did not track gender-disaggregated outputs and outcomes, significant effort was made to close gender gaps by enhancing the voice of female beneficiaries, investing in women-centered assets, and improving farming technologies and practices for women.** While the Project was not gender-tagged at appraisal, it was gender-tagged by AF in 2015. At that point, only a gender-disaggregated target of beneficiaries was added to the RF, without a gender-disaggregation of other outputs or outcomes. Various activities, however, allude to potential improvements in women's outcomes. This is commendable given significant social and cultural barriers that prevent women from participating in outdoor activities. The Project included consultations with female community members during design and implementation, as well as training for women in CDCs and VWOs to access the Grievance Redress Mechanism (GRM). Of the 345 grievances brought forward, 117 were brought forward by women (i.e. on late payment of VWOs and selection of water access points). Each sub-project included two separate Grievance Redress Committees (GRCs), one for men and another for women. Across the 275 completed schemes 36,919 social infrastructure were put in place. These included culverts, water access points, and wash places, with the intent of improving women's activities. Nine demonstration plots in three provinces were women-owned plots thereby exposing women farmers directly to improved farming technologies and practices.

Institutional Strengthening

45. **While some progress has been made on the strengthening of institutions, the aim to strengthen capacity at various levels and with various tools has not been fully realized.** Components B and C were aptly aligned to the Bank's consecutive strategies on institutional capacity building (See Section IIA). First, the training for staff in the project, ID, and MAIL strengthened MAIL's capacity on OFWM activities. However, capacity retention on OFWM activities will have to rely on follow-on projects, because project staff were not integrated into ID or MAIL (See RF in Annex 1). Second, the joint implementation of this project by ID and DGAED was designed to enhance intra-ministry (inter-directorate) coordination. This joint implementation exercise was in practice quite superficial, as evidenced by different M&E systems for Component A (managed by PIU/ID) and Component D (managed by DGAED). Third, supporting change in and better articulation of policy in the irrigation sector was designed to enhance inter-ministry coordination across MAIL, MEW, and MRRD. While OFWMP (under MAIL) and IRDP (under MEW) jointly developed five sites, no other schemes of the 275 were developed jointly. Moreover, there had been no tangible coordination with MRRD, except tangentially via OFWMP support to CDCs.

Mobilizing Private Sector Financing

46. **OFWMP engaged private contractors for scheme rehabilitation and farmers for LLL services, and it supported the strengthening of IAs for post-rehabilitation O&M activities.** Works contracts for 275 schemes were awarded to private contractors. This important engagement with the private sector can pave the way for future engagement

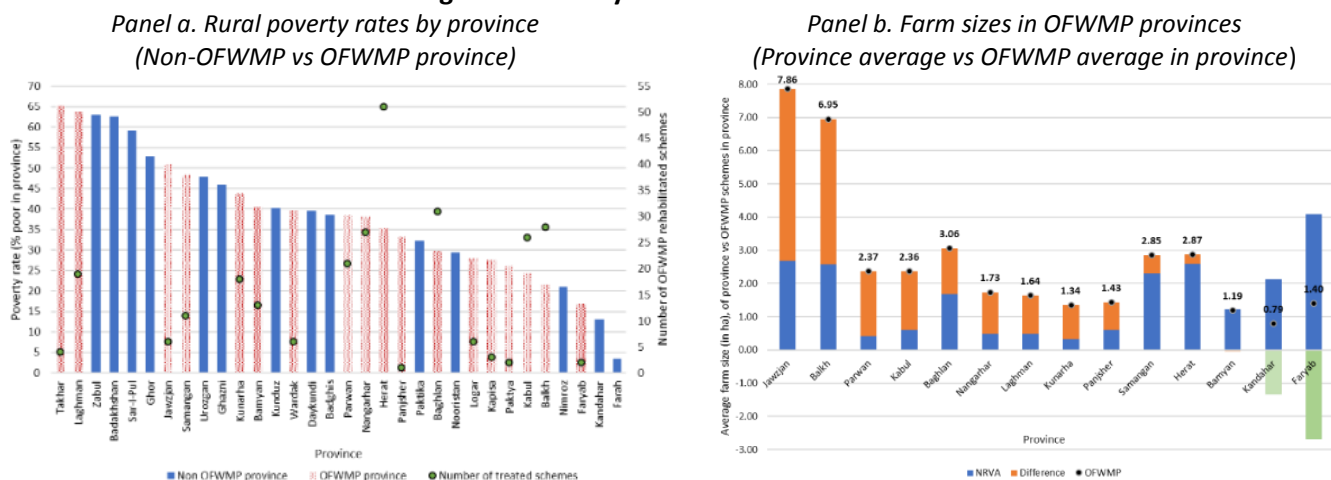


in other aspects, such as scheme surveying and designing, and complementary productive investments (for example, to improve PCPL testing and production). LLL services were outsourced to the private sector. Farmers were provided an initial subsidy and became owners of the LLL equipment, and they rented these LLL equipment and services out to other farmers. IAs were providing their own financing and time for O&M. The Project supported IAs through registration, training, and opening of bank accounts. Across 261 IAs with data on bank accounts, the total balance was 7.7 million Afghanis (or roughly \$100,000), which is a considerable lower bound on IA contribution to O&M activities.

Poverty Reduction and Shared Prosperity

47. **OFWMP focused on rural areas in many of the poorest provinces. Its scheme selection criteria carefully balanced pro-poor targeting with other technical needs.** The Project initially covered 16 of the 32 provinces in the country. Many of these selected provinces had the highest rural poverty rates, such as Takhar and Laghman (See Figure 2, Panel a). By AF, even more provinces were covered, for a total of 24 provinces. Within provinces, the set of criteria for selecting schemes mentioned “Farm size distribution should be such that pro-poor targeting is guaranteed” (See PIP page 13, and Annex E page 57). Similarly, IDS selection included the criterion that farm size should be less than 5 ha (See PIP Annex N page 74). The Project was careful in balancing pro-poor targeting with other necessary criteria needed to secure productivity gains or ensure greater impact. For example, IDS had to have close access to roads, thereby ensuring that demos were more visible to more farmers. This balancing of pro-poor targeting with other important technical criteria leads to farms which are larger than the province-average farm (See Figure 2, Panel b). Nevertheless, poverty rates are substantial in rural areas even for those with larger farms. In 2011/12, the poverty rate was 33 percent for those with 0.01-0.5 ha of land, 31 percent for those with 1-3 ha of land, and still 23 percent for those with >5 ha of land. Thus, any effort to target farmers in these rural areas was undoubtedly pro-poor.

Figure 3. Poverty and farm size in OFWMP



Source: ICR author's calculations using NRVA 2011/12 and OFWMP Baseline Survey data 2013

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

48. **Key risks were astutely identified at design, including absence of experience on OFWM activities which were new to the country, low overall capacity of ID/MAIL, and high capacity needs for coordination.** (See Table 4).
49. **However, the scale objective and timeline at appraisal did not adequately reflect the key risks.** The PDO was clear and the Project design intended to achieve this PDO was straightforward and logical. But the scale objective was overly ambitious given the pilot nature of OFWMP, in the sense that OFWM in the country was a new area of intervention both for the Bank and MAIL. Two other challenges compounded this pilot nature: the low capacity of ID which was a new directorate and the higher capacity needs of OFWMP given the importance of coordination with the rehabilitation of primary/secondary canals. *The initial scale objective (52,500 ha) within the initial three-year timeline was thus not viable.* Other minor shortfalls at design stage were discussed in Section IB, including that the PAMC was too restrictive on the technology to be used for rehabilitation (Component A), while too vague in its plan for staff training (Component B).

Table 4. Summary of Select Risks and Risk Ratings

Risk identified	Risk mitigation	Risk area	Rating [Residual Rating]
<i>Under III. Operation-specific risks:</i> Lack of Bank and Client experience in tertiary canal work	Capacity building, leverage external expertise (ICST and WMTI), and developing robust IAs	Technical/design (quality of works)	Substantial [Moderate]
		Delivery quality	High [Substantial]
<i>Under II. Institutional risks:</i> ID's weak capacity (and lack of experience implementing Bank operations) and poor management capacity in MAIL	Capacity building for MAIL and for ID staff	Implementation capacity	High [Substantial]
		Governance	High [Substantial]
<i>Under III. Operation-specific risks:</i> Need for coordinated irrigation and agriculture investments. Ambiguous 2009 Water Law in delineating MAIL and MEW responsibilities.	Coordination with other programs, donors, and WB projects; appropriate site selection; and seeking clarification of Water Law	Implementation sustainability	Substantial [Substantial]

Source: ICR author's summary from PAMC, 2011.

50. **The RF and monitoring plan established at the design stage were adequate.** The initial RF was mostly simple and clear, and included key output measures at the component level and appropriate outcomes measures at the PDO level, with baseline and target values included, where possible. The Project Implementation Plan (PIP) detailed the M&E activities and deliverables, including: i) development, hosting, and management of a Project MIS which included financial disbursements and physical progress, ii) status reports every six months, iii) surveys and evaluations at baseline, midterm, and endline, iv) thematic studies to inform midterm review, and v) the development of a broader



irrigation database. The PIP assigned clear responsibilities for the PIU, the five area teams, and an external M&E agency, and it included indicative timelines for achievement of activities.

51. **The stakeholder and beneficiary selection criteria established at the design stage were adequate.** Choosing to directly work with and to strengthen IAs was well aligned with the context at appraisal (See Section IA). The PIP listed appropriate selection criteria for choosing which schemes to rehabilitate and for choosing which plots as IDs. The criteria balanced social and technical requirements in selecting schemes (See Section IIE, Poverty Reduction). Targeting women was not explicit at design, but it was made explicit by AF in 2015 (See Section IIE, Gender).

B. KEY FACTORS DURING IMPLEMENTATION

Factors subject to the control of the government and PIU

52. **Changes in staffing structure and changes in project leadership coincided with changes in implementation quality. In addition, relatively high turnover in leadership, and poor incentives and job insecurity resulted in high staff turnover.** The ebbs and flows of implementation success in the initial period were closely linked to Project leadership. An appropriate replacement of the PD was made early on (the first PD served from 2010-2012), but effective PDs are typically promoted thereby increasing PD turnover. The second PD served from 2013-2015, the third PD from 2015-2018, and the fourth (acting) PD from 2018 to closing. OFWMP spanned three different MAIL ministers reflecting some degree of instability. As discussed in Section IB, the MTR in 2013 highlighted poor HR organization with lack of clarity of roles and misalignment of incentives. While efforts were made to improve HR, high staff turnover persisted. Particularly towards closing, the integration of OFWMP staff into ID/MAIL was not achieved (See Annex 1).
53. **The intra-ministry and inter-ministry coordination required for a cohesive irrigation sector continued to be a challenge.** As discussed in Section IIE, the coordination of activities within MAIL (across OFWMP, ID, and DGAED) was unclear. It was difficult to gauge the strategic planning (i.e. coordinated timing and geographic targeting) across activities under OFWMP, ID, and DGAED. The coordination of activities across ministries was equally deficient. The criterion for choosing sites which had been rehabilitated by EIRP was discontinued and the direct coordination with MEW did not go beyond five pilot sites. As further discussed below, the progress is unclear on policy development and reform to encourage coordination via FAO-TA.
54. **A robust Project MIS can be credited for the persistent progress made to reach and exceed targets for key project outputs.** Despite a slow start in the first two years of the Project, a robust MIS was initiated to monitor disbursement and physical progress for works. The first version of the MIS was launched in 2012/2013, the second version in 2014, and the third version in 2017. Each version improved on the other, and the current version houses 12 MIS subsystems (including contracts, HR, assets, M&E, etc.) As part of OFWMP TA to the ID, an OFWM GIS unit had also identified 24,000 schemes in five river basins. This MIS tracked output achievements. Despite a disconnect between the monitoring of Component A which fell under ID and the monitoring of Component D which fell under DGAED, the disconnected monitoring systems tracked the component-wise output progress well.
55. **While the tracking of outputs was commendable, the tracking and evaluation of outcomes was poor.** The initial plan was to have surveys at baseline by June 2011, at midterm by 2012, and at endline by 2013. However, the external M&E agency came only onboard in 2013 and the baseline survey was only completed in May 2013. The midterm survey was never conducted, and endline surveys were conducted only in 2018 and 2019. This meant that OFWMP had no information on achievement of outcomes until 2018 and 2019. The endline surveys were conducted with support from FAO-TA instead of an external M&E agency.



56. On top of the delays in collection of outcomes data, other M&E shortfalls during implementation and subject to government control include the following:

- The Project did not systematically track data on yields of other non-wheat crops, despite its inclusion as a PDO indicator at design and in the grant agreement (See Section IB and IIB).
- The Project had an untimely and incorrect attempt at collecting data for the PDO indicator on income and crop conversion. As such, the data collected for this indicator lacks validity (See Section IIB).
- The Project did not initially collect data at follow-up for the control group. This was only rectified after the ICR mission (in December 2019) identified that a viable control group could be surveyed, hence permitting the DD reanalysis conducted for this ICR (See Section IIB).¹²

57. Key consultancies (ICST, M&E agency, and IPs) identified in the design to mitigate risks were onboarded but with significant delays, then discontinued at AF.

- To fill the gap in technical capacity, an *Implementation Consultant Support Team (ICST)* was to supply international technical staff. However, by late 2011 (after a full year of implementation) the ICST was still not onboarded, and there were other difficulties in recruiting international procurement and FM specialists. The Bank engaged two international irrigation experts to backstop the missing ICST. National Engineering Services Pakistan (NESPAK) joined as the ICST in its first mission in April 2012. But by January 2013, the MTR went into great detail about the inadequacy of NESPAK. It is hard to gauge, however, what the counterfactual scenario would have been without NESPAK, since the available options for an Afghanistan-based ICST were limited.
- The external M&E agency, *Inclusive Consultancy Services (ICS)*, was not onboarded until 2013 due to failed negotiations in 2012. ICS conducted the baseline survey from March to April 2013, but thereafter neither ICS nor any other external M&E firm was engaged in OFWMP M&E activities.
- Four NGO *implementing partners (IPs)* (Care Afghanistan, UN Habitat, BRAC, and CHA) were engaged in 2011 and 2012. Among other forms of support, the IPs supported the establishment of the initial 175 IAs. However, OFWMP discontinued IPs and instead increased the number of social mobilizers per region (from two to three). The IPs cost \$6,000 per IA established and were deemed expensive by the PIU.

58. As OFWMP discontinued key consultancies, FAO then became a key TA facility for OFWMP after AF. The FAO-TA worked closely with the MAIL Deputy Minister for Irrigation and Natural Resources. It started in February 2017, a delayed start (See Section IB). The contract was extended twice and closed in December 31, 2019 with a total spending of US\$ 550,000. The FAO-TA in OFWMP was preceded by a different FAO-TA facility in IRDP. In IRDP, FAO-TA was a large share of the budget and was a de-facto PMU. In contrast, in OFWMP the FAO-TA was a smaller share of the budget and was intended to provide just-in-time support to an existing and well-functioning market-hired PIU. Part of the rationale for establishing the FAO-TA facility was its comparative advantage to onboard international consultants for short-term tasks in this FCV setting. As such, outputs 1 and 2 under the FAO-TA included technical support to Components A and B, somewhat replacing the role of NESPAK and of WMTI.

59. The FAO-TA was envisioned to progress the policy agenda added to OFWMP at AF, but its effectiveness and achievement on this front remain unclear. FAO-TA output 3 was to support policy development and reform, supporting the development of: National Irrigation Policy 2018, Irrigation Sector Reform Framework, National e-

¹² A control group was surveyed by the M&E agency in 2013 and remained untreated throughout the project, thereby providing an uncontaminated control group.



Agriculture Strategy, Assessment of Cooperation between Agriculture Schools and Extension (CASE), draft of National Agri Mechanization Policy, and Irrigation Sector Investment Roadmap (See FAO Terminal Report). Notable among these is the National Irrigation Policy, approved by the President's office in November 2018. However, the discussions with the FAO-TA team during the ICR mission highlighted limitations. First, the policy engagement does not seem to have impacted the implementation of OFWMP. Either the prepared drafts were not adopted or endorsed by the government and so could not be used by OFWMP, or the proposals did not relieve implementation constraints such as the proposed FCC which was part of OFWMP implementation. Second, the proposed reform to the Water Law had not yet been adopted and was still awaiting approval in the lower house by December 2019. Third, ID did not adopt the FAO-TA-proposed reorganization, whereas MEW did. Based on these various examples, it is unclear whether the FAO-TA facility was the right platform for the expected policy engagement. It is unclear what the expected outcomes were on the policy agenda, and whether these were overly ambitious in the scope of OFWMP and given the IPF financing instrument.

Factors subject to the control of the World Bank

60. **The Bank was consistently proactive in allowing for corrective action and for scaling up of successes, despite a high turnover of TTLs.** This was demonstrated by an initial flagging of poor performance and unrealistic targets via an informal "relaxed fit" in 2012 and then a formal restructuring in 2013. The restructuring coincided with improvement in monitoring and management. Project ratings adequately reflected poor performance when needed. The PDO rating was downgraded from S to MS in February 2012, then to MU in August 2012 and in March 2013. The Implementation Progress rating was downgraded from S to MU in February 2012, then to U in August 2012 and in March 2013. Via the AF in 2015, the Bank seized the opportunity to scale successes and leverage a PIU which gained momentum to deliver on core outputs under Component A. TTL turnover was quite high, as the team evolved over four sets of TTLs: from preparation in 2010 to July 2013 (including MTR and restructuring), from July 2013 to September 2014, from September 2014 to December 2017 (including AF), and from December 2017 to closing in December 2019. The TTLs varied in their skill set (agriculture specialists vs irrigation and water specialists with civil engineering backgrounds) and in whether they jointly managed IRDP (and MEW dialogue).
61. **Third Party Monitoring (TPM) by an agency contracted by the Bank became a core tool in ensuring implementation quality of civil works.** A crucial tool in this FCV context, TPM focused on civil works and served as an independent cross-check on construction quality. TPM was conducted by International Relief Development (IRD) from 2013-2014 and by MSI from 2016-2019, with a one-year gap in 2015 during AF preparation (excluding about 6 schemes from TPM activities). TPM was typically conducted by engineers after the initial handover or through the defect-liability period (one year after initial handover). Apart from the schemes excluded from TPM in the gap year 2015, a TPM was conducted for every scheme. For the period up to April 2019, there were 1325 deviations reported, of which 1,262 were rectified, and 63 were considered not rectifiable ex-post (i.e. laborers were not using proper equipment).
62. **There were gaps in M&E oversight and support from the World Bank, particularly in evaluation and the completion of surveys.** Earlier ISRs consistently flagged the delays in completing the baseline survey, which was then completed in 2013. The M&E was rated MS from February 2012 to September 2014. However, after baseline completion, no mention was made thereafter on the need for completion of any interim follow-up survey, despite the inclusion in the initial design of a midterm and endline survey to be completed prior to initial closing in 2013. The M&E rating was upgraded from MS to S in February 2015, and the rating remained S until closing. An interim follow-up survey was conducted in 2018 and an endline survey in 2019, but even for these there were technical gaps in data collection and analysis (See Section IIB and Annex 6). Particularly given the absence of an external M&E agency, more proactive Bank engagement in technical aspects of M&E could have supplemented FAO-TA.



63. **The Bank reported on implementation issues in ISRs and Aide Memoires with clarity and candor, but the updating of and the reporting on the RF was poor.** The Bank completed 18 ISRs and 13 Aide Memoires. While the ISRs and Aide Memoires were clear and candid, the Bank lacked diligence in updating the RF in the ISRs, thereby necessitating a data reassembly of the RF for this ICR. There were discrepancies between what was reported in the ISR and its corresponding Aide Memoires, for example in September 2014, February 2015, October 2016, January 2018, July 2019. There were discrepancies on the indicators and the reported baseline, target, and actual values (See Section IB and IIB).

Factors outside the control of the government and PIU

64. **Worsening conflict and insecurity significantly constrained OFWMP as manifested in and permeated through the considerable implementation challenges discussed above.** The last mission which may have included field visits seems to have been in September 2013. By July 2014, field visits were being cancelled due to security concerns, and the situation only worsened. The TPM became the primary vehicle for non-PIU supervision, and this focused primarily on civil works. By April 2016, a new risk was added to the ISRs relating to the security situation in the eastern part of the country. This was rated substantial from when it was included up to closing. Instability and low fiscal capacity relate to the observed high staff and leadership turnover in the public sector and to the lack of intra- and inter-ministry coordination. Lack of access to rural areas relates to the various delays in project implementation.

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

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

M&E Design

65. **The M&E design at appraisal was adequate, with only some minor gaps.** The theory of change was sound and reflected in the RF. The RF indicators encompassed the two outcomes in the PDO statement and the intermediate results. The intermediate results reflected how activities were designed to achieve outcomes. Indicators were specific, measurable, achievable, relevant, and time-bound. Baseline values were included for all indicators, but the source for baseline values was sometimes unclear, such as for land and water productivity. Although the design indicated measuring productivity for different crops, the PAMC only reported on wheat. This gap in reporting persisted through closing. The PIP did not detail sampling, data collection, or analysis methods, but it specified involvement of an external M&E agency in collecting baseline, midterm, and endline data (See Section IIIA).

M&E Implementation

66. **While the RF was streamlined in AF 2015, this redesign left the RF vague.** The following PDO indicator was later included "Improved agriculture productivity due to the conversion to the higher value crop due to improved irrigation services". It was unclear what the unit of measure was, or how this was going to be measured. In addition, the target set for the PDO indicators became vague. The AF indicated baseline values and targeted percentage increases which were different from those indicated at appraisal. Finally, there were gaps in the IRIs, such as the lack of indicators to measure adoption of new technologies (See Section IB.)
67. **OFWMP succeeded in the monitoring of output data, but the measurement, reporting, and evaluation of outcomes were poor.** As discussed in Section IIIB, a robust MIS was in place to track outputs and gauge implementation progress, with only some minor concerns, such as having separate MIS for Components A and D. However, the measurement, reporting, and evaluation of outcomes were poor. The baseline survey data were collected by an external M&E agency, as planned. However, follow-up data on outcomes were not periodically



collected, and there were reporting gaps in the ISRs. Follow-up data were collected in-house where capacity was weak, thereby putting into question the soundness of the data collection and analysis methodologies, as well as its independence. The reanalysis conducted for this ICR details the difficulties in using the data and the analysis gaps in the original impact evaluation (See Annex 6).

M&E Utilization

68. **The poor measurement, reporting, and evaluation of outcomes meant that such information could not be used to aid management and decision-making.** Output information crucially informed management and decision-making. The tracking on output information led to the downscaling in 2013 (Restructuring) and then the upscaling in 2015 (AF). Data on outcomes did not inform these decisions. Particularly in AF 2015, it was still unknown whether some achievements had been realized on the key PDO indicators (land and water productivity). This lack of understanding on achievements on outcomes meant that OFWMP could not make evidence-based decisions on whether and by how much to change outcome targets.

Justification of Overall Rating of Quality of M&E

69. **The Quality of M&E is rated MODEST.** This rating considers the moderate shortcomings in M&E design, and the significant shortcomings in M&E implementation and utilization, with a lack of focus on outcomes.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

70. **OFWMP was Environmental Assessment Category B. Four E&S safeguard policies were triggered, and appropriate mitigation measures put in place. An ESMF was prepared and disclosed, and training on safeguards was widespread and adequate.** The following policies were triggered: Environmental Assessment (OP/BP 4.01), Pest Management (OP/BP 4.09), Involuntary Resettlement (OP/BP 4.12), and Project on International Waterways (OP/BP 7.50).¹³ An ESMF was disclosed in November 2010, and a revised ESMF at AF was disclosed in September 2015.¹⁴ Public disclosure and stakeholder consultation on E&S safeguards were adequate, and trainings were widespread and in-depth at the community and management levels. OFWMP had a national safeguards focal point and five regional safeguards officers, and allocated one percent of the total project budget to E&S management.
71. **E&S safeguards were satisfactorily complied with. ESMPs were completed and largely adhered to and a GRM system was established and accessible.** By closing, the overall safeguards rating and the ratings for the first three triggered policies were satisfactory. ESMPs for all subprojects were completed. OFWMP conducted regular monitoring to ensure that contractors followed the approved ESMPs and complied with E&S requirements. Audit reports were finalized for all subprojects, employees Code of Conduct were included in all subprojects contract documents, and contractors were provided with training on labor issues. However, there were some gaps to Occupational Health and Safety (OHS) management. The project did not provide adequate reports on OHS management, and there was some evidence where work sites and labor camps did not provide clean drinking water, first aid material and education, safe and hygienic conditions, and sanitation. Moreover, laborers were not using adequate safety gear such as safety helmets, safety boots, and safety gloves. A comprehensive and effective

¹³ With exception to notify other riparian states as the rehabilitation works would not alter the design parameters of the original schemes (Para 7c of OP 7.50)

¹⁴ As part of *environmental safeguards*, the Project would plant double the number of trees if needed to mitigate deforestation, ensure safe disposal and recycling of earth, and follow the pest management plan with IPM. As part of the *social safeguards*, the Project was designed to work with IAs and the existing *Mirab* structure, to follow consultation and documentation processes for the exceptional cases of minor voluntary land donation (with insignificant impact on livelihoods), and to respect the other uses of the schemes by including culverts in the design (for laundry, water collection, or ablution) (See Section IIE).



GRM system was established. According to the annual 2018 TPM, GRM documents were available at all the sites. A total of 345 grievances had been registered and resolved, including on project design, late payment of wages, and grievances from women beneficiaries.

72. **Financial management gaps on asset management and liquidated damages (LDs) have since been resolved.** Cumulative expenditures totaled US\$ 66.5 or 95 percent of the grant (minus the cancelled amount). OFWMP received unqualified audit reports for FY11 to FY18, with that for FY19 expected in mid-2020. The observations of the external and internal audit reports have been addressed by OFWMP and the evidence of resolution has been shared with the Bank. The quarterly Interim Unaudited Financial Reports have been received on time. Two fiduciary issues are to be flagged. First, asset management remained a constant observation. The recording and verification of assets was outdated and irregular, and some assets were used for irrelevant purposes. Recently, however, the MIS module for asset management was completed and fixed, and asset verification reports have been shared with the Bank. Second, OFWMP deducted a cumulative amount of US\$ 122,143.73 as LDs from the contractor from project inception until January 2018 and deposited this amount in MAIL Revenue Account. This practice was stopped from January 2018, and LDs were then since deducted from the total amount payable to the contractor.
73. **Some procurement gaps, including procurement staff termination and an outdated procurement plan, remain outstanding issues.** Two procurement specialists were terminated without any reason and the Bank is still yet to receive the report from MAIL. Moreover, the procurement plan is outdated and many of the dates are inserted without any service standard. For procurement of works, all of the packages for schemes have been awarded. For procurement of goods, all procurement has also been completed with no outstanding issues. The complaint registration book has been prepared, and any complaints were forwarded to MAIL by the Bank.

C. BANK PERFORMANCE

Quality at Entry

74. **The Bank had moderate shortcomings at entry, most notably the contradiction between the pilot nature of OFWMP and its initial scale.** The PDO was well aligned with the Bank's strategy for Afghanistan, as well as with the country priorities and development challenges (See Section IB and IIA). The Project design was simple and logical, and the M&E arrangements at design were also adequate. There were limitations to Project Design, in some parts too rigid (Component A- technology) and in some parts too vague (Component B- training), but these were easily rectified by restructuring after MTR. The risk assessment adequately foresaw the key risks and outlined mitigation mechanisms, but OFWMP's initial scale contradicted its pilot nature (See Section IIIA).

Quality of Supervision

75. **The Bank had moderate shortcomings during supervision, most notably the lack of oversight to M&E implementation.** The Bank was proactive in supporting necessary and timely adjustments to OFWMP, candid and clear in reporting on project performance, and diligent in monitoring fiduciary and safeguard compliance (See Section IIIB and IVB). Such proactivity and quality of supervision are particularly impressive given the constraints to field visits as the security situation progressively worsened. The turnaround of the project at restructuring is also attributable to better monitoring and management systems, introduced by the Bank team (See Section IB), and awarded a World Bank VP award. There were, however, considerable gaps in Bank M&E oversight, particularly in ensuring timely and quality measurement and evaluation of *outcomes*, indicating a somewhat weaker focus on development impact. The inclusion of the policy engagement under the AF did not necessarily support the PDO, and a set of indicators to track outputs and outcomes on this policy engagement was lacking. While the poor transition arrangements (such as the



lack of integration of OFWMP staff into ID/MAIL) indicate potential concerns to sustainability, this was largely out of the control of the Bank.

Justification of Overall Rating of Bank Performance

76. **Bank Performance is rated MODERATELY SATISFACTORY.** This rating balances the proactivity of the Bank against moderate shortcomings both at entry and during supervision described above.

D. RISK TO DEVELOPMENT OUTCOME

77. **Implementation shortcomings discussed above reflect broader political risk and weak government ownership of OFWM activities. These shortcomings did not affect efficacy or meeting the PDO, rather they point to some risk in sustaining the significant achievements made.** First, the lack of integration of staff into MAIL/ID questions the extent to which the successful model and the momentum on OFWM interventions can be sustained and scaled. Second, the persistent gaps in intra- and inter-ministry coordination mean that longer-lasting impacts on productivity are uncertain because complementary investments in agricultural productivity and sustainability of water availability may be lacking in Project areas. Pushing forward with the policy reforms included in the OFWMP design would be crucial for sustaining development outcomes. These policy reforms align with the CPF FY17-20 pillar on building strong and accountable institutions (See Section IIA) and are fundamental for sustaining outcomes in a context of fragility. It remains to be seen whether the policy engagement under FAO-TA laid some of the groundwork. While not sufficient for policy reform, it may have been a necessary condition.
78. **Notwithstanding, the security situation in the country is worsening, and can lead to the decimation of rehabilitation works and the weakening of IAs.** The key risk to the development outcomes achieved is the same root issue that necessitated the Project (See Section IA). Conflict and insecurity had decimated irrigation infrastructure and weakened local community institutions which are themselves responsible for O&M. OFWMP successfully rehabilitated tertiary canals and established and strengthened IAs, but these successes are at risk as conflict and insecurity continue to escalate. The IAs are at the frontlines for O&M of these canals. Continuous support and monitoring of these IAs is requisite. Furthermore, the worsening climate risks and the recent COVID-19 pandemic pose challenges to sustaining the progress made on productivity, food production, and food security.

V. LESSONS AND RECOMMENDATIONS

79. **OFWMP effectively filled a crucial gap in irrigation systems and achieved and exceeded the objectives it intended to achieve. This can largely be credited to the flexibility to course-correct and a strong project team.** OFWM activities had never been conducted in the country prior to OFWMP, and the prevailing context was one of low capacity and increasing insecurity. In this context, such achievements and the scale realized are quite laudable.
- i. While at design OFWMP had set excessive targets over an unrealistic timeline for a pilot project, the proactivity of the government and Bank teams ensured that OFWMP was *flexible to change targets, correct timelines, and adjust project design*. The long cumulative duration of the Project ensured ample space for the team to build valuable experience around testing and scaling.
 - ii. OFWMP had a *strong market-hired team* which received ample training and appropriate incentives. Despite the high turnover, some staff were retained and remain key to maintaining institutional memory and momentum. Due to the novelty of OFWM activities, the market for staff with the needed skills was thin and



non-existent in the then government staffing. OFWMP relied on a set of new staff and provided training and capacity building. However, the tradeoff with a market-hired team in a stand-alone PIU is that the team has now to rely on a follow-on project if they are not subsumed into the ID/MAIL structure.

80. There are gaps which if left unchecked threaten the sustained success of OFWMP. These include poor monitoring of IAs, low levels of complementary on-farm support and investments, and limitations to the M&E system.

- iii. At the outset OFWMP acknowledged the need to strengthen IAs, as these IAs are crucial to the sustainability of the rehabilitated schemes and to maintaining harmony in communities. However, *the lack of a platform to monitor IA performance* or to monitor of the status of schemes post-rehabilitation precludes an understanding of whether the impacts are being sustained over the longer-term. Solving this opaqueness allows for targeting support to IAs and O&M where needed.
- iv. The scale of scheme rehabilitation largely outweighs the scale of on-farm technical support and investments. *Integrating complementary non-rehabilitation interventions* (which largely fall under Component D) will help ensure that the benefits of scheme rehabilitation are maximized, sustained, and distributed more equitably within communities.
- v. *The M&E system was heavily focused on outputs tracking and it introduced unnecessary complexities.* It was not oriented towards measuring and evaluating outcomes, and it failed to generate and document rigorous evidence. This is a missed opportunity, especially since OFWMP was successful in a challenging context. Others could have learned from this success, if documented well. Moreover, OFWMP faced difficulties in measuring complex variables such as water productivity and income changes from crop conversion.

81. Finally, there are lessons to be learned on the existing and potential capacities of the public and private sectors. There was a persistent lack of *public sector* convergence within and across ministries. Concurrently, there are opportunities for the *private sector* to engage in more technical OFWM activities.

- vi. *Public sector coordination on irrigation and agriculture were bottlenecks.* There were efforts to encourage inter-ministry coordination across MAIL, MEW, and MRRD (via engagement on policy development and reform) or intra-ministry coordination between ID and DGAED (via the inclusion of a stand-alone component under DGAED). These efforts were futile or fleeting. It remains unclear whether the policy engagement facility under the FAO-TA planted the seeds for future policy reform, or instead whether OFWMP was overreaching on this agenda. Moreover, that the Bank team leaders were different for flagship projects in MAIL and MEW was not likely to have improved interaction across projects and ministries.
- vii. While the private sector was well-engaged in the civil works for scheme rehabilitation, there is *an opportunity to further support the development of the private sector* by outsourcing surveying and design activities of OFWM. Doing so may enhance efficiency and sustainability. A robust private sector for other aspects of OFWM activities could help in mitigating the gaps in employment of the project staff, who must now rely on a follow-on project.

82. Mapped to the seven lessons summarized above, this ICR offers seven recommendations:

- Scale the rehabilitation of tertiary canals without delay to capitalize on the momentum and to leverage the unique experience built under OFWMP. Activities to improve agriculture and water productivity become especially pressing as climate change is expected to increase the water that crops demand. For example, winter wheat will



require up to 17 percent more water by 2030.¹⁵ Moreover, the current COVID-19 pandemic and its impacts on food security make the scale-up of scheme rehabilitation even more urgent. Such effort to secure and improve food production and livelihoods in rural areas of the country has important immediate and long-term returns.

- Devise a careful and explicit transition plan to protect the existing OFWM skill set. In the *immediate term*, this requires support to a follow-on project to scale the rehabilitation works. In the *medium term*, this involves integrating at least some of the OFWMP staff into the ID of MAIL, to leverage their training, experience, and expertise. In the *longer term*, given fiscal constraints, this includes supporting the development of private sector led consultancies to house OFWM expertise.
- Establish and maintain a comprehensive monitoring platform for IAs and O&M activities for all rehabilitated schemes. Use this platform to target and prioritize areas where IA and O&M support should be provided.
- Balance canal rehabilitation works with complementary agriculture interventions aimed at improving yields and water efficiency. Achieving a better balance will help maximize, sustain, and enhance the equity of the benefits from canal rehabilitation.
- Build on the rich MIS platform but re-focus the M&E towards outcomes. Integrate the M&E systems for rehabilitation and non-rehabilitation activities. Consider more stringent and independent technical oversight in the form of an external M&E agency and with support from the Bank team. In an FCV context where capacity is low, simpler indicators should be considered. Measuring income and water productivity are more complex than measuring crop yields.
- Employ a *bottom-up* approach to public sector convergence in agro-water investment projects, and consider alternative financing instruments for broader *top-down* policy change.¹⁶ A bottom-up approach in an investment project would include: a) mandating small pilots of convergence for cross-ministry and intra-ministry projects, and documenting the lessons from pilots; b) integrating other MAIL directorates in intra-ministry projects but improving the incentives and monitoring of cross-directorate interaction; and c) ensuring more coordination within the Bank— at the least, by ensuring joint agriculture and water sector leadership in projects. This would encourage an integrated approach to agriculture productivity and water resource management.
- Outsource to the private sector a subset of technical OFWM activities, including the design and survey of schemes. This would capitalize on the already significant effort made in including the private sector via civil works contracts for scheme rehabilitation. Supporting the development of and actively engaging local consultancies for design and survey of schemes will not only generate efficiencies, but also address fiscal constraints to maintaining a team of technical experts housed in the public sector.

¹⁵ *Pilot Climate Change Impact Analysis on Hydrology and Agriculture in the Balkhab Watershed, Northern Afghanistan* (World Bank, 2018). This report also notes that the challenges that climate change poses on water resources also suggests that a broader and more comprehensive landscape approach would be needed to utilize water resources and balance economic, environmental, and social needs. Such an approach would combine irrigation rehabilitation with improving ecosystem services, considering upstream-downstream linkages, and conservation of soil moisture and control erosion.

¹⁶ See *Governance in Irrigation and Drainage: Concept Cases, and Action-Oriented Approaches- a Practitioner's Resource* (World Bank, 2020), for a thorough discussion of governance challenges in irrigation and drainage.



ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

REASSEMBLY OF RESULTS FRAMEWORK

Indicator (unit)	Baseline	2011	2012	2013 **	2014	2015	2016 **	2017	2018	2019	Target (EOP)	Achievement (Based on RF)
PDO Indicators												
1. Land productivity of wheat (ton/ha)	2.5 ('10) 2.0 ('15)	-	2.50	2.28	2.34	2.35	2.85	2.85	3.40	3.40	+20%	Exceeded
2. Water productivity of wheat (kg/m3)	0.63	-	0.63	0.63	0.76	0.71	0.73	1.07	0.94	0.84	+20%	Exceeded
3. Increased irrigated area (ha '000s) ++	0	0	0	6.4	12.9	19	19	42	58	75.7	64	Exceeded
4. Operational IAs established and strengthened (number)	0	-	65	171	171	175	311	311	614	631	325	Exceeded
5. Beneficiaries (number '000s), gender disaggregated)	0	-	-	-	-	60 (30)	120 (54)	210 (-)	387.8 (189.4)	382.7 (187.5)	120 (60)	Exceeded
6. Improved agricultural productivity due to the higher value crop due to improved irrigation services (percentage)	0	-	-	-	-	-	-	-	-	+31.7	+15%	Exceeded
7. IAs expressing satisfaction with the project activities (percentage)	0	-	-	-	-	70	70	70	96	97	85	Exceeded



Indicator (unit)	Baseline	2011	2012	2013 **	2014	2015	2016 **	2017	2018	2019	Target (EOP)	Achievement (Based on RF)
Component A												
Length of watercourse rehabilitated (km)	0	0	0	193	342	342	420	440	519	743	138	Exceeded
Conveyance efficiency (percentage, liters/second at tail divided by liters/second at head)	40	-	-	-	60	60	60	60	83	80	65	Exceeded
Decrease in conveyance duration (percentage)	0	0	0	0	60	60	60	60	68	64	65	Effectively Met
Decrease in time to divert water to farmer's field (percentage)	0	0	0	0	70	70	70	70	70	65	65	Met
Portion of the rehabilitated scheme rated satisfactory by the beneficiaries (percentage)	0	-	0	48	60	60	60	60	96	97	80	Exceeded
Annual on-farm job created (labor days, '000s)	0	-	-	-	-	200	200	200	1,018.8	1,937	592	Exceeded
Component B												
MAIL staff trained for water management and irrigated agriculture ++	0	25	39	75	75	35	35	35	350	350	50	Exceeded
Preparation of draft Law on Irrigation and Drainage (text)	Not drafted	-	-	-	-	-	-	-	Drafted & under discussion	Drafted & approved	Prepared	Met



Indicator (unit)	Baseline	2011	2012	2013 **	2014	2015	2016 **	2017	2018	2019	Target (EOP)	Achievement (Based on RF)
Recruitment of CBR based staff in the ID (number)	0	0	0	0	0	0	0	0	0	4	46	Unmet
Component D												
Irrigation demonstration sites (number / ha) ++	0	0	1	19	25	25	45	45++	562	408	25 no. 120 ha.	Exceeded
Farmers participating in demonstrations (number '000s)	0	0	0.5	1.83	2.11	2.00	2.27	2.27	3.12	3.94	4.00	Effectively Met
Farmers' information center built and operational (number)	0	-	-	-	-	0	0	0	5	6	5	Exceeded

A. RESULTS INDICATORS

A.1 PDO Indicators

Objective/Outcome: Improve agricultural productivity

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Land productivity	Number	2.29	2.88	2.40	3.40



		16-Mar-2011	30-Jun-2014	31-Dec-2019	20-Nov-2019
Comments (achievements against targets):					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Water productivity	Number	0.63	0.72	0.76	0.84
		16-Mar-2011	30-Jun-2014	31-Dec-2019	31-Dec-2019
Comments (achievements against targets):					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of beneficiaries	Amount(USD)	0.00	120000.00		382700.00
		01-Jan-2011	31-Dec-2019		20-Nov-2019
Comments (achievements against targets):					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Area with improved irrigation	Hectare(Ha)	0.00	64000.00		75787.00



		16-Mar-2011	31-Dec-2019		31-Dec-2019
Comments (achievements against targets):					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of Operational IAs established and Strengthened	Number	0.00	325.00		631.00
		02-Jan-2011	31-Dec-2019		20-Nov-2019
Comments (achievements against targets):					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved agriculture productivity due to the conversion to the higher value crop due to improved irrigation services	Percentage	0.00	15.00		31.70
		01-Jan-2011	31-Dec-2019		31-Dec-2019
Comments (achievements against targets):					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
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Percentage of IAs expressing satisfaction with the project activities	Percentage	0.00 01-Jan-2011	85.00 31-Dec-2019		97.00 31-Dec-2019
Comments (achievements against targets):					

A.2 Intermediate Results Indicators

Component: On Farm Water Management

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Proportion of rehabilitated schemes obtaining at least satisfactory rating from irrigation water users	Percentage	0.00 16-Mar-2011	70.00 30-Jun-2014	80.00 31-Dec-2019	97.00 31-Dec-2019
Comments (achievements against targets):					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Conveyance efficiency %	Percentage	40.00 16-Mar-2011	60.00 30-Jun-2014	65.00 31-Dec-2019	80.00 31-Dec-2019

**Comments (achievements against targets):**

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Decrease in conveyance duration (%)	Percentage	0.00	40.00	65.00	64.00
		16-Mar-2011	30-Jun-2014	31-Dec-2019	31-Dec-2019

Comments (achievements against targets):

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Decrease in time to divert water to farmer's field	Percentage	0.00	70.00	65.00	65.00
		16-Mar-2011	30-Jun-2014	31-Dec-2019	31-Dec-2019

Comments (achievements against targets):

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Length of watercourse rehabilitated	Kilometers	0.00	180.00	138.00	743.00
		16-Mar-2011	30-Jun-2014	31-Dec-2019	31-Dec-2019

**Comments (achievements against targets):**

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Annual On Farm Job Created	Number	0.00 01-Jan-2011	592000.00 31-Dec-2019		1937000.00 31-Dec-2019

Comments (achievements against targets):**Component:** Institutional strengthening and capacity building of the MAIL

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of persons MAIL staff trained for water management and irrigated agriculture	Number	15.00 11-Mar-2011	50.00 30-Jun-2014		350.00 20-Nov-2019

Comments (achievements against targets):

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Preparation of a draft Law on	Number	0.00	1.00		1.00



Irrigation and Drainage		16-Dec-2015	31-Dec-2019		20-Nov-2019
Comments (achievements against targets):					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Recruitment of CBR based Staff in the ID	Number	0.00	46.00		4.00
		16-Dec-2015	31-Dec-2019		20-Nov-2019
Comments (achievements against targets):					

Component: Support for Productivity Enhancement

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of farmers participating in irrigation demonstrations	Number	0.00	4000.00		3938.00
		16-Mar-2011	30-Jun-2014		20-Nov-2019
Comments (achievements against targets):					

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
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Hectares of irrigation demonstration sites including land leveling and advanced irrigation technology	Hectare(Ha)	0.00	25.00	120.00	408.00
		16-Mar-2011	30-Jun-2014	31-Dec-2019	20-Nov-2019

Comments (achievements against targets):

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of farmers' information center built and operational	Number	0.00 16-Dec-2015	5.00 31-Dec-2019		6.00 20-Nov-2019

Comments (achievements against targets):



B. KEY OUTPUTS BY COMPONENT

Objective/Outcome 1. Improve agricultural productivity	
Outcome Indicators	<ol style="list-style-type: none"> 1. Land productivity of wheat and other crops (tons/ha) 2. Improved agricultural productivity due to higher value crop due to improved irrigation services
Intermediate Results Indicators	<ol style="list-style-type: none"> 1. Length of watercourse rehabilitated (km) 2. Conveyance efficiency (liters/second at tail : liters/second at head) 3. Decrease in conveyance duration (%) 4. Decrease in time to divert water to farmer’s field (%) 5. Irrigation demonstration sites (ha) 6. Farmers participating in demonstrations (number) 7. Farmer’s information center built and operational (number)
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	<ol style="list-style-type: none"> 1. Rehabilitated schemes, tertiary canals lined 2. Functional IAs, IAs received training 3. Farmers with training/demos of on-farm water-saving techniques 4. Staff with knowledge on OFWM to survey and design schemes 5. Sites selected with adequate flow from primary/secondary canals 6. Sites selected with other non-water support to agri-productivity
Objective/Outcome 2. Enhance the efficiency of water used	
Outcome Indicators	<ol style="list-style-type: none"> 1. Water productivity of wheat (kg/m3) 2. Increased irrigated area (ha)
Intermediate Results Indicators	<ol style="list-style-type: none"> 1. Length of watercourse rehabilitated (km) 2. Conveyance efficiency (liters/second at tail : liters/second at head) 3. Decrease in conveyance duration (%) 4. Decrease in time to divert water to farmer’s field (%) 5. Irrigation demonstration sites (ha)



	<ul style="list-style-type: none"> 6. Farmers participating in demonstrations (number) 7. Farmer’s information center built and operational (number)
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	<ul style="list-style-type: none"> 1. Rehabilitated schemes, tertiary canals lined 2. Functional IAs, IAs received training 3. Farmers with training/demos of on-farm water-saving techniques 4. Staff with knowledge on OFWM to survey and design schemes 5. Sites selected with adequate flow from primary/secondary canals 6. Sites selected with other non-water support to agri-productivity
Objective/Outcome 3. Project outreach and scale	
Outcome Indicators	<ul style="list-style-type: none"> 1. Beneficiaries (number, gender disaggregated) 2. Operational IAs established and strengthened (number) 3. IAs expressing satisfaction with project activities (%)
Intermediate Results Indicators	<ul style="list-style-type: none"> 1. Length of watercourse rehabilitated (km) 2. Farmers participating in demonstrations (number) 3. Farmer’s information center built and operational (number)
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	<ul style="list-style-type: none"> 1. Rehabilitated schemes, tertiary canals lined 2. Functional IAs, IAs received training 3. Farmers with training/demos of on-farm water-saving techniques



ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Preparation	
Johannes Georges Pius Jansen	Task Team Leader(s)
Elliot Mghyeni	Task Team Leader(s)
Asta Olesen	Social Specialist
Mohammad Arif Rasuli	Senior Environmental Specialist
Abdul Mohammad Durani	Social Specialist
Supervision/ICR	
Amanullah Alamzai	Task Team Leader(s)
Toru Konishi	Task Team Leader(s)
Bayarsaikhan Tumurdavaa	Task Team Leader(s)
Jun Matsumoto	Task Team Leader(s)
Mir Ahmad	Task Team Leader(s)
Aimal Sherzad	Procurement Specialist(s)
Zakir Hussain Gulzari	Financial Management Specialist
Rahimullah Wardak	Procurement Team
Mohammad Arif Rasuli	Senior Environmental Specialist
Manievel Sene	Team Member
Najla Sabri	Social Development Specialist
Nilofar Amini	Team Member
Qais Agah	Social Development Specialist



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	15.850	72,663.83
FY11	37.202	158,563.44
FY12	0	-6,381.71
Total	53.05	224,845.56
Supervision/ICR		
FY12	41.875	184,113.73
FY13	56.291	172,889.01
FY14	66.932	185,358.55
FY15	53.159	226,797.64
FY16	41.572	151,385.38
FY17	52.645	210,754.61
FY18	48.524	212,401.20
FY19	47.450	154,780.57
FY20	43.446	162,975.39
Total	451.89	1,661,456.08



ANNEX 3. PROJECT COST BY COMPONENT

Components	Amount at Approval (US\$M)	Actual at Project Closing (US\$M)	Percentage of Approval (%)
On Farm Water Management	42.9	43.1	100%
Institutional strengthening and capacity building of the MAIL	8.2	5.4	66%
Project management, coordination and monitoring & evaluation	13.0	15.1	116%
Support for Productivity Enhancement	5.9	2.9	49%
Total	70.00	66.5	95%



ANNEX 4. EFFICIENCY ANALYSIS

Analysis at Appraisal, Restructuring, and Additional Financing

83. In the cost-benefit analysis (CBA) at project appraisal (2010), the calculations of benefits were performed on a per hectare (ha) basis at two levels, the farmer level and the project level. For estimating benefits, only the increase in crop yield for wheat was considered, given wheat was the dominant crop in the country and given data constraints to carrying out a comprehensive and detailed economic and financial analysis (EFA). A revised CBA was conducted at project restructuring (2013) following the same approach at appraisal. The CBA was conducted for a 10-year period of cash flows. The estimated farmer level internal rate of return (IRR) was 67 percent at appraisal and 77 percent at restructuring. The estimated project level IRR was 34 percent at appraisal and 18 percent at restructuring. Since the IRR was above the opportunity cost (12 percent), the project was considered economically viable at both appraisal and restructuring, although much less so by restructuring. Sensitivity analysis also demonstrated the robustness of the IRR. The net present value (NPV) at the farmer level, using a discount rate of 12 percent, was \$529/ha at appraisal and \$637/ha at restructuring. The NPV at the project level was \$357/ha at appraisal and \$160/ha at restructuring. The reduction in the project level IRR and NPV at restructuring is attributed to the sizable scaling down of Component A2 (the target command area) from 52,500 ha to 10,000 ha. A key constraint to the financial analysis at appraisal and restructuring is that there was no distinction made between financial and economic values.
84. By additional financing (AF) in 2015, richer data was available from studies carried out during the then four years of project implementation. The CBA was conducted for a 20-year period of cash flows, and included a transformation of financial prices, costs, and benefit streams into economic values by calculating economic import/export parity prices at the farm gate, applying the appropriate conversion factor for each category of costs, eliminating taxes and transfers, and taking into account incremental costs after the project implementation period (notably, tertiary level irrigation infrastructure maintenance). The EFA for the 2015 AF was based on 57 irrigation schemes¹⁷ which were completed and handed over to Irrigation Associations (IAs) by August 2013. The schemes covered 13,219 ha of irrigated area. The EFA assumed scaling up to 120 irrigation schemes covering 40,000 hectares, as planned during the AF. The economic rate of return (ERR) at project level was 28 percent.¹⁸ The ERR was 36 percent for east (Nangarhar) region, 31 percent for central (Kabul) region; 29 percent for west (Herat) region; and 24 percent for central (Bamyan) region

Analysis at Completion (ex post)

85. The ex post costs and benefits are assessed following the same methodology at AF. The ex post EFA further includes actual data on rehabilitated areas, actual changes in cropping intensities and crop yields, and the actual time period of the project. The corresponding assumptions on future cropped area and yields have also been updated. The ex post EFA builds on the data collected and the analysis in the Impact Evaluation Report 2018, the Impact Evaluation Report January 2020, and the reanalysis (in Annex 6). In addition, some supplementary raw data was included. The surveys collected data on

¹⁷ World Bank Report No: 98698-AF – November 2015

¹⁸ The analysis at appraisal did not disclose the NPV.



the improvement of infrastructure for the existing irrigation schemes, socioeconomic characteristics of farm households, agricultural production technology, and output and input prices in the project areas. The ex post EFA is also conducted in full for each region separately.

Project Costs

- 86. The ex post EFA considers actual project costs, and has been carried out in two ways: (i) a **less conservative approach** which includes only the costs associated with Component A (On-Farm Water Management) and Component C (Project Management and Coordination), and (ii) a **conservative approach** which includes all project costs.
- 87. The project activities began in 2011, but there were substantial delays in rehabilitation activities which then translates into delays in materializing project benefits. The analysis considered actual costs incurred (and actual timing of costs, by component and by region) over the period from 2011 to December 2019. To convert the costs to price levels in December 2019, deflator factors from the forecast of commodity prices was used (World Bank November 2019 issue). Total project costs in financial value was US\$ 65.646 million in nominal terms, total project costs in financial value was US\$ 84.360 million in current terms, and total project costs in economic value was US\$ 77.9 million. Summary of nominal project costs are shown below.

Table A4.1. Summary of Project Completion Costs (US\$ M)

Description	Project Completion Costs (Latest Estimates)
Central Region (Kabul)	6.299
East Region (Nangarhar)	5.307
North Region (Mazar-e-Sharif, Balkh)	6.882
West Region (Herat)	8.417
Central West Region (Baghlan)	4.792
Central ¹⁹	33.949
Total	65.646

Project Benefits

- 88. The PDO set at appraisal remained unchanged through project completion. However, the project underwent a restructuring in 2013 and an AF in 2015, with the latter extending the closing from December 31, 2015 to December 31, 2019. At AF, the design was modified to scale-up the pre-AF pilot activities on improving agricultural productivity with the introduction of a new Component D to be implemented by the Directorate General of Agriculture Extension and Development (DGAED). In addition, a policy reform agenda was included (under Component B). The EFA at AF and at completion exclude any benefits from these additional activities, due to the lack of and difficulty in measuring these benefits. Moreover, the amounts invested in these activities are quite small.
- 89. Benefits are estimated as the incremental difference between the ‘with project’ (WP) and the ‘without project’ (WOP) scenarios over a 20-year²⁰ period, similar to the AF. The WOP scenario considers data before the rehabilitation of the schemes for yields and cropped area. For wheat yields, particularly,

¹⁹ For the purpose of analysis by region, the costs allocated to ‘Central’ is added to Kabul region.

²⁰ With the project period starting year 2011 to 2019, and the cash flow analysis proceeding 10 years further.



the WOP scenario considers control group data before and after the rehabilitation works of the schemes. Conservatively²¹, the WOP scenario assumes that the poor physical status of irrigation schemes will continue without further deterioration, even under the lack of maintenance of the WOP schemes over the analysis period. The WP scenario considers data after the rehabilitation of the schemes for yields and cropped area. For wheat yields, particularly, the WP scenario considers control group data before and after the rehabilitation works of the schemes. A discount rate of 12 percent was used.

90. *Scale and coverage.* OFWMP focuses on rehabilitating tertiary level irrigation water conveyance infrastructure (watercourses) to reduce conveyance losses, facilitate equitable water distribution, and create ease in irrigation operations. The project area covers five regions²², 16 Provinces, and 48 districts. Project interventions were designed to provide farmers with improved, reliable and equitable distribution of irrigation water to increase agricultural productivity and farm income. The PDO is to “*improve agricultural productivity in project areas by enhancing the efficiency of water used.*” OFWMP has completed and formally handed over 275 irrigation schemes to IAs, with a total command area of 75,478 ha against the design objective of 64,000 ha. The completed irrigation schemes are distributed in five regions grouped as central, east, north, west and central-west regions. The 50 sampled schemes covered 15,940 ha of irrigated area in the project area in five regions. The benefits estimated from these sampled schemes were scaled up to the actual total rehabilitated 275 schemes covering 75,478 ha.
91. *Quantified benefits.* The quantified benefits focus on agricultural production gains (and cost reductions) from higher crop yields and from more land under cultivation (and an increase in irrigated area). These benefits are estimated from rehabilitation activities (under Component A) and result from overall improvement in irrigation, including increased conveyance speed, reduction in water losses, improvements in drainage, gains from land leveling, more water availability, reduction in time for irrigation, and more timely irrigation.
92. *Changes in irrigated area.* The increase in irrigated area results from increased conveyance speed and reduction in water losses. The total irrigated area increased from 62,668 ha (before rehabilitation) to the full command area²³ of 75,478 ha (after rehabilitation of the 275 irrigation schemes). In addition, cropping intensity increased from 78.4 percent to 86.5 percent. The summary is illustrated in Table A4.2 below.

²¹ It may be noted that under ‘without project’ situation, no major investment is anticipated for irrigation infrastructure rehabilitation due to competing demands for scarce capital investment. But further deterioration in the already dilapidated watercourses/ water channels is likely, bringing down the scheme performance further, reducing the cropped area and reliability and affecting the crop yields. Hence, the assumption of no change between before project and without project situation is considered as conservative approach.

²² Afghanistan is classified into eight diverse agricultural planning regions as North, Northeast, West, West-central, Central, South, East and Southwest regions. OFWMP regions are grouped based on the five agricultural planning regions for this analysis. These regions are diverse in agricultural resource base and farm production potentials. The 16 provinces are 1) Bamyan, 2) Baghlan, 3) Ghor 4) Herat, 5) Kunar, 6) Laghman, 7) Nangarhar, 8) Kabul, 9) Kapisa, 10) Panjsher, 11) Parwan, 12) Balkh, 13) Faryab, 14) Jawzjan, 15) Samangan and 16) Saripul.

²³ Increases in irrigation area are not necessarily new areas brought under irrigation, but land within the command area which was originally irrigated but subsequently deprived of water due to poor condition of irrigation infrastructure, poor maintenance, and inefficient management practices.



Table A4.2. Irrigated area and cropping intensity

Region	Number of Schemes Rehabilitated	Irrigated Area (Ha)		Cropping Intensity %	
		Before Rehabilitation (WOP)	After Rehabilitation (WP)	Before Rehabilitation (WOP)	After Rehabilitation (WP)
Central Region (Kabul)	65	13,871	16,409	106.5	115.8
East Region (Nangarhar)	64	9,408	10,989	71.6	82.7
North Region (Mazar-e-Sharif, Balkh)	47	15,334	17,115	69.8	77.0
West Region (Herat)	51	18,680	20,782	76.5	80.8
Central West Region (Baghlan)	48	5,375	10,183	67.7	76.5
Overall	275	62,668	75,478	78.4	86.5

Source Project Impact Evaluation Report 2020: Key: WOP = WOP, WP=With Project

93. *Changes in land productivity.* The increase in land productivity for wheat was estimated following a difference-in-differences approach (See Annex 6 for results and a detailed discussion). A summary of the results for the estimated increase in wheat yield by region is in Table A4.3 below.

Table A4.3. Impact of scheme rehabilitation on wheat yields, by region

Region	Year 2013 (tons/ha)	Year 2019 (tons/ha)	% increase in yield (diff-in-diff)
Central Region (Kabul)			
Treat/ Project Intervention Area	1.99	3.16	16%
Control / No Project Intervention	1.80	2.68	
East Region (Nangarhar)			
Treat/ Project Intervention Area	2.87	3.57	32%
Control / No Project Intervention	2.86	2.66	
North Region (Mazar-e-Sharif, Balkh)			
Treat/ Project Intervention Area	1.40	3.20	27%
Control / No Project Intervention	1.08	2.59	
West Region (Herat)			
Treat/ Project Intervention Area	2.35	3.74	58%
Control / No Project Intervention	2.94	2.62	
Central West Region (Baghlan)			
Treat/ Project Intervention Area	2.62	3.51	23%
Control / No Project Intervention	2.19	2.57	
Overall			
Treat/ Project Intervention Area	11.23	17.18	31%
Control / No Project Intervention	10.87	13.12	

94. The increase in yields for other crops was estimated using less stringent impact estimation methodologies and with more indicative data from less rigorous sources. While wheat is present in all regions, other crops are available and hence analyzed in some regions. For example, grapes are only grown in Kabul and Herat. The average increase in yields at the project level for other crops is shown below. Note that for improvements in wheat yields, the before-after estimation has been shown to be a lower estimate than the differences-in-differences estimation used. This suggests that the estimates on yield increases for non-wheat crops might be a lower bound, as well.



Table A4.4. Impact of scheme rehabilitation on yields of other crops

Crop	Yield Increase After Rehabilitation %	Crop	Yield Increase After Rehabilitation %
Wheat	20.1	Onion	10.0
Cotton	10.5	Grapes	8.0
Rice	11.7	Apricot	7.2
Corn	13.8	Vegetables	13.0
Barley	11.3	Orchards	12.2
Tomato	12.8	Almond	11.7
Vegetables	13.0	Orchards	12.2

95. The economic benefits of the project were calculated by estimating average crop and activity budgets for the main crops by region (based on incremental crop yields and cropping intensities). These regional analyses are then aggregated to represent the benefits at the project level.

Results

96. The results are presented by region and overall. Under the less conservative estimate, the economic NPV is \$56.9 million and the ERR is 21.9 percent. Under the conservative estimate the economic NPV is \$51.8 million, the and the ERR is 20.7 percent. The ex post ERR is much lower than the ERR at the AF stage of 28 percent, but it remains above the opportunity cost of 12 percent. The ex post results and AF results are not comparable with the EFA results at either appraisal or restructuring due to substantial differences in methodology.

Table A4.5. Summary results of EFA- base case

Region	At AF (2015)	By Completion (2019)			
		Less Conservative		Conservative	
	ERR (%)	ENPV (US\$ M)	ERR (%)	ENPV (US\$ M)	ERR (%)
Central Region (Kabul)	31	38.6	24.5	34.4	22.2
East Region (Nangarhar)	36	3.4	21.8	3.2	20.5
North Region (Mazar-e-Sharif)	19	1.3	15.5	1.1	14.7
West Region (Herat)	29	10.0	28.9	9.8	28.1
Central West Region (Baghlan)	24	3.6	19.0	3.3	17.7
Overall	28	56.9	21.9	51.8	20.7

Sensitivity Analysis

97. Sensitivity analysis²⁴ was conducted to assess the robustness of the results in relation to key variables subject to a level of uncertainty over time. Since the investment costs has already been through, and there is no incremental value of O&M as explained above. The sensitivity analysis has been carried out as if the benefits are reduced over the period of analysis by 10 percent. The results are

²⁴ Full realization of benefits will be in 5-years after completion of rehabilitation works at the scheme. There are about 65 schemes out of 275 which were completed in year 2019, as such the realization of full benefits at project level will be achieved in year 2024. Thus, the sensitivity analysis has been done for the variation or delay in benefits.



summarized at the Table below. A decrease in benefits of 10 percent result in little changes to the ERR for both the less conservative and conservative scenarios, suggesting a robustness of the results.

Table A4.6. Sensitivity analysis

Region	Less Conservative			Conservative		
	(ERR%)		Switching Values (Benefits Decrease %)	(ERR%)		Switching Values (Benefits Decrease %)
	Decrease in Benefit by 10%	Decrease in Benefit by 20%		Decrease in Benefit by 10%	Decrease in Benefit by 20%	
Central Region (Kabul)	23.0	21.4	53.9	20.7	19.2	46.9
East Region (Nangarhar)	20.2	18.5	42.4	19.0	17.4	38.7
North Region (Mazar-e-Sharif, Balkh)	14.2	12.8	15.2	13.5	12.1	10.6
West Region (Herat)	26.9	24.9	58.0	26.3	24.3	56.9
Central West Region (Baghlan)	17.4	15.7	42.4	16.2	14.5	38.3
Overall	20.4	18.7	42.4	19.1	17.5	38.3



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

Government's comments

On Section IB, Para 19

Since OFWMP was first ever project implemented in the country with new concept of on farm water management (OFWMP) interventions and there was dire need to build the capacity of the project staff in on farm water management practices such as canal lining, pipe and lift irrigation schemes, high efficiency irrigation system (drip & sprinkler), Laser land level (LLL), System of rice intensification (SRI) and System of wheat intensification (SWI) etc. All these new OFWM technologies were acquired by the project staff during these training. Indeed, the capacity building was never done because it was obvious that for implementing such project need capacity building of the staff in mentioned OFWM interventions.

On Section IIIB, Para 54

With respect to intra ministry coordination, OFWMP had better coordination with ID and DGAED which can be obvious from the technical support provided to ID directorate in term of development of different irrigation manuals, provided in-country and abroad trainings, On jobs training on HEIS, LLL, did technical survey and design of irrigation schemes, lift irrigation and gabion structure for protection of Agri-land in different regions. Beside that the project provides constant support to DGAED and had close coordination for implementing the component B (Agriculture productivity enhancement) activities (SRI, LLL, System of wheat intensification) in different regions.

The project had close coordination with EIRP project both at central and regional level for implementation of OFWMP irrigation rehabilitation activities. the criteria of EIRP intake rehabilitated was discontinued because they have mostly worked on the rehabilitation of main canal intake structures while the OFWMP has work to rehabilitated the secondary and tertiary canal network.

Looking into the impact of rehabilitation of the irrigation schemes the project has continued its activities in irrigation schemes where the intakes were rehabilitated by EIRP or any other project at Main, secondary or sub-secondary level.

On Section IIIB, Para 55

Based on the actions those agreed during the supervision mission dated July 2019, the environmental consultant at the WB guided OFWMP to prepare an action plan for OHS, sanitation and hygienic situation for the labors in the project sites the deadline was 31 July/2019. The project prepared the OHS action plan sent to the WB for their approval, and delivered the training to the labors. The first aid facilities, equipment and access to first aiders provided to all workers. In addition, all workers were given clear information about the first aid, drinking water, available at their workplace, including the: location of first aid kits, names and locations of first aiders, and procedures to follow when they need first aid and etc. Moreover, the deviations and findings of the third party about the OHS were rectified as required and were on time.



World Bank team response to Government's comments

The ICR discussion on capacity building gaps is based on the project's Midterm Report.

The ICR discussion on intra and inter-ministry coordination is based on the ISRs and aide memoires, as well as the lack of a unified M&E system across Component A and D.

The ICR discussion on OHS for laborers is based on Third Party Monitoring reports and reviews of the ESMPs and reports.



ANNEX 6. REANALYSIS OF IMPACTS

Background and data

98. This reanalysis of impacts is an evaluation of the efficacy of the project, defined as the extent to which the PDO statement was met, which was “to improve agricultural productivity in project areas by enhancing the efficiency of water used”. This evaluation triangulates different data sources, and further compares the reanalysis with results from other evaluations. The data used here combines project administrative data on scheme rehabilitation and other non-rehabilitation interventions, and raw data from the baseline survey and an endline survey. The search for and initial compilation of these data sources were conducted during the ICR mission in December 2019.
99. The *baseline survey data* were collected between March-April 2013, covering all the then initially selected 175 treatment schemes (or schemes to be rehabilitated) and another 70 control schemes (or schemes which were not to be rehabilitated). Control schemes were selected as those with similar conditions and which were adjacent to a treatment scheme. Six households were surveyed in each scheme, two households each in the head, middle, and tail of the scheme. The total baseline sample consisted of 1,050 treatment scheme households and 420 control scheme households.²⁵
100. The *endline survey data* for treatment schemes were collected between April-July 2019, covering 50 treatment schemes (selected from the then full set of 261 treated schemes). Wheat yields in each of the 50 sampled treatment schemes were collected using nine crop cuts, three cuts each in the head, middle, and tail of the scheme. The total endline treatment sample consisted of 450 crop cuts. In addition to crop cut yield data, treatment households were asked to self-report information on wheat yields prior to scheme rehabilitation (without specifying exactly when prior to rehabilitation). The endline survey data for the control group was collected later in December 2019, covering 45 baseline schemes. However, due to gaps in identifying variables, the ICR team faced some challenges in perfectly matching across different data sources to create a panel of schemes. Of the 50 sampled treatment schemes at endline, 19 were matched to baseline treatment schemes. Of the 45 sampled control schemes at endline, 33 were matched to baseline control schemes.
101. The outcome variables in this evaluation are separated into three groups: *primary, secondary, and tertiary outcome variables*. Outcome variables are grouped first based on the degree of attribution of impact (i.e. whether the impact estimated can be attributed to the project intervention). Attribution is tied to the quality of the impact estimate defined by the evaluation method that can be employed or the counterfactual that can be used given the available data. Secondly, outcome variables are grouped based on whether it is a direct or explicit representation of the PDO statement.
102. The *primary* outcome variable is wheat yield, measured as tons of wheat output per hectare. This appears as a PDO indicator and is directly linked to the PDO statement. Irrigated area (which is a PDO indicator) and time needed to irrigate one jerib (which is not a PDO indicator) are *secondary* outcome variables. Both indicators can be evaluated with some confidence in attribution, and the latter is well linked to the PDO statement despite not being included as a PDO indicator. Water productivity and improved agriculture productivity (due to conversion of higher value crop due to improved irrigation

²⁵ While there should exist 245 baseline schemes in the data (175 treatment schemes plus 70 control schemes), the actual data received included 256 baseline schemes. The reason for this slightly larger sample is unexplained but this is unlikely to impact the validity of the data or analysis.



services) are *tertiary* outcome variables. While both indicators are good representations of the PDO statement and are PDO indicators, the data available precludes a more rigorous assessment of impact and of attribution.

103. The primary project intervention evaluated is the rehabilitation of irrigation schemes (i.e. rehabilitation of tertiary canals of the irrigation schemes), which is Component A. This forms the bulk of project expenditures, at \$42 million by project closing, or 60% of total disbursements (not including project management costs). The additional impact of some interventions under Component B are also estimated, including irrigation demonstration sites (IDS) and farmer field schools (FFS). Due to data constraints, the analysis of the impacts of high efficiency irrigation schemes (HEIS) and laser land leveling (LLL) are excluded from this evaluations.

Impact of scheme rehabilitation on wheat yields

104. This subsection presents and discusses the impact of scheme rehabilitation on wheat yields. Three versions of wheat yields are analyzed: i) the average of yields across the head, middle, and tail of the scheme, ii) the yields at only the tail of the scheme, and iii) the difference in the yields between the tail and head of the scheme. While the first version of wheat yields would represent average impacts across all beneficiaries in a scheme, the latter two versions focuses on impacts for those at the tail of the scheme and on whether the gap between yields for those at the head and tail of the scheme have narrowed as a result of rehabilitation. For each version of the yield variable, mean yields across schemes are presented *for 2013* (which is pre-rehabilitation, and reported at the time of baseline), *for 2019* (which is post-rehabilitation, and reported in endline), and *for a pre-2019* time period (which is a self-reported recall of pre-rehabilitation yields, and reported at the time of endline).

Table A6.5. Impact of scheme rehabilitation on wheat yields

		i) Avg for head, mid, tail (ton/ha)			ii) Tail only (ton/ha)			iii) Diff between head & tail (ton/ha)		
		2013	Pre-2019	2019	2013	Pre-2019	2019	2013	Pre-2019	2019
Treat	mean	2.27	2.88	3.44	2.41	2.57	3.17	-0.13	0.65	0.53
	sd	1.15	0.51	0.49	1.86	0.45	0.52	2.25	0.29	0.23
	obs	130	50	50	118	50	50	109	50	50
Control	mean	2.07	-	2.63	1.91	-	2.48	0.03	-	0.31
	sd	0.99	-	0.10	0.98	-	0.16	0.93	-	0.13
	obs	32	0	45	26	0	44	23	0	43
Treat - Control	mean			0.81***			0.69***			0.22**
	t-stat			10.8			8.6			5.4

105. Table A6.1 presents basic results and A6.3 presents more rigorous estimation results.

- A naïve *pre-post* estimation of impact comparing yields of treatment schemes in 2019 vs treatment schemes in 2013 shows that rehabilitation improved yields by over 1 ton/ha or a 49% increase (relative to the treatment mean in 2013).



- An improved *treatment-control* estimation of impact comparing yields of treatment schemes in 2019 vs yields of control schemes in 2019 shows that rehabilitation improved yields by 0.81 ton/ha or a 31% increase (relative to the control mean in 2019).
- Given the data available, a *difference-in-differences* estimation provides the most rigor. This method calculates the difference in yields for treatment schemes in 2019 and 2013 and then subtracts the difference in yields for control schemes in 2019 and 2013. The results are estimated using a regression framework so that standard errors can be calculated along with the difference-in-differences estimate. The results are presented in Table A6.3 (See Column 3). The difference-in-differences estimate indicates that rehabilitation improved wheat yields by 0.72 ton/ha or a 34% increase (relative to the control mean in 2013). This point estimate is statistically significant at a 99% confidence level.

106. The impact for each region using a simple non-regression (non-panel) *difference-in-differences* is presented in Table A6.2, as follows: a 0.51 ton/ha increase or 23% increase in Baghlan (relative to the control group mean in 2013), a 0.29 ton/ha increase or 27% increase in Balkh, a 1.7 tons/ha increase or 58% increase in Herat, a 0.29 ton/ha increase or 16% increase in Kabul, and a 0.9 ton/ha increase or 32% in Nangarhar.

107. Table A6.3 also presents results on impacts on yields at the tail of the scheme and for the yield gap between head and tail. Following a differences-in-differences approach, the impact on yield specifically at the tail of the scheme is 0.65 ton/ha or a 34% increase (relative to the control mean in 2013) (See Column 7). This shows that large positive yield impacts were realized at the tail of the schemes. Rehabilitation of the schemes had slightly larger impacts at the head of the scheme, so that on average, the gap in yields between the head and the tail widened. The impact on the head vs tail yield gap was 0.13 ton/ha (See Column 11). This is, however, a small increase in the yield gap relative to the total yield gain at the tail of the scheme, indicating that scheme rehabilitation largely reduced water losses through the canal.

108. The impact of treatment duration (a continuous treatment variable) is also estimated by leveraging the variation in the date of completion of rehabilitated schemes. The results are presented in Table A6.3. Each additional month after rehabilitation is completed generates a 0.012 ton/ha increase in yield (See Column 4). This suggests that each additional year after completion of scheme rehabilitation generates a 0.14 ton/ha increase in yields, equivalent to an annual increase in yields of about 7% (relative to the control mean in 2013).

109. *Two other sets of evaluations of the impact of scheme rehabilitation on wheat yields have been conducted.* First, the official project impact evaluation report and project completion report were both completed in early 2020. These reports used only the treatment group endline 2019 data and employed a simple naïve *pre-post* estimation using only the pre-2019 self-reported recall measure of pre-rehabilitation yields. These reports show that yields increased from 2.9 tons/ha pre-rehabilitation to 3.4 tons/ha after rehabilitation, which is an impact of 0.5 ton/ha or an 18% increase in yields (relative to the treatment mean in pre-2019) (See Table A6.1). This low impact estimate, however, does not accurately account for a counterfactual.



Table A6.6. Impact of scheme rehabilitation on wheat yields, by region

		i) Avg for head, mid, tail			ii) Tail only			iii) Diff between head & tail		
		2013	Pre-2019	2019	2013	Pre-2019	2019	2013	Pre-2019	2019
Baghlan										
Treat	mean	2.62	3.22	3.51	2.86	2.85	3.23	-0.32	0.75	0.58
	sd	1.31	0.25	0.28	2.16	0.29	0.27	2.84	0.22	0.15
	obs	32	10	10	31	10	10	28	10	10
Control	mean	2.19	.	2.57	2.11	.	2.39	-0.39	.	0.36
	sd	0.55	.	0.065	0.31	.	0.037	0.41	.	0.063
	obs	7	0	10	5	0	10	4	0	10
Balkh										
Treat	mean	1.4	2.82	3.2	1.37	2.46	2.95	-0.048	0.7	0.5
	sd	0.42	0.31	0.29	0.86	0.31	0.3	1.26	0.091	0.23
	obs	26	10	10	26	10	10	25	10	10
Control	mean	1.08	.	2.59	1.13	.	2.41	-0.34	.	0.36
	sd	0.39	.	0.04	0.61	.	0.05	0.52	.	0.056
	obs	7	0	8	6	0	8	6	0	8
Herat										
Treat	mean	2.35	2.96	3.74	3.24	2.7	3.53	-1.03	0.52	0.4
	sd	1.45	0.88	0.69	3.03	0.73	0.69	3.05	0.33	0.14
	obs	24	10	10	20	10	10	20	10	10
Control	mean	2.94	.	2.62	1.08	.	2.44	1.17	.	0.35
	sd	1.61	.	0.057	1.05	.	0.026	1.42	.	0.075
	obs	4	0	5	4	0	4	3	0	3
Kabul										
Treat	mean	1.99	2.54	3.16	1.95	2.29	2.83	0.089	0.6	0.68
	sd	0.88	0.41	0.57	0.94	0.32	0.54	1.31	0.3	0.25
	obs	22	10	10	16	10	10	13	10	10
Control	mean	1.8	.	2.68	2.07	.	2.55	0.048	.	0.28
	sd	0.78	.	0.049	0.36	.	0.09	1.33	.	0.11
	obs	8	0	14	5	0	14	4	0	14
Nangarhar										
Treat	mean	2.87	2.85	3.57	2.56	2.53	3.34	0.67	0.68	0.49
	sd	0.76	0.24	0.31	0.57	0.26	0.39	1.68	0.4	0.29
	obs	26	10	10	25	10	10	23	10	10
Control	mean	2.86	.	2.66	2.95	.	2.55	0.11	.	0.25
	sd	0.52	.	0.2	0.95	.	0.31	0.67	.	0.23
	obs	6	0	8	6	0	8	6	0	8



Table A6.7. Impact of scheme rehabilitation on wheat yields, panel regression estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent variable	<i>i) Average for head, mid, tail</i>				<i>ii) Tail only</i>				<i>iii) Difference between head & tail</i>			
<i>Treatment</i>	0.806*** (0.08)		0.719*** (0.06)		0.694*** (0.08)		0.649*** (0.08)		0.217*** (0.04)		0.134** (0.06)	
<i>Treatment Duration</i>		0.016*** (0.00)		0.012*** (0.00)		0.014*** (0.00)		0.011*** (0.00)		0.004*** (0.00)		0.003** -0.001
<i>i) Baseline value- Avg</i>			0.084*** (0.03)	0.102*** (0.03)								
<i>ii) Baseline value- Tail</i>							0.048** (0.02)	0.069*** (0.02)				
<i>iii) Baseline value- Diff</i>											0.006 (0.01)	0.002 -0.014
<i>Constant</i>	2.630*** (0.05)	2.775*** (0.06)	2.459*** (0.07)	2.464*** (0.08)	2.480*** (0.06)	2.604*** (0.06)	2.413*** (0.07)	2.412*** (0.07)	0.313*** (0.03)	0.356*** (0.03)	0.275*** (0.04)	0.274*** (0.04)
Observations	95	85	51	45	94	84	43	37	93	83	36	33
R-squared	0.555	0.321	0.774	0.608	0.445	0.262	0.657	0.563	0.246	0.117	0.127	0.136
Mean in Control	2.63	2.63	2.071	2.071	2.48	2.48	1.912	1.912	0.313	0.313	0.033	0.033

Notes: These are panel regression estimates using 2013 baseline data and 2019 endline data for treatment and control schemes. The sample size decreases in the ANCOVA difference-in-differences estimations which include the corresponding baseline outcome variable as a regressor. This is due to data constraints which results in imperfect scheme matching between baseline and endline. The difference-in-differences estimations correspond to columns 3, 4, 7, 8, 11, and 12. Significance level: * at 90 percent significance, ** 95 percent significance, and *** at 99 percent significance.



110. Second, an independent geospatial impact evaluation (GIE) was completed in 2018 by authors from AidData at the College of William and Mary, in partnership with USAID. The GIE combined administrative data from 80 geo-referenced OFWMP schemes and 30-meter square grid satellite images used to calculate the Normalized Difference Vegetation Index (NDVI), a measure of greenness, which correlates with wheat yields. The data used spans January 2006 to December 2016, and a quasi-experimental panel method is used by leveraging the difference in the timing of treatment (where schemes varied in completion between January 2013 and August 2016). The estimation included seasonal, yearly, and cell-level fixed effects. This GIE estimated a 19% increase in greenness, which roughly corresponds to a 0.95 tons/ha increase in yield during harvest season, over their study period. The relative 19% estimate impact on yields in the GIE is smaller than the 34% reanalysis estimate using the updated data. Notably, the GIE estimated the impacts only on older schemes and much before project closing. It also only used greenness as a proxy for yields. While the magnitudes of impact are slightly different between this reanalysis and the GIE, the story is consistent. The GIE also finds that while all treatment cells experienced an increase in greenness, there are slightly greater increases for areas within 750 meters of the canal starting point (or the head of the scheme).

Impact of scheme rehabilitation on irrigated area, time to irrigate land, water productivity, and crop conversion

111. The rehabilitation of schemes has important impacts beyond the increase in wheat yield. The PDO statement describes that the primary channel through which increased yields would be achieved is via an increase in water productivity (or crop per drop). Water productivity is a key outcome in and of itself given the nature of the intervention. This evaluation thus turns to the secondary and tertiary outcomes to build the evidence around the achievement of the PDO statement.

112. Secondary outcomes are those for which we can construct a simple non-regression *difference-in-differences* estimate of impact. There are two secondary outcomes this evaluation turns to: **irrigated area and the time needed to irrigate one jerib of land** (equivalent to five hectares). Results are presented in Table A6.4. Following a difference-in-differences approach, the scheme rehabilitation has led to an increase in irrigated area by 18.7 ha, equivalent to a 14% increase (relative to the control mean at baseline in 2013). The time needed to irrigate one jerib of land has largely decreased by 117 minutes per jerib, equivalent to a 157% decrease in the time needed to irrigate land (relative to the control mean at baseline in 2013). This shows that in rehabilitated schemes water flows much faster to farm land. However, neither an increase in irrigated area nor a decrease in time to irrigate (a fixed amount of land) directly implies that water productivity improved.

Table A6.8. Secondary evaluation outcomes: impact of scheme rehabilitation on irrigated area and time needed to irrigate land

		Irrigated Area			Time to Irrigate Land		
		2013	Pre-2019	2019	2013	Pre-2019	2019
Treat	mean	73.1	182.9	219.4	117.5	115.4	50
	sd	70	124.9	143.9	226.2	53.9	16.9
	obs	131	50	50	123	50	50



Control	mean	132.5	-	260.1	74.9	-	125.3
	sd	259.6	-	425.8	49.1	-	59.5
	obs	33	0	45	30	0	45
Treat - Control	mean			-40.7			-75.3***
	t-stat			0.64			8.6
Diff in Diff	mean			18.7			-117.9

113. Tertiary outcomes are those for which we can only construct a simple naïve *pre-post* estimate of impact for the treatment group. There are two tertiary outcomes we look at, water productivity and income in the area for which the crop was converted. While the tertiary outcome indicators are more directly connected to the PDO statement, the estimation of rehabilitation impacts on these outcome variables are much less attributable. The impact on these two PDO indicators, water productivity and income from crop conversion, are thus harder to gauge, as only some rough form of a pre-post estimation can be conducted.
114. **The PDO indicator water productivity of wheat (kg/m³)** is defined as the annual wheat yield (kg) divided by annual water used (m³).
115. Endline measure. The measure of water productivity for the treatment group at endline in 2019 was 0.84 kg/m³. This measure is, however, an inaccurate measure as it was collected from irrigation demonstration sites (IDS) and not from the plots of beneficiary farmers along the scheme. The IDS water productivity would be an overestimate of the impacts of the project on beneficiaries, because: i) IDS sites were not widespread and only existed in some schemes, ii) where IDS sites exist, farmers in the area do not necessarily adopt the best practices and improved technologies in the IDS either because the learning was not diffused to farmers or the needed investments and technologies were not available to apply in one's own plot.
116. Thus, the water productivity measure at endline of 0.84 kg/m³ needs to be scaled down to better represent water productivity at farmer plots. While water productivity was only measured at IDS, wheat yields were measured at both the IDS and beneficiary farmer plots. This allows for a comparison of wheat yields at endline measured in IDS and farmer plots, and can serve as the foundation to an assumption of how much to downscale the water productivity measure. The average yield in IDS at endline was 3.77 ton/ha whereas the average yield in farmer plots at endline was 3.44 ton/ha. This suggests that IDS yields are higher than farmer plot yields by about 0.33 ton/ha or by about 10%. As such, we assume that water productivity at farmer plots in endline in 2019 was 0.76 kg/m³ (which is 10% lower than the 0.84 kg/m³ measured at IDS).
117. Baseline measure. The RF reports a baseline measure of 0.63 kg/m³. It is, however, unclear what the source of this information is. As such, we reconstruct a baseline measure of water productivity based on the available raw variables from the 2013 baseline survey (measured in farmer plots). Three variables from the baseline survey were used to generate the annual water used variable (in m³): a) the number of irrigations provided to a given wheat field in the past month, b) the average time that each irrigation lasted (in minutes) for a given wheat field, and c) the actual flow of water to the wheat field (in liters per second). Total annual water used is calculated by multiplying these three variables, multiplying by 60, dividing by 1,000 (to get m³), and then multiplying by 12 (to convert from monthly to annual). We then divide wheat output (in kg) with water used (in m³). We estimate that water



productivity measured in farmer plots in 2013 was 0.65 kg/ m³ on average. This is remarkably close to the 0.63 kg/m³ reported as the baseline value in the RF, for which the source is unknown. The recalculated baseline value using the 2013 data is a conservative and reasonable estimate. During the period 2000-2007 prior to baseline, estimated average water productivity for wheat in Afghanistan was as low as 0.40 kg/m³ (Zwart et al., 2010). Over the same period, the range of estimates for wheat productivity from a set of neighbors include: 0.38 kg/m³ for Iran, 0.53 kg/ m³ for Turkmenistan, 0.59 kg/ m³ for Iraq, 0.65 kg/ m³ for Tajikistan, and 0.80 kg/ m³ for Pakistan.

118. Table A6.5 summarizes the calculations. By comparing 0.76 kg/m³ in 2019 with 0.65 kg/m³ in 2013, our *pre-post* estimate of improvement in water productivity is a 17% increase over the period 2013 to 2019. Our estimate is lower than simply comparing the gains from the IDS estimate in 2019 with the farmer plots estimate in 2013.

Table A6.9. Tertiary evaluation outcomes: impact of scheme rehabilitation on water productivity and income from crop conversion

		Water productivity (kg/m ³)			Income in converted crop area (USD)	
		2013 (at farmer plots)	2019 (at IDS)	2019 (downscaled to farmer plots)	Pre-2019	2019
Treat	mean	0.65	0.84	0.76	556.1	2022.1
	sd	0.59	0.28	-	399.3	1942.6
	obs	48	40	-	65	65

119. **The PDO indicator improved agriculture productivity** (due to conversion of higher value crop due to improved irrigation services) is operationally defined as an increase in income due to conversion to higher value crops. The project conducted a separate data collection exercise for which six farmers each were surveyed in 70 treatment schemes to ask whether they had converted some of their land, and for the land which was converted what the income increase was. Of the 420 farmers surveyed in this exercise, 133 farmers had converted some of their land. Of the 133 farmers who converted some land, the average increase in income (only for the area which was converted) was 1,465 USD equivalent to a 2.6-times increase in income (relative to the pre-2019, pre-rehabilitation income). Table A6.5 summarizes the calculations. A key weakness in this estimate is that this is an increase only among those who converted, and only for the area that was converted for those who converted. This is then an overestimation of project impact on both crop conversion and income gains from crop conversion. Moreover, the data is based on self-reported recall of incomes and yields pre-rehabilitation, as opposed to more accurately collected real-time baseline data.

Additional impact of IDS and FFS on wheat yields

120. While the bulk of the project expenditures were on irrigation scheme rehabilitation (Component A), the project also included interventions which aimed to improve agricultural productivity and water productivity. The project included extension-type interventions to introduce better technologies to farmers, such as irrigation demonstration sites (IDS) and farmer field schools (FFS).



121. There were 51 IDS in the project. Of these, 34 were matched to at least one treatment scheme (with two cases where two IDS matched to one scheme, for a total of 32 unique schemes which are matched to at least one IDS). Another 16 IDS were matched neither to a control nor to a treatment scheme and are dropped from the data. Of the 32 matched treatment schemes, 12 overlapped with the sample of 50 treatment schemes at endline. The analysis here thus limits itself to treatment schemes, and compares wheat yields in rehabilitated schemes which had an IDS with wheat yields in rehabilitated schemes which did not have an IDS. This arrives at an estimate of the *additional impact of IDS on yields in rehabilitated schemes*.

122. Results are presented in Table A6.6. Among rehabilitated schemes, an IDS vs non-IDS estimate (i.e. treatment vs control estimate) of impact suggests an additional 0.14 ton/ha increase in yield, equivalent to a 4% increase (relative to the non-IDS mean in endline 2019), however this estimate is not statistically significant. A more reliable (non-regression) difference-in-differences estimate of the impact of IDS on rehabilitated schemes is higher, equivalent to an additional 0.24 ton/ha increase or a 10% increase (relative to the non-IDS mean in baseline 2013).

Table A6.10. Impact of IDS on wheat yields among rehabilitated schemes

		i) Avg for head, mid, tail		ii) Tail only		iii) Diff between head & tail	
		2013	2019	2013	2019	2013	2019
IDS schemes	mean	2.19	3.54	2.3	3.34	-0.26	0.41
	sd	0.91	0.28	1.12	0.34	1.26	0.24
	obs	24	12	23	12	22	12
non-IDS	mean	2.29	3.4	2.43	3.12	-0.098	0.57
	sd	1.2	0.54	2.01	0.55	2.44	0.22
	obs	106	38	95	38	87	38
IDS vs non-IDS	mean		0.14		0.22		-0.16**
	t-stat		0.83		1.25		2.22
Diff in Diffs	mean		0.24		0.35		0.002

123. There were 121 FFS in the project. Of these, 94 were matched to at least one treatment scheme (with 10 cases where two FFS matched to one scheme, and two cases where three FFS matched to one scheme, for a total of 80 unique treatment schemes matched to at least one FFS). Another 26 FFS were matched neither to a control nor to a treatment scheme and are dropped from the data. Of the 80 matched treatment schemes, 32 overlapped with the sample of 50 treatment schemes at endline. Similar to the above, the analysis here limits itself to treatment schemes, and compares wheat yields in rehabilitated schemes which had an FFS with wheat yields in rehabilitated schemes which did not have an FFS. This arrives at an estimate of the additional impact of FFS on yields in rehabilitated schemes.

124. Results are presented in Table A6.7. Among rehabilitated schemes, an FFS vs non-FFS estimate (i.e. treatment vs control estimate) of impact at endline suggests an additional 0.27 ton/ha increase in yield, equivalent to an 8% increase (relative to the non-FFS mean in endline 2019). A more reliable



(non-regression) difference-in-differences estimate of the impact of FFS on rehabilitated schemes is an additional 0.35 ton/ha, equivalent to a 15% increase (relative to the non-FFS mean in 2013).

Table A6.11. Impact of FFS on wheat yields among rehabilitated schemes

		a) Avg for head, mid, tail		b) Tail only		c) Diff between head & tail	
		2013	2019	2013	2019	2013	2019
FFS schemes	mean	2.21	3.53	2.69	3.27	-0.67	0.53
	sd	1.28	0.52	2.7	0.56	2.74	0.24
	obs	27	32	25	32	23	32
non-FFS	mean	2.29	3.26	2.33	3.01	0.015	0.53
	sd	1.12	0.4	1.58	0.39	2.1	0.21
	obs	103	18	93	18	86	18
FFS vs non-FFS	mean		0.27*		0.26*		0.00
	t-stat		1.96		1.71		0.06
Diff in Diffs	mean		0.35		-0.10		0.69

125. Overall, the above analysis of the impacts of IDS and FFS suggests that they have additional impacts on yield, over and above the impact of the scheme rehabilitation. The additional impact of IDS and FFS on yields, is about a 10% and 15% increase, respectively. Moreover, there is suggestive evidence that such interventions, for example IDS, would have even larger impacts at the tail relative to at the head of the scheme. Note, however, that IDS and FFS were less widespread than the scheme rehabilitation activities. As such, the additional impacts of IDS and FFS only apply to a subset of the project beneficiaries.



ANNEX 7. SUPPORTING DOCUMENTS

The following documents are in the project file:

- Proposal to the ARTF Management Committee (January 2011)
- Restructuring Paper, Report No. 77375-AF (April 2013)
- Project Paper on Proposed Additional Financing Report, Report No. 98698-AF (November 29, 2015)
- Grant Agreement (March 16, 2011)
- First Amendment to Grant Agreement (May 8, 2013)
- Second Amendment to Grant Agreement (January 19, 2016)
- Implementation Status and Results Reports (Sequence No. 1-16, 2010-2019)
- *Aide Memoires*
(August 2011, February 2012, August 2012, March 2013/Technical Mission, September 2013, January 2014, September 2014, February 2015, May 2016, December 2016, May 2018, February 2019, July 2019, November 2019)
- *Management Letters*
(August 2011, February 2012, August 2012, September 2013, January 2014, September 2014, February 2015, May 2016, December 2016, May 2018, February 2019, July 2019, November 2019)
- Project Implementation Plan (October 2010)
- Environmental and Social Management Framework (November 2010)
- Procurement Plans

Additional documents, studies, and reports:

Inception Report for the Baseline Survey, OFWMP, ICS/ATR Consulting Joint Venture, March 2013.

Baseline Survey Report, OFWMP, ICS/ATR Consulting Joint Venture, October 2013.

Progress and Way Forward Report for the Project Mid-Term Review, OFWMP, MAIL, January 2013.

Impact Evaluation Report, OFWMP, MAIL, November 2018.

Impact Evaluation Report, OFWMP, MAIL, January 2020.

Project Completion Report for On Farm Water Management Project, 2010-2019, January 2020.

Final Report: Evaluation of the On-Farm Water Management Program. A Geospatial Impact Evaluation of the Effects of OFWMP Canal Improvements on Agricultural Productivity. Ariel BenYishay, Carey Glenn, Seth Goodman, Dan Runfola, and Rachel Trichler. AidData at William & Mary and USAID, 2018.

Rebuilding Irrigation Infrastructure and Institutions: Evidence from Afghanistan. Updated preliminary manuscript of the AidData Geospatial Impact Evaluation. Ariel BenYishay, Carey Glenn, Seth Goodman, and Rachel Trichler, College of William & Mary and Yale University, 2020.



Terminal Report for Technical Assistance for OFWMP, Project Findings and Recommendations. FAO, Rome, 2020. Report FAAF: UTF/AFG/O90/AFG.

Interim Strategy Note for Islamic Republic of Afghanistan for the Period FY09-FY11, World Bank Report No. 47939-AF, May 2009.

Interim Strategy Note for Islamic Republic of Afghanistan for the Period FY12-FY14, World Bank Report No. 66862-AF, March 2012.

Afghanistan Systematic Country Diagnostic, World Bank Report No. 103421, February 2016.

Country Partnership Framework for Islamic Republic of Afghanistan for the Period FY17-FY20, World Bank Report No. 108727-AF, October 2016.

Performance and Learning Review of the Country Partnership Framework for Islamic Republic of Afghanistan for the Period FY17-FY20, World Bank Report No. 136690-AF, June 2019.

Implementation Completion and Results Report for the Afghanistan National Solidarity Program III, World Bank Report No. ICR00003688, December 2017.

Implementation Completion Report Review for the Afghanistan National Solidarity Program III, Independent Evaluation Group, World Bank, Report No. ICRR0021060.

Implementation Completion and Results Report for the Afghanistan Rural Enterprise Development Program, World Bank Report No. ICR00004556, January 2018.

Afghanistan Poverty Status Update: An analysis based on National Risk and Vulnerability Assessment (NRVA) 2007/08 and 2011.12, World Bank, October 2015.

Afghanistan Living Conditions Survey 2013-14: National Risk and Vulnerability Assessment. Central Statistics Organization, Islamic Republic of Afghanistan, 2016. s

World Bank (2020). Governance in Irrigation and Drainage. Concepts, Cases, and Action-Oriented Approaches- A Practitioner's Resource.

World Bank (2018). Pilot Climate Change Impact Analysis on Hydrology and Agriculture in the Balkhab Watershed, Northern Afghanistan.

Zwart et al. (2010). A global benchmark map of water productivity for rainfed and irrigated wheat. Agriculture Water Management, 97 (2010): 1617-1627

Databases used:

Irrigation scheme database, TPM observation tracker, project expenditure data, baseline survey data 2013, endline survey data 2019, endline survey data control follow-up 2019, crop conversion database 2019, IA registry, FFS and IDS registry, and NRVA 2011/12.