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The World Bank

Report No: ICR00003918

IMPLEMENTATION COMPLETION AND RESULTS REPORT
(IBRD-75760/IDA-44990)

ON A

LOAN/CREDIT

IN THE AMOUNT OF SDR 34.5 MILLION
(US\$56 MILLION EQUIVALENT)

TO THE

REPUBLIC OF INDIA

FOR AN

ODISHA COMMUNITY TANKS MANAGEMENT PROJECT

December 20, 2016

Water Global Practice
South Asia Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective October 4, 2016)

Currency Unit = USD
INR 1.00 = US\$0.01502912
US\$1.00 = INR 66.53749521

FISCAL YEAR

ABBREVIATIONS AND ACRONYMS

AI	Artificial Insemination
ALSS	Agricultural Livelihood Support Services
CCA	Culturable Command Area
CPS	Country Partnership Strategy
CRRI	Central Rice Research Institute
DPD	District Project Director
DPU	District Project Unit
EMF	Environmental Management Framework
ENPV	Economic Net Present Value
ERR	Economic Rate of Return
FIG	Farmers Interest Group
FNPV	Financial Net Present Value
FRR	Financial Rate of Return
GoO	Government of Odisha
GoI	Government of India
ICRR	Implementation Completion and Results Report
ISR	Implementation Status and Results Report
LSWI	Land Surface Wetness Index
M&E	Monitoring and Evaluation
MID	Minor Irrigation Department
MIP	Minor Irrigation Project
MTR	Midterm Review
O&M	Operation and Maintenance
OCTDMS	Odisha Community Tank Development and Management Society
OCTMP	Odisha Community Tank Management Project
OFD	On-Farm Development
OUAT	Odisha University of Agriculture and Technology
PAD	Project Appraisal Document
PDO	Project Development Objective
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PP	Pani Panchayat
RRR	Repair, Renovation, and Restoration
SPU	State Project Unit

SPV	Special Purpose Vehicle
SRI	System of Rice Intensification
TIMP	Tank Improvement and Management Plan
WRD	Water Resources Department
WUA	Water User Association

Senior Global Practice Director: Guang Zhe Chen
Practice Manager: Meike van Ginneken
Project Team Leader: Ranjan Samantaray
ICR Authors: Sudhirendar Sharma, Sekhar Muddu, Scott Moore and Kunduz Masyllkanova

INDIA
Odisha Community Tanks Management Project

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A. Basic Information			
Country:	India	Project Name:	IN Odisha Community Tank Management Project
Project ID:	P100735	L/C/TF Number(s):	IBRD-75760, IDA-44990
ICR Date:	11/18/2016	ICR Type:	Core ICR
Lending Instrument:	SIL	Borrower:	GOVERNMENT OF INDIA
Original Total Commitment:	US\$112.00 million	Disbursed Amount:	US\$56.59 million
Revised Amount:	US\$66.93 million		
Environmental Category: B			
Implementing Agencies: Odisha Community Tank Development and Management Society			
Co-financiers and Other External Partners: Government of Odisha			

B. Key Dates				
Process	Date	Process	Original Date	Revised / Actual Date(s)
Concept Review:	12/15/2006	Effectiveness:	03/17/2009	03/17/2009
Appraisal:	01/02/2008	Restructuring(s):	04/20/2011	04/20/2011
Approval:	09/30/2008	Mid-term Review:	11/27/2012	11/30/2012
		Closing:	08/31/2014	06/30/2016

C. Ratings Summary	
C.1 Performance Rating by ICR	
Outcomes:	Moderately Satisfactory
Risk to Development Outcome:	Moderate
Bank Performance:	Moderately Satisfactory
Borrower Performance:	Moderately Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)			
Bank	Ratings	Borrower	Ratings
Quality at Entry:	Moderately Satisfactory	Government:	Moderately Unsatisfactory
Quality of Supervision:	Moderately Satisfactory	Implementing Agency/Agencies:	Moderately Satisfactory
Overall Bank Performance:	Moderately Satisfactory	Overall Borrower Performance:	Moderately Satisfactory

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

D. Sector and Theme Codes		
	Original	Actual
Sector Code (as % of total Bank financing)		
Agricultural markets, commercialization and agri-business	2	2
Animal production	5	5
Crops	6	6
Irrigation and Drainage	82	82
Public administration - Agriculture, fishing and forestry	5	5
Theme Code (as % of total Bank financing)		
Other rural development	33	33
Rural services and infrastructure	34	34
Water resource management	33	33

E. Bank Staff		
Positions	At ICR	At Approval
Vice President:	Laura Tuck	Isabel M. Guerrero
Country Director:	Junaid Kamal Ahmad	Rachid Benmessaoud
Practice Manager/Manager:	Meike van Ginneken	Gajanand Pathmanathan
Project Team Leader:	Ranjan Samantaray	Deepak Ahluwalia
ICR Team Leader:	Ranjan Samantaray	
ICR Primary Author:	Sudhirendar Sharma	
	Scott Michael Moore	
	Kunduz Masyllkanova	
	Sekhar Muddu	

F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document)

The proposed project development objective is for selected tank-based producers to improve agricultural productivity and water user associations to manage tank systems effectively.

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

(a) PDO Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1:	Percentage increase in crop productivity (measured in % increase)			
Value (quantitative or qualitative)	Paddy: 2.88 t/ha Green gram: 0.40 t/ha Mustard: 0.45 t/ha Groundnut: 1.25 t/ha Vegetables: 10.0 t/ha	Paddy: 25% increase Green gram: 30% increase Mustard: 30% increase Groundnut: 20% increase Vegetables: 50% increase	Paddy: 25% increase Green gram: 30% increase Mustard: 30% increase Groundnut: 20% increase Vegetables: 50% increase	Paddy: 42% increase with existing technology and 83% increase with new technology Green gram: 57% increase with existing technology and 95% increase with new technology Mustard: 150% increase with existing technology and 200% increase with new technology
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Achieved. Productivity increases for paddy, pulses, and oilseeds considerably exceeded the targets. The target for vegetables was achieved.			
Indicator 2:	Percentage increase in cropping intensity (measured in % increase)			
Value (quantitative or qualitative)	125%	20% increase	20% increase	15% increase
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Partially achieved. A 143% (or 17% increase from baseline 125%) cropping intensity was observed during the survey in 2015, the reporting year was a drought year. Since a high cropping intensity was achieved during a drought year, the target was likely to be achieved during normal years.			
Indicator 3:	Percentage increase in fish productivity (measured in % increase)			

Value (quantitative or qualitative)	0.03 t/ha	400% increase	400% increase	883% increase
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Achieved. Fish productivity considerably exceeded the target by 483%.			
Indicator 4:	Percentage of water users in rehabilitated tank systems satisfied with WUA operations and maintenance (measured in %)			
Value (quantitative or qualitative)	0%	75%	85%	71.5%
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Mostly achieved. The target was achieved to a significant degree at the time of project closing.			
Indicator 5:	% of WUAs in rehabilitated tank systems whose O&M expenditure is as per annual O&M plan			
Value (quantitative or qualitative)	0%	80%	85%	54%
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Partially achieved. WUAs cover the cost of O&M plans through a combination of in-kind contributions from members, ad-hoc cost recovery for repairs, and subsidies received from the MID. The rate of WUAs expense per the annual O&M plan is likely to go up after project closing following the January 2016 government approval for WUAs to collect taxes.			

(b) Intermediate Outcome Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1:	WUAs holding general body meetings (measured in %)			
Value (quantitative or qualitative)	0%	80%	80%	92%
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Achieved. The target has been surpassed by 12 percentage points.			
Indicator 2:	WUAs maintaining appropriate cash books and water regulation registers (measured in %)			
Value (quantitative)	0%	80%	85%	99.3%

or qualitative)				
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Achieved. WUAs performance reflects capacity building trainings by the project.			
Indicator 3:	Total current-year assessed water charge collected (measured in %)			
Value (quantitative or qualitative)	0%	90%	95%	0%
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Not achieved. Regulations allowing the WUAs to levy and collect water charges were issued in January 2016. This did not yet translate in collection at the time of project closing. Tax collection is ongoing at the time of ICRR writing.			
Indicator 4:	Minor Irrigation Department deemed able to implement, monitor and evaluate minor investments (measured through qualitative assessment)			
Value (quantitative or qualitative)	Weak	n.a.	Able	Able
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Achieved. The project significantly enhanced the capacity of the Minor Irrigation Department to support tank systems in Odisha.			
Indicator 5:	Tank command area irrigated (under normal rainfall conditions) (measured in %)			
Value (quantitative or qualitative)	54% (64,800 ha)	90% (108,000 ha)	90% (57,813 ha)	123% (79,162 ha)
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Achieved. The target exceeded at 123%. The project tanks are designed for protective irrigation in <i>Kharif</i> (monsoon) season only. However, the tanks delivered water to 92.1% of command areas in <i>Kharif</i> season and additional 20,000 ha (31%) in <i>Rabi</i> season. Original baseline and end target area was 120,000 ha. Restructuring baseline area was 60,000 ha.			
Indicator 6:	Middle reach and tail end farmers reporting improved water availability in rehabilitated tanks (measured in % increase)			
Value (quantitative or qualitative)	0%	75%	75%	94%
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Achieved. The target exceeded at 94%. Improved water availability was reported by (a) 95.6% of head reach farmers, (b) 95.4% of middle reach farmers, and (c) 91.7% of tail end farmers.			
Indicator 7:	Increase in value of crop output per unit of water in command area of rehabilitated tanks (measured in % increase)			
Value (quantitative or qualitative)	0%	15%	20%	11%
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016

Comments (incl. % achievement)	Achieved. Drought impact was seen in the last season, but it also reflects resilience on account of tank system improvement.			
Indicator 8:	Tanks with social and environment action plans prepared and implemented (measured in %).			
Value (quantitative or qualitative)	0%	100%	100%	100%
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Achieved.			
Indicator 9:	Farmers in project area adopting improved production techniques (measured in %).			
Value (quantitative or qualitative)	10%	40%	45%	47.8%
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Achieved. The target has been achieved. The completion value is the weighted average of all crop production techniques adopted by the project farmers.			
Indicator 10:	Tank fishing communities in project area adopting improved production/harvesting techniques (measured in %)			
Value (quantitative or qualitative)	0%	40%	45%	84%
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Achieved. Fishermen reported widespread adoption of improved production/harvesting techniques, reflected in increased fish catch.			
Indicator 11:	Increase in number of improved breed cattle in project area (measured in units)			
Value (quantitative or qualitative)	0	12,000	7,000	2,470
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Partially achieved. Even the revised target value was unrealistically high.			
Indicator 12:	Increase in share of final sale value obtained by farmer marketing groups in targeted commodities (measured in % increase)			
Value (quantitative or qualitative)	0%	10%	15%	15%
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Achieved. In selected cases, notably the case of Onion, farmer groups made significant income gains.			
Indicator 13:	No. of functioning farmer marketing groups established (measured in units).			

Value (quantitative or qualitative)	0	500	250	225
Date achieved	07/01/2008	07/01/2012	06/30/2016	08/01/2016
Comments (incl. % achievement)	Partially achieved. The target was 90% achieved with 225 farmer marketing groups having been established.			

G. Ratings of Project Performance in ISRs

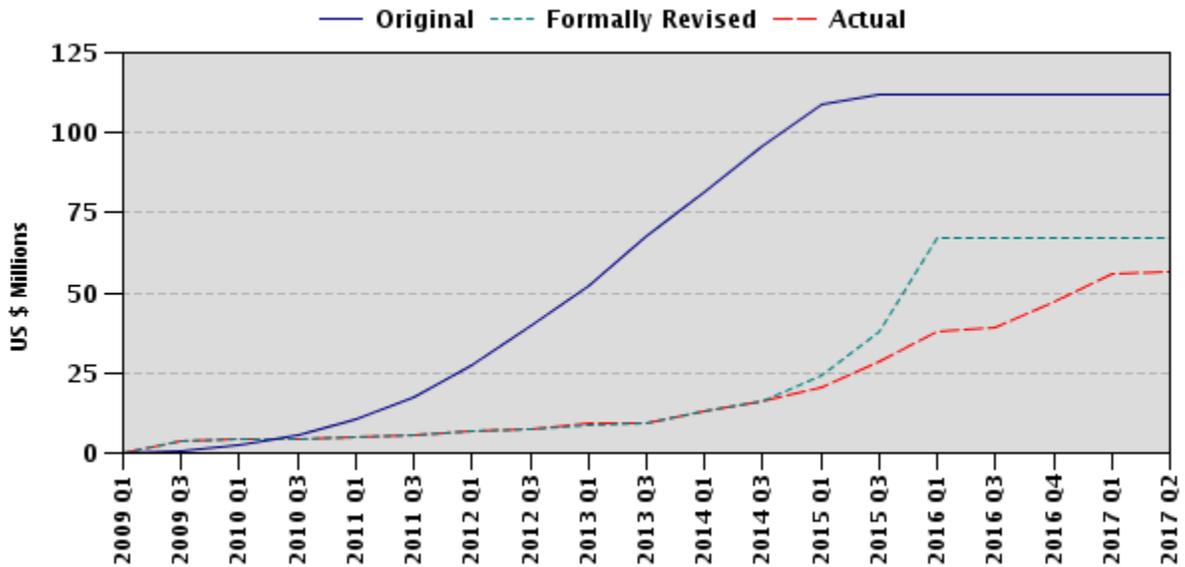
No.	Date ISR Archived	DO	IP	Actual Disbursements (US\$, millions)
1	04/11/2009	Satisfactory	Satisfactory	4.00
2	11/10/2009	Satisfactory	Moderately Satisfactory	4.29
3	05/23/2010	Satisfactory	Moderately Satisfactory	4.53
4	12/11/2010	Moderately Satisfactory	Moderately Unsatisfactory	5.01
5	06/10/2011	Moderately Satisfactory	Moderately Unsatisfactory	5.80
6	12/24/2011	Moderately Satisfactory	Moderately Satisfactory	6.77
7	06/03/2012	Moderately Satisfactory	Moderately Satisfactory	7.49
8	12/09/2012	Moderately Unsatisfactory	Moderately Unsatisfactory	9.02
9	06/12/2013	Moderately Unsatisfactory	Unsatisfactory	11.21
10	11/30/2013	Moderately Unsatisfactory	Unsatisfactory	12.84
11	05/17/2014	Moderately Satisfactory	Moderately Satisfactory	16.18
12	12/30/2014	Moderately Satisfactory	Moderately Satisfactory	27.05
13	03/03/2015	Moderately Satisfactory	Moderately Satisfactory	27.05
14	09/30/2015	Moderately Satisfactory	Moderately Satisfactory	37.93
15	12/29/2015	Moderately Satisfactory	Moderately Satisfactory	38.35
16	06/30/2016	Moderately Satisfactory	Moderately Satisfactory	47.14

H. Restructuring (if any)

OCTMP (Odisha Community Tank Management Project) was launched as a model project to improve irrigation efficiency of 900 existing tanks in the state of Odisha in March 2009. Just when the project was ready for implementation, the Government of India launched the Repair, Renovation and Restoration (RRR) scheme with an aim to drive the minor irrigation sector in the country. Consequently, OCTMP was restructured (Level 2) on April 20, 2011, downsized from US\$ 121.3 million to US\$86.24 million as 568 selected tanks were reallocated to the RRR project.

As a result of RRR all works and contracts in the project approved between 2009-2011 were cancelled. In addition to losing valuable time invested in prioritising villages and in selecting tanks, the project had to invest additional time in the cancellation of old contracts and finalization of new contracts, a process that lasted till April 2012. The project was given a revised completion date of June 30, 2016, but without any change in the Project Development Objectives (PDO).

I. Disbursement Profile



1. Project Context, Development Objectives, and Design

1.1 Context at Appraisal

1. Odisha¹ is the ninth largest state by area in India and the eleventh largest by population, which at the time of appraisal had 85 percent of its population dependent on agriculture for its primary source of livelihood. Although the state is endowed with rich natural resources, contribution of agriculture to the state's gross domestic product has remained stagnant at about 30 percent, resulting in higher incidence of poverty (39.9 percent to 46.4 percent) compared to the national average of 21.8 percent to 27.5 percent.

2. Odisha has embarked on a program of structural and fiscal reforms to boost economic growth and reduce poverty. Though some improvement in agricultural growth has been observed in recent years, average productivity levels have continued to be low²—for instance, per hectare yield of paddy (which accounts for more than half the annual cultivated area in the state) is about 70 percent of the India average and less than half of what is obtained in more advanced agricultural states such as Punjab. An important reason for the low productivity³ is that over 70 percent of the cultivated area is exposed to weather fluctuations.

3. The absence of assured irrigation inhibits the use of improved seeds, fertilizers, and other complementary inputs, which in turn affects productivity levels. Given the importance of irrigated agriculture for increasing agricultural growth and providing rural employment round the year, the Government of Odisha (GoO) attaches high priority to expanding irrigation facilities and optimizing utilization of available water resources. Issues at the time of appraisal that contributed to project formulation were (a) the need to improve minor irrigation infrastructure⁴, and (b) a greater community ownership in the operation, management, and maintenance of tanks, an important source of irrigation.

4. At the time of preparation of the OCTMP, minor irrigation schemes or tanks were contributing 8.4 percent and 1.2 percent to *Kharif* and *Rabi* irrigation, respectively. In comparison, major and medium irrigation schemes in the state were contributing 20.3 percent in *Kharif* and 9.1 percent in *Rabi*. At the project appraisal stage, it was found that the percentage of area irrigated through tanks to the total irrigated area was a mere 18.56 percent, although there were as many as 28,303 tanks in the state. As of March 2007, 57.10 percent minor irrigation schemes were in a functional state, 23.15 percent were partly derelict, 14.81 percent were fully derelict, and the remaining 4.94 percent were delivering water.

¹ Orissa State was officially renamed 'Odisha' following the adoption of the Orissa (the Alteration of Name) Bill by the Parliament of India in 2011.

² Pant, N., and R. K. Verma. 2010. *Tanks in Eastern India: A Study in Exploration*. International Water Management Institute, IWMI-TATA Water Policy Research Program; India: Centre for Development Studies. doi:10.5337/2010.228.

³ Das, S. R. 2012. "Rice in Odisha." IRRI Technical Bulletin No. 16. Los Baños (Philippines), International Rice Research Institute, ISSN 0074-7807.

⁴ Minor irrigation schemes have culturable command area (CCA) up to 2,000 ha, medium schemes range from 2,000 ha to 10,000 ha CCA, and major schemes have CCA greater than 10,000 ha.

5. Before the project inception, the GoO had sought cabinet approval for expanding membership of Water User Association⁵ (WUA) to cover fishers, and for making the WUA management committee a permanent elected body empowered to levy, collect, and retain water charges and use them for operation and maintenance (O&M) purposes. This was a significant departure from the typical top-down approach where government departments collected water charges and returned a portion of it to the WUAs for O&M. Empowering the WUAs to collect and retain water charges was expected to significantly transform tank systems management by contributing to irrigation expansion covering tail end farmers and improving water productivity by engaging farmers in water budgeting and crop planning.

6. As the tank system has been an age-old part of the agrarian community in the state, the project was designed to improve tank systems to close the gap between tank irrigation potential and the actual coverage, increase productivity of water through adoption of improved agricultural technologies, and develop fisheries. This was in line with the Odisha State Water Policy 2007 that had laid emphasis on Participatory Irrigation Management to improve performance of all irrigation projects, management of irrigation systems, and particularly for water distribution and collection of water charges.

Rationale for Bank Involvement

7. The World Bank has a long history of supporting irrigation development in many states of India, namely, Karnataka (Karnataka Community-Based Tanks Management Project; Credit No. 3635-IN), Tamil Nadu (Tamil Nadu Irrigated Agriculture Modernization and Water-Bodies Restoration and Management Project; Loan No. 4846-IN/Credit No. 4255-IN), and Andhra Pradesh (Andhra Pradesh Community-Based Tanks Management Project; Loan No. 48570/Credit No. 42910). Having gained experience with projects that successfully promoted stakeholders' involvement in rural infrastructure development, transfer of improved agricultural technologies, and facilitating of farmer-market linkages, the present project strengthened World Bank involvement in participatory irrigation infrastructure development in Odisha. The project also fitted into the national priority of strengthening decentralized management of tank systems.

1.2 Original Project Development Objectives (PDO) and Key Indicators

8. The PDO mentioned in the Project Appraisal Document (PAD) is for selected tank-based producers to improve agricultural productivity and water user associations to manage tank systems effectively.

9. The tank system rehabilitation was designed in a decentralized manner so that the intended beneficiaries not only play an active role in planning, implementing, and sustaining project interventions but also contribute to improving agricultural productivity and incomes through better access to agricultural technologies and facilitation of market linkages. Considering the design description, it can be concluded that the project aimed at improving water productivity but poverty reduction was not its intended direct outcome.

⁵ WUA in Odisha is known as *Pani Panchayat* (PP). As WUA is a widely accepted term, PP and WUA have been interchangeably used in this report.

10. The key performance indicators proposed for measuring and monitoring progress toward achieving the PDOs corroborate the above conclusion. The indicators were:

- (a) Increase in agricultural (including livestock and fisheries) productivity and production from tank systems
- (b) Improved water availability for tail end farmers
- (c) Resource raised and O&M expenditures incurred by user groups

1.3 Revised PDO (as approved by Original Approving Authority) and Key Indicators, and Reasons/Justification

11. The Project Restructuring Paper⁶ did not propose revision of the PDO, as it was assessed that despite a truncated budget and revised timeline, the project will achieve its development objectives. However, some Intermediate Outcome Indicators were subjected to restructuring.

12. As the outcome indicators were designed in relative terms, these were kept unchanged albeit to be measured in the context of the reduced project area. However, some of the values of the indicators changed on account of the restructured target to reflect more intensive work proposed in that component.

13. Some Intermediate Outcome Indicators were revised to accommodate more intensive activities related to the WUAs and livelihoods support services. Two indicators were measured in absolute numbers and were required to be adjusted to the new project scale.

14. One new Intermediate Outcome Indicator was added to reflect the technical assistance proposed for the Minor Irrigation Department (MID), which was recognized as critical to ensuring sustainability of the tank systems and supporting the functions of the WUAs.

1.4 Main Beneficiaries

15. The PAD does not explicitly mention the number of beneficiaries the project would serve; however, the project did seek involvement of many community groups, namely, the WUAs, farmer's interest groups (FIG), women self-help groups, fishermen cooperatives, and marketing groups. Membership of the WUAs aggregated 99,000 persons including 1,300 fishermen; 1,050 FIGs and 15 self-help groups involved 11,550 women in project activities; 4,713 fishermen benefited through fishermen cooperatives and fisheries interest groups; and 198 marketing groups contributed to improved market access.

16. At a more direct level, the project generated employment opportunity through civil works to 317,140 women; a total of 45,194 farmers and vegetable growers benefited from on-farm demonstrations; 10,950 women were trained and provided chicks for backyard poultry; and another 514 women were engaged in mushroom cultivation. Though some of these numbers are likely to overlap, it is clear that the project extended diversity of benefits, directly and indirectly, to farmers, women, youth, and children across the command area of the selected tanks. Notable is the

⁶ Restructuring Paper on Proposed Project Restructuring of Orissa Community Tanks Management Project. Report No: 61146 – IN, April 20, 2011.

fact that the project extended economic and social benefits to the weaker sections of the community.

1.5 Original Components

17. The PAD had four components.

Component A: Institutional Strengthening (US\$8.8 million)

18. The objective of this component was to establish the capacity of the WUAs to take over tank O&M, along with key related tasks such as water tariff collection, and to improve tank-based agricultural livelihoods. The component financed four primary activities: (a) formation of community-based institutions, (b) contracting of third parties to support capacity building of WUAs, (c) technical assistance for the development and implementation of Tank Improvement and Management Plans (TIMPs), and (d) a variety of training workshops and sessions to support key WUA tasks.

Component B: Tank Systems Improvements (US\$90 million)

19. This component was designed to improve the performance of selected tank systems to expand irrigated area, enhance water productivity, and improve water availability for tail end farmers. About 900 tanks with culturable command area of 120,000 ha, spread across 29 districts of the state, were proposed to be rehabilitated under the project. This component supported a set of broad activities: (a) hydrological assessment of selected tanks, and engineering support consultants to ensure acceptable construction quality standards, (b) dam safety review for ensuring safety of dams/tank bunds that are more than 10 meter high, (c) groundwater monitoring in command area of selected tanks, and (d) development of a statewide geographically referenced minor irrigation database to enable the MID better plan future interventions.

Component C: Agricultural Livelihoods Support Services (US\$16.1 million)

20. This component was designed to enhance tank-based livelihoods by increasing production, productivity, and profitability of agriculture, horticulture, fisheries, and livestock through improvements in production technologies, management practices, better input-output market linkages, and augmentation of community-level productive capacities as well as infrastructure. The outputs expected from this component included higher productivity in agriculture, livestock, and fisheries; better alignment of farm-based productive activities with improved water availability; and diversification into more market-oriented agriculture and livestock production. This component consisted of five subcomponents: C.1: Agriculture and Horticulture (US\$7.5 million); C.2: Livestock (US\$3.6 million); C.3: Fisheries (US\$2.4 million); C.4: Foreshore Area Treatment (US\$0.5 million); and C.5: Agricultural Marketing (US\$2.1 million).

Component D: Project Management (US\$6.4 million)

21. The project activities were coordinated and implemented by a multidisciplinary State Project Unit (SPU) to ensure smooth implementation of project activities, monitoring of project implementation progress and outputs/outcomes achieved, and learning from implementation experience. Activities in this component included (a) setting up and supporting (through capacity

building and equipment) SPU at the state and DPU at the district levels; (b) designing and establishing a project-specific management information system; (c) setting up the project monitoring, evaluation, and learning activities; (d) contracting an external monitoring and evaluation (M&E) agency as consultant for the duration of the project; (e) providing support for emerging needs and innovations during implementation; (f) liaising with other agencies and government departments; and (g) documenting project experience and disseminating it to the wider development community.

1.6 Revised Components

22. The project had met with an unexpected setback in 2009, following the introduction of the Repair, Renovation, and Restoration (RRR) scheme of the Government of India (GoI) aimed at driving the minor irrigation sector in the country. This caused administrative chaos in the OCTMP, forcing downsizing of investment in the project from US\$121.3 million to US\$86.24 million as 568 selected tanks were diverted to the RRR scheme. As a consequence, the project was subjected to a Level 2 restructuring, which was approved on April 20, 2011.

23. The project restructuring resulted in the following major changes:

- (a) Only 320 tanks were to be rehabilitated covering 60,000 ha against the original target of rehabilitating 900 tanks covering 120,000 ha.
- (b) As a result, US\$35.06 million of funding (including US\$17.53 million from the IBRD loan and US\$17.53 million from IDA credit) was canceled.
- (c) Following restructuring, the percentage allocation for individual components was kept in the same proportion as in the original project.

1.7 Other Significant Changes

24. The subcomponent on Foreshore Area Treatment primarily was dropped, and the allocated budget was suitably appropriated in Component C. This primarily dealt with catchment treatment on those lands on which the project did not have any control. The project was restructured and its closing date was extended from the original end date of August 31, 2014 to the new closing date of June 30, 2016 for the reasons already indicated.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design, and Quality at Entry

25. **Background analysis.** The project was well aligned with government priorities. It built effectively on the 2001 Country Assistance Strategy and related strongly to the GoI's priority to expand irrigation facilities and optimize utilization of available water resources. In consonance with GoI emphasis on restoration and rejuvenation of tanks on priority and GoO paradigm shift toward sustainable water resource management based on user participation, Odisha embarked upon the project (the OCTMP) to help elected WUAs play a meaningful role in the management of tank systems. The background analysis leading to the project preparation was based on sound evaluation of the irrigation scenario in the state, and of the policy environment which favored

investments in tank system improvements and WUAs. The GoO was aware that tank irrigation has the potential to irrigate about 0.69 million ha in the state, but deficient maintenance and management contributed to its poor performance.

26. Building on the importance of participatory irrigation management by the World Bank–funded Odisha Water Resources Consolidation Project (Credit 2801-IN), which closed in 2004, the project also took cognizance of non–World Bank–funded projects, including a European Commission–funded project, which demonstrated that the performance of the WUAs in managing tank systems is significantly better when substantive efforts are undertaken to build the capacity of the WUAs. Even the project restructuring stressed on more intensive activities on the WUAs and livelihoods support services.

27. **Project design.** The project design combined physical infrastructure (Component B) with institutional strengthening (Component A) to enhance local livelihoods through agriculture diversification (Component C). Unlike other projects, the project played a proactive role in ensuring water budgeting as mandatory criteria for water delivery at the farm level. As a result, the project design created a sound balance between irrigation development and livelihood improvement. The project vested implementation with a special-purpose vehicle, the Odisha Community Tank Development and Management Society (OCTDMS), which included representatives from both civil society and relevant government departments in its governing body.

28. **Quality at entry.** The GoO’s commitment toward decentralized water resource management based on user participation had adequately justified World Bank involvement in the project. The lending instrument, a Specific Investment Loan, proved appropriate for this project because it permitted adequate oversight and transparency, and ensured sustainability and flexibility for the project, which led the GoO to continue to see value in the project despite the existence of similar GoI-financed tank system rehabilitation and improvement programs (RRR).

29. The project was designed keeping the PDO and the intended outcomes in view. The Results Framework was comprehensively designed to cover all aspects of the project, but some of the indicators were not easy to monitor (see section 2.3 for details). Overall, the project was well structured, with components and activities suitably intertwined to deliver water at the tail end. The GoO had already sought cabinet approval for expanding membership of the WUA to fishers and made the WUA management committee a permanent elected body under the Odisha Pani Panchayat Act, 2002 and the Odisha Pani Panchayat Rules, 2003. These reforms provided for greater inclusion, and continuity of the WUAs.

30. **Risk assessment.** The project risk overall was rated as Moderate, driven primarily by several critical identified institutional risks, including the weak procurement capacity of the OCTDMS, coordination between line departments, the possibility of elite capture within the WUAs, and low transparency in the WUA decision making. Mitigation measures were pursued in the form of institutional support such as SPU and DPU level steering committees and capacity building within the OCTDMS and the WUAs.

31. In practice, many of these risks were also mitigated through training; however, weak procurement capacity did delay project implementation, while delays in securing approval for water tax collection contributed to the project falling short of its intermediate institutional-

strengthening indicator at the time of project closing. However, to some extent the risk entailed was mitigated by enhanced reliance on MID to conduct some O&M tasks while WUAs were strengthened, and as described further in Section 2.5, the institutional strengthening component successfully laid the foundation to sustain development outcomes post-completion. In addition to these identified risks, leadership issues and the lack of a dedicated project director for several months to some extent reduced project effectiveness, but as further described in Section 2.2, these issues did not prevent the project from achieving most of its objectives. Technical risks were rated as negligible, and no financial management risks were identified. As such, these issues did not measurably affect project effectiveness.

2.2 Implementation

32. The project suffered unexpected delay in implementation on account of the launch of the RRR scheme by the GoI in 2009. The ambitious scheme was to collapse five years later, but not before it had caused administrative chaos in the OCTMP, forcing downsizing of investment and diversion of selected tanks to the scheme. The project lost valuable time already invested in prioritizing villages and in selecting tanks, and had to invest additional time in the cancellation of old contracts and finalization of new contracts. Noticeable is the fact that despite the unexpected delays, the entire project was practically implemented in about four years, starting from April 2012 and closing on June 2016.

33. The Command Area Development Authority was seized of the need to empower WUAs to collect and retain water charges, and has taken steps to sustain WUAs by engaging them in minor engineering and repair works. The primary objective of engaging the WUAs in minor works was to give them operational responsibility alongside making significant savings from works allocated to the civil engineering department. To this effect, the project did stimulate serious discussions at the level of the principal secretary, who is committed to creating a regulatory environment conducive for the growth and sustainability of the WUAs. The GoO views it as a 'process' and considers 'hand-holding' of the WUAs crucial for playing a meaningful role in the management of tank systems over time and thereby ensuring sustainability of project outcomes. In addition, the Bank team and the borrower focused on enhancing the role of MID in part to compensate for the delay in securing approval for WUAs to collect water charges.

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

34. **M&E design.** The set of result indicators was adequate to comprehensively measure project outcomes and results. Baseline and targets were provided for most of the indicators. While most indicators were measurable, some indicators were difficult to measure and monitor. The result indicator to measure increases in value of crop output per unit of water is one example. Also, the project tanks were designed to provide protective irrigation to be supplemented with other sources of water but no volumetric measuring system to monitor all sources of irrigation water was in place. The target setting for the project was ambitious and some of the target values had to be adjusted at restructuring, when also a part of the project resources were cancelled.

35. **M&E implementation.** Initially, due to the limited capacity of the project M&E team, M&E activities were carried out on an ad hoc basis. As engineering work was the predominant activity in the project, the M&E team was not technically equipped to monitor and record progress.

However, starting in 2012 the PMU significantly bolstered M&E by engaging a third-party consultancy agency, which helped the project develop the baseline and midterm database that helped the M&E team deliver timely surveys of satisfactory quality. A delay in conducting baseline survey was attributed to the launch of RRR.

36. **M&E utilization.** From 2013 onward, the project developed a simple Excel-based M&E database to monitor progress. The project management closely monitored the data and findings of the surveys and used these for decision making. Based on the survey findings, the project activities on the demonstration of new technologies and livelihood activities were intensified. Moreover, the project achievements and lessons learned were widely shared with the relevant line departments. The project recently developed videos featuring project beneficiaries and success stories for dissemination both within and outside the state of Odisha. Unlike other past and ongoing projects in the state, the project was designed to increase water productivity by addressing technical, institutional, and knowledge aspects of production in agriculture, livestock, and fishery. It was also unique with regard to inclusiveness by supporting resource-poor segments of the population, including women, landless, and youth.

2.4 Safeguard and Fiduciary Compliance

39. **Financial management.** No significant audit observations were reported in any of the financial compliance reports, and audit reports were submitted on time. Adoption of ‘single’ state level project bank account along with web-based payment facilities to DPU contributed to significant efficiency in fund management. Engagement of Chartered Accountant firms to provide accounting support to PPs contributed to streamlining of accounting documentation.

40. **Procurement.** The project encountered significant procurement challenges but successfully adhered to procurement guidelines and effectively achieved project objectives. Despite the highly-staggered project interventions involving participating line departments, the bidding and selection process was conducted in a fair and transparent manner. In spite of the large number of schemes undertaken, there were very few complaints, and these were promptly attended to by the project. This was possible due to regular trainings in procurement management throughout the implementation period. Due to reallocation of tanks to the RRR scheme in the initial phase of the project, there were delays that slowed the procurement of civil works and consultancies. These were gradually resolved. At times, disbursement was slow due to rebidding of work packages and prolonged delays in obtaining administrative sanctions for procurement packages. At times, not all World Bank procurement procedures were strictly followed, as noted in several post procurement reviews. These shortcomings were addressed through regular training and capacity building. Contract management capacity was also an issue that contributed to time overruns in some cases. Overall procurement under the project was rated Moderately Satisfactory.

41. **Safeguards.** The Environmental Assessment (OP 4.01), Pest Management (OP 4.09), and Safety of Dams (OP 4.37) safeguards were triggered; in addition, two social safeguards on Involuntary Resettlement and Indigenous Peoples (OP 4.12 and OP 4.10) were also triggered. All the triggered safeguard policies were monitored and well captured in the Environmental and Social Safeguards Framework, including in the scheduled areas. No negative impact was reported in the Environmental Management Framework (EMF).

42. **Environmental safeguards.** Environmental safeguards applied during the project were Satisfactory, especially given the low level of identified risk. The project triggered Environmental Category B (Partial Assessment) safeguard. Environmental impacts relating to enhanced fertilizer use, waterlogging, siltation, and effects on biodiversity and natural habitats were identified and incorporated into the EMF, which outlined procedures to minimize potential environmental impacts. The EMF also established a Dam Safety Panel to ensure compliance with OP 4.37. These procedures evidently proved adequate as no significant environmental concerns were raised during project implementation. Pest Management safeguards were pursued through partnerships with the Central Rice Research Institute (CRRI) and Odisha University of Agriculture and Technology (OUAT). Results of these partnerships were not quantitatively captured in project outcomes, but according to mission reports, these substantially influenced project implementation.

43. **Social safeguards.** Overall, social safeguards proved adequate; no resettlement was required, and OP 4.10 concerns were minimized because most scheduled area tanks were not removed from the project during restructuring. A Resettlement Policy Framework was developed drawing on the State of Odisha Resettlement and Rehabilitation Policy, which provided that a Resettlement Action Plan would be prepared in the event resettlement is to be integrated into TIMP. Since no resettlement was required under the project, no Resettlement Action Plan was developed.

44. The Social Assessment conducted during project preparation identified the following principles to guide project implementation: (a) participation, (b) inclusion and equity, (c) decentralization, and (d) institutional development. A Tribal Development Plan was prepared to address these issues in scheduled areas affected by the project. The Tribal Development Plan specified that DPUs would provide apex support to the WUAs in the tribal areas, and that specialized nongovernmental organizations would be contracted to mobilize and build community capacity. While most of the tanks in scheduled areas were not removed during restructuring, the remaining tanks in scheduled areas encountered no significant problems with respect to participation and inclusion.

2.5 Post-completion Operation

45. **O&M arrangement.** The implementing agency developed and implemented an ‘exit strategy’ to sustain project outcomes post-completion. The project’s institutional strengthening component built sufficient capacity for most WUAs to undertake O&M functions. Furthermore, the Command Area Development Authority has committed to maintaining some staff dedicated to strengthening the capacity of the WUAs to undertake these functions both at SPU and DPU levels. The role of the OCTMP is seen by the GoO as an ‘attitude changing’ platform for its 3,000 engineers and 6,000 staff. The GoO has drawn plans to start 100 PP training centers spread across all the districts in the state, empowering PPs to take bigger responsibility on financial and institutional aspects with continuous technical backstopping by the MID. The OCTMP is seen as a good stepping stone for Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)⁷, as the irrigation

⁷ PMKSY stands for Prime Minister Agriculture Irrigation Scheme

department has captured ‘resilience’ as an essential element for demonstrating irrigation efficiency at the micro basin/catchment level in the follow-up project being proposed.

46. **Sustaining reforms and institutional capacity.** The project was designed to build the WUA capacity so that they would be able to take over water tariff collection and tank system O&M, and a detailed training system was designed and implemented for this purpose. During project restructuring, specific emphasis was put on strengthening and sensitizing the MID in delegating such responsibilities to the WUAs. As a result, MID is capable of supporting O&M in tank systems where WUAs are not yet fully ready to take over O&M. Finally, during the later stages of the project, a ‘hand-holding’ procedure was instituted so that till the WUAs take independent responsibility in O&M, the SPU would continue to aid the WUAs in O&M following project closure. As of project closing, O&M responsibilities had been transferred for 292 out of a total of 383 tank systems (78 percent). This transfer lays the foundation for WUAs to steadily assume a growing role in O&M following the project completion.

3 Assessment of Outcomes

3.1 Relevance of Objectives, Design, and Implementation

47. **Relevance of objectives (*High, Pre and Post restructuring*).** The project’s balance of infrastructure and institutional objectives supported the FY2012–2017 CPS. The project’s focus on improving agricultural livelihoods supported the urban-rural transformation pillar—the project addressed a key constraint in rural development in Odisha, namely its high dependence (over 70 percent of cultivated area) on variable, rainfed agriculture. The project’s institutional strengthening component, meanwhile, supported a second pillar, inclusion. The project also incorporated past lessons, including previous World Bank–funded projects in Odisha, and took full cognizance of state policy encouraging the involvement of community-based institutions in water resource management.

48. The PDO, by taking ‘improving agricultural productivity and the WUAs to manage tank systems effectively’ as the core objectives, was realistic given that the project scope was to revive the irrigation potential created in the minor irrigation schemes by improving irrigation efficiency through tank system rehabilitation, which transforms into improved agriculture productivity with the participatory management by the WUAs in managing improved storage structures, water distribution, and tax collection. The inclusion of a specific WUA indicator at the PDO level was also responsive to the policy context, including the government’s Bharat Nirmaan and PMSKY initiatives, which heavily favored enhancing irrigated agricultural productivity and the role of WUAs. However, as noted in Section 2.3, the PDO-level target regarding WUA O&M collection proved to be somewhat ambitious. Post-completion sustainability of tank system O&M is nonetheless judged by the ICRR authors to be feasible given strong institutional capacity enhancement accomplished by the project and client commitment to sustaining project achievements (see Section 3.2B).

49. **Relevance of design/implementation (*Substantial, Pre and Post restructuring*).** The project incorporated several key lessons learned in its design, especially the fundamental design and emphasis on community-based institutions was sound. The design recognized the importance of engaging several types of community-based institutions, namely Fisheries Cooperative Societies

(FCS) and FIGs alongside the WUAs, and incorporating an Agricultural Livelihood Support Services (ALSS) component alongside irrigation improvement schemes. However, the project at appraisal did not fully account for the importance of state institutions, including the MID and the Water Resources Department (WRD), in supporting the WUAs. As a result, targets proved to be overly ambitious. These limitations were partially recognized at project restructuring with the inclusion of new institutional strengthening subcomponents (Community-based Activities and Minor Irrigation Department), which laid the foundation for the WUAs and MID to maintain sustainable tank system O&M post-completion (see Section 3.2B).

50. The Results Framework was well-aligned with the PDO, and appropriately focused on measuring improved water management from the modernization of physical assets alongside institutional strengthening. Moreover, the indicators generally contributed adequately to the measurement of outcomes of the overall project, as well as the various components, with one exception, namely water management

51. Although innovative water measurement devices were incorporated in the main canals and distributaries after the sluice gates in several tanks, the approach for monitoring and recording the water measurements using these devices was not systematic, necessitating some revision of water management indicators. However, this did not materially affect project outcomes.

52. The implementation arrangements were adequate. The project implementation plan was relevant in delivering the PDOs. The combination of effective engineering options, irrigation modernization approaches, water management considerations, and ALSS were clear and effective. In agriculture, the involvement of various agencies reflected the need to use scarce irrigation water through crop intensification and diversification, water saving irrigation practices, and optimization of income per drop of water through livestock, fishery, and agri-marketing. With respect to institutional strengthening, implementation of water tax collection efforts were stalled because of a delay in securing government approval. However, the PMU's strong capacity-building efforts thanks to WUA training modules and enhanced MID capacity provide a foundation to ensure project sustainability despite failure to achieve the WUA O&M fee collection targets (see Section 3.2B).

53. The active involvement of OUAT, Water and Land Management Institute, and CRRI in the project was essential. It created a pool of innovations, which were put into practice by the project to successfully bridge the traditional divide between research and practical application. OUAT field-tested improved practices and innovations, which were disseminated through the respective line departments.

54. At completion, the implementation mechanisms put in place by the SPU led to effective coordination between the line departments to deliver respective components of the project. There were three striking instruments that led to effective implementation of the project: at the state level, a steering committee headed by the chief secretary was instrumental in coordinating implementation of annual plans of water resources, agriculture, and fishery departments; at the project level, leading Indian Council of Agricultural Research institutes were brought on board to deliver innovative practices in the ayacut; and at the local level, the project developed partnership protocols to pilot agribusiness value chains in selected commodities. Overall, the implementation is rated as highly relevant.

3.2 Achievement of Project Development Objectives

The PDO consists of two parts: (a) selected tank-based producers improve agricultural productivity and (b) the WUAs effectively manage tank systems. This section discusses each part in turn.

A. Selected Tank-based Producers Improve Agricultural Productivity (*Modest, Pre-restructuring and Substantial, Post restructuring*)

55. The project originally envisaged the rehabilitation of 900 tanks to provide irrigation for 120,000 ha with a cost of US\$90 million. However, under restructuring, only 320 tanks were selected with a land coverage to provide irrigation to half of its original size (that is, 60,000 ha) albeit with a proportionally higher allocation of US\$60.6 million, which along with the addition of the subcomponent of additional work to improve irrigation through on-farm development (OFD) works were considered vital for maintaining an efficient irrigation system through selective concrete lining of field channels, bringing unlined reaches to the designed section, fixing new outlets, and provision of concrete diversion structures, all of which have contributed to achieving higher outcomes on productivity.

56. The review of the indicators with respect to tank system improvement and modernization shows the following: by the end of the project period, rehabilitation of 328 tanks against the target of 332 tanks (98.87 percent) was completed and the tank ayacut area of 63,769 ha (99.27 percent) against the design ayacut area of 64,236 ha was restored. The irrigated area for protective *Kharif* crop achieved the target specified in the project (that is, 90 percent of the tank area) and increased by 27 percent from that in 2011 as given in Table 1. Furthermore, rehabilitation of the tank structures combined with improvements in the irrigation conveyance infrastructure through OFD works led to higher efficiency in delivery, which resulted in a substantial increase in the irrigated area of 245 percent from that in 2011. This, in turn, has led to reduction of gap areas under irrigation both in *Kharif* and *Rabi* seasons. The irrigation of tank ayacut for the *Kharif* season is essentially for paddy (approximately 90 percent of the tank area), and the water productivity for paddy showed a significant increase of 91 percent (0.189 kg/m³ in 2011 to 0.36 kg/m³ in 2015).

Table 1. Change in Irrigated Area and Water Productivity (2011–2016)

	Pre-project (2011)	Post project (<i>Kharif</i> 2015 and <i>Rabi</i> 2016)	Project Results (Outcome)	Comments
Irrigated area - <i>Kharif</i> (in ha, thousands)	13.6	17.3	+3.7	Increase in irrigated area: 27%
Irrigated area - <i>Rabi</i> (in ha, thousands)	4.9	17.5	+12.6	Increase in irrigated area: 245%
Gap area in <i>Kharif</i> - rainfed and fallow (in ha, thousands)	5.5	1.8	-3.7	Gap area brought under irrigation in <i>Kharif</i>
Gap area in <i>Rabi</i> - rainfed and fallow (in ha, thousands)	14.2	1.7	-12.5	Gap area brought under irrigation in <i>Rabi</i>
Cropping intensity (in %)	125	143	+18	Increased by 14.5% against a target of 20%
Water productivity for paddy (in kg/m ³)	0.189	0.36	+0.17	Increase in gross water productivity including efficient water delivery and improved farm practices for <i>Kharif</i> paddy: 91%

57. **Tank system rehabilitation improves water availability to tail end farmers.** Rehabilitation of the MIPs, increase in water conveyance efficiency, and reduction in losses resulted in 68 percent of middle reach and tail end farmers in the tank command area being able to access protective irrigation during *Kharif*. This was achieved by efficient irrigation infrastructure as a result of OFD works pertaining to selective concrete lining of field channels, bringing unlined reaches to the designed section. Overall, the area irrigated in the project tanks showed an increase of 5.9 percent, 13.0 percent, and 15.6 percent in the head reach, middle reach, and tail end, respectively (Table 2). These physical interventions coupled with improved water management by the WRD and WUAs and improved agricultural and fisheries practices, aided by capacity-building support under the project, significantly improved water productivity. It should also be noted that because many of the WUAs adopted processes intended to include tail-end farmers in decision-making, it helped to ensure project benefits accrued to tail-end as well as headwater farmers.

Table 2. Percentage Increase in Area Irrigated by Tank

Tank Reach	% Area Irrigated by Tank during Pre-project	% Area Irrigated by Tank during Post-project	% Area Increase
Head	90.65	96.57	5.92
Middle	82.37	95.39	13.02
Tail end	76.09	91.74	15.65

58. **Increased productivity per unit of water.** Crop production increased by nearly two to three times for main crops (paddy, green gram, mustard, and groundnut), a much higher increase than the targeted 20–30 percent. Extensive trainings and demonstrations by the project have noticeably influenced farmers in the command area, as indicated by the unanticipated shift in cropping pattern. Farmers have made changes in the cropping patterns and broken the traditional paddy-paddy cycle by replacing an estimated 13 percent area under *Rabi* paddy with pulses and 5 percent area under *Kharif* paddy with brinjal and tomato. Further, the dissemination of improved seeds and complimentary crop and animal husbandry technologies resulted in a large increase in productivity, and have contributed to the higher-level objectives stated in the PDO. The reported *Kharif* paddy yield in selected MIPs increased by 58 percent in 2014 since the midterm review (MTR) in 2012. The paddy productivity in *Kharif* increased from 2.88 ton/ha (as reported in the PAD) to 4.7 ton/ha in the final assessment at project closure, which showed 63.2 percent increase.

59. Productivity of indigenous and crossbred cows increased from 0.99 l/day and 2.42 l/day to 1.91 l/day and 5.56 l/day, respectively. At project design, a 300 percent increase in milk productivity was conceived, but only 91 percent and 130 percent increase was observed for traditional and crossbred cows, respectively. In retrospect, the increase in milk productivity perceived during project design seemed unrealistically high. Improved fishery practices in conjunction with various interventions including trainings and exposure visits resulted in a phenomenal increase in fish productivity by 883 percent against a target of 400 percent.

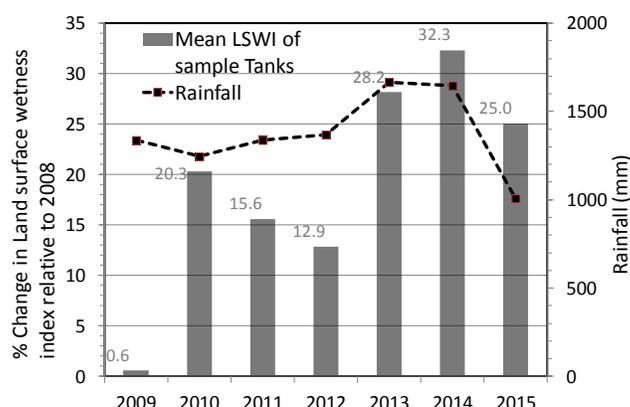
60. **Residual moisture buffered drought conditions.** The temporal distribution of mean Land Surface Wetness Index⁸ (LSWI) from satellite data for the selected 21 MIPs in different project districts during the *Kharif* (monsoon) season in different years (2009–2015) is presented in Figure

⁸ Xiao, X., S. Boles, J. Liu, D. Zhuang, S. Frohling, C. Li, and B. Moore. 2005. "Mapping Paddy Rice Agriculture in Southern China Using Multi-temporal MODIS Images." *Remote Sensing of Environment* 95 (4): 480–492.

1, indicating a substantial increase in the wetness index in the tank ayacut post rehabilitation. The impacts of rainfall variability during the years of lower and higher rainfall are captured in this index. It was also observed that despite the higher negative deviation of rainfall (by nearly -17%) in 2015, the LSWI showed robust values in the tank systems indicating that the modernization of tank systems including OFD works contributed to efficient water delivery within the ayacut and thereby buffered the drought conditions as observed in the ground surveys.

61. A key outcome of the project was additional irrigation coverage in *Rabi* season, which indicated gains in the productivity assessment for several crops including paddy. The temporal distribution of LSWI for 2010–2015 (Figure 2) indicated a positive correlation of the relatively higher wetness index with *Rabi* crop productivity.

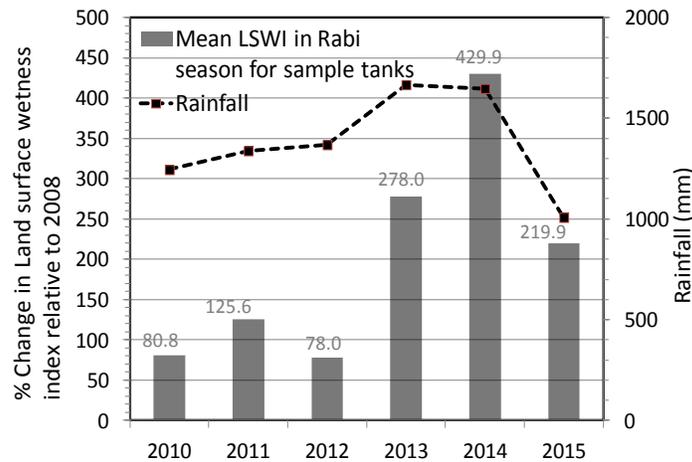
Figure 1. LSWI of Sample Tanks in Kharif (Monsoon) Season



62. Supplemental irrigation during critical growth stages has been known to buffer crop productivity against weather anomalies, such as delayed rainfall and droughts, and build climate resilience of agriculture. The project increased availability of water for irrigation through rehabilitation of tank systems and promotion of less water-intensive crops during both *Kharif* and *Rabi*. Besides improving water use efficiency, crop diversification and seasonal rotations also enhanced the resilience of cropping systems to diseases and pests. To complement resilience building in cropping systems, the project had also focused on diversification of income sources, through livestock rearing, fisheries, and mushroom culture, safeguarding against potential reduction in yield or crop failure due to climate hazards such as droughts, floods, and cyclones that are known to affect the project area.

63. Even though the PDO and key outcome indicators did not change, but there was a significant reduction in the number of tanks rehabilitated and the overall area covered. Thus, the achievement of the PDO is rated ‘Modest’ pre-restructuring and ‘Substantial’ post-restructuring.

Figure 2. LSWI and surface wetness index of Sample Tanks in Rabi (Non-monsoon) Season



B. WUAs Effectively Manage Tank Systems (Substantial, Pre-and Post-restructuring)

64. The efficacy for the second PDO (for water user associations to manage tank systems effectively) is rated substantial based on the enhanced capacity of the WUAs, of which 78 percent has taken over &M responsibilities. The MID is continuing to provide technical and financial support to the WUAs, and continuing the process of WUA takeover of O&M. WUAs use a combination of financial resources, including user contributions and subsidies to finance the operation and maintenance of tank systems. A survey of the functioning of WUAs showed a considerable difference in the functioning of WUAs that were supported through the project vis-à-vis a control group (see Table 5). The survey showed that 85.9 percent of WUAs supported by the project performed well, compared to 31 percent in the control group.

Table 3. WUA Functioning Indicator

Indicator	Control	Intervention
Number of WUA executive board members	8	14
Number of general body meeting attendees	216	219
% of WUAs featuring subcommittees	33	96
% of WUAs holding at least one executive board meeting per month	16.7	91.9
% of WUAs holding at least one general body meeting every six months	25	78.4
% of WUAs featuring a change in leadership (president)	16.7	12.2
% of WUAs performing well according to survey	31	85.9

65. The project substantially contributed to enhanced capacity of the WUAs to manage tank systems effectively. As of the time of writing of this ICRR, 364 WUAs have been created or strengthened from a baseline of 0, and against a target of 374. The enhanced capacity of WUAs stems largely from a significant investment in strengthening MID on one hand, and in training WUAs on the other. With respect to the former, the Bank team appropriately assessed the importance of MID in achieving project objectives following appraisal, and included an intermediate indicator to track progress on strengthening MID’s institutional capacity. Moreover, following project restructuring, the client placed expanded emphasis on capacity building, and five training modules were developed in five areas, including financial management, participatory planning, and O&M. The effect was to significantly enhance the capacity of the WUAs and build

a foundation for them to take over O&M post-completion (see Tables 4 and 5). This enhanced capacity also had a broader positive effect on social and institutional development in project tank areas. At project closing 71.5% of water users in rehabilitated tank systems were satisfied with the O&M performed by the WUAs.

Table 4. WUA Performance Indicators

Training Theme	WUAs Trained
Role and responsibility of the WUAs	364
Financial management	364
Participatory planning and monitoring	350
Water management	350
O&M and crop water management	300

66. At project closing, 292 out of 383 tank systems (78 percent) of the WUAs had been delegated O&M responsibilities. However, the project fell short of achieving the PDO in terms of percentage of the WUAs in rehabilitated tank systems whose O&M expenditures are as per annual O&M plans. Fifty five percent of WUAs did fully cover their cost of O&M plans through a combination of in-kind contributions from members, ad-hoc cost recovery for repairs, and subsidies received from the MID. Government approval for WUAs to collect taxes was issued in January 2016.

Table 5. WUA O&M Performance

Indicator	Baseline	Target	Achievement
% of water users in rehabilitated tank systems satisfied with WUA O&M	0	85	71.5
% of WUAs in rehabilitated tank systems whose O&M expenditures is as per annual O&M plans	0	85	54

3.3 Efficiency (Substantial, Pre and Post restructuring)

67. The efficiency of the project is rated substantial as the ERR of the project, estimated at project closing is 18.6 percent. This is well above the threshold value of 12 percent used for economic viability. The estimated ERR at project closing is roughly the same as the ERR estimated at restructuring (18.8 percent).

68. The ENPV of the project estimated at project closing is INR 0.83 billion. This is lower than the estimated ENPV at restructuring (INR 1.03 billion). The difference in ERRs is explained by the lower investment costs (US\$87.8 million versus US\$54.6 million), the larger than expected expansion of irrigated area, and delays in project implementation. The FRR estimated at project closing is 15.7 percent which is in line with the estimate at restructuring estimate (16.1 percent). The FNPV estimated at INR 0.46 billion is lower than the restructuring projection of INR 0.72 billion.

69. At appraisal, the ERR was estimated at 20.8 percent and the ENPV at INR 2 billion. The FRR and FNPV were estimated at 17.7 percent and INR 1.40 billion. Major changes to project costs, scope, and benefits were introduced during project restructuring. As a result, a comparison of rates of return and net present values between appraisal estimates and end-of-project estimates has limited use. The economic and financial analysis was not updated at restructuring. The ICRR team updated the appraisal analysis using the costs and benefits at the time of restructuring and

used the same methodology to estimate the rate of return and the net present value at project close. The methodology developed at appraisal was used for both analyses. The only assumption was adjusting to a 30 years period (rather than a 25-year period) to allow more accurate estimates benefits as the technical life of tanks is 20 years. The methodology for calculating rates of returns and net present values is included in Annex 3.

70. The ICRR analysis estimated financial returns to the representative project beneficiaries. The estimated incremental annual returns per beneficiary range from INR 2,000 to INR 32,230. The lowest incremental returns were generated to the female wage laborer who benefited from the temporary employment during rehabilitation. The highest incremental returns were estimated for the project farmer with a landholding size of 1.0 ha who would benefit from the combination of expansion in irrigated areas, intensification, diversification, and adoption of new technology. The incremental annual returns to the woman mushroom producer and landless poor engaged in poultry production is estimated at around INR 8,500 and INR 8,180, respectively.

3.4 Justification of Overall Outcome Rating

Rating: Moderately Satisfactory

71. The overall assessment of the outcome considered the ratings against both the original and revised scope of the project, and weighed the assessment against the proportion of funds disbursed before and after restructuring in April 2011 as shown in the table below. Even though the PDO and outcome indicators did not change, there was a significant reduction in the number of tanks rehabilitated and the overall area covered.

Table 6: Summary of Pre- and Post-Restructuring Ratings

Category	Pre-restructuring	Post-restructuring
Relevance of objectives	High	High
Relevance of design/implementation	Substantial	Substantial
Efficacy		
PDO1: Improve agricultural productivity	Modest	Substantial
PDO2: WUAs effectively manage Tank systems	Substantial	Substantial
Efficiency	Substantial	Substantial
Rating	U (2)	MS (4)
Weightage	11%	89%
Overall	2*11%+4*89%=3.78 (Moderately Satisfactory)	

3.5 Overarching Themes, Other Outcomes, and Impacts

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

72. **Poverty impacts.** While poverty reduction was not a direct objective of the project and, therefore, was not explicitly measured, the project appears to have raised income in tank areas through both higher agricultural production and livelihood support activities. The average family income increased by approximately 35 percent during the course of the project. Although this increase cannot be conclusively attributed to the project alone, since poverty rates in Odisha

overall decreased significantly during the project,⁹ surveys of income from crops show that average net income in project areas was INR 24,799 versus INR 13,677 in control areas; this compared to pre-project figures of INR 13,285 in project areas versus INR 8,606 in control areas. However, the increase in incomes reported here precludes external factors influencing poverty in general, which are equally applicable in tank command areas.

73. **Gender aspects.** The project made a major effort to engage women, particularly in ALSS activities like mushroom production and backyard poultry activities. PPs have a legal requirement to include at least one-third females, and 11,500 women took part in training activities. A total of 514 women benefited from mushroom production training, resulting in additional income of INR 3,500 per year. However, the project had only partial success in improving gender-based social inclusion and equality. It was observed that while many women benefited from and took up training opportunities offered under the project's ALSS component, helping to empower their participation in the WUAs and decision making remained largely male-dominated. Moreover, employment figures show that while males earned an average of INR 6,319 from 2,958 days of total employment generated as a result of the project, women earned an average of only INR 1,758 from 535 days of employment. This discrepancy likely reflects systemic issues that were not a focus of the project.

74. **Social development.** The project consciously adopted an inclusive criterion wherein tank command was considered one unit, extending benefits from agribusiness and livelihood activities to those who could not draw gains from irrigation expansion. There are no reliable quantitative measures to assess the project's input on social development. However, this ICRR considers that the project did contribute meaningfully to social development in the following respects: (a) the formulation of TIMPs followed participatory processes, potentially contributing to the mainstreaming of participation, and (b) surveys found that 68.2 percent of middle reach and tail end farmers experienced improved water availability as a result of the project, suggesting that it promoted inclusion.

(b) Institutional Change/Strengthening

75. A significant outcome of the project was to improve the business-as-usual approach of the MID, by capacity building of the predominantly engineering outfit to integrate social concerns in irrigation infrastructure development. The project substantially contributed to improving the WUA capacity for tank management as well as to the general capacity of the GoO in water resource management. A major focus of the project following restructuring was on reconstituting the WUAs to make them more inclusive and to include fishers and other tank system stakeholders. Beyond the specific outcomes envisioned by the project, the OCTDMS has become a model for PP-level training within Odisha. For example, it appears that the GoO is committed to disseminating the training modules developed by the OCTDMS for use by the WUAs in other tank systems; the principal secretary, GoO, reported that the GoO has allocated US\$2 million for this purpose.

⁹ Odisha experienced the greatest reduction in poverty of any state during the project period, reducing poverty rates from 57 percent in 2005–2006 to 33 percent in 2011–2012. However, Odisha still has one of the highest rates of rural poverty in India.

(c) Other Unintended Outcomes and Impacts (Positive or Negative)

76. **Drought resilience.** Studies of the sample tanks found that despite a severe drought in 2014, agricultural productivity was not affected, suggesting that the project created a buffer against drought in the project tanks. For example, rainfall in 2012–2013 decreased by 4.6 percent in the state overall relative to the long-term average, but paddy productivity increased to 35.77 quintals/ha as compared to 24.01 quintals/ha in 2009–2010.

77. **Residual moisture.** The severe drought of 2015 had, on an average, resulted in 108 percent decrease in southwest monsoon rainfall (June to October) in 12 project districts, but the modernization and rehabilitation of tank system infrastructure created an ability to buffer this weather anomaly, and the designed protective *Kharif* irrigation in the tank command was effective. For example, the recorded data of Parhel MIP in the severely drought affected Boudh District (reporting 193 percent decrease in monsoon rainfall) indicated that the entire tank command of 220 ha was irrigated during *Kharif*. While it may be too early to generalize, significant is the fact that decentralized, protective irrigation through tank systems under the OCTMP has enabled small and marginal farmers, prevalent in the tank command areas, to continue with their farming practices even in the event of extreme drought.

3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

78. **Institutional strengthening.** Interviews indicate that the relatively high satisfaction ratings given to the WUAs are attributable to cooperation among members, regular meetings, support for activities like poultry, and provision of agricultural inputs to farmers. This bolsters the view that WUA capacity to take over O&M was significantly strengthened by the project. Interviews also indicate that in most of the tank projects, the WUAs would have liked to become more involved in tank system improvement works, but these works were undertaken by private companies with little consultation with the WUAs.

79. **Tank system improvements.** A post-project survey indicated that the completed tank improvement project, on an average, benefited 293 families directly, and an additional 301 families indirectly. Of these, an average of 266 families benefited directly from the construction of diversion weirs, while 266 families benefited directly from reservoir construction; in addition, 103 families benefited indirectly from diversion weirs and 225 families benefited indirectly from reservoir construction. Substantial gains have accrued to the families in the command area from labor employment in the construction activities.

4 Assessment of Risk to Development Outcome

Rating: Moderate

80. The risk to the sustainability of development outcome is rated moderate. This rating takes into account two aspects: the sustainability of assets created by the project, and the sustainability of institutions established or supported by the project. Only by ensuring sustainability of assets and institutional sustainability, can project benefits be sustained during the post-completion operation phase.

81. The sustainability of assets created by the project is secured through the appropriate construction method used, the ownership of farmers and water users association of the assets, and the operation and maintenance arrangements that have been put in place by the project. The assets financed by the project are simple in construction and easy to maintain. Users are familiar with the type of assets that have been built. No complex spare parts have to be transported from outside the project area. It should be noted that the project design factored in climate variability to a limited extent. More importantly, the tank system rehabilitation helps to mitigate against climate variability as it can store water in wet periods for use in dry spells.

82. The sustainability of institutions established and supported by the project is secured through the extensive capacity building that was carried out. The project significantly enhanced the capacity of MID. The institutional sustainability of the Water User Associations is assessed to be high given the surveys' results that show the high ownership of water users of WUAs. Many WUAs have been innovative in combining various in-kind and financial resources to carry out operation and maintenance. The 2016 decision to allow WUAs to collect taxes will further contribute to the institutional sustainability of the WUAs. Tax collection is ongoing at the time of ICRR writing.

5 Assessment of Bank and Borrower Performance

5.1 Bank Performance

(a) Bank Performance in Ensuring Quality at Entry

Rating: Moderately Satisfactory

83. Bank performance in ensuring quality at entry is rated moderately satisfactory as the project design was based on a sound analysis, including an appropriate risk assessment. The instrument chosen (Sector Investment Loan) was appropriate, and the project components effectively balanced investment in infrastructure and institutions. The Results Framework was aligned with the PDO. The World Bank was responsive to the state and national policy context, as well as to the client demand. The World Bank incorporated lessons from other projects into the project design, particularly with respect to institutional strengthening and ALSS. Environmental and social safeguard risks, particularly related to tank systems in Scheduled Tribal Areas, were adequately identified and incorporated into the project design. These risk mitigation measures helped to limit the overall risk of the project. In hindsight, targets were overly ambitious given the relatively long timelines associated with institutional capacity-building.

(b) Quality of Supervision

Rating: Moderately Satisfactory

84. The World Bank provided timely support, including on procurement, financial management and safeguards. The deployment of experienced and technically capable World Bank specialists created substantial value for the client. The Bank's team strong implementation support contributed to the high quality of engineering works. The Bank team conducted regular supervision missions, provided candid ISRs, and was responsive to client requests. The team responded timely when a request for project restructuring was received. The team worked extensively with the SPU to build institutional capacity within WUAs and MID to ensure

sustainability of project outcomes. The project procurement specialists received detailed training, which they credit with enabling them to maintain robust procurement procedures. In addition, the procurement specialists commented that they were in constant touch with their World Bank counterparts and received prompt response to their queries.

(c) Justification of Rating for Overall Bank Performance

Rating: Moderately Satisfactory

85. Overall, the World Bank performance is rated Moderately Satisfactory based on ensuring quality at entry and during supervision.

5.2 Borrower Performance

(a) Government Performance

Rating: Moderately Unsatisfactory

86. The borrower satisfied most of the conditions set out in the borrower's agreement, including satisfactory compliance with the Anti-Corruption Guidelines. The establishment of an SPV was an innovative and important step that helped to ensure project effectiveness by creating a bespoke administrative entity responsive to Bank team input and focused on project results. The Government adequately empowered the SPV and delegated responsibilities for project management. However, progress toward establishment of DPUs was slower than expected. This was further affected by the introduction of the RRR scheme, and a lack of clear decision by GoO had led to delays in project implementation and project restructuring. The government decision to provide authority for the WUAs to collect water tariffs was substantially delayed. In the later project stages, the GoO displayed strong support for the project and helped the project to achieve most of its objectives despite a slow start.

(b) Implementing Agency or Agencies Performance

Rating: Moderately Satisfactory

87. The implementing agency, which was created from scratch, got off to a slow start and encountered delays in contracting for tank system rehabilitation. However, following a substantial investment in training for agency personnel, capacity improved markedly, and robust procurement, financial management, and other capabilities were in place within both the SPU and DPUs in the later stages of project implementation. Following the appointment of a new project director, progress improved markedly, and this enabled the project to complete most of the planned activities by project closure. In particular, use of spreadsheets to track expenditures bolstered financial management. The Implementing Agency kept in close communication with World Bank staff. The project incorporated several first-of-its-kind innovations in Odisha, such as allowing DPUs to open subsidiary accounts under the SPU account (known as mother-and-child), improving financial management and oversight, and allowing the SPU to immediately detect any financial irregularities. Performance with respect to dam safety is noteworthy: the cooperation with the Dam Safety Panel was excellent, and regular inspections were conducted, as a result of which, no serious lapses in compliance were recorded.

(c) Justification of Rating for Overall Borrower Performance

Rating: Moderately Satisfactory

88. The overall Borrower Performance is rated Moderately Satisfactory. This rating combines the early shortcomings in Government and Implementing Agency performance with a strong track record in later project stages. The combination of the Moderately Unsatisfactory rating for the Government Performance and Moderately Satisfactory rating for the Implementing Agency is tipped towards Moderately Satisfactory by the strong fiduciary performance of the Agency which was enabled by the full devolution of responsibilities by the Government to the SPV.

6. Lessons Learned

89. **The potential of community-based institutions in agricultural water management.** The project demonstrated how WUAs can play a positive and expanded role in irrigation. This requires substantial investments in capacity building of both WUAs and government institutions. In the case of the project, the interface between the GoO and the community in delivering enhanced services from rejuvenated tank systems functioned well because of the considerable capacity building investments in MID and the WUAs.

90. **Interdisciplinary expertise for maximum impact.** The key operation concepts of the OCTMP were new to the WRD as the project needed synergy between the core team of water resources with the irrigation department, agriculture department, CRRI, fisheries department, and so on. The SPU had difficulty in the early years taking these concepts even though at the end, the project has demonstrated effective convergence and collaboration with other departments. Going forward, future water resources management projects in India should specifically consider interdisciplinary expertise to maximize development impact.

91. **Effective revenue models at design stage.** To transform the gains attained in water and crop productivity in the project, effective revenue models need to be designed and implemented at the WUA level. Such mechanisms should be based on an analysis of all potential sources of revenues, including in-kind contributions from users.

92. **Evaluate tank system performance using automated devices.** An achievement in the project has been the installation of the state-of-the-art cutthroat flume in the canal and distribution system for accurate measurement of water flows in a large number of MIPs (80 percent). However, the design did not include any monitoring of flows either through manual or simple automated devices in a continuous manner to evaluate performance efficiency of the tank system with regard to net additional water realized after modernization of tank systems and to quantify water budgets/intake for crops. Going forward, such systems might help assess performance of crop water systems in the tank ayacut during low rainfall years as part of a strategy toward climate resilience.

93. **Use of remote-sensing for effective M&E.** The M&E in the project relied heavily on field surveys in a selected sample as per the design of the project. Even though advanced and robust

remote-sensing tools¹⁰ are available for retrieving and tracking the crop and water variables with a good spatial resolution in the tank ayacut and good temporal frequency during the entire project period, such approaches were not relied upon to fill the information gap from field surveys to complement the output indicators. Such complementary data are very useful for monitoring the performance of modernized tanks systems beyond the project period.

94. **Measuring sustainability and local capacity.** Agriculture water resources management projects can only achieve sustainable results if the sustainability of assets and institutional sustainability are secured by project closing. Traditional project indicators measure the progress at the time of project closing. Going forward, more thought could be given to how to better assess local capacity for WUA functioning and how to measure sustainability of institutions and development outcome after completion.

95. **Time requirements for institutional capacity building.** This project relied heavily on local capacity to support an enhanced WUA role in tank system management. The long times needed to build such capacity, and the inevitable variation in results, will need to be taken into account when setting institutional targets for a time bound project. In hindsight, the targets WUA functioning for this project should have been less ambitious.

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

(a) Borrower/Implementing Agencies

96. The GoO has had an opportunity to review this ICRR and has expressed its satisfaction with it. It provided no comments to the ICRR authors.

97. Annex 7 provides comments on the implementation and progress of components by the principal secretary, GoO. In general, the GoO is satisfied with the tank system rehabilitation and improvement in meeting the PDO.

98. Considering that the downsized project has been able to meet its revised and restructured targets, the project has been somewhat circumspect about the overall rating being Moderately Satisfactory. The GoO appreciated the support provided by the World Bank's supervision team and seeks a follow-up project from the World Bank.

(b) Co-financiers

Not applicable.

(c) Other partners and stakeholders

Not applicable.

¹⁰ Muruganantham, M., and M. Krishnaveni. 2015. "Water Delivery Performance Evaluation of a Tank Irrigated System and Best Management Practices for Paddy Agriculture." *Indian Journal of Science and Technology* 8 (15): 1–12. doi:10.17485/ijst/2015/v8i15/71645.

Annex 1: Project Costs and Financing

	Components	Appraisal Estimate (US\$, millions)	Revised Estimate at Restructuring (US\$, millions)	Actual/Latest Estimate (US\$, millions)	Percentage of Appraisal
A	Institutional Strengthening	8.8	5.1	2.6	51%
B	Tank Systems Improvement	90	60.6	48.4	80%
C	Agricultural Livelihoods Support Services	16.1	11.0	5.4	50%
C1	- Agriculture and Horticulture	7.5	5	1.9	
C2	- Livestock	3.6	2.1	0.5	
C3	- Fisheries	2.4	1.7	0.5	
C4	- Foreshore Area Treatment	0.5	0		
C5	- Agricultural Marketing	2.1	2.2	2.4	
D	Project Management	6.4	5.7	5.3	93%
	Total Baseline Cost	121.3	82.4	61.8	75%
	Physical Contingencies	1.5	0.8		
	Price Contingencies	5	4.6		
	Total Project Costs	127.8	87.8	61.8	
	Front-end fee PPF	0	0		
	Front-end fee IBRD	0	0	0.1	
	Total Financing Required	127.8	87.8	61.9	

Source of Funds	Appraisal Estimate (US\$, millions)	Revised Estimate at Restructuring (US\$, millions)	Actual/Latest Estimate (US\$, millions)	Percentage of Appraisal
Borrower	11.5	10.9	5.4	26%
Community	4.3			
IBRD	56	38.5	31.6	82%
IDA	56	38.5	24.8	64%
Total	127.8	87.8	61.9	

Annex 2: Outputs by Component

1. A striking feature of the project was that its PDO level indicators had remained unchanged. The implementation progress outpaced data collection in the early years which has subsequently improved since May 2015. The external monitoring agency has played a major role in ensuring quality data management and undertaking impact assessments. It is also important to report that there were a few indicators which were not possible to measure (that is, water tax collection by PP) as the GoO did not have regulations authorizing PP to collect tax in general.
2. **Rating.** While the project made substantial all-round progress, and was committed to expedite progress before the project closure, the PDO and implementation progress were rated Moderately Satisfactory.
3. The allocation of restricted components is as described in table 2.1

Table 2.1 Project Restructuring (all figures in US\$ millions)

Restructured Components	Financing at Appraisal	Restructured Allocation
Component A: Institutional Strengthening was divided into two subcomponents with a redistributed budget.	8.8	5.1
Subcomponent A.1: Community-Based Activities: To strengthen the project's focus on supporting the WUAs through training and capacity building to enable them to take over tank system O&M	8.8	4.0
Subcomponent A.2: Minor Irrigation Department: To finance capacity-building of MID to plan, implement, monitor, and evaluate investments in minor irrigation schemes	—	1.1
Component B: Tank Systems Improvements was rechristened as 'Tank Systems and Irrigation Improvements' with two subcomponents with independent budgetary allocation.	90.0	60.6
Subcomponent B.1: Tank Systems Improvements: To include tank systems improvements and additional works in irrigation improvements at estimated unit costs of INR 35,000 and INR 12,000 per ha, respectively	—	50.6
Subcomponent B.2: Additional Work to Improve Irrigation: For the main canals, excavation and judicious lining of field channels, and construction of control structures	—	10.0
Component C: ALSS was modified to reflect restructured operations on account of reduction in area/districts covered.	16.1	11.0
Subcomponent C.4: Foreshore Treatment was discontinued.	0.5	0.0
Component D: Project Management	6.4	5.7

Component A: Institutional Strengthening

4. For the O&M of the rehabilitated tank systems, the project developed an institutional structure in the name of PP (WUA). The PPs are formed as per the Pani Panchayat Act and normally comprise the water users of the tank command area. Apart from forming/promoting new PPs, the project has taken measures to reconstitute the existing PPs, making them more representative and inclusive as per the amended Pani Panchayat Act (amended in 2008). In the 332 MIPs, 383 PPs have been formed, meaning that some MIPs have more than one PP, as per the O&M requirements.

5. The project developed five training modules and exclusive trainings were organized on these modules. To strengthen PPs, training programs were organized in different phases for the executive and general body members. Trainings were provided to the PPs on these modules, that is, (a) Module 1: Role and responsibilities of PPs, (b) Module 2: Financial management, (c) Module 3: Participatory planning and monitoring, (d) Module 4: Water management, and (e) Module 5: Operation, maintenance, and crop water management. The project also organized trainings for system operators. Apart from organizing trainings, the project took up measures to give exposure to the PP members to other initiatives within and outside the state. The objective of exposure visits was to understand different functional aspects of the PP and adopting the feasible options in their own functioning for efficient management.

6. Most of the PPs in the project tanks (95.9 percent) have created different subcommittees to look after the affairs of the PPs. Regularity of PP meetings was well-recognized by the members (92.4 percent). Absence of members in the Executive Committee or General Body meeting was often due to preoccupation in activities, not much attributed to individual or institutional dynamics. In view of the functionality of the PPs, with regard to holding regular meetings of the general body, it can be said that the end target of the intermediate outcome indicator, that is, percentage of PPs holding regular general body meeting was satisfied. The achievement exceeded by 17.3 percent from the end target of 80 percent. The PPs have been maintaining records to track their financial and non-financial activities. Achievement of intermediate indicator, that is, percentage of PPs maintaining cash book remained higher than the end project target by 15 percent. However, PPs were found wanting in maintaining water regulation register.

7. The PPs at the intervention tanks had developed a blueprint for higher revenue generation and sustenance of their operations. To this effect, the project conducted visioning workshops for the PPs to strengthen revenue stream of the PPs, apart from dealing with other water distribution related issues. 86.49 percent PPs had a plan for higher revenue generation. As per the plan, average annual revenue expected to be generated, irrespective of the tank type (reservoir and diversion weirs) and its command area, was estimated at INR 67, 607.52.

8. At present, the local revenue inspector is responsible for collection of water tax from the farmers. As PP has come up as a community-based representative institution, it is planned to delegate water tax collection to the respective PPs. Apart from this, the local PP can emerge as an irrigation service provider in the locality and can improve the irrigation system through appropriate repair and renovation measures. However, till the end of the project, no PP is observed to be collecting any water tax from the farmers due to non-completion of handing over process of tax collection and responsibility delegation.

9. Looking at the current level of satisfaction expressed by the PP members, it can be stated that the project has achieved the related outcome indicator. As per the PAD, it was expected that by the end of the project, 85 percent water users will be satisfied with regard to O&M. It is evident from the final assessment that 85.9 percent PP members have expressed their satisfaction, which is 0.9 percent higher than the target. PP has emerged as a vibrant institution for water management; however, operational sustainability to achieve engineering saturation of tanks by PPs is a work in progress. The enabling regulatory framework to collect water tax by PPs is a positive outcome. Conscious attempts by the project to handhold PPs will ensure their long-term sustainability.

Component B: Tank Systems Improvements

10. The expected intermediate outcome for Component B was tank systems improvements, and additional works to improve irrigation. The following indicators and associated targets were identified in the PAD for measuring its achievement:

- 332 tanks modernized with total irrigation area coverage of 90 percent of the designed ayacut of 19,161 ha;
- 100 percent completion of OFD works in tank ayacut covering 33,100 ha; and
- 68 percent of middle and tail end farmers reporting improved water availability in the rehabilitated tanks.

11. Table 2.2 presents the results of outputs against the target indicators for the 332 tanks, and figure 2.1 presents the percentage ayacut area stabilized in rehabilitated tanks and their spatial distribution in various districts. Figure 2.2 presents percentage irrigated area coverage in the modernized tanks and associated districts.

Figure 2.1. Percentage Ayacut Area Stabilized in the Rehabilitated Tanks in Various Districts

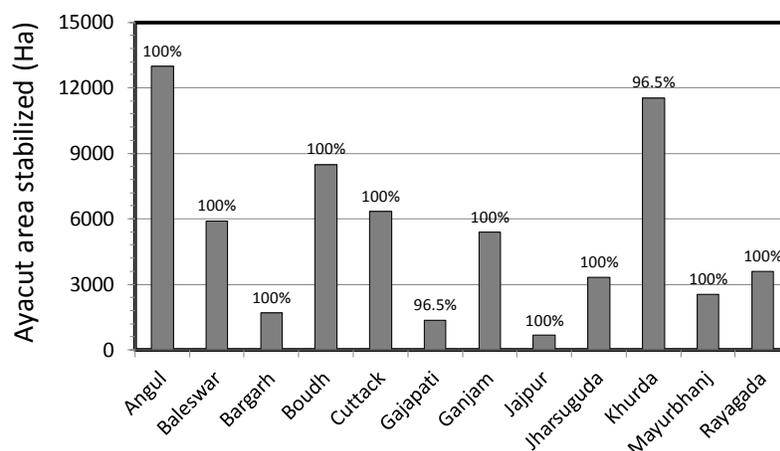
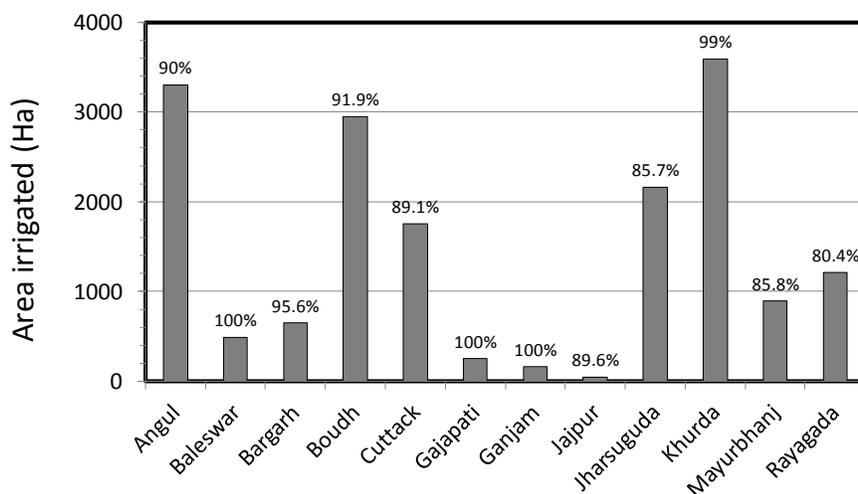


Table 2.2. Results under Project Component B: Tank Systems and Irrigation Improvements

No.	Activity	Output Target	Output Achievement
B.1 Tank systems and irrigation improvements			
B.1	Tank systems improvements	332 MIPs modernized, covering 64,000 ha CCA	<p>Target Achieved</p> <p>(a) Rehabilitation and modernization of tank structures, earthen dams, water distribution systems in all the 332 MIPs achieved stabilizing an ayacut of 99.27 percent of the target;</p> <p>(b) Irrigated area coverage in the tank system substantially increased and recorded 17,647 ha (92 percent of the designed ayacut area) for <i>Kharif</i> crop;</p> <p>(c) 332 TIMPs were prepared in a participatory manner with the WUAs;</p> <p>(d) 27 percent increase in tank command area under irrigation during <i>Kharif</i> and 245 percent increase during <i>rabi</i>;</p> <p>(e) 15 percent increase in cropping intensity;</p> <p>(f) 91 percent increase in water productivity; and</p>

No.	Activity	Output Target	Output Achievement
			(g) 68 percent of middle and tail end farmers accessing protective irrigation during <i>Kharif</i> .
B.2	Additional work to improve irrigation	OFD works covering 33,100 ha in 332 MIPS; installation of state-of-the-art fiber reinforced plastic measuring devices of cutthroat flume type in canals and distribution systems for accurate measurement of water flows	Target Partially Achieved (a) The CAD wing of DoWR and district project directors (DPDs) have executed OFD works for 26,480 ha (80 percent), against the target of 33,100 ha as on July 4, 2016, and additional OFD works in remaining tanks are in progress; (b) Water measuring devices installed in 263 MIPS; and (c) 843 system operators from 274 MIPS were trained in operational procedure of head regulator and water discharging and regulating principles.

Figure 2.2. Percentage Area Irrigated in the Rehabilitated Tanks in Various Districts



12. OFD activities were directed to provide irrigation water to the farmers having agricultural land in the middle and tail end of the tank by improving water distribution systems and irrigation efficiency. Assessment indicates 68.20 percent farmers having land in the middle and tail end of the tank command area are having improved water availability. In the middle reach of the command, area irrigated in the intervention tanks has increased from 82.37 percent to 95.39 percent, that is, a growth of 13.02 percent. Consequently, an area irrigated by other sources has declined in the middle reach by 8.73 percent while the households accessing irrigation in the middle reach has increased by 18.5 percent. It was observed that 24.57 percent more households are accessing tank irrigation in the tail end of the tank command after the implementation of the project. Total area irrigated also increased by 15.65 percent from 76.09 percent to 91.74 percent. Area irrigated by other sources has declined by 11.66 percent from 13.2 percent to 1.54 percent. In the control tanks, no change is observed in area irrigated through other sources. Improved management of water distribution by the PPs and OFD activities have been helpful in achieving greater accessibility to tank irrigation in the tail end.

Table 2.3. Irrigated Area Coverage in the Middle and Tail End of the Rehabilitated Tanks

Tank Reach	Pre Project				Post Project			
	% Area Irrigated by Tank	% Area Irrigated by Other Sources	% Total Area Irrigated	% Non-irrigated Area	% Area Irrigated by Tank	% Area Irrigated by Other Sources	% Total Area Irrigated	% Non-irrigated Area
Middle reach	82.71	9.68	92.39	7.53	92.10	1.52	95.97	4.03
Tail end	76.09	13.20	89.29	10.49	91.74	1.54	93.27	6.73

13. Prolonged and severe droughts occurred in the project area during the implementation affecting project achievements, especially the irrigated area target. Majority of the project districts received less rainfall than normal from 2009 to 2012 and a severe drought in 2015 as shown in Figure 2.3 and Figure 2.4. The severe drought of 2015, on an average, resulted in 108 percent decrease in southwest monsoon rainfall (June to October) in 12 project districts. Modernization and rehabilitation of the tank system infrastructure has created an ability to buffer this weather anomaly and the designed protective *Kharif* irrigation in the tank command was feasible. For example, the recorded data of Parhel MIP in the severely drought-affected Boudh District (reporting 193 percent decrease in monsoon rainfall) indicated that the entire tank command of 220 ha was irrigated during *Kharif*. While it may be too early to generalize, significant is the fact that decentralized, protective irrigation through tank systems under the OCTMP has enabled small and marginal farmers, prevalent in the tank command areas, to continue with their farming practices even in the event of extreme drought.

Figure 2.3. Rainfall Departure from Normal during 2009–2015

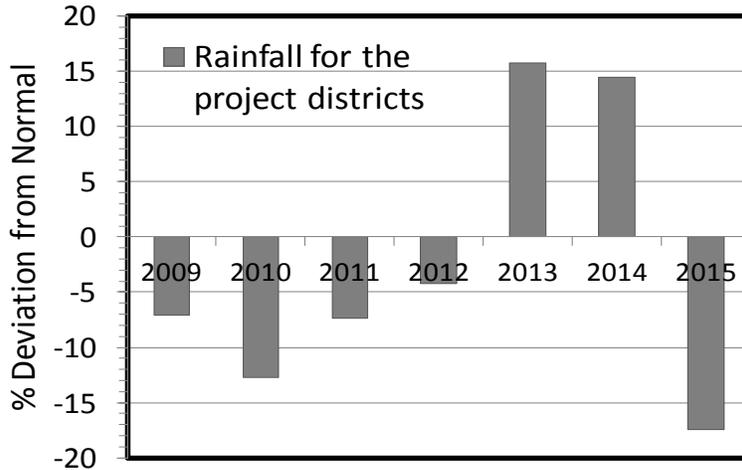
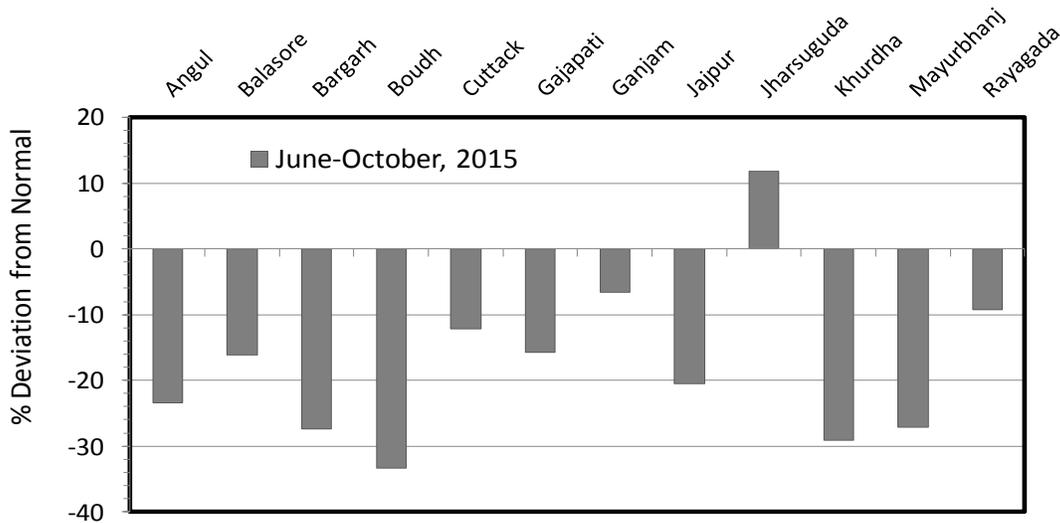


Figure 2.4. Rainfall Departure from Normal for 2015 Drought in Project Districts



Component C: Agricultural Livelihoods Support Services

14. In Odisha, 11 districts fall into 10 agro-climatic zones on the basis of soil, weather, and other characteristics. Its land can be classified into three categories, namely low, medium, and uplands. The agricultural activities, such as cropping system and production/productivity, are dependent to a large extent on agro-climatic conditions and related characteristics. Promotion of agricultural activities in the tank command was designed to suit the local agro-climatic conditions. For example, recommended package of practices adhered to the basic principle that considers the soil type, selection of crops by soil, local climatic conditions, crops' water requirement, and so on.

15. The project adopted an agricultural marketing strategy to link producers to markets for a remunerative return. The agricultural marketing basically focused on specific commodities like onion, potato, and mushroom. For the management of supply chain, the project adopted a cluster approach for collectivization of produce, and linked it to the markets. Different wholesale markets (*mandis*) were contacted in different districts like Sambalpur, Cuttack, and Bhubaneswar, for selling of produce. Successful demonstration and higher yield motivated the farmers to adopt improved technologies and 40,270 farmers adopted improved technologies in paddy and recorded an increase of 11.94 percent in yield. Similarly, 13,945 farmers adopted improved technologies in pulses increasing yield by 3.57 percent. Farmers adopting recommended technologies in groundnut and mustard/sesame recorded yield increase of 7.93 percent and 7.50 percent respectively.

16. Of the total farmers covered under agricultural technology demonstrations, about 97.7 percent have continued to use the demonstrated technologies. Paddy has been the most common crop across all the project districts where the demonstrated production technologies were adopted. Major adoption has been line transplanting which is adopted by 60.66 percent of the farmers who were involved in demonstrations. About 28.25 percent farmers also adopted the system of rice intensification (SRI). Crop-specific agricultural technology was also adopted by some farmers in green gram, potato, onion, and sunflower. Total area covered under technological adoption was about 1,057.4 acres with an average of 1.87 acres. About 49 percent of the farmers were covered under the demonstration program. About 98 percent of the farmers participating in demonstrations

have adopted the demonstrated technologies. Of the total farmers in the project area, 47.8 percent adopted the demonstrated technologies.

17. Apart from agriculture, the project supported livestock and fish production in selected tanks. To improve crossbred cows, AI camps were organized along with animal health camps for domesticated animals. Special trainings were also conducted on livestock management. The activities were taken up in collaboration and convergence with the Animal Husbandry and Fishery Department. The objectives of promoting and strengthening livestock sector was to strengthen supportive and supplementary livelihood of people living in the tank command, improving livestock management through capacity building, and taking supportive measures for breed improvement and livestock health management. About 34.6 percent families in the tank command have cattle and 8.09 percent families having cattle population availed dairy development and management services under the project, apart from general services that were provided by Animal Husbandry and Fishery Department.

18. The average annual income and number of livestock rearing families increased in project tanks in poultry, the number of families increased from 4.9 percent to 15.4 percent, and average annual income increased from INR 1,394 to INR 2,716. Similarly, in dairy, families having milk animals increased from 16.8 percent to 22.5 percent with an increase in average annual income from INR 7,966 to INR 12,806. Rearing of small ruminants by the families also increased from 4.9 percent to 5.8 percent with marginal income growth.

19. Under the agricultural marketing subcomponent, the OCTMP attempted to promote integrated value chain local information network system, strengthening backward linkage of the producers through formation of farmers collectives as FIGs, and strengthening capacity of farmers through training, exposure visits, and hand-holding. The project developed a holistic perspective to deal with the whole chain of agricultural activities in the production to consumption model.

20. The project made an attempt in this regard, though the scale of operation was limited to selected project districts, tank systems, and limited agricultural/horticultural commodities. The approach under agricultural marketing was to develop product-specific clusters in selected tank command areas (based on feasibility), imparting training to farmers on specific products, supporting farmers in accessing quality seeds, transferring product specific technology to farmers, convergence with the Directorate of Horticulture for scheme based linkage, sharing the cost of production with farmers (part of the cost, about 30 percent was shared by the OCTMP), facilitating post-harvest management, and establishing forward market linkage with *mandis*/wholesale markets. Focus under agricultural marketing has been on onion, potato, and mushroom. While development of mushroom cluster was at a preliminary stage (Mayurbhanj and Balasore Districts), onion and potato clusters emerged as promising avenues for the farmers in the tank commands. Onion clusters were developed in Boudh and Angul, whereas initiatives for potato cluster development were undertaken in seven project districts.

Component D: Project Management

21. To steer the project implementation and putting it in perspective, the project established the SPU at the state headquarters. The project equipped the SPU with required professional staff and established six program units within the SPU. The program units were in line with the project

requirement, like (a) institutional strengthening, (b) livelihoods (ALSS), (c) technical inputs, (d) monitoring, learning, and evaluation, (e) finance and procurement, and (f) communication. These program units were constituted with required number of professionals. To look after the environmental aspects, an environment specialist was also recruited in the later part of the project. The functioning of the SPU was guided, monitored, and supervised by the project director. For day-to-day functioning, the project director was supported by the project manager.

22. The SPU was responsible for project planning and management, coordination with DPUs, management of project finances, quality assurance, monitoring of project activities, and providing technical assistance to DPUs. Thematic experts were recruited through a competitive selection process in each unit. Some of the key staff of the SPU was also on deputation from other departments of the Government like Agriculture, Fisheries, Livestock, Finance, and WRD to provide thematic support.

23. In line with the SPU, a DPU was established in each project district (total 12 DPUs). The DPU was headed by the executive engineer of the Minor Irrigation department, who was designated as the DPD. The DPUs remained fully functional during the life of the project with required staff and facilities. The DPDs worked under the guidance of the district collector, who acted as the Chairman of the District Level Steering Committee of the project and remained accountable to the state project director. The DPUs were the implementation arm of the project at the district level and responsible for physical and financial progress of the project. Based on the requirement, the DPUs were provided with required technical and managerial support by the specialists of the SPU from time to time.

Annex 3: Economic and Financial Analysis

Appraisal Economic and Financial Analysis

1. The appraisal economic and financial analysis estimated potential project benefits to project investments in instructional strengthening, community tank improvement, and agricultural livelihood services. The agricultural benefits were quantified for 120,000 ha of command areas operated by around 900 tanks that were planned for rehabilitation at the project appraisal. Main sources of the project benefits were to derive from: (a) an incremental production of *Kharif* crops on 43,680 ha of tank command areas where the irrigation water delivery service would resume after the rehabilitation; (b) an incremental production of high-value crops on 30,000 ha of unirrigated lands where production of non-paddy crops would become possible in *Kharif* and *Rabi* seasons due to the improved residual soil moisture conditions increasing cropping intensity from 125 percent to 150 percent; (c) an increased agricultural production through the adoption of SR) on around 6,000 ha of paddy areas and improved production techniques on 24,400 ha under pulses, vegetables, and oilseeds crops; (d) an incremental milk production from 22,000 crossbred dairy cows produced through AI over the project life of 25 years and assuming a daily milk productivity at 9 l/day for a crossbred cow; (e) an incremental fish production on 6,500 ha of water spread area in 740 tanks where fish productivity would increase from 30 kg/ha to 90 kg/ha as a result of improved fish production techniques; and (f) an incremental income generated from marketing of 1.1 million cubic feet commercial timber which would be produced in selected tanks as a result of foreshore treatment. In addition to these, assuming that the expansion in irrigated areas would reduce the risk of low paddy production in poor rainfall years, the analysis estimated an incremental paddy production produced in dry years.

2. The analysis used a baseline data for 1,025 tanks, sample data collected from 269 households in 15 representative tanks and results of water budget analysis to develop the without project (WOP) and with project (WP) scenarios. Agricultural benefits were estimated based on representative production models for inland plains, coastal plains, and inland hills. The analysis also considered probability of occurrences of normal, flood, and drought years for future scenarios. Based on rainfall data between 1991 and 2005, probabilities for the good, normal, and drought years were assumed at 15 percent, 47 percent, and 38 percent, respectively.

3. The project benefits were estimated in 2007 prices over a period of 25 years and using the discount rate of 12 percent. The total financial project costs of INR 5.46 billion, inclusive of physical and price contingencies, was accounted. Financial prices of inputs and outputs, however, were used in 2007 prices without adjustments for the future inflations. The financial prices of traded inputs and commodities were converted into economic prices at their import/export parity prices. A standard conversion factor of 0.9 was used to convert prices of the non-traded inputs and commodities.

4. Economic and financial returns were estimated separately for the main sources of benefits. The irrigated area expansion and diversification alone was estimated to generate the ERR of 14.1 percent and ENPV of INR 0.5 billion. Returns to technology adoption would increase the ERR to 19.1 percent and ENPV to INR 1.6 billion. When returns to reduced risk of water scarcity is added, the overall project was estimated to generate ERR of 20.8 percent and ENPV of INR 2 billion. The FRR and FNPV were estimated at 17.7 percent and INR 1.40 billion.

5. Project restructuring did not involve changes to the project design and its objectives. The major restructuring included: (a) reduction of the tank command area from 120,000 ha to 64,000 ha and the number of tanks from 900 to 320 tanks, and associated reduction in the cost of rehabilitation component by 47 percent; (b) a 30–45 percent reduction in the costs of institutional strengthening and agricultural livelihoods services components; (c) reallocation of the budget allocated for foreshore treatment as plantation of commercial timber was not possible on the government forest and private lands; and (d) revision of targets for several existing and inclusion of new outcome indicators to reflect several new activities added to the institutional strengthening and livelihood services components and also to update the baseline levels of indicators based on the new baseline data compiled for the 300 tanks. The restructuring resulted in a higher than appraisal level investment costs per ha, reduction of fish production area, and elimination of investments in foreshore treatment for commercial timber production. The economic and financial analysis, however, was not reexamined. Based on the increased targets for the potential benefits and results of the appraisal sensitivity analysis that suggested the ERR at 16.1 percent when the project costs increases by 25 percent, the Restructuring Paper concluded that the project will remain economically and financially feasible.

6. The project scope and costs at appraisal, restructuring, and completion are summarized in table 3.1.

Table 3.1. Proposed and Actual Project Scope and Cost

	Appraisal	Restructuring	Actual
Tanks proposed for rehabilitation (numbers)	900	300	332
Command area of tanks (ha)	120,000	60,000	64,237
Total project costs (US\$, millions)	127.8	87.8	54.6
A. Institutional Strengthening	8.8	5.1	2.4
B. Tanks Systems and Irrigation Improvements	90.0	60.6	40.0
C. Agricultural Livelihoods Support Services	16.1	11.0	6.4
D. Project Management	6.4	5.7	5.8
Rehabilitation cost per ha (US\$/ha)	750.0	1,010.0	622.8

ICRR Economic and Financial Analysis

a. Methodology

7. The appraisal and ICRR economic analysis, which are based on the considerably different project scope, costs, and benefits, are incomparable. Ideally, the appraisal analysis should have been revised reflecting the major changes in costs, benefits, and scope introduced during project restructuring. To address this issue, using the original appraisal analysis in an Excel spreadsheet, the ICRR team recalculated the appraisal analysis using the restructured project costs, scope, and target benefits, while keeping all other relevant assumptions adopted in the appraisal analysis. Key cost and benefits assumptions include (a) the project cost at INR 5.9 billion; (b) the tank command areas for rehabilitation at 64,000 ha; (c) the targets for the agricultural, livestock, and fish production as presented in table 3.1; and (d) no commercial timber production. The benefits are calculated in 2007 prices over a period of 25 years at the opportunity cost of capital at 12 percent. This analysis is referred to as the restructuring analysis. Results of the restructuring analysis will be discussed under the economic analysis section.

8. Using the same appraisal analysis in the Excel spreadsheet, the ICRR economic analysis re-estimated the economic and financial returns to the project largely following the methodology of the appraisal analysis with some modifications, which included the following:

- (a) Adjustments to type, scope, and accumulation timeline of project benefits were made to reflect changes introduced during project restructuring and actual results recorded at the project completion both in the project and control tanks. These changes will be discussed in detail under the section on the project benefits.
- (b) With an aim to measure the project impact on productivity and production more accurately and to rule out the inflation impact, the ICRR analysis examined the project benefits in 2007 prices for over a period of 25 years and using opportunity cost of capital at 12 percent. The approach of using the 2007 prices does not allow measuring impacts of the project investments on quality and prices of produce. The previous ICRR mission observed that the marketing groups supported by the project receive higher retail prices as a result of improved access to markets. However, the impact assessment survey did not present evidence for such benefits. Similarly, no case studies with sufficient details that would allow measuring the project impacts on prices and quality were made available to the ICRR team. Therefore, the above approach is used although it might result in an insignificant underestimation of the project benefits.
- (c) The potential technical life of rehabilitated tanks, if adequately maintained and operated, would be 20 years. The appraisal analysis therefore estimated the benefits over the period of 25 years assuming the project implementation period of 5 years and 20 years of technical life of rehabilitated tanks. In reality, around 80 percent of the project tanks were rehabilitated during the last three years of the 10 year project implementation period. Therefore, the appraisal approach for the project life at 25-year period is not applicable to the ICRR analysis as it would not allow an accurate estimation of the full potential returns to the project investments in the tank rehabilitation. The ICRR analysis, therefore, measured the project returns over the period of 30 years, and additionally tested the project returns for the 25-year period (refer to the third scenario in the following paragraph).
- (d) The economic and financial returns were calculated under three scenarios. The base scenario examined the project returns based on the actual implementation period, benefits, scope, and benefit accumulation timeline and over the period of 30 years. The second ‘what if’ scenario attempts to measure the impact of implementation delays on the project returns. This scenario examines the potential returns to the project investments assuming (i) the appraisal projections for the project implementation period (5 years) with associated benefits accumulation phases (5 percent, 20 percent, 53 percent, 83 percent, and 100 percent starting from year 2); (ii) the total project costs over the 5-year project implementation period inclusive of contingencies; and (iii) the project life of 25 years. The third ‘what if’ scenario is similar to the base scenario but tests the project returns for the 25-year project life.

9. The ICRR analysis used findings of the impact assessment survey which was undertaken in 2015 by the external agency. The survey, which covered 65 project tanks and 12 control tanks, was designed to capture changes both in *Kharif* and *Rabi* seasons. It should, however, be noted that 2015 was a drought year. As such, the survey findings do not reflect a full scope of potential project benefits.

b. Project Costs

10. The actual project cost, inclusive of all contingencies, is estimated at INR 3.6 billion which was distributed among components in following shares: (a) 4 percent for the Institutional Strengthening component; (b) 73 percent for the Tank Systems Improvement component; (c) 12 percent for the Agricultural Livelihoods Support Services component; and (d) 11 percent for the Project Management component.

c. Project Benefits

11. As discussed above, a few modifications were introduced to reflect changes to sources, types, and scopes of project benefits that took place since the appraisal. Results recorded during the impact assessment survey, both in the project and control tanks, were used to update the WOP and WP scenarios and assumptions for future projections. These changes are summarized below and key parameters are presented in Table 3.2.

- (a) **Irrigated area expansion.** The project actually rehabilitated 332 tanks with a command area of 64,237 ha. All the project tanks are designed to provide supplementary irrigation in *Kharif* season only. Before rehabilitation, around 34,688 ha (or 54 percent) of the command areas received irrigation water from the tanks during the *Kharif* season. After rehabilitation, the tanks provided supplementary irrigation to 59,355 ha (or 92.4 percent) of command area in *Kharif* season and another 20,000 ha (or 31 percent) in *Rabi* season. These results are impressive given that the observed year was a drought year. The currently irrigated area is likely to expand further during the normal rainfall years. The analysis, however, conservatively assumes no changes to the irrigated areas during normal years. In the flood years, the tanks are assumed to provide supplementary irrigation to 92.4 percent in *Kharif* and 45 percent in *Rabi* season.
- (b) **Intensification and diversification.** The appraisal projections for crop diversification were not realized. Only marginal increases were observed in areas under pulses, oil crops and vegetables in the project tanks compared with the baseline data. The same was observed in the control tanks. Assuming that the marginal changes in cropping pattern may be related to drought, the analysis assumed current non-paddy production areas for the future years. The appraisal analysis projected increases in cropping intensity from 125 percent to 150 percent. The cropping intensity recorded in 2015 (drought year) was 143 percent that translates into an additional crop on 11,500 ha. The ICRR analysis conservatively assumed the current cropping intensity (143 percent) for the normal years, and a cropping intensity of 150 percent for the flood years.

- (c) **Improved technology and production practices.** The SRI technology was not taken up due to the higher labor requirements. The integrated crop management technology (or line transplanting), however, was adopted almost on 14,000 ha of paddy. In addition, improved production techniques were adopted on 3,700 ha of pulses, 1,150 ha of oilseeds, and 5,150 ha of vegetables. The survey findings suggest a 42 percent increase in paddy productivity due to improved water availability and production practices and 83 percent increase when, in addition to the improved water and improved farm practices, integrated crop management is adopted. Similarly, improved water availability and improved farm practices resulted in a 57 percent increase in pulse productivity, and 94 percent increase was achieved when farmers adopted improved technology.

Table 3.2. Productivity Parameters in WOP and WP Scenarios

	Appraisal		Restructuring		ICRR		
	WOP	WP			WOP	WP	WP
Agriculture							
Crops (t/ha)							
Paddy	2.88	3.64	2.88	3.60			
Paddy - <i>Kharif</i>					3.40	4.08	5.27
Paddy - <i>Rabi</i>					2.80	4.40	5.43
Green gram	0.40	0.52	0.40	0.52	0.40	0.55	0.75
Mustard	0.45	0.59	0.45	0.59	0.45	1.00	1.20
Sesame	n.a.	n.a.	n.a.	n.a.	0.00	1.00	1.20
Groundnut	1.25	1.50	1.25	1.50	1.25	1.59	2.04
Vegetables	10.00	15.00	10.00	15.00	10.00	15.00	20.00
Cropping intensity (%)**	125.0	150.0	125.0	150.0	125.0	143.0	
Irrigated areas in <i>Kharif</i> (%)	54.00	90.00	54.00	90.00	54.00	92.40	
Irrigated areas in <i>Rabi</i> (%)	0.00	0.00	0.00	0.00	0.00	0.31	
Adoption of improved practices and technology (%)	0.0	40.00	0.0	45.00	0.0		47.80
Livestock							
Milk productivity (l/day/cow)							
- traditional	1.00	3.00	1.00	3.00	1.00	1.91	
- improved	n.a.	9.00	n.a.	9.00	2.42		5.56
Crossbred dairy cows (numbers)	0.00	12,000	0	7,000			2,470
Adoption of improved practices and technology (%)	0.0	40.00	0.0	45.00	0.0		47.80
Fishery							
Fish productivity (kg/ha)	30.0	90.0	30.0	90.0	30.0		257.0
Water spread area (ha)		6,000	—				1,072
Adoption of improved practices and technology (%)	0.0	40.00	0.00	45.00			47.80
Marketing							
Functioning farmer marketing	0.0	500.00	0.0	250.0	0.0		225.00
Share in final sale value obtained by farmer marketing groups (%)	0.0	10	0.0	15	0.0	n.a.	

- (d) **Reduced water scarcity.** The ICRR analysis updated the appraisal projections for drought, normal, and flood years using the actual data till 2016 and projections for the

remaining years. The project impact on the paddy production through reduced water scarcity was recalculated following the appraisal methodology.

- (e) **Livestock.** Against the project target of 7,000 cows, only 2,424 calves were actually produced through AI by the end of the project. Similarly, the actual milk productivity for the crossbred cows was recorded at 5.6 l/day/cow against the target of 9.0 l/day/cow which technically seems impossible to reach. Therefore, the current productivity (5.6 l/day) was assumed for the future years. The appraisal analysis additionally assumed that after the project completion the project trained *paravets* will continue provision of AI services as a result of which numbers of the crossbred cows would reach 22,000 cows (215 percent increase) over the period of 25 years. The ICRR analysis conservatively assumes the final number of crossbred cows at 3,636 (or 50 percent increase).
- (f) **Fisheries.** Based on the appraisal project scope (900 tanks with 120,000 ha), the appraisal analysis projected incremental fish production on 6,000 ha of water spread area. The impact of restructuring (320 tanks and 60,000 ha) on the water spread areas was not measured and discussed. At project completion, the improved fishery practices were adopted on 1,072 ha of water spread area and fish productivity was recorded at 257 kg/ha against the project target of 90 kg/ha. No changes to the current water spread area and productivity levels were projected for the future years.
- (g) **Livelihood activities.** Considerable success was observed in assisting the landless, poor, and women with creation of additional sources of livelihoods. Returns to major livelihood activities such as poultry and in-house mushroom production were included into the ICRR analysis.
- (h) **Agricultural marketing.** With the aim of increasing profitability through improved access to markets, the project established and supported around 200 marketing groups for joint marketing of onion, mushroom, potato, and banana. These groups reportedly receive higher retail prices for onion and mushroom. No case studies were carried out on these activities, however. Similarly, the impact assessment survey did not cover this activity adequately. Due to lack of detailed and accurate information, the returns to the agricultural marketing activities were not accounted for in the ICRR analysis.
- (i) **Foreshore treatment.** The activity was canceled during restructuring. Accordingly, this benefit was excluded from the ICRR analysis.

Economic and Financial Results

a. Economic Analysis

12. **Restructuring analysis.** When the restructuring scope, costs, and benefits are considered, the project investments would generate the ERR of 18.6 percent and ENPV of INR 1.03 billion. These results are lower than the appraisal ERR of 21.6 percent and ENPV of INR 1.87 billion largely due to the increased investments costs per ha of agricultural land.

13. **ICRR analysis.** The ICRR base case scenario suggests a slightly lower than the restructuring projected ERR at 18.2 percent and considerably lower ENPV at INR 0.83 billion. Significant delays in project implementation and benefit accumulation, and unrealized projection for the diversification and intensification are key factors behind the low ENPV.

14. When the project benefits are tested assuming ‘no implementation delays’, the results suggest that, if the project was implemented within the projected 5-year period, the project would have yield ERR of 21.6 percent and ENPV of INR 1.87 billion. These results are considerably higher than the appraisal and restructuring projected returns. The project is expected to generate an ERR of 17.4 percent and ENPV of INR 0.64 billion when the project returns are estimated only for the 25 years there by underestimating the potential returns to the project investments in tank rehabilitation.

15. Results of the appraisal, restructuring and ICRR analyses are summarized in table 3.3.

Table 3.3. Summary Economic and Financial Analysis

	ERR (%)	NPV*, INR, billions	FRR (%)	NPV*, INR, billions
Appraisal base level *	20.8	2.00	17.7	1.40
Restructuring base level*	18.6	1.03	16.1	0.72
ICRR base scenario**	18.2	0.83	15.7	0.46
ICRR ‘no delay’ scenario*	21.6	1.87	19.2	1.19
ICRR ‘25 year’ scenario *	17.4	0.64	14.8	0.31

Note: * NPV at 2007 prices over a 25-year period.

** NPV at 2007 prices over a 30-year period.

b. Financial Analysis

16. The appraisal analysis presented the financial returns to the project activities such as paravets, crossbred cattle, and aquaculture in the tanks. The ICRR analysis used a slightly different approach and examined the financial returns to individual farmers, landless poor, women, fishermen, and wage laborers.

17. Results of financial analysis are presented in table 3.4. The investments in rehabilitation and agricultural support services were expected to generate an annual incremental income to a farmer with a landholding size of 1 ha at: (a) INR 3,343 due to the expansion of irrigated areas; (b) INR 4,906 when the projected levels of diversification and intensification were achieved; and (c) INR 32,230 when the farmer adopted new technologies. The project investments in livelihoods services were estimated to generate an additional annual income of INR 8,505 to a woman mushroom producer, and INR 8,180 to the landless poor provided with chicks for poultry production. The project beneficiary who transited from the traditional cow to crossbred cow was expected to earn an annual incremental return of INR 5,083 per cow. The project investments in fish production were expected to generate an additional income at INR 4,509 per ha of water spread area. In addition to these, the rehabilitation works created temporary employment for around 200 households. Average incomes earned by male and female laborers were estimated at INR 6,400 and INR 2,000, respectively.

18. The overall estimated FRR and FNPV to the project is estimated at 15.7 percent and INR 0.46 billion. Refer to table 3.3 for results.

Table 3.4. Financial Returns to Beneficiaries

Activities	Annual Income per Beneficiary		
	WOP	WP	Incremental
Crop production: expansion of irrigated areas (INR/ha)	2,952	6,295	3,343
Crop production: expansion diversification (INR/ha)	2,952	7,859	4,906
Crop production: expansion, diversification and new technology (INR/ha)	2,952	35,183	32,230
Mushroom production (INR/person)	0	8,505	8,505
Poultry production (INR/person)	0	8,180	8,180
Milk production - crossbred cow (INR/cow)	2,106	7,188	5,083
Fish production (INR/ha)	950	5,459	4,509
Wage laborers - male (INR/person)	0	0	6,400
Wage laborers - female (INR/person)	0	0	2,000

Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Deepak Ahluwalia	Lead Agriculture Economist	SASDA	Task Team Leader
Philip Beauregard	Senior HR Specialist	HRDCO	Legal
Xiaokai Li	Lead Water Resource Management	GWA01	Lead Water Resources Specialist
Manvinder Mamak	Senior Financial Management Specialist	GGO24	Financial Specialist
Ranjan Samantaray	Senior Agricultural Specialist	GFA12	Agricultural Specialist
Suryanarayana Satish	Senior Social Development Specialist	GSU06	Social Development Specialist
Animesh Shrivastava	Program Leader	ECCU8	Agricultural Economist
Paul Singh Sidhu	Consultant	GFA06	Agricultural Specialist
Manivannan Pathy	Consultant	GFA12	Agribusiness and Marketing
Samik Sundar Das	Consultant	GFA12	Institutional Development
Manmohan Singh Bajaj	Consultant	SARPS	Procurement
Nibir Kumar Bandyopadhyay	Consultant	SASDA	Irrigation Engineer
Prabir Joardar	Consultant	GSU18	Agriculturist
S. Selvarajan	Consultant	SASDA	Economist
Assaye Legesse	Consultant	GFA13	Monitoring and Evaluation
Jacqueline Julian	Operations Analyst	GFA06	Costab Specialist
Supervision/ICR			
Ranjan Samantaray	Senior Agricultural Specialist	GFA06	Task Team Leader
Abdulhamid Azad	Lead Water Resources Management Specialist	GFA05	Task Team Leader
Bekzod Shamsiev	Senior Agriculture Economist	GFA03	Task Team Leader
Ranjan Samantaray	Senior Agricultural Specialist	GFA06	Task Team Leader
Samik Sundar Das	Senior Rural Development Specialist	GFA06	Rural Development Specialist
Nagaraju Duthaluri	Lead Procurement Specialist	GGO01	Procurement Specialist

Names	Title	Unit	Responsibility/ Specialty
Anju Gaur	Senior Water Resources Specialist	GWA06	Irrigation Specialist
Manvinder Mamak	Senior Financial Management Specialist	GGO24	Financial Management Specialist
Manivannan Pathy	Senior Agricultural Specialist	GFA12	Agricultural Specialist
Suryanarayana Satish	Senior Social Development Specialist	GSU06	Senior Social Development Specialist
Satyanarayan Panda	Procurement Specialist	GGO06	Procurement Specialist
Joop Stoutjesdijk	Lead Irrigation Engineer	GWA02	Lead Irrigation Engineer
R. K. Malhotra	Consultant	GFA12	Construction Specialist
Maroti A. Upare	Consultant	GFA12	Fisheries Specialist
Paul Singh Sidhu	Consultant	GFA12	Agriculturist
Vanitha Kommu	Consultant	GEN06	Environment Specialist
U.E. Hanbali	Consultant	GFA12	Irrigation Engineer
N. Raman	Consultant	FAO	Procurement
S. Mohanty	Consultant	FAO	Procurement
M. Burton	Consultant	FAO	Institutional Specialist
Kunduz Masykanova	Consultant	FAO	Monitoring and Evaluation Specialist
Benjamin O'Brien	Consultant	FAO	Agriculturalist
T. Fleccia	Consultant	FAO	Agriculturalist
I. Punda	Consultant	FAO	Economist
John Weatherhogg	Consultant	FAO	Agricultural Economist/M&E Specialist
Sitaram Machiraju	Senior Water and Sanitation Specialist	GWAGP	Private Sector Partnership and Business Linkages,
Ai Chin Wee	Senior Operations Officer	SASDA	Monitoring and Evaluation Specialist
Jai Mansukhani	Senior Program Assistant	SACIN	

(b) Staff Time and Cost

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	No. of Staff Weeks	US\$, thousands (including travel and consultant costs)
Lending		
FY07	17.40	40.90
FY08	47.44	141.26
FY09	23.12	77.68
Total:	87.96	259.84
Supervision/ICR		
FY10	32.54	117.09
FY11	19.78	114.06
FY12	27.49	115.80
FY13	28.01	138.18
FY14	22.93	135.06
FY15	14.08	89.22
FY16	17.71	71.55
FY17	3.96	24.27
Total:	166.50	805.23

Annex 5. Beneficiary Survey Results
(if any)

Annex 6. Stakeholder Workshop Report and Results

Not applicable.

Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR

Prologue

1. The GoO in partnership with the GoI had initiated the OCTMP, with funding from the World Bank. At closure, the project covered 332 MIP tanks across 12 districts of the state. The total design ayacut areas of these projects stand at 64,239 ha. The OCTMP was conceived with an overarching objective for selected tank-based producers to improve agricultural productivity and the WUAs to manage tank systems effectively. It further intended to usher in sustainable improvement of tank based agriculture livelihood systems by increasing production, productivity, and profitability of agriculture, horticulture, fisheries, and livestock. To achieve the project objectives, the project was implemented through four main components: Institutional Strengthening (Component A), Tank System and Irrigation Improvements (Component B), Agricultural Livelihoods Support Services (Component C), and Project Management (Component D). The OCTMP came into effect from November 1, 2008 with a stipulated closing date of August 31, 2014 which, following an extension of 22 months, was closed on June 30, 2016.

Project Assessment

2. **Component A.** The project was started with complex institutional involvement of the GoO and independent institutions/agencies. To make people aware of the project and its beneficial dimensions, the project conducted awareness and sensitization activities in all villages in the tank command areas. For the O&M of the rehabilitated tank systems, the project developed an institutional structure of the PP (WUA). The PPs were formed as per the Pani Panchayat Act and mainly comprises of water users in command area. In addition to forming/promoting new PPs, the project has taken measures to reconstitute the existing PPs, making it more representative and inclusive.

3. In the 332 MIPs, considered for intervention by the project, 383 PPs have been formed, meaning that some MIPs have more than one PP to match the O&M requirements. The project has taken intensive measures by providing training and exposure to PP members to improve their managerial capacity. In view of the functionality of the PPs, with regard to holding regular meetings of the general body, it can be said that the end target of the intermediate outcome indicator, that is, percentage of PPs holding regular general body meeting is satisfactory. The PPs have been maintaining records to keep track of their financial and non-financial activities. With regard to record keeping, the project has achieved in improving documentation of financial transactions at PP level. The PPs at the intervention tanks have developed a blueprint for higher revenue generation and sustenance of their operations. The project has conducted visioning workshops with the PPs to strengthen the revenue stream of the PPs, apart from dealing with other water distribution-related issues. At present, local revenue inspector is responsible for collection of water tax from the farmers. As PP have come up as community based representative institution in the course of implementation of the project, it is planned to delegate water tax collection to the respective PPs in their area of jurisdiction. PPs have emerged as a vibrant institution for water management. However, full financial and operational sustainability to achieve engineering saturation of tanks by PPs is a work in progress. The enabling regulatory framework to collect water tax by PPs is a positive outcome. Conscious attempt by the project to

handhold PPs to take up other economic/entrepreneurial activities will ensure their sustainability in the long run.

4. **Component B.** The tanks taken up under the OCTMP for system improvement are having a total ayacut of 64,237 ha. As all these tanks are preexisting tanks, measures taken under tank system improvement were to revive and restore the irrigation potential of these tanks. To realize its irrigation potential, TIMPs were prepared for all the reservoirs and diversion weirs under the project. The plan document was prepared in a participatory and consultative manner involving local community. The substantial increment in irrigated area in the tank command area achieved the end line target of 90 percent irrigation, including the OFD works.

5. **Component C.** The project promoted adoption of package of practices in different crops, cultivated in the tank command that suits its environmental conditions. The project adopted an agricultural marketing strategy to link the producers to the market for a remunerative return. The agricultural marketing basically focused on specific commodities like onion, potato, and mushroom. About 49 percent of the farmers were covered under demonstration, and from among the farmers who took part in demonstration, some 98 percent had adopted the technologies. Apart from agriculture, the project had taken measures to strengthen the supportive/supplementary livelihood of the families living in the tank command. Livestock development and management is one such initiative. The approach under agricultural marketing has been to develop product specific clusters in selected tank command areas (based on feasibility), imparting training to farmers on specific products.

6. **Component D.** To steer the project implementation and putting it in perspective, the project established a multidisciplinary SPU at the state headquarters. In line with the SPU, the DPU was established in each project district (12 DPUs, one in each project district).

7. **Outcome indicator.** The assessment reveals that the project achieved the indicator substantially with regard to improving paddy productivity. While the end project was to achieve 25 percent growth in paddy productivity, the project achieved 91.06 percent growth in productivity in the tank command area. Overall increase in paddy productivity went up from 2.46 t/ha (Baseline) to 4.7 MT/ha in *Kharif* 2015–2016 (91.06 percent). The cropping intensity for the project area was calculated to be 1.47%. As a result of the OCTMP interventions, fish productivity has increased to 295 kg/ha (0.29 t/ha) from a baseline of 12 kg/ha. Milk productivity per cow (indigenous) per day has increased from 0.99 l/day/cow to 1.91 l/day/cow. In case of crossbred cows, it has increased from 2.42 l/day/cow to 5.56 l/day/cow. Increasing association of PPs has benefited people in the tank command for which there is a growth in percentage of satisfaction among the users.

8. Among the PPs, GB meeting is organized twice a year and it is found to be organized regularly in 92 percent cases. The achievement is higher by 12 percentage points from the end target (80 percent). With effective facilitation support of the project, cash book maintenance was observed to be in 100 percent PPs which is higher by 15 percentage points from the end target. The Water Regulation Register captures information on amount of water released, water distribution planning, and related aspects. Keeping such records helps in planning/scheduling water release based on the availability of water. Project progress, with regard to this indicator, is about 42 percent. It is observed that about 92.1 percent of the total holding by the families in the

tank command is covered under tank irrigation. The achievement is 2 percentage points higher than the end line target of the project (90 percent) and 20.9 percentage points higher than the baseline (71.2 percent during *Kharif*). The assessment finds 68.20 percent farmers having land in the middle reach and tail end of the tank are having improved water availability. All PPs are found to have prepared social and environmental action plans quite thoroughly. Out of the total farmers in project area, about 47.8 percent of the farmers have adopted technology in their fields. Out of the total fishermen who received training, 564 fishermen constituting around 20 percent have adopted improved production and harvesting techniques. As per the final assessment report, it was found that there is 22.8 percent increase in the final sale value of onion compared to the average picture of the non-FIG based vegetables which is said to be the impact of the farmer marketing group. The project has promoted 243 FIGs and 1 Producer Organization for production augmentation and market linkage.

Stakeholder Involvement

9. Unlike many projects which follows a top-down approach, this project consciously built in stakeholder participation right from the beginning. This preparation of the TIMP was a consultative process. The formation of PPs and inclusion of landless members into PPs was also through consultation. The MTR also had stakeholder consultations and disclosure. Similarly, the final assessment was also shared with stakeholders drawn from all levels. In the initial phase, the inputs from stakeholder contributed to fine-tuning design and operational strategy. Consultation during the MTR and final assessment has contributed to feedback and learning. The stakeholders have taken this project as a learning exercise and at no point any major resentment or adverse environment has been encountered.

10. The reorganized PP institutions have been trained to manage the water sources and collect water tax for their self-sustainability. They have also been trained to maintain financial account and implements supplied to them. However, there is need for further hand-holding support to carry forward the PP activities in sustainable basis. These would require moral and some financial support to remain going according to the objective of the project. The department is expected to provide necessary technical assistance in maintaining the distribution system and to mainstream the PPs according to PP manuals and PP rules. These institutions are also expected to be felicitated every year in recognition of their achievements and best practices.

Annex 8. Comments of Co-financiers and Other Partners/Stakeholders

Not applicable.

Annex 9. List of Supporting Documents

Project Preparation

- Project Information Document, 2006
- Environmental Assessment, 2007
- Indigenous Peoples Plan, 2007
- Social Assessment, 2007
- Resettlement Plan, 2007
- Project Appraisal Document, August 2008
- Financing Agreement, January 2009

Supervision

- Sixteen Implementation Status and Results Report; Aide Memoires; and Management Letters, 2006 to 2016
- Midterm Review Report, 2012
- Project Paper: Restructuring, April 2011

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