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Report No: PAD3166

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US\$165 MILLION

TO THE

REPUBLIC OF INDIA

FOR THE

ODISHA INTEGRATED IRRIGATION PROJECT FOR CLIMATE RESILIENT AGRICULTURE

September 6, 2019

Agriculture Global Practice
South Asia Region

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CURRENCY EQUIVALENTS

(Exchange Rate Effective August 31, 2019)

Currency Unit = Indian Rupee (INR)

INR 71.46 = US\$1

US\$1.37 = SDR 1

FISCAL YEAR

April 1 – March 31

Regional Vice President: Hartwig Schafer

Country Director: Junaid Kamal Ahmad

Senior Global Practice Director: Juergen Voegele

Practice Manager: Kathryn Hollifield

Task Team Leader(s): Ranjan Samantaray, Abel Lufafa, IJsbrand Harko de Jong

ABBREVIATIONS AND ACRONYMS

AE	Agri-Entrepreneur
AET	Actual Evapo-transpiration
APC	Agriculture Production Commissioner
APMC	Agricultural Produce Marketing Committee
ATMA	Agricultural Technology Management Agency
AWPBs	Annual Work plans and Budgets
CAAA	Controller of Aid Accounts and Audit
CAG	Comptroller and Auditor General
CDA	Chilika Development Authority
CERC	Contingent Emergency Response Component
CGIAR	Consultative Group on International Agricultural Research
CGWB	Central Ground Water Board
CPF	Country Partnership Framework
CSA	Climate-Smart Agriculture
DAFE	Department of Agriculture and Farmer Welfare
DC	District Collector
DDO	Drawing and Disbursement Officer
DoC	Department of Cooperation
DoE	Department of Energy
DoFARD	Directorate of Fisheries and Animal Resources Development
DoWR	Department of Water Resources
DoPR&DW	Department of Panchayat Raj and Drinking Water
DPMT	District Project Management Team
DSO	Dam Safety Organization
DSP	Dam Safety Panel
EA	Environmental Assessment
EHS	Environmental Health and Safety
EMF	Environmental Management Framework
EMP	Environmental Management Plan
ERR	Economic Rate of Return
EX-ACT	Ex-Ante Carbon-balance Tool
FAO	Food and Agriculture Organization
FIAC	Farm Information and Advisory Center
FIG	Farmer Interest Group
FM	Financial Management
FMIS	Financial Management Information System
GDP	Gross Domestic Product
GHG	Green House Gas
GoI	Government of India
GoO	Government of Odisha
GRM	Grievance Redress Mechanism
GRS	Grievance Redress Service
Ha	Hectare
IBRD	International Bank for Reconstruction and Development
ICARDA	International Center for Agricultural Research in Dry Areas
IE	Impact Evaluation
INR	Indian Rupee
IPF	Investment Project Financing
IPNMP	Integrated Pest and Nutrient Management Plan

IRRI	International Rice Research Institute
IUFR	Interim Unaudited Financial Report
IWRM	Integrated Water Resources Management
KALIA	Krushak Assistance for Livelihood and Income Augmentation
KVK	Krishi Vigyan Kendra
M&E	Monitoring and Evaluation
MFD	Maximizing Finance for Development
MI	Minor irrigation
MIS	Management Information System
MTR	Mid Term Review
NCB	National Competitive Bidding
NDC	Nationally Determined Contributions
NSSO	National Sample Survey Office
O&M	Operation and Maintenance
OCTDMS	Odisha Community Tank Development and Management Society
OCTMP	Odisha Community Tanks Management Project
OGFR	Odisha General Financial Rules
OIIPCRA	Odisha Integrated Irrigation Project for Climate Resilient Agriculture
OPDC	Odisha Pisciculture Development Corporation
OSAMB	Odisha State Agriculture Marketing Board
OSSC	Odisha State Seed Corporation
OSSOPCA	Odisha State Seed and Organic Products Certification Agency
OUAT	Odisha University of Agriculture Technology
PACS	Primary Agriculture Cooperative Societies
PC	Project Cell
PD	Project Director
PDO	Project Development Objective
PET	Potential Evapo-transpiration
PFCS	Primary Fishermen Cooperative Society
PIM	Project Implementation Manual
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PP	Pani Panchayat
PPP	Public Private Partnership
PPSD	Project Procurement Strategy Document
PSC	Project Steering Committee
SC	Scheduled Caste
SDG	Sustainable Development Goals
SHG	Self-Help Group
SMF	Social Management Framework
SORT	Systematic Operations Risk-Rating Tool
SPU	State Project Unit
ST	Scheduled Tribe
STEP	Scheduled Tracking of Exchanges in Procurement
TA	Technical Assistance
TOC	Theory of Change
TOR	Terms of Reference
TPP	Tribal Peoples Plan
TPPF	Tribal Peoples Planning Framework
US\$	United States Dollar
WAMIS	Works and Accounting Management Information System
WB	World Bank



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DATASHEET

BASIC INFORMATION

Country(ies)	Project Name	
India	Odisha Integrated Irrigation Project for Climate Resilient Agriculture	
Project ID	Financing Instrument	Environmental Assessment Category
P163533	Investment Project Financing	B-Partial Assessment

Financing & Implementation Modalities

<input type="checkbox"/> Multiphase Programmatic Approach (MPA)	<input checked="" type="checkbox"/> Contingent Emergency Response Component (CERC)
<input type="checkbox"/> Series of Projects (SOP)	<input type="checkbox"/> Fragile State(s)
<input type="checkbox"/> Disbursement-linked Indicators (DLIs)	<input type="checkbox"/> Small State(s)
<input type="checkbox"/> Financial Intermediaries (FI)	<input type="checkbox"/> Fragile within a non-fragile Country
<input type="checkbox"/> Project-Based Guarantee	<input type="checkbox"/> Conflict
<input type="checkbox"/> Deferred Drawdown	<input type="checkbox"/> Responding to Natural or Man-made Disaster
<input type="checkbox"/> Alternate Procurement Arrangements (APA)	

Expected Approval Date	Expected Closing Date
30-Sep-2019	31-Dec-2025
Bank/IFC Collaboration	Joint Level
Yes	Historical Project/Activity implemented in sequence with an IFC activity(Loan/Credit/Guarantee/AAA)

Proposed Development Objective(s)

The Project Development Objective is to intensify and diversify agricultural production, and enhance climate resilience in selected districts of Odisha.



Components

Component Name	Cost (US\$, millions)
Climate-Smart Intensification and Diversification of Production	74.60
Improving Access to Irrigation and Water Productivity	137.90
Institutional Capacity Strengthening	9.70
Project Management	12.93
Contingent Emergency Response	0.00

Organizations

Borrower:	Republic of India
Implementing Agency:	Odisha Community Tank Development and Management Society, Department of Water Resources

PROJECT FINANCING DATA (US\$, Millions)

SUMMARY

Total Project Cost	235.54
Total Financing	235.54
of which IBRD/IDA	165.00
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Bank for Reconstruction and Development (IBRD)	165.00
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Non-World Bank Group Financing

Counterpart Funding	70.54
Borrower/Recipient	70.54

Expected Disbursements (in US\$, Millions)



WB Fiscal Year	2020	2021	2022	2023	2024	2025	2026
Annual	4.06	10.79	25.03	46.31	51.37	27.43	0.00
Cumulative	4.06	14.85	39.88	86.19	137.57	165.00	165.00

INSTITUTIONAL DATA

Practice Area (Lead)

Agriculture and Food

Contributing Practice Areas

Water

Climate Change and Disaster Screening

This operation has been screened for short and long-term climate change and disaster risks

Gender Tag

Does the project plan to undertake any of the following?

a. Analysis to identify Project-relevant gaps between males and females, especially in light of country gaps identified through SCD and CPF	Yes
b. Specific action(s) to address the gender gaps identified in (a) and/or to improve women or men's empowerment	Yes
c. Include Indicators in results framework to monitor outcomes from actions identified in (b)	Yes

SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	● Low
2. Macroeconomic	● Low
3. Sector Strategies and Policies	● Moderate
4. Technical Design of Project or Program	● Moderate
5. Institutional Capacity for Implementation and Sustainability	● Moderate
6. Fiduciary	● Moderate
7. Environment and Social	● Substantial



8. Stakeholders	● Moderate
9. Other	
10. Overall	● Substantial

COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

Yes No

Does the project require any waivers of Bank policies?

Yes No

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	✓	
Performance Standards for Private Sector Activities OP/BP 4.03		✓
Natural Habitats OP/BP 4.04	✓	
Forests OP/BP 4.36		✓
Pest Management OP 4.09	✓	
Physical Cultural Resources OP/BP 4.11	✓	
Indigenous Peoples OP/BP 4.10	✓	
Involuntary Resettlement OP/BP 4.12		✓
Safety of Dams OP/BP 4.37	✓	
Projects on International Waterways OP/BP 7.50		✓
Projects in Disputed Areas OP/BP 7.60		✓

Legal Covenants

Sections and Description

Section I.A.2(a) of the Schedule to the PA: The Project Implementing Entity shall establish, within three (3) months of the Effective Date, and maintain throughout the period of Project implementation, a Project Steering Committee (PSC) at the state level, chaired by the chief secretary of Odisha, and comprising of the secretaries or principal secretaries of the government of Odisha for DoWR, DAFE, Department of Fisheries and Animal Resources Development, DoPR&DW, APC and OSAMB; which committee shall have functions and responsibilities acceptable



to the Bank, including, inter alia: (i) advising on strategic directions and supporting activities; (ii) approving annual work plan and budget; (iii) ensuring collaboration among stakeholders; and (iv) reviewing Project progress reports, ensuring Project activities are effective and advising on any adjustments needed to the annual work plan.

Sections and Description

Section I.A.2(b) of the Schedule to the PA: The Project Implementing Entity shall establish, within three (3) months of the Effective Date, and maintain throughout the period of Project implementation, an Advisory Panel, comprising of eminent experts, and chaired by the APC, which panel shall have the main function of providing strategic advice to the PSC.

Sections and Description

Section I.A.2(c) of the Schedule to the PA: The Project Implementing Entity shall maintain throughout the period of Project implementation, an SPU within OCTDMS, headed by a Project director (serving as the secretary of the PSC); and comprised of a full-time environment specialist, technical component coordinators (i.e. irrigation, water management, fisheries, marketing, agriculture), finance officer, procurement officer, human resources and administration officer, and social safeguards officer; which unit shall be responsible for the day-to-day Project implementation, including, inter alia: (i) preparing annual work plans and budgets and ensuring all Project activities are planned, financed and implemented accordingly; (ii) ensuring Project implementation is in accordance with the PIP; (iii) ensuring that procurement and financial management activities are carried out in timely manner in accordance with the PIP; (iv) ensuring compliance with the Safeguard Documents; (v) monitoring Project activities; and (vi) preparing quarterly and annual Project progress reports and ensuring their timely submission to the Bank.

Sections and Description

Section I.A.2(d) of the Schedule to the PA: The Project Implementing Entity shall establish, within three (3) months of the Effective Date, and maintain throughout the period of Project implementation, one Project Cell in each of the Directorate of Agriculture and Food Production, Directorate of Horticulture, and Directorate of Fisheries, responsible for annual work planning and budgeting for their respective activities, and interfacing with the SPU and district officials to offer guidance in Project implementation.

Sections and Description

Section I.A.2(e) of the Schedule to the PA: The Project Implementing Entity shall establish, within three (3) months of the Effective Date, and maintain throughout the period of Project implementation, a District Level Project Management Team in each Project district, comprised of, inter alia, the district collector, executive engineer (minor irrigation), deputy director (agriculture)-cum-ATMA director, deputy director (horticulture) , district fisheries officer, and the executive engineer (DoPR&DW); chaired by the district collector, which team shall be provided with experienced and qualified staff, in sufficient numbers and under terms of reference acceptable to the Bank, to carry out the responsibilities of Project implementation and monitoring at the district level, including: (a) supporting the preparation of integrated cascade development plans; (b) executing civil works; (c) providing advisory and marketing services to farmers; and (d) managing and coordinating with district-level support organizations.

Sections and Description

Section I.B to the Schedule to the PA: The Project Implementing Entity shall prepare, approve and adopt a Project Implementation Plan (PIP) in a manner and substance satisfactory to the Bank, and thereafter carry out the Project in accordance with the provisions of the PIP, which manual shall include, inter alia: (i) the details of the Project activities including results framework and overall budget; (ii) the Project implementation arrangements; (iii) the



criteria and process of selection of AEs and terms and conditions applicable for providing training and Stipends; (iv) the criteria, process of selection of PFCs, famers, and Farmer Groups to receive In-Kind Support, as well as implementation of related activities, monitoring and evaluation procedures, and options for cost-sharing arrangements; (v) the model forms for MoUs to be entered into between the Project Implementing Entity and each Sub-Recipient with terms and conditions applicable to the use of In-Kind Support; (vi) the format of the interim unaudited financial reports to be submitted under the Project; (vii) the Project's administrative, accounting, auditing, reporting, financial management (including cash flow aspects) and procurement requirements, including those related to provision of Stipends and In-Kind Support, as applicable; (viii) the Project's environmental and social safeguard requirements; and (ix) the Project's monitoring and evaluation, and reporting requirements.

Sections and Description

Section I.E.1 to the Schedule to the PA: The Project Implementing Entity shall -

- (i) carry out the Project in accordance with the EMF (including an Integrated Pest Management Plan and Dam Safety Management Plan) and the SMF (including the TPPF);
- (ii) whenever an EMP shall be required for any proposed Project activity in accordance with the provisions of the EMF, ensure that: (a) prior to the commencement of such activity, such EMP is, as applicable: (i) prepared and furnished to the Bank for review and no-objection; (ii) disclosed and consulted upon in accordance with the provisions of the EMF; and (iii) thereafter finalized and adopted as accepted by the Bank, in a manner satisfactory to the Bank; and (b) thereafter such measures are taken as shall be necessary or appropriate to ensure compliance with the requirements of such EMP; and
- (iii) whenever a TPP shall be required for any proposed Project activity in accordance with the provisions of the SMF, ensure that: (a) prior to the commencement of such activity, such TPP is, as applicable: (i) prepared and furnished to the Bank for review and no-objection; (ii) disclosed and consulted upon in accordance with the provisions of the SMF; and (iii) thereafter finalized and adopted as accepted by the Bank, in a manner satisfactory to the Bank; and (b) thereafter such measures are taken as shall be necessary or appropriate to ensure compliance with the requirements of such TPP.

Sections and Description

Section I.E.2 to the Schedule to the PA: The Project Implementing Entity shall ensure that groundwater is not used for any activity under the Project unless and until the DoWR has developed appropriate regulation on use of groundwater under sub-component 2.1(ii), in manner and substance satisfactory to the Bank, and has submitted such regulation for adoption by Odisha. Subsequent to such submission, the Project Implementing Entity shall ensure that groundwater is used only in accordance with the provisions of such regulation, and after the adoption of such regulation by Odisha, in existing form or as modified, in accordance with such adopted regulation.

Sections and Description

Section I.E.11 and I.E.12 to the Schedule to the PA:

1. The Project Implementing Entity shall maintain, throughout the implementation of the Project, a Dam Safety Panel, which shall be an independent panel of experts, under terms of reference and with personnel possessing qualifications satisfactory to the Bank. Such personnel shall include, inter alia, a hydrologist, structural engineer and geologist, with the purpose of providing advice on the safety and other critical aspects of Project Dams including,



inter alia, any technical design, construction procedures, dam safety, appurtenant structures, catchment area, areas surrounding the reservoir, downstream areas, and environmental, social, and health and safety aspects, to support and inform the preparation of the detailed project reports that will inform the carrying out of structural interventions in tanks.

2. To ensure the proper management and safety of Project Dams, the Project Implementing Entity shall:

- (a) within one (1) year from the Effective Date: (i) cause the Dam Safety Panel to review the status of the structures of the Project Dams; (ii) thereafter, accordingly prepare detailed project report(s) on the structural interventions in the tanks; (iii) submit such report(s) to the Bank for its review; and (iv) adopt and publicly disclose such report(s), and undertake the applicable activities under the Project in accordance with such report(s);
- (b) thereafter, cause the Dam Safety Panel to carry out a safety inspection of each Project Dam at least twice a year, pre- and post-monsoon, and submit the reports from such inspections to the Bank for its review; and
- (c) in accordance with terms of reference set forth in the Dam Safety Management Plan and in a manner satisfactory to the Bank: (i) prepare and/or update the operation and maintenance plans and emergency preparedness plans for each Project Dam; (ii) furnish said plans to the Bank for its review; (iii) adopt, implement and publicly disclose said plans, taking into account the views of the Bank on the matter; and (iv) carry out an on-site training program for the staff engaged in the implementation of the operation and maintenance plans and emergency preparedness plans above referred.

Sections and Description

Section I.C to the Schedule to the PA:

- 1. For the purpose of providing input and/or output marketing services and/or advisory services to farmers, the Project Implementing Entity shall competitively select AEs to receive training, and thereafter receive Stipends, in accordance with the eligibility and selection criteria and procedures and transaction mechanisms and using appropriate documents, acceptable to the Bank and set forth in the PIP, such mechanisms to include, inter alia:
 - (a) for payment of the first tranche of the Stipend, confirmation that the selected AE has satisfactorily participated in the required training activities under the Project, such confirmation to be made in accordance with the terms set forth in the PIP;
 - (b) for payment of the next tranches of the Stipend, confirmation that the selected AE has made satisfactory progress in setting up their proposed income-generating activity, such confirmation to be made in accordance with the terms set forth in the PIP; and
 - (c) the right of the Project Implementing Entity to suspend or terminate the provision of training and/or Stipends:
 - i. upon any failure of the AE to complete the training requirements, before, during or after the delivery of training; or



- ii. upon any failure of the AE to perform its obligations in accordance with the PIP.
2. The Project Implementing Entity shall ensure that the selected AE shall:
- (a) establish and/or maintain policies and procedures that would allow the Project Implementing Entity and/or the Bank to carry out supervision and monitor the implementation of the AE's activities under the Project;
 - (b) prepare and furnish to the Project Implementing Entity and/or the Bank, all such information that the Project Implementing Entity and/or the Bank may reasonably request in relation to the AE's activities under the Project; and
 - (c) accept random and/or unannounced physical or documentary inspections by the Project Implementing Entity and/or the Bank for the monitoring of, and in relation to, the carrying out of the AE's activities under the Project.

Sections and Description

Section I.D to the Schedule to the PA:

3. For purposes of carrying out the activities under sub-components 1.2(ii) and 1.3(ii) of the Project, the Project Implementing Entity shall invite PFCs, and farmers and/or Farmer Groups, respectively, to submit proposals; and screen and select the proposals in accordance with the eligibility criteria and procedures detailed in the PIP, including, inter alia:
- (a) That PFCs, farmers, and/or Farmer Groups have the qualification to set up fingerling production business and/or crop diversification and produce marketing, as applicable, in support of the achievement of the Project objectives;
 - (b) That the proposals of selected PFCs, farmers, and/or Farmer Groups are approved in a manner satisfactory to the Bank;
 - (c) That the selected PFCs, farmers, and/or Farmer Groups enter into a memorandum of understanding (MoU) with the Project Implementing Entity under terms satisfactory to the Bank, which terms include, inter alia:
 - (i) The Project Implementing Entity's obligation to provide In-Kind Support to selected PFCs, farmers and/or Farmer Groups ("Sub-Recipients");
 - (ii) the requirement that the Sub-Recipient carries out its activities under the Project in accordance with the PIP and the Safeguard Documents, as applicable, with due diligence and efficiency and in accordance with sound technical, financial, environmental and managerial standards, including Anti-Corruption Guidelines;
 - (iii) that the Sub-Recipient shall: (i) establish and/or maintain policies and procedures that would allow the Project Implementing Entity and/or the Bank to carry out supervision and monitor the implementation of the activities under the Project; (ii) prepare and furnish to the Project Implementing Entity and/or the Bank, all such information that the Project Implementing Entity and/or the Bank may reasonably request in relation to the Sub-Recipient's activities under the Project; and (iii) accept random and/or unannounced physical or documentary inspections by the Project Implementing Entity and/or the Bank for the monitoring of, and in relation to, the



carrying out of Sub-Recipient's activities under the Project;

(iv) the obligation of the Sub-Recipient to provide the resources needed to carry out their respective activities on a determined cost-sharing basis, in accordance with the provisions set forth in the PIP; and

(v) the right of the Project Implementing Entity to suspend or terminate the right of the Sub-Recipient to receive In-

Kind Support:

(a) upon any failure of the Sub-Recipient to perform its obligations under the Project in accordance with the PIP;
or

(b) upon the Bank declaring the Sub-Recipient ineligible under the Anti-Corruption Guidelines.

Conditions



I. STRATEGIC CONTEXT

A. Country Context

1. India's growth remains robust but has moderated from prior high levels in the past fiscal year (FY18/19). After growing at 7.2 percent in FY17/18, economic growth slowed to 6.8 percent in FY 18/19, with quarterly growth falling to 5.8 percent (y-o-y) in Q4. Growth remains broad-based, but the impact of accelerating industrial growth was counterbalanced by decelerations in services and agriculture growth, on the production side. On the demand side, consumption has been bolstered by public spending, but investment growth has decelerated. In FY18/19, the current account deficit is estimated to have reached 2.6 percent of Gross Domestic Product (GDP) but a strong rebound in foreign investment over the second half of the year allowed foreign reserves to remain at a comfortable level of US\$411.9 billion, as of end-March 2019 (equivalent to about 9.7 months of imports). Going forward, output growth is projected to recover and stabilize at around 7.5 percent, thanks primarily to resilient private consumption, but also to a rise in exports of goods and services and a gradual recovery in investment. The current account deficit is projected to narrow to 1.9 percent of GDP in FY19/20 but external headwinds—in the form of re-escalating trade tensions and elevated oil prices—could put pressure on the balance of payments.

2. Since the 2000s, India has made remarkable progress in reducing absolute poverty. Between FY2011/12 and 2015, poverty declined from 21.6 to an estimated 13.4 percent at the international poverty line (2011 PPP US\$ 1.90 per person per day), continuing the earlier trend of robust reduction in poverty. Aided by robust economic growth, more than 90 million people escaped extreme poverty and improved their living standards during this period. Despite this success, poverty remains widespread in India. In 2015, with the latest estimates, 176 million Indians were living in extreme poverty while 659 million, or half the population, were below the higher poverty line commonly used for lower middle-income countries (2011 PPP US\$ 3.20 per person per day). Recent trends in the construction sector and rural wages, a major source of employment for the poorer households, suggest that the pace of poverty eradication may have moderated.

3. The economy has undergone a structural shift away from agriculture as the dominant sector, to services and industry, but agriculture continues to be essential for reducing poverty and boosting shared prosperity. The sector employs about 59 percent of the country's total workforce, is a source of livelihood for 70 percent of India's rural households and is the main source of economic linkages in rural areas. The Government of India's (GoI) priority in agriculture is to accelerate sector growth to double farmers' incomes in real terms by 2022.

B. Sectoral and Institutional Context

4. While Odisha has transitioned from a predominantly agro-based economy, agriculture remains a key sector, providing employment and livelihoods to more than 62 percent of the population, and contributing close to 20 percent to the State's GDP. Like much of India, agricultural growth in Odisha has been low¹, and inadequate to ensure food security², effectively contribute to reducing malnutrition³, and reduce poverty, especially in rural areas,⁴ where more than 80 percent of the state's poor reside.

¹ Averaging 2.8 percent per year between 2011-2017, but also characterized by negative growth every alternate year.

² Based on the Food Security Outcome Index, out of Odisha's 30 districts, only 1 is food secure, 5 are moderately secure, 6 moderately insecure, 13 severely insecure and 5 extremely insecure.

³ 34 percent and 20 percent of children <5 are stunted and wasted respectively, and 8 percent are severely malnourished.

⁴ About 36 percent of the rural population continue to subsist below the poverty line.



5. Key constraints to improved agricultural sector growth include:
- *Low productivity:* For example, an average farm in Odisha produces only 58 percent, 47 percent, 22 percent, and 5 percent, respectively, of the demonstrably achievable yields of paddy, pulses, sesame, and medium irrigation tank-based aquaculture;
 - *Limited diversification:* Between 2014-2017, for example, the total area devoted to food grains in Odisha increased, while the area under spices, vegetables, fruits, and floriculture - a proxy for diversification - declined⁵;
 - *Limited access to reliable irrigation:* Of the total cultivable area of 8.7 million hectares (ha), only 1.9 million is under irrigation, only 34 percent of the total irrigation potential of 5.5 million ha has been developed. Groundwater is potentially an important supplemental source of water, but its sustainable use is location specific and there are weaknesses in the understanding;
 - *Inadequate management of water resources:* Weaknesses exist in the management of ground and surface water, which comes at a high cost in view of climate change. There is limited stakeholder involvement in decision making on water, inadequate support to associations of water users (Pani Panchayats - PP), and a zero-sum approach to irrigation rehabilitation even in cases where there is scope for win-win outcomes in terms of water availability in cascades;
 - *Fragmented value chains for important crops:* Supply chains for most crops are fragmented and uncoordinated, often involving multiple layers of intermediaries in some places, and no players in many other places. Additionally, there are no reliable market information systems to inform farmers' decisions on production and marketing;
 - *Weaknesses in institutional planning and coordination:* There is lack of coordination and convergence among Government of Odisha (GoO) departments with the joint responsibility of implementing programs in support of agricultural growth (i.e. Department of Agriculture and Farmer Empowerment - DAFE, Department of Water Resource - DoWR, Directorate of Fisheries and Animal Resources Development (DoFARD), Department of Cooperation - DoC, and the Department of Energy - DOE). This has often led to inefficient integration, implementation and delivery of services to farmers, thus undermining the impact of government interventions; and
 - *Gender inequities in the sector:* A 2010 review of access to agricultural extension services across India found that only 18 percent of female-headed households received extension services compared to 29 percent of male-headed households (World Bank, 2010). A recent multi-country study found that 78 percent of Indian women farmers in the survey reported facing gender discrimination in the agriculture sector. The study identified lower wages to women farmers, lack of training needed to manage farms and to optimize the use of technological advances in farming, and limited financial resources as major hurdles to achieving gender equality in agricultural sector and improving farm productivity⁶. The study's results are also relevant in Odisha where women have less access to productive resources such as land, irrigated plots, aquaculture assets, and extension support services. Additionally, women have limited voice as decision-makers in farmer support institutions. These barriers constrain women's productivity and undermines their potential contribution to overall sector growth in Odisha. Typical interventions in support of agricultural intensification, diversification and enhanced climate resilience in Odisha, rarely consider the specific

⁵ Government of Odisha, 2018: Odisha Economic Survey of 2017-18.

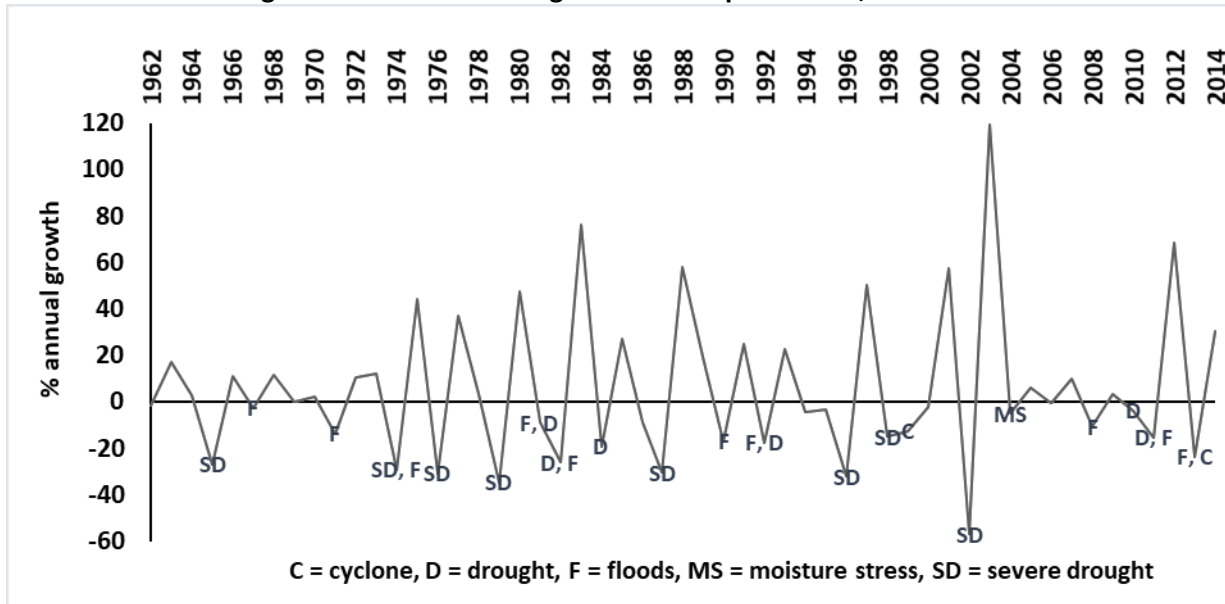
⁶<https://www.corteva.com/content/dam/dpagco/corteva/global/corporate/general/files/Global%20Women%20In%20Agriculture%20White%20Paper%20100318.pdf>



needs of women farmers.

6. In addition, the sector is highly vulnerable to extreme weather events. Figure 1 for example, shows percent annual growth in rice production - the major crop - over five decades, and exemplifies the impacts of frequent extreme weather events - droughts, floods, and cyclones - on the sector.

Figure 1: Percent annual growth in rice production, 1962-2014⁷



7. Notable cyclones like *Phailin* are reported to have destroyed more than 0.5 million ha of crops, worth an estimated US\$395 million, along with hundreds of thousands of livestock and other agricultural assets. The flood of 2008 is known to have resulted in a damage of US\$161 million on the crop sector alone, while the drought of 2000, led to a crop loss of US\$104 million and that of 2015 is believed to have depressed total production of major crops by more than 4.3 million tones⁸.

8. Recent trends point to an increasing frequency and intensity of extreme weather events as well as more agricultural areas coming under their ambit. Since 2009 for example, the frequency of meteorological droughts in the State has increased from 1 in 5 years to 1 in 2 years, and about 70 percent of total cultivated area is prone to droughts today compared to 40 percent in 1970s⁹. In fact, based on historical data, the “normal” 120 days of monsoon rain has shrunk to 60 - 70 days, thus increasing the probability of agricultural droughts. As observed since 2013, floods are now devastating areas beyond the hitherto known 33,400 km² of traditional flood zone. Climate projections indicate that by 2050, median temperatures in Odisha will breach the 2°C threshold (ranging from 2.9 to 4.5°C depending on location) and that drier areas will become drier, while wetter areas will become wetter. In the absence of appropriate action, these changes are expected to further amplify the extreme weather events and, thus, the impacts on agriculture. In drier areas for example, climate change will put a high premium on the improved management of water resources, increasing the need for surface and groundwater and the

⁷ Data source: Government of Odisha, Status of Agriculture in Odisha, 2014-2015.

⁸ Government of Odisha, 2018: Odisha Economic Survey of 2017-18.

⁹ Odisha Climate Change Action Plan, 2018-2023. Forest and Environment Department, Government of Odisha.



demand for providing more reliable irrigation services. Women farmers are particularly more vulnerable to these climate change impacts because their differential access to resources limits their adaptive capacities.¹⁰

9. On the other hand, agriculture is a major source of Greenhouse Gas (GHG) emissions in Odisha, responsible for about 25 percent (i.e. 25 MtCO₂e) of overall state emissions - a level comparatively higher than the sector's 18 percent share in total national GHG emissions. As part of its commitment to global efforts to limit the increase in average global temperatures to less than 2°C above pre-industrial levels, India, through its Nationally Determined Contributions (NDCs), has identified agriculture as one of the priority sectors for GHG emission reduction¹¹. Odisha would be expected to contribute to this national pledge to the global community.

10. In this context then, Odisha faces a complex and interconnected constellation of challenges in agriculture: improving sector growth to ensure food security, better nutrition outcomes and double farmers' income, managing its water resources in a more sustainable manner while avoiding climate change impacts and reducing sector GHG emissions - to lessen both the extent of climate change and future needs for adaptation.

11. The GoO has embraced these challenges and has variously articulated its vision and strategy to address them in the State Agricultural Policy (2013), State Water Policy (2007) and the State Action Plan on Climate Change (2018-2023). The GoO has identified closing the yield gaps for major crops, diversification towards high-value and more nutritious crops, supporting on-farm adoption of resilient production practices (both for adaptation and mitigation), expansion of irrigation coverage, improvement of irrigation efficiency, stakeholder participation and more sustainable management of ground- and surface water resources at cascade and catchment level, and improved produce marketing for priority action. Activities in several of these areas are already ongoing through state action (e.g. dissemination of resilient rice varieties, more efficient use of irrigation water, demand-side management of agricultural pumps and water management in rice to reduce emissions, policy reforms in marketing, support to production¹² etc.) as well as through national "missions" (e.g. the National Mission for Sustainable Agriculture¹³, *Pradhan Mantri Krishi Sinchayee Yojana* - PMKSY¹⁴, National Mission on Agriculture Extension, National Millet Mission etc.)

12. The proposed Odisha Integrated Irrigation Project for Climate Resilient Agriculture (OIIPCR) contributes to these ongoing efforts. The proposal is to support: (i) improved crop productivity for food security and income growth; (ii) farmer adoption of resilient agricultural practices and technologies (both adaptation and mitigation); (iii) diversification¹⁵, especially during the *Rabi* (winter) season and for some areas under upland rice in *Kharif* (monsoon), for income growth, improved nutrition and adaptation to climate change; (iv) more efficient water use and better quality and reliability of irrigation service delivery;

¹⁰ Chanana et al., 2018. Integrating Gender into the Climate-Smart Village Approach of Scaling out Adaptation Options in Agriculture https://reliefweb.int/sites/reliefweb.int/files/resources/Infonote_gender_CSV.pdf

¹¹ India is the world's third largest GHG emitter, and 18 percent - 481MTCO₂e - of its total emissions come from agriculture. <https://unfccc.int/sites/default/files/resource/INDIA%20SECOND%20BUR%20High%20Res.pdf>

¹² For example through Krushak Assistance for Livelihood and Income Augmentation (KALIA), a Rs. 10,180 crore three-year (2020-21) scheme which will provide financial assistance to cultivators and landless agricultural laborers to agriculture production, life insurance and interest free loans.

¹³ Promotes adoption of suitable adaptation and mitigation measures in agriculture.

¹⁴ Seeks to expand cultivable area under assured irrigation, improve on-farm water use efficiency, enhance the adoption of precision-irrigation and other water saving technologies (more crop per drop), among others.

¹⁵ We define diversification as reducing the emphasis on food grains and increasing the share of high-value agriculture. This will be done taking into account the country policy intent to shift rice production to relatively more water-abundant states like Odisha.



(v) a better framework for more efficient and sustainable management of surface - and groundwater resources, including a better knowledge of sustainable levels of groundwater use given its location-specific nature, a more systematic support to PPs and the piloting of Integrated Water Resources Management (IWRM); and (vi) improved produce marketing in 15 districts in Odisha. The districts are selected because of poverty, vulnerability to droughts and limited access to reliable irrigation services.

13. OIIPCRA builds on the progress achieved under an earlier Bank-financed “Odisha Community Tanks Management Project (OCTMP)” which sought to bridge the gap between the then existing irrigation potential and actual irrigation coverage of selected tanks. OIIPCRA however, further expands and deepens this earlier engagement to encompass improving the capacity of: (i) the state extension system, to provide quality advisory services on Climate-Smart Agriculture (CSA) to a larger number of farmers, including those outside the irrigation tanks command areas; (ii) the seed system, to sustainably deliver good quality, better yielding and resilient germplasm to farmers; (iii) the marketing system, to facilitate improved agricultural produce marketing; (iv) the DoWR to adopt a cascade approach to investments in tank irrigation systems, to introduce IWRM in a pilot catchment, to incentivize improved water management and technology adoption by promoting a cost-sharing approach, and to strengthen in a more systematic and comprehensive manner the capacities of PPs and assess the sustainability of groundwater use; (v) relevant institutions in the agriculture and water sector for better coordination and integrated planning. OIIPCRA also pursues reforms in the water sector with the goal of improving the quality and reliability of irrigation service delivery as well as promoting the efficient and sustainable use of water at cascade and catchment level.

C. Relevance to Higher Level Objectives

14. The project contributes to key GoI development priorities, including: (i) enhancing agricultural productivity - with the goal of doubling farmers’ incomes by 2022 - as espoused in the 3-year action agenda (FY17-19); (ii) building the resilience of the agriculture sector to climate change - as conceived under the National Mission for Sustainable Agriculture; and (iii) expanding cultivable area under assured irrigation and improving water use efficiency (more crop per drop) - as envisaged under *PMKSY*. The project also contributes to the attainment of the Sustainable Development Goals (SDGs) on ending poverty (SDG1); ending hunger, achieving food security and improved nutrition (SDG2); availability and sustainable management of water for all (SDG6); resilient communities (SDG 11); and combating climate change and its impacts (SDG13). By supporting adoption of resilient practices, the project contributes to meeting India’s mitigation goals as articulated in its NDC.

15. The project is also consistent with both the “What” and “How” planks of the India Country Partnership Framework - CPF (2018/22). In terms of the “What”, the project contributes to the CPF objective of promoting more resource-efficient, inclusive and diversified growth in the rural sector under Focus Area 1 (promoting resource efficient growth) of the proposed Bank engagement. Proposed project support to extension services, seed systems, produce marketing, and water management, is rendered in the spirit of improved services delivery and helping crowd in private sector investment in the agriculture sector and is thus consistent with the CPF catalytic “Hows” of strengthening India’s public-sector institutions for improved service delivery and leveraging private finance. By supporting the adoption of CSA, the project also contributes to the CPF cross-cutting theme of climate-smart engagement and aligns closely with “*Climate Resilience*,” one of the areas of increased focus of the South Asia Regional Strategy. Lastly, project support to better management of surface and ground water resources at cascade and catchment level, improving irrigation efficiency, and expansion of irrigated area as a drought risk management measure, directly contributes to the water security agenda as conceived in the Bank’s recently launched “*Action Plan on Climate Change Adaptation and Resilience*”.



II. PROJECT DESCRIPTION

A. Project Development Objective

PDO Statement

16. The Project Development Objective is to intensify and diversify agricultural production, and enhance climate resilience¹⁶ in selected districts of Odisha.

PDO Level Indicators

17. Proposed PDO level indicators include: (i) increase in productivity of selected agricultural commodities supported by the project (percent); (ii) increase in productivity of water use at tank level (percent); (iii) share of non-paddy products in total production in project areas (percent); (iv) farmers adopting improved agricultural technology (number); and (v) share of target beneficiaries with rating “Satisfied” or above on process and impact of project interventions (percent).

B. Project Components

Component 1: Climate-Smart Intensification and Diversification of Production (US\$74.6 million)

18. The objective of this component is to intensify production, strengthen farmers’ capacity to adapt to climate change stresses affecting crop and aquaculture production, and diversify production, especially in *Rabi* in response to effective market demand. A key legacy of the green revolution in India has been the tendency to conflate intensification/resilience building with irrigation. Consequently, many programs in support of intensification/resilience building almost invariably focus on irrigated systems often at the expense of rainfed areas. OIIPCRA pursues a different approach, with support under this component proposed to target farmers both inside and outside the irrigation tanks command areas. In this case, the tank command areas will be the nuclei from which project support then expands into adjoining rainfed areas which will be delimited by relevant administrative boundaries (e.g. villages or blocks), depending on local context. Under this component, support will be organized around three subcomponents:

Subcomponent 1.1: Support to Improved Productivity and Climate Resilience (US\$32.1 million)

19. Funding under this subcomponent will support farmer adoption of CSA technologies and practices to increase productivity, improve resilience to climate shocks and reduce GHG emissions, as a co-benefit. For the most part, a wide range of frontier CSA technologies and practices already exist within India’s agricultural innovation system (see compendium at http://www.nicra-icar.in/nicrarevised/images/publications/Tbu_CSA_Book.pdf) and incentives for their adoption, especially inputs support through myriad government interventions, abound. However, among others, weaknesses in extension services provision¹⁷, delivery mechanisms for inputs - especially high yielding resilient seed¹⁸, and produce marketing, constrain widespread farmer adoption of these technologies. As a result, less than 40 percent of farmers in Odisha have access to information and training on frontier production

¹⁶ Defined as the ability to withstand and recover from climatic shocks, particularly droughts and excess rain. It can be achieved by adoption of CSA practices and diversification of crops grown or income sources.

¹⁷ Including inadequate manpower (one extension staff serves over 1,100 operational holdings), limited knowledge and skills, and overall system orientation towards input distribution rather than advisory services provision, etc.

¹⁸ Mainly due to limited availability of breeder seeds- especially for non-paddy crops- which affects the multiplication chain, lack of awareness on the farmer’s part of new seed varieties, and limited distribution networks, among others.



technologies and practices¹⁹, and indeed, fewer than 15 percent are believed to be growing improved crop varieties (including those that are climate resilient), especially those of non-paddy crops.

20. To increase farmers' awareness, access to, and adoption of climate-smart technologies and practices, the project will support extension service provision through both the public and private sector. In terms of the public sector, the project will strengthen the capacity of existing GoO extension services through targeted training and retooling of frontline staff²⁰ on CSA and market-oriented production, strengthening of the Farm Information and Advisory Centers (FIAC) for CSA, and provision of support for incremental logistical costs (e.g. for demonstrations, farmer field schools, expanded use of Information and Communications Technology - ICT in technology transfer²¹) associated with promoting beneficiary adoption of CSA practices through the Agricultural Technology Management Agency (ATMA)²².

21. The project will also support the evolution of a possible private sector solution to contribute - even if modestly- to addressing the chronic challenge of inadequate manpower that underlies the limited reach and coverage of the extension system by testing, and if successful, scaling up an extension service delivery mechanism designed as an adjunct service to the core business²³ of a network of local private rural agriculture entrepreneurs (AEs) to be catalyzed and primed by the project²⁴. The project will support an increase in the number of women AEs to reduce the gender gap in access to extension services. In this respect, the project will support Technical Assistance (TA) and operational costs related to the competitive selection of the AEs (including women AEs); their training, capacity building and accreditation/certification²⁵; a temporally time-bound stipend necessary to ensure their smooth transition into their roles; and some of their extension service delivery related activities²⁶. In complement, the project will strengthen the human and logistical capacity of Farm Science Centers, commonly known as Krishi Vigyan Kendras (KVKs)²⁷ and ATMA at district levels to provide the necessary intellectual ballast to the AE network, support the AEs in effective provision of CSA advisory services, and ensuring the overall quality of their services.

22. Experience with analogous models in India and Bangladesh generally points to reasonable success rates²⁸ but also highlights some potential drawbacks of such an approach to extension service delivery. These include misaligned incentives, which for example, could encourage dishonest AEs to misadvise farmers by overprescribing input use as a profit maximizing strategy and/or skew advisory service provision towards only those crops for which the AEs sell input, to the neglect of other enterprises. The project will support TA to assess the extent and impact of these distortions with the aim of promoting measures to align AE incentives with the effective delivery of extension services.

23. Beyond increasing the reach, coverage and footprint of advisory services to foster CSA adoption, this complementary AE system: (i) generally wouldn't increase GoO's long-term financial resource outlay

¹⁹ In 2013/14, the year for which data is available, only 448,000 out of the State's 4.6 million farmers were reached by the extension system.

²⁰ Including the Krushak Sathis, Village Agriculture Workers, Horticulture Extension Workers, and Agricultural Officers, etc.

²¹ Relying on the services of the agriculture technology media lab at the Odisha University of Agriculture Technology (OUAT).

²² Agency responsible for coordinating all ongoing extension efforts and setting out priorities for extension in each district.

²³ Mainly input supply and output marketing. See Annex 2 for details.

²⁴ Ensuring that adequate numbers of female AEs are selected to reduce the potential gender gap in access to extension - as evidence suggests that women farmers are more receptive to women extension agents.

²⁵ See Annex 2 for details on the proposed training as well as the training agencies.

²⁶ For example, organizing farmers for technology transfer purposes, technology sourcing and demonstration, etc.

²⁷ Field research units of the national agricultural research system conceived to test new technologies in field conditions - before adoption by farmers - and to conduct farmer outreach through demonstrations and training.

²⁸ Out of every 100 AEs created, 45-54 are typically still in business 5 years later.



for advisory service provision - especially important since the GoI has altered the funding pattern for extension services, reducing the central share from 90 percent to 10 percent; (ii) advances a key GoO policy objective of encouraging a pluralistic extension system; (iii) addresses the farmers' main complaint about Odisha's extension system, i.e. its predominant focus on centralized agendas, rather than catering to local needs; (iv) helps crowd-in private investment in the provision of advisory services, in the logic of Maximizing Finance for Development (MFD); and (v) contributes to the CPF's jobs creation objective.

24. With respect to improving farmers' access to high yielding resilient seed varieties, the project will support efforts to: (i) introduce and broaden farmers' awareness of resilient varieties; (ii) better characterize relative demand to justify decisions regarding what varieties to multiply and market; (iii) accelerate seed multiplication and dissemination; and (iv) encourage the private sector to test the commercial market for preferred varieties by building supply chains linked to the AE network as well as to the Odisha State Seed Corporation (OSSC) seed dealer network.

25. Through partnerships with the International Rice Research Institute (IRRI) and the International Center for Agricultural Research in Dry Areas (ICARDA), the GoO is promoting farmers access to new resilient paddy and pulse varieties in parts of the State through the private sector. The proposal is to build on these partnerships by expanding both IRRI's and ICARDA's efforts to the project areas. In this case, the project will support IRRI and ICARDA - working with relevant national agencies - to: (i) create awareness of varieties through demonstrations; (ii) estimate seed demand for preferred varieties; (iii) multiply breeder seed and bulking it into foundation seed²⁹; (iv) build the technical capacity of AEs to engage in the commercial sale of seeds as a viable business line; (v) stimulate the commercial production and sale of certified seeds; (vi) certify seed through the Odisha State Seed and Organic Products Certification Agency (OSSOPCA); and (vii) promote community multiplication and distribution of resilient varieties for which there is limited private sector incentive to invest.

26. As variously documented, this approach, which focuses on demonstrating the risk reduction arising from the use of resilient seeds, coupled with ensuring availability of the seeds in local markets at commercial rates, is a much better guarantor of sustained adoption than a supply driven push through subsidies - the hallmark of the OSSC seed delivery mechanism. The approach is also congruent with the GoO intention to increase private-sector participation in the seed sector, comports with the MFD approach to leverage the private sector to support sustainable growth and is expected to contribute to expanding the generally narrow market for seeds in Odisha (characterized by a small number of low volume transactions), rendering it attractive for private investment - in the medium to longterm - including by IFC.

Subcomponent 1.2: Support to Aquaculture Production (US\$5.7 million)

27. Project support under this subcomponent is opportunistic, taking advantage of the improved water situation as a result of irrigation modernization and management in the cascades, to support climate-resilient aquaculture in the rehabilitated tanks, as well as other tanks in the cascade. In line with GoO policy, most of the rehabilitated tanks suitable for aquaculture would be leased to women. Besides contributing to increased and diversified farmer incomes (a key adaptation strategy) and maximizing the utility and productivity of water stored in the tanks, support to aquaculture will improve nutrition outcomes for project beneficiaries and also contribute to climate change mitigation as the tanks/ponds serve as carbon sinks. By targeting the landless and women, this subcomponent would also lead to greater social inclusion and more equitable distribution of project benefits.

²⁹ In collaboration with Ouat for breeder seed production and OSSC for foundation seed production.



28. Good aquaculture production hinges on high quality climate-resilient fish seed/fingerlings, feed, and good management practices. However, Odisha is generally deficient in good quality fish seed- a key input, with most estimates pointing to a chronic and mounting deficit over the last decade. Horizontal expansion of aquaculture as proposed under the project is expected to accentuate this deficit. The project will therefore support investments that not only ensure reliable access of participating farmers to good quality climate-resilient fingerlings, but also contribute to closing the overall supply gap in the state. Among others, this will include: (i) support to the Odisha Pisciculture Development Corporation (OPDC) to improve efficiency and realize its installed capacity for fingerling production, through rehabilitation and improving the energy use efficiency of hatchery infrastructure, as well as support for related fingerlings production costs and business planning; (ii) one-off capital investment (mainly infrastructure related), provided as a matching grant³⁰, as well as technical assistance to organized groups³¹ (e.g. Self-Help Groups - SHGs, Primary Fishermen Cooperative Societies - PFCS) to set up fingerling production units to meet the demand of climate-resilient fish seed in their localities where it exists; and (iii) technical support to the AEs to establish fingerlings production business lines, where relevant. In tandem, based on diagnostics to be conducted in the first year of implementation, the project will support a spectrum of actions, expected to be mainly in the policy and regulatory realm, to reduce the distortionary effects of state involvement in the fingerlings/hatchery business with the view of promoting increased fingerlings supply through the private sector.

29. In addition, the project will provide limited input (seed and feed) support to landless farmers experimenting with improved aquaculture production for the first time following GoO norms to encourage income diversification for this vulnerable group. The project will also promote good aquaculture management practices through technology transfer via the Directorate of Fisheries and Animal Resource Development (DoFARD) extension service and the AE network with a focus on climate-smart practices, e.g. multi cropping of climate-resilient fingerlings, short-term culture of alternate species (to escape climate induced reductions in water volumes in tanks), use of grow-out ponds (to respond to climate induced water shortages during critical parts of the growth cycle), promotion of species that are adapted to shallow ponds (as an adaptation measure to climate change induced water shortages), and use of re-circulatory water systems - where applicable and commercially viable. In this respect, the project will crowd-in the support of WorldFish to provide global knowledge and technical backstopping, as well as capacity strengthening of DoFARD staff and AEs for effective technology transfer³², with a focus on climate resilient technology.

30. Fish volumes from the project areas are generally expected to be modest and ordinarily would be effectively handled by synchronising harvesting with demand, thus eliminating the need for investment in post-harvest management infrastructure, e.g., cold storage. However, due to climate change, unanticipated water shortages in tanks have increasingly become common and often create the need to harvest fish across tanks in large quantities at short notice, sometimes leading to difficulties in marketing. As an adaptation measure, the project will, on a cost-sharing basis³³, support interested beneficiaries to purchase ice boxes, as well as train them to dry and prepare value added products, e.g. pickles and papad,

³⁰ Grants in kind, and not in cash; GoO norms with respect to share of beneficiary contribution, gender and vulnerable group targeting.

³¹ With preference to women's groups.

³² WorldFish already has a memorandum of agreement with DoFARD to support the increased productivity of aquaculture in Odisha. OIIPCRA will cover only the incremental costs related to participation in project-specific activities.

³³ Following GoO norms on eligibility and cost sharing ratios and provided through direct benefit transfer mechanisms.



in case of gluts.

Subcomponent 1.3: Support to Diversification and Produce Marketing (US\$36.8 million)

31. The objective of this subcomponent is twofold: (i) support farmers to reduce the current emphasis on food grains (especially paddy and wheat) and increase the share of high-value and more nutritious products (e.g. fruits and vegetables) in their overall production structure³⁴; and (ii) improve produce marketing to reduce price risks associated with diversification, increase incomes, and ensure sustained farmer adoption of CSA practices to strengthen resilience to climate change. A successful shift in favor of more diversified production would also lead to improved nutrition outcomes for farmers and the broader community, reduce the water footprint of paddy, foster biodiversity, and strengthen resilience of the production systems to climate change.

32. Many efforts to support crop diversification in India have yielded mixed results. According to several practitioners, this is partly due to market distortions related to suboptimal price support policies, lack of government incentives (e.g. credit, extension services and subsidized inputs) that are typically available for the food grains segment, poor infrastructure, and constrained access to reliable remunerative markets. Indeed, for some of these reasons, recent Bank attempts to promote diversification under the OCTMP were partially successful - only leading to marginal diversification, not different than the level of diversification observed in non-project areas. Based on a growing body of evidence, we postulate that marketing arrangements, offering favorable and predictable returns for other crops, can sufficiently mitigate the risk associated with marketing and that improved marketing prospects, combined with improved access to necessary inputs should tilt farmers' production decisions in favor of diversification.

33. A market assessment commissioned as part of preparation identified several high value crops³⁵ for which sufficient demand exists to which farmers could profitably diversify and where women participation is sufficiently high. To improve marketing of these crops, the project will support marketing arrangements bringing together producers and commercial off-takers in mutually beneficial productive alliances underpinned by contractually binding agreements on the terms and conditions for the production and marketing of produce. Such marketing arrangements are effectively enabled by the draft Odisha Agricultural Produce and Livestock Contract Farming and Services Act, 2018 and the streamlined regulations and policy reforms in support of agribusiness as introduced through a recent International Finance Corporation (IFC) advisory program.

34. In this context, the project will fund TA to build capacity within the DAFE to promote productive alliance models and raising investment opportunities (that could be take advantage of IFC financing) for these and other competitive value chains (especially those that foster adaptation to climate change) that could emerge during implementation. The project will provide support for: (i) increasing farmer awareness of diversification opportunities; (ii) continuous identification of competitive value chains as well as potential off-takers - leveraging the potential agribusiness investment leads identified through IFC's Odisha Inclusive Partnership Program; (iii) organizing or strengthening already existing farmer groups for effective participation in productive alliances³⁶; (iv) farmer experimentation with new crops and training/demonstration of relevant climate resilient production technologies; (v) training farmers on production and marketing skills (including on input sourcing, production, aggregation, and new

³⁴ Farmers wishing to diversify into backyard poultry, especially those affected by cyclone Fani could also be supported.

³⁵ Including black gram, pigeon peas, marigold and a basket of vegetables.

³⁶ Converging with and leveraging SHGs organized under the Bank-financed National Rural Livelihood Project and FPOs.



technologies, among others); (vi) climate-informed business plan development; (vii) fostering linkages with the financial sector or other government programs for access to credit; (viii) financing - on a cost-sharing basis³⁷ - of selected productive investments identified in the business plans (with a focus on productive investments that equally promote resilience to climate change e.g. warehouses); and (ix) leveraging private capital into competitive value chains e.g. through blended financing to maximize finance for development.

35. In complement, especially to support farmers who cannot integrate into viable productive alliances, the project will train and strengthen the capacity of the AEs to provide input and output marketing services (see Annex 2). This will include support for market intelligence, postharvest management and aggregation infrastructure (e.g. storage facilities to reduce commodity exposure to extreme weather conditions), inter alia, on a cost-sharing basis³⁸. Through specialized TA, the project will also assist the Odisha State Agriculture Marketing Board (OSAMB) to develop a market intelligence system with sufficient coverage and outreach to provide up to date market/price information including demand position, current prices, likely price trends, market practices. The project will also support the OSAMB to assess medium- and long-term opportunities for given products and to build farmers' capacity to use e-NAM, an online trading platform for agricultural commodities in India.

Component 2: Improving Access to Irrigation and Water Productivity (US\$137.9 million)

36. Improving the reliability of irrigation and increasing water storage is critical to enhancing crop productivity, building resilience to climate change, and promoting diversification and access to markets. It is particularly important in the targeted project areas that are characterized by frequent droughts and highly variable rainfall. The need to bridge increasingly longer dry spells during Kharif and producing higher value and more diverse crops during Rabi when there is no margin for water supply errors, puts a high premium on better management of water storage facilities and the quality of irrigation services.

37. The reliability of irrigation services and a more productive use of water resources in the project areas is weighed down by: (i) the poor condition of hydraulic assets- mainly due to deferred maintenance; (ii) limited knowledge and skills in water management - often inadequate to provide supplemental irrigation during Kharif season, and to cover water-stress conditions during Rabi; and (iii) weak arrangements for operation and maintenance (O&M). Additionally, most of the tank irrigation systems have been developed for paddy cultivation. A more diversified cropping system that is more demanding in terms of water management, requires retro-fitting of the irrigation infrastructure to provide water in a more reliable manner.

38. Tank systems in Odisha are often part of a cascade of tanks that are hydrologically and hydraulically interconnected, with one tank depending on the return flows from another. Addressing water-related constraints and defective hydraulic assets at tank level will then lead to zero-sum results, whereby increases in water availability in some tanks come at the expense of losses of similar magnitude in other tanks. Improving water management therefore requires adopting a comprehensive cascade approach that identifies and prioritizes win-win investments based on their contribution to improving cascade-wide water availability throughout the year, and that leverages both surface and groundwater.

39. The project will improve the performance of irrigation throughout the year and across cascades of

³⁷ Financing will be provided as in-kind grants following already existing GoO norms (as detailed in the PIM) with respect to provision of different kinds of productive investments. Caps on indicative absolute amount of financing to a single group are provided in the PIM.

³⁸ Details on eligibility and percentage of farmers' matching funds are in the PIM.



selected tank irrigation systems through institutional reforms and modernization of hydraulic assets and related capacity strengthening. The objective is to use water more efficiently, reduce water losses and save water during *Kharif* season, and transfer these savings to *Rabi* season to support crop diversification and aquaculture. The project will adopt a cascade approach that will consider the management of each tank not in isolation but as part of a larger cascade of reservoirs. Support under this component will go towards: (i) introducing water sector reforms, including piloting of IWRM at catchment level, support for the preparation of groundwater regulation that would take into consideration the fact that sustainable groundwater use is location specific, establishment of a PP support unit in DoWR, and piloting of Public-Private Partnerships (PPP) in irrigation management; and (ii) investments in selected cascades of irrigation tank systems.

Subcomponent 2.1: Support to Water Sector Reforms (US\$5.9 million)

40. The project will support the following reforms:

- *Introduction of IWRM:* In one pilot catchment, Kharkhari Nala, located in the Rushikulya basin, the project will support the introduction of IWRM, including: (i) establishing a catchment council that will serve as a platform for representatives for all main water users in the catchment to participate in water management decisions and coordinate between water users, and an authority that will be responsible for water resources allocation and management, and preparation of a catchment management plan; (ii) establishing a monitoring network to collect data on surface water, groundwater, soil moisture, actual and potential evapo-transpiration (AET and PET), cropping patterns and intensity, and agricultural and irrigation practices; (iii) conducting hydrological investigations and surveys, and (iv) preparing a catchment development and water management plan.
- *Groundwater regulatory reform:* Groundwater use for irrigation in command areas is prohibited in Odisha as per existing GoO Order. The GoO has expressed interest to lift this Order to allow the use of groundwater for irrigation in locations where this is sustainable, but is concerned that, in the absence of adequate data on sustainable yield levels and in view of the high hydrogeological variation in the state, such a move might lead to unsustainable exploitation of ground water. In this context, the project will finance a study to assess yield levels and quality of groundwater in Odisha and help the GoO design appropriate regulation to ensure sustainable use of groundwater for irrigation in locations with different hydrogeological conditions, while safeguarding water and soil quality. This will include design of implementation and enforcement systems, institutional and organizational arrangements, budget and financing requirements, etc. The project will work closely with the Central Ground Water Board (CGWB) and Chief Engineer of Groundwater Department of Odisha, in designing the regulation. Only after the regulation has been adopted will the project support groundwater use, and only in those locations that have been identified in the study as having a good potential for sustainable use.
- *Establishment of a PP Support Unit:* The Project will support the establishment and strengthening of a unit within the DoWR that will provide comprehensive and targeted support to PPs, including capacity strengthening and extension, support for the daily administration and management of the PP, and preparation of manuals and guidelines including those related to ensuring the inclusion of women in decision making position in PP committees. The project will finance equipment, office furniture and technical assistance for the preparation of training material.
- *Public-Private Partnerships (PPP) in irrigation management:* The project will conduct a transaction advisory study into options for PPP in irrigation management to increase the efficiency of water use



and improve the quality of irrigation service delivery in these tanks.

Subcomponent 2.2: Support to Investments in Cascades (US\$132.0 million)

41. The project will invest in hydraulic infrastructure in selected cascades. All tanks located within the cascade will be eligible for investment and support, regardless of their size, institutional or management arrangement. A total of 162 “no regret” tanks have been identified that meet all criteria for selection and that are not located immediately upstream or downstream of other tanks and that would thus neither be impacted by, nor impact water availability in other tanks. Investments in these “no regret” tanks do not require an assessment to ascertain their hydrological impact on other tanks and will be taken up during the first year of project implementation. For the remaining 370 tanks, the project will: (i) identify the cascades based on technical and social considerations, using the initially identified tanks as an entry point; (ii) engage with beneficiaries to identify the priority investments within the identified cascades; and (iii) conduct a rapid hydrological assessment to identify investments that contribute to optimizing water use across the cascade and throughout the year.

42. Investments to be defined through the rapid hydrological assessment may include strengthening of canal bunds, installation of field channels, improving the distribution network, modernizing hydraulic canal structures, installation of sub-surface pressurized pipes, and Internet of Things (IoT) based monitoring system. The project will help farmers to access subsidies at central and state level for technology adoption (including micro-irrigation and solar panels).

43. The project will support the establishment of cascade-level water management organizations that will be responsible for water allocation and management between tanks at cascade level. PP will be established in each of the tanks within a given cascade, and these PPs will federate into Cascade PPs that will be responsible for water management and water allocation at cascade level. To that end, the project will provide office equipment and supplies, invest in water data measurement at cascade level, help Cascade PPs prepare cascade water management plans and strengthen capacities in modern irrigation technologies, improving irrigation efficiency and rational hydraulic asset management, through Farmers’ Field Schools and demonstrations, among others. This will enhance the water security of individual farms by reducing the risks associated with climate variability and help them adapt better during the non-monsoon period.

44. The project will adopt a competitive approach to investment fund allocation among cascades, as follows. Investments in improved water management at cascade level will be made after reaching an agreement with cascade beneficiaries about the soft improvements in the management of water at cascade level that the beneficiaries would like to accomplish, including e.g., establishment of a functioning PP or a Federation of PPs at cascade level, collection of PP membership fees for O&M, compliance with groundwater regulation, etc. Additional funds for investments will be made available to those cascades that meet these agreed requirements. The project will help beneficiaries to achieve the agreements. The Project Implementation Manual (PIM) will provide a detailed description of the process.

45. To improve the sustainability of irrigation systems, the project will: (i) strengthen capacities of stakeholders at tank and cascade level to identify, plan and manage maintenance works; (ii) support PPs and their federations to undertake agreed actions to become eligible for a second round of investments; and (iii) provide more systematic support to PPs and their federations through establishment of a PP support cell within DoWR. Operation and Maintenance (O&M) will continue to be undertaken exclusively by the beneficiaries out of their own PP membership contribution. Larger maintenance works on the main canal and tank infrastructure will continue to benefit from public support through DoWR.



Component 3: Institutional Capacity Strengthening (US\$9.7 million)

46. Delivery of agricultural public services in Odisha is the shared responsibility of several line departments, each with their own mandate and, frequently, rigid organizational boundaries. Support to crop production is the mandate of DAFE; fisheries and livestock production, the mandate of the Directorate of Fisheries and Animal Resources Development (DoFARD); minor and major irrigation, the mandate of DoWR; small irrigation systems (below 40ha), the responsibility of DoPR&DW; the supply of energy for agricultural purposes, the mandate of the DoE; and produce marketing the mandate of DoC. Effective planning and coordination across these departments, especially for cross sector initiatives e.g. OIIPCRA, is key to overall state capability to deliver better agricultural services and the achievement of the GoO's objectives in agriculture more generally.

47. An institutional assessment, conducted as part of project preparation³⁹, points to significant weaknesses in existing planning and coordination mechanisms across these line departments - mainly the result of lack of a strong supra authority to foster coordination and convergent planning and implementation of otherwise cross-sectoral activities across several departments. The assessment also highlighted the limited institutional capacity to deliver complex intersectoral programs; and to plan, innovate and modernize for the future (e.g. in response to climate change) - with most of the institutional focus being accorded to price support programs rather than to long-term sector growth. In addition, the assessment also shows the coordination and monitoring challenges at the district level⁴⁰, where most of the implementation takes place, and how these undermine the progress and effectiveness of program implementation. In fact, these institutional weaknesses are often negatively implicated in the suboptimal performance of most GoO agriculture/water resource development programs.

48. The objective of this component is to improve overall capacity of the GoO for interdepartmental planning, coordination and implementation of cross-sectoral programs in the agriculture and water resource sectors with the view of strengthening farmers' capacity to adopt to climate change. In this respect, the project will finance TA to build a secretariat within the office of the Agriculture Production Commissioner⁴¹ (APC) for the purposes of improving planning and convergence, coordination, oversight, monitoring, analytics, policy formulation, and partnerships building. Besides ensuring better OIIPCRA outcomes, a strengthened office of the APC would help guide the state's long and short-term vision for water and agriculture development and adaptation/mitigation of climate change, build the state's capability to deliver programs, and help forge strategic long-term partnerships for improved performance of relevant sectors.

49. At the district level, the project will finance the establishment, staffing and operation of a Monitoring Cell within the office of the DC to be charged with monitoring all activities in the agriculture, fisheries, and water sectors, including those funded by OIIPCRA. In addition, based on capacity assessments to be conducted during implementation, the project will design and finance training for relevant departmental staff, including that related to strategic leadership, project management, climate change, and any technical aspects across departments.

Component 4: Project Management (US\$12.93 million)

³⁹ The objective was to map and assess the capacity of institutions relevant to delivering on the PDO and identify alternative institutional approaches that would better deliver the project outcomes.

⁴⁰ Mainly because all government programs across multiple sectors are managed by a single often understaffed office of the DC.

⁴¹ Organizationally responsible for overseeing DoWR, DAFE, DoC, DoFARD, and DoE.



50. This component will finance activities related to state and district-level project coordination and management, including developing annual work plans and budgets, financial management (FM) and procurement, human resource management, safeguards compliance monitoring, development and implementation of a Management Information System (MIS), monitoring and evaluation (M&E) and impact evaluation (IE) studies, a communication strategy and citizen engagement as well as a Grievance Redress Mechanism (GRM).

Component 5: Contingent Emergency Response (US\$0 million)

51. This zero-cost, contingent emergency response component (CERC) will finance eligible expenditures in case of natural or man-made crises, disasters, severe economic shocks, or other crises and emergencies in Odisha. Implementation of this component will follow a detailed Contingent Emergency Response Implementation Plan (CERIP) satisfactory to the World Bank that will be prepared for each eligible crisis.

Project Cost and Financing

52. Total project cost including physical and price contingencies (5 percent) is US\$235.54 million of which IBRD will contribute US\$165 million (70 percent) under Investment Project Financing (IPF) and the balance, US\$70.54 million will be counterpart financing (see Table 1 below).

Table 1. Project Costs by Component and Source of Financing (US\$, millions)

Project Components	Project Cost	IBRD	Counterpart Funding
Climate-Smart Intensification and Diversification of Production	74.60	52.22	22.38
Improving Access to Irrigation and Water Productivity	137.90	96.53	41.37
Institutional Capacity Strengthening	9.70	6.79	2.91
Project Management	12.93	9.05	3.88
Contingent Emergency Response	0.00	0.00	0.00
Total Project Cost	235.13	164.59	70.54
Front-end fees	0.41	0.41	-
Total Financing Required	235.54	165.00	70.54

C. Project Beneficiaries

53. Total direct project beneficiaries are estimated at about 125,000 smallholder households from the 15 participating districts. Of these, approximately 72,800 households are expected to doubly benefit from improved irrigation (component 2 activities) and project interventions in support of climate-smart intensification and diversification of crop production (subcomponent 1.1 activities); 52,200 households, outside the command areas, will benefit solely from subcomponent 1.1 activities, and 3,000 households are expected to benefit from improved aquaculture production. About 20,000 households with enough endowments to produce a marketable surplus, will benefit from the improved marketing support (subcomponent 1.3 activities). In addition, about 500 AEs (including women AEs), and state institutions will benefit from the project in terms of training and capacity building. A key criterion for beneficiary selection will be promoting synergy and convergence with other ongoing programs to ensure greater transparency in support provided by several schemes.

D. Results Chain

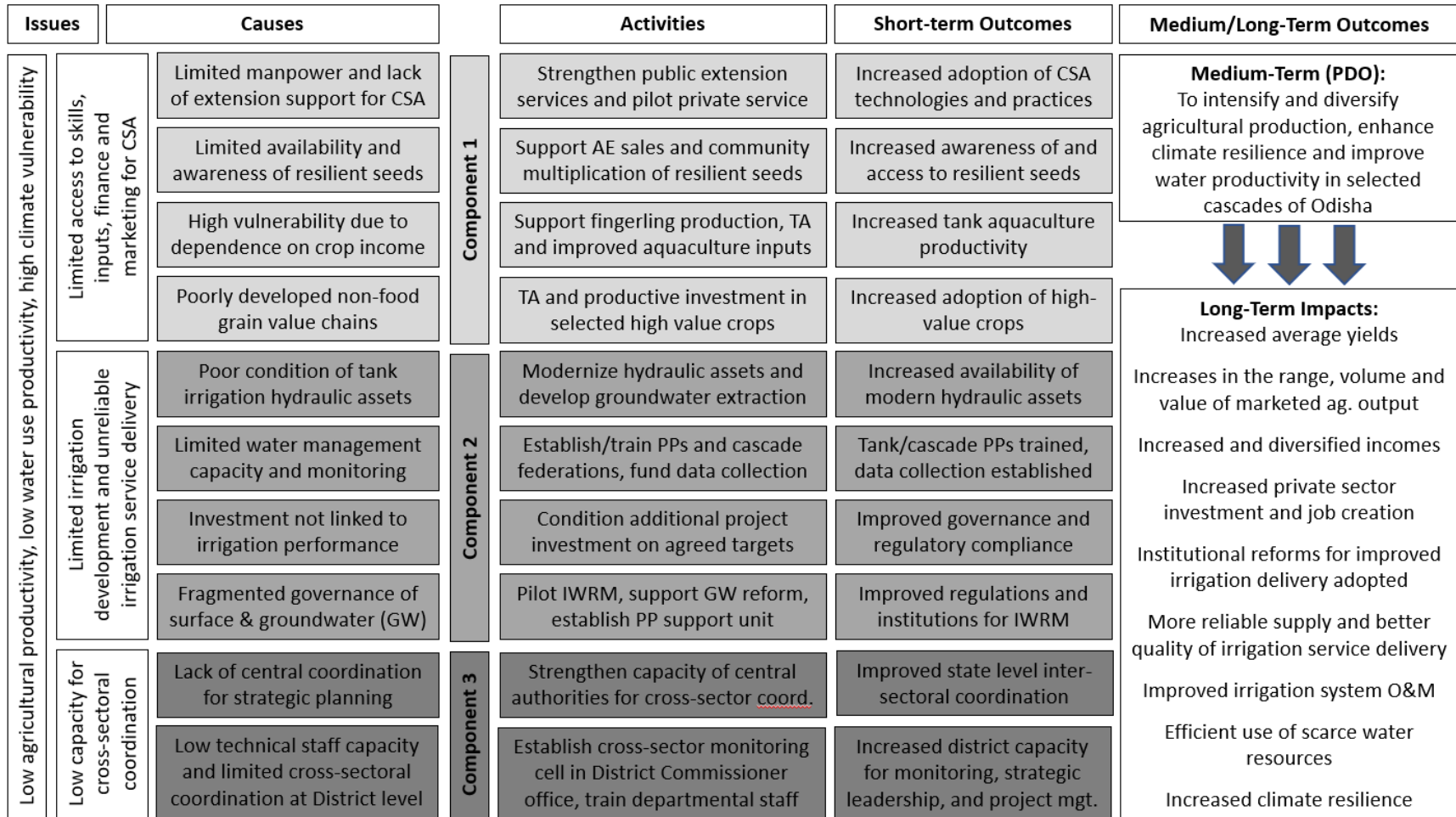
54. The project theory of change (TOC) is presented in Figure 2 below. This TOC depends on several critical assumptions and could be affected by several external factors. The TOC assumes firstly that



farmers and other agro-entrepreneurs are interested to diversify their crop selection, production methods, and marketing strategies. However, there is strong evidence globally that resource-poor farmers are highly risk-averse; hence, the project design incorporates both training/demonstration activities and access to limited investment finance to offset the risks of adopting new technologies, practices, and crops. The TOC also depends on the ability of these resource-poor farmers to develop new direct marketing arrangements with private sector partners that could have negative implications for actors currently benefitting from the existing marketing systems, such as traders and other “middle men.” Moreover, the TOC assumes that new cascade-level governance institutions and performance-based investments will be sufficient to incentivize better irrigation system O&M and service delivery. While these reforms represent good practice in the sector globally, the project will need to monitor the extent to which water resource managers invest in improved system management given the well-documented cycle of build-neglect-rebuild that has characterized irrigation systems in the state. Finally, the TOC assumes that state and district authorities have an interest in coordinating their activities, despite historically siloed governance and financing arrangements. The IWRM pilot is expected to help demonstrate the benefits of more coordinated water management. Furthermore, the project’s ability to achieve its development objectives could be affected by extreme climate conditions, natural disasters, market distortions, and the actions of actors benefitting from the status quo.



Figure 2. OIIPCRA Theory of Change





E. Rationale for Bank Involvement and Role of Partners

55. Supporting farmers to improve productivity for enhanced food security and income growth, adapt to climate change, reduce the GHG emission footprint of their activities, and use irrigation water more efficiently and productively are high GoI and GoO priorities as reflected in national, as well as state-level policies, strategies and missions. The justification for the Bank's involvement and support to these priorities stems from multiple considerations. First, over the years, the Bank has partnered with the GoO to boost agricultural growth and build the resilience of agriculture to climate change through expansion of irrigation and has achieved good results. There is a strong rationale for continuing and scaling-out this support, given: (i) the significant contribution of agricultural growth to ending extreme poverty and boosting shared prosperity in Odisha; (ii) the vulnerability of Odisha's agricultural sector to climate change; (iii) the commitment of the WB through the CPF to support GoI's development priorities – including enhancing agricultural productivity and promoting climate change adaptation and mitigation and water use efficiency; (iv) the need to improve the implementation capacity of relevant GoO institutions as facilitators or providers of public goods in support of agricultural growth, climate change adaptation and mitigation, and resource use efficiency among smallholders; and (v) the positive impact that the Bank's global experience can bring to bear on building the capacity of such institutions.

56. Second, the project complements the planned Bank-financed Agriculture Risk Resilience and Insurance Program (P165923) for India. Farmers supported to build resilience under this project and yet availing themselves of insurance risk cover against weather extremes as envisaged under the insurance program are expected to pay lower insurance premiums. Third, the support actualizes the Bank's commitment to scale up climate action in high-impact areas⁴², and specifically aligns with “rebalancing the WB climate portfolio towards greater focus on adaptation and resilience” - one of the five strategic shifts underpinning the WB's Climate Change Action Plan (2016-2020). Fourth, the project is an important contribution to the Bank's objective in India as embodied in the CPF to improve the efficient use of water resources in support of poverty reduction and economic growth.

F. Lessons Learned and Reflected in the Project Design

57. The OIIPCRA design draws on lessons from many Bank-financed projects including the OCTMP as well as other global projects and initiatives. Key lessons include:

- *Strong coordination among government departments with key implementation roles is critical to attainment of desired project outcomes:* OIIPCRA pursues an integrated approach to agricultural growth and climate resilience, with specific interventions on sustainable and resilient intensification and diversification, irrigation management and modernization, improved aquaculture management, and agricultural produce marketing. Each of these areas is the mandate of a different GoO department. Experience from OCTMP shows the undesirable effect of the lack of strong coordination among project executing departments on project outcomes. Instead of relying on ad hoc collaboration arrangements, as was the case in OCTMP, collaboration among DoWR, DAFE, OSAMB, and DoFARD under OIIPCRA will be ensured through oversight and coordination by the office of the APC. Indeed, among others, support to the APC as proposed in section B above is provided with the view of strengthening its ability to ensure coordination of project activities across departments.
- *Market orientation and improved marketing opportunities are ultimately the best drivers and*

⁴² Climate-smart land use, water, and food security; sustainable and resilient cities; sustainable mobility; renewable energy and energy efficiency; and green competitiveness.



guarantee of sustainable adoption of climate resilient production practices and diversification into new commodities: Experience from Bank-financed projects that promoted adoption of improved technologies and diversification into new higher value commodities shows that if farmers are to continue using any practices post-project, they need to have access to remunerative markets for their products. Favorable output prices justify continuing investments in CSA practices. This understanding underlies the project emphasis on supporting improved produce marketing.

- *Achieving agricultural diversification and intensification in a changing climate requires improving the management of surface- and groundwater resources to provide more reliable and sustainable water services.* A more reliable access to water puts a high premium on the use of productivity enhancing inputs, provides more flexibility, diversity, reliability, quality and product uniformity that form important requirements for markets access, and enables farmers to capture higher seasonal prices. More reliable water services should be provided at the cascade level to ensure that improvements in one tank do not come at the expense of other tanks in the same cascade. Piloting integrated water resources management will help ensure stakeholder involvement in water allocation for sustainability.
- *Prospects for adoption and sustained use of high-yielding resilient crop varieties are higher when seeds are provided through market-based approaches instead of supplied through subsidized public distribution:* Ongoing work by IRRI to promote high-yielding drought tolerant and flood tolerant paddy varieties in Odisha shows that an approach based on awareness creation and ensuring availability of resilient varieties in local markets at market prices was superior to the customary subsidized public-sector driven distribution in promoting sustained adoption. This is largely in line with experience elsewhere and underpins the design decision to pursue promotion of resilient varieties through support to awareness creation and stimulating commercial sales through the private sector.
- *A world of increasing vulnerability to climate change demands increased investment in building the resilience in rain-fed areas:* All else equal, rain-fed areas are comparatively more vulnerable to climate change than adjacent irrigated areas. However, mainly because of a legacy of the green revolution, rain-fed areas in India mostly remain neglected in terms of investments in building resilience. This is the case even when the literature notes the greater marginal impact of an additional unit of investment in building resilience in rain-fed areas compared to irrigated areas. This project extends CSA adoption support to areas outside the command areas of irrigation schemes to build the resilience of rain-fed production systems.
- *Effective agricultural produce marketing minimizes a blind push of produce into markets and instead emphasizes the market pull:* The suboptimal outcomes with respect to improved produce marketing under OCTMP attest to the futility of strategies that delink production decisions from market demand with the expectation that produce would be remuneratively pushed into presumed markets. Thus, the OIIPCRA design instead focuses on building resilience and improving the production of commodities for which market demand has been ascertained to exist.

III. IMPLEMENTATION ARRANGEMENTS

A. Institutional and Implementation Arrangements

58. The project will be jointly implemented by the DoWR, DAFE, and DoFARD, with each entity taking the technical lead on project activities for which they have the institutional mandate and working through



their respective implementation structures at the state, district and community levels in line with the policy of decentralized implementation of GoO programs. In this case, DAFE will take the lead on activities related to project subcomponent 1.1 and 1.3 (working collaboratively with OSAMB on produce developing market intelligence systems and use of e-NAM in subcomponent 1.3); DoFARD will be the lead agency on activities in support of aquaculture production as proposed in subcomponent 1.2; while activities on improving access to irrigation and water productivity as defined under Component 2 will be led by the DoWR, working together with DoPR&DW on Gram Panchayat tanks. Component 3 activities will be led by the office of the APC in collaboration with DAFE, DoWR, and the Department of Cooperation. Several technical service providers and agencies - as identified in the PIM- will be hired to provide specific support to implementation. Overall project management and leadership will be the responsibility of the DoWR.

59. There will be a State Project Unit (SPU) established within the Odisha Community Tanks Development and Management Society (OCTDMS) in DoWR for day-to-day management and coordination of project activities, including preparation of annual work plans and budgets (AWPBs), project procurement, ensuring compliance of implementation with safeguards policies, monitoring and reporting progress, etc. The SPU will be headed by a Project Director (PD) and will be staffed with experts in procurement, FM, environment and social safeguards, M&E as well as other technical skills e.g. agribusiness, fisheries, etc., that are needed for effective project implementation. There will be Project Cells (PCs), one each, in the Directorate of Agriculture and Food Production, Directorate of Horticulture and Directorate of Fisheries at the state-level to be charged with annual work planning and budgeting for their respective activities and interfacing with the SPU, and district officials to offer technical support and guidance in implementation of project elements in their respective components. At the district level, there will be a District Project Management Team (DPMT), comprising of the Executive Engineer - Minor Irrigation (MI), Project Director ATMA, Deputy Director - Horticulture, Deputy Fisheries Officer, and the Executive Engineer - PRDW. The DPMT will be chaired by the DC and will oversee the day-to-day operations of the project in each district. A Monitoring Cell established in the office of the DC will be responsible for regular tracking of project activities at the district level. The office of the APC will ensure inter-departmental coordination and integration of workplans and budgets, and effective monitoring of project progress and outcomes.

60. A Project Steering Committee (PSC) comprising the APC, Principal Secretaries of Department of Finance, DoWR, DAFE, DoFARD, DoPR&DW, and OSAMB, and chaired by Chief Secretary, will be established to provide overall strategic and policy guidance during project implementation and to approve annual workplans and budgets. The PSC will meet at least twice a year to review overall implementation progress.

B. Results Monitoring and Evaluation Arrangements

61. The project will establish an M&E system to monitor the level of achievement of expected results. A baseline survey to provide information against which to monitor and assess project progress and effectiveness of implementation through an IE has been conducted and will be linked with, and followed by, a mid-term evaluation survey and an end of project evaluation survey. These surveys will be backed by smaller surveys to track seasonal and periodic changes in key result indicators. The seasonal surveys will be implemented by GoO staff in the relevant departments, while the IE surveys will be contracted to a third party. In complement, a simple management information system (MIS) will be established in the office of the APC to track implementation progress, including disbursement, procurement, and the implementation of planned activities. The MIS will have separate but interlinked modules for the SPU, DAFE, DoFARD, DoWR and any other implementing agencies.



C. Sustainability

62. Several of the project's design features are based on lessons learned and partly reflect efforts to ensure that OIIPCRA achievements endure beyond its life. These features include: (i) complementing investments in climate-smart intensification and diversification with marketing support to help resolve second generation marketing challenges that often dissuade farmers from continued adoption of new practices and commodities; (ii) encouraging the private sector to engage in commercial production and sale of resilient seed; (iii) supporting diversification to high value commodities to ensure that costs related to continued adoption of intensive and resilient practices (in terms of inputs and services), and provision of reliable irrigation services, can be defrayed by increased farm revenues; (iv) stimulating the evolution of private sector provision of advisory services; (v) competitive allocation of investments among cascades to promote ownership among beneficiaries; and (vi) building systematic capacity in GoO institutions (e.g. the APC for joint planning, coordination and implementation, creation of a dedicated PP support unit in DoWR).

63. In addition, GoO accords high priority to improving productivity and resilience of agriculture to climate change and to improved management of the state's water resources as demonstrated by the current policy thrust and the increasing public expenditure allocated to the agriculture and water sectors. The expectation then is that OIIPCRA activities, if successful, will continue receiving GoO attention and should be scaled out to other areas in the state using GoO's own resources.

IV. PROJECT APPRAISAL SUMMARY

A. Technical, Economic and Financial Analysis

64. **Technical:** Broadly, OIIPCRA is an effort to integrate agricultural growth, with a responsiveness to climate change - through CSA, and the efficient and more productive use of agricultural water. A recent World Bank review of CSA in more than 30 countries across all regions, as well as several studies in India, conclude that lack of knowledge, and limited access to input and output markets are the biggest barriers to CSA adoption. OIIPCRA technical design seeks to remove these barriers to CSA adoption for farmers in Odisha. The decision to complement existing GoO extension services through the AE network is meant to address the limited coverage and reach of the existing extension system to ensure wider dissemination of CSA knowledge to farmers.

65. The design decision to strengthen produce marketing through productive alliances is meant to improve marketing prospects for farmers to guarantee continued CSA adoption. Augmenting the productive alliance approach with output marketing support through the AE network reflects a recognition that not all farmer's produce can be effectively marketed through productive alliances, and neither can all farmers be expected to engage in productive alliances. The proposed market-based approach to seed delivery is meant to ensure timely and reliable access to good quality resilient seed. The cascade approach to the rehabilitation of hydraulic infrastructure is meant to optimize water storage and distribution across several tanks/beneficiaries and aims to maximize climate change adaptation benefits accruing to the stored water. Adopting a competitive approach to investment fund allocation among cascades is meant to leverage the project support as an incentive for improved performance and management of irrigation by beneficiaries. Support for regulation of surface- and groundwater resources will improve the sustainability of these services and help to improve the quality of irrigation service delivery in response to the production of crops that are more demanding in terms of water supply. Better quality of irrigation services, in turn, will remove some of the impediments to production of higher value



crops for markets.

66. **Economic and Financial Analysis:** An economic and financial analysis was undertaken to assess, and answer three main questions related to the proposed project design and expected outcome i.e.: (i) what is the project's expected development impact? (ii) is public funding needed? and (iii) what is the WB's value added in the project?

67. **Development impact:** Project investments are expected to improve crop and aquaculture production, produce marketing, and agricultural water management in target areas. Main benefits estimated in the analysis include: (i) agricultural benefits resulting from expansion in irrigated areas and increased intensification, diversification and climate resilience of crop production; (ii) aquaculture benefits resulting from intensification of fish production; and (iii) climate co-benefits resulting from adoption of improved water and farm management and climate smart agricultural practices. Improved access to markets, improved marketing strategies, and adoption of improved technologies and post-harvest practices are expected to lead to marketing of incremental production of non-paddy crops and thus, likely benefits in terms of additional price premium for farmers' produce are assumed.

68. Economic and financial returns are assessed in 2019 constant prices, at a discount rate of 5 percent. Climate co-benefits are examined at both high and low shadow prices of carbon recommended in the World Bank's guidance note of September 2017. The project returns are estimated for a period of 26 years, which corresponds to the technical life of rehabilitated and modernized tanks, if adequately operated and maintained, and includes a six-year project implementation period.

69. When the climate co-benefits are excluded, economic rate of return (ERR) to the project investments is estimated at 10.8 percent with an economic net present value (ENPV) of Rs. 947.6 crore (US\$132 million) and BCR of 1.8. With the climate co-benefits at the low shadow prices of carbon, the ERR increases to 12.6 percent, ENPV to Rs. 1,334.9 crore (US\$186.8 million), and BCR to 2.13. When the climate benefits are considered at high shadow prices for carbon, the ERR is increases to 14.2 percent, ENPV to Rs. 1,722.3 crore (US\$241 million), and the BCR at increases to 2.45.

70. The project returns are tested for six sensitivity variables including changes to costs, benefits, benefit accumulation delays, and no diversification towards vegetables. The project returns are sensitive to changes in benefit scopes and implementation delays. When a simultaneous 20 percent reduction in benefit scopes and 20 percent increase in costs is assumed, the base ERR of 12.6 percent drops to 8.3 percent. Similarly, the ERR drops to 7.2 percent when a 3-year delay in the project implementation and 20 percent reduction in benefit scopes are assumed to occur simultaneously. The sensitivity to changes in project scope (individual events) is negligible while the sensitivity to other variables is moderate. The sensitivity of the project's return to major risk factors was additionally tested through a Monte Carlo simulation. The simulated ERRs range from 7.1 percent to 12.6 percent with a coefficient of variation of 11 percent. The expected ERR, estimated at 10.5 by the risk model, can be considered robust, with a negligible probability of falling below 5 percent.

71. **Justification for public financing:** OIIPCRA supports the pursuit of three broad outcomes: (i) increased productivity and diversification of agricultural production; (ii) enhanced resilience of agricultural production to climate change; and (iii) improved water productivity. First, increased agricultural and aquaculture production and diversification is expected to contribute to agricultural growth, improved food security and nutrition, poverty reduction and shared prosperity – all of which are public goods. In this case, public financing to increased productivity and diversification of agricultural production is well justified. Public financing for improved water productivity is justified based on the attendant improvements in sustainability of water resources, an important public good (and increasingly



so, in the face of a changing global climate) associated with protecting the environment. Finally, project support to enhanced climate resilience will yield both adaptation and mitigation co-benefits, which are global public goods and would thus merit public financing.

72. **World Bank's value added:** The Bank's value added under this Project is mainly in two areas: (a) mobilizing and crowding-in new knowledge and innovations; (b) promoting more results-oriented investments, and (c) optimizing the use of scarce public resources. Over the years, the Bank has amassed unmatched global experience in supporting innovations, projects and programs targeting increased agricultural productivity, improved agricultural water management and efforts to speed the adoption of CSA and diversification of agricultural production systems. This knowledge has already been brought to bear on the OIIPCRA design and should be further expanded during implementation support missions. The key challenge is to strengthen understanding of the ways that public funding can share risks in testing new technologies and encouraging their adoption, as opposed to operating as an income transfer to reduce the cost of agricultural inputs.

73. The Bank's commitment to the regular measurement of progress in relation to a well-defined results framework reinforces the results orientation of this investment. This is backed by the regular review of results achieved during each implementation support mission, and the evaluation of factors that may speed or undermine the achievement of the expected results. The Bank's support also assures a continuing commitment to build GoO systems for its development investments. These include basic fiduciary management under laid by the Bank's backstop training and advisory support for financial management and procurement, as well as the strengthening of monitoring and evaluation systems essential to support the GoO to manage for results.

B. Fiduciary

74. **Financial Management:** FM arrangements reflect lessons learnt from OCTMP and are adapted to the OIIPCRA specificities. Based on an assessment, proposed FM arrangements are acceptable, and provide reasonable assurance that loan proceeds will be used for intended purposes and properly accounted for. The following principles underpin the FM arrangements: (i) mainstreaming the project into the State's planning and budgeting processes; (ii) use of the State's Financial Management Information System (FMIS) for online allocation of project funds, application of internal checks and controls, accounting and financial reporting, to the extent feasible; (iii) agreement on a robust operational framework for funding of selected business plans; and (iv) putting in place supplemental measures to mitigate risks of disbursement lags that could arise from delays in accounting for expenses incurred at the field level. With the agreed supplemental measures in place, the residual FM risk is rated "Moderate".

75. The FM staff in various line departments will be responsible for managing the project funds. To cope with the additional workload, additional accounting staff on contract basis, will be engaged at the Directorate level and will support the existing departmental staff to ensure adequate FM performance. The SPU will also engage and maintain through the project life adequately qualified FM staff to manage the project's accounting and financial reporting functions.

76. WB funds will flow to the GoO through the GoI, under the standard back-to-back arrangements. Upon approval of the annual budget and enactment of the Appropriation Act, the budget will be placed with the PD and with the Chief Engineer, MI for non-civil works related expenditures and capital work-related expenditures, respectively. The Chief Engineer, MI will disburse funds to the executing agencies at the divisional level. The PD will disburse funds to the Directors of Agriculture and Food Production, Horticulture, and Fisheries who will further distribute the funds to their field formations responsible for



project implementation. Departmental field staff will draw funds from the Treasury using following existing procedures.

77. The project will use GoO/OCTDMS systems of accounting and all accounting centers - State, District and field level will be required to account for and record all receipts and payments made out project proceeds. The PD will be responsible for preparing quarterly interim financial reports (IFRs) to be submitted to the Bank within 45 days of the close of each quarter and will form the basis for disbursements from the loan. Through the State Principal Accountant General, the Comptroller and Auditor General (CAG) will conduct the external audits in accordance with terms of reference agreed WB-financed projects. Audit reports will be submitted within nine months of the end of each financial year. The SPU will engage a firm of chartered accountants to conduct the annual statutory audit for OCTDMS as per the agreed TORs. Disbursement will be based on quarterly IFRs submitted to the Controller of Aid Accounts and Audit (CAAA) and the WB.

78. **Procurement:** Project procurement will be carried out in accordance with Procurement Regulations for IPF Borrowers dated July 2016, revised November 2017 and August 2018 and the provisions of the Financing Agreement. The project will be subject to the World Bank's Anti-Corruption Guidelines, dated October 15, 2006, and revised in January 2011 and July 2016.

79. The SPU has experience implementing World Bank-funded projects and many resource persons with adequate knowledge of Bank procurement procedures. It is also in the process of strengthening its procurement capacity by hiring a Procurement Specialist with appropriate experience to be charged with managing OIIPCRA procurement. However, the procurement risk assessment identified knowledge gaps at DoFARD and DAFE and a need to orient their staff on Bank procurement. These gaps will be addressed through a comprehensive training program, which is part of the agreed capacity building and institutional strengthening plan for the SPU. The SPU has also established a comprehensive system for handling complaints.

80. The SPU, working together with the line departments (DoFARD, DAFE etc.) will spearhead procurement for the bulk of Component 1 activities - save for the small value procurements e.g. those related to extension service provision which will be procured at the district level by ATMA with assistance from DAFE. With the support of the SPU, the Executive Engineers, Minor Irrigation Department, will be responsible for procurement of civil works under Component 2, while procurement for all the other activities envisaged under this component will be executed by the SPU. The SPU will also be responsible for procurements under Component 3 and 4.

81. Results from a recent bidding process for 43 civil works packages planned under the project, point to low bidder participation (many packages either attracted a single bid or none at all). In view of the low bidder participation, limited capacity of new officials involved in the implementation of the project; and governance risks related to interference, fraud and corruption, the overall procurement risk rating for the project is considered 'substantial'.

C. Safeguards

82. **Environmental Safeguards:** The project is assigned environmental screening Category B, as there are no significant, irreversible, adverse environmental impacts envisaged to arise from project activities. Physical investments under the project would mainly include the rehabilitation of existing tanks and hydraulic assets, where, improper construction could result in some localized, temporary and small-scale impacts. The project will not support any new dam or irrigation system construction. The following



environment safeguards policies have been triggered: Environmental Assessment (OP/BP 4.01), Natural Habitats (OP/BP 4.04), Pest Management (OP/BP 4.09), Physical Cultural Resources (OP/BP 4.11) and Safety of Dams (OP/BP 4.37). The project will also adopt WBG Environmental, Health, and Safety (EHS) guidelines for labor and community worker's health and safety management. The project does not involve any international waterways and thus does not trigger OP 7.50.

83. An Environmental Management Framework (EMF), laying out the protocols for environmental management under the project has been prepared. The EMF also includes an Integrated Pest Management Plan, Dam Safety Management Plan (DSMP), Aquaculture Management Plan, and standalone Environmental Management Plans (EMPs) for civil works. Where required, the EMPs will be prepared based on the detailed project reports and integrated into contractual documents to ensure effective environmental management during construction. The EMF includes a negative list of activities that the project will not finance, and a screening mechanism will be adopted to avoid impacts on sensitive environmental receptors, natural habitats and physical cultural resources (PCR) which could be located close to any of the project interventions. In compliance with OP 4.11, if screening identifies a PCR within the vicinity of the project area, a site-specific PCR management plan will be prepared following guidance provided in the EMF.

84. As part of the DSMP, a Dam Safety Panel (DSP) for the project has been established by the State Dam Safety Organization (DSO). This comprises of experts in the field of hydrology, structural engineering and geology to review and assess (with full investigations) all dams above 10 m height in the project area in accordance with OP 4.37 within the first year of the project. The DSMP also includes: (i) the ToR for the DSP for the duration of the project; (ii) institutional and budgetary provisions for undertaking the investigations, reporting and implementation of the remedial measures; and (iii) monitoring and reporting formats according to the provisions of OP 4.37 of the needed remedial measures. All small dams (below 10 m height) will be assessed by a qualified engineer in the engineering design team. Assessments of the three large dams above 15m identified in the project area (Jaunriya, Kalimati and Bahiya) have been previously conducted by a DSP of the state DSO and reviewed by the Bank.

85. A full-time Environment Specialist is in place in the SPU to oversee implementation of the EMF and will be supported by nodal officers within the implementing departments at district level. The specialist will also coordinate safeguards activities with the line departments, along with providing the necessary environmental safeguards training to all concerned stakeholders of the project. At the district level, the environmental specialist will be supported by Executive Engineer, Monitoring, Minor Irrigation Department. At the State level, the Agronomist in the SPU will support implementation of the Integrated Pest Management Plan.

86. During preparation of the EMF, nine minor irrigation project tanks representing different agroclimatic zones and basins were selected as sample tanks and stakeholder consultations were held with community-based organizations such as PPs, FPOs, women's groups, fisherfolk and with key institutions, including MI department, Department of Agriculture, Department of Horticulture, Department of Forestry, DoFARD, DSO, Chilika Development Authority (CDA), among others. The draft EMF was disclosed on DoWR's website⁴³ on March 18, 2019, and subsequently by the World Bank on March 19, 2019.

87. **Social Safeguards:** OIIPCRA beneficiary communities are diverse in many ways - social (Scheduled Caste, others), economic (landless, small, marginal), ethnic (Scheduled Tribes, others), occupation (fishers,

⁴³ [http://www.dowrorissa.gov.in/EAP/OCTDMS/EMF%20OIIPCRA%20\(Main%20Document\).pdf](http://www.dowrorissa.gov.in/EAP/OCTDMS/EMF%20OIIPCRA%20(Main%20Document).pdf)



crop producers), tank water usage (domestic, aquaculture and irrigation purposes), and proximity to the head works (head, middle and tail ends). This diversity renders community mobilization for collective action and linkage to support institutions, a daunting task. Based on a social assessment, the following principles are proposed to underpin project implementation: (i) participation; (ii) inclusion and equity; and (iii) decentralization. A Social Management Framework (SMF) initially used for OCTMP has been revised – taking into consideration new legislative developments and the expanded scope of OIIPCR - to guide implementation. The SMF has been discussed with stakeholders and disclosed. The project focuses on already existing irrigation systems in which case, no involuntary land acquisition is anticipated. Odisha has a significant presence of Scheduled Tribes and to ensure their targeting and inclusion, a Tribal Peoples Planning Framework (TPPF) has been prepared in accordance with OP 4.10 (Indigenous Peoples). The TPPF provides guidance on conducting assessments, preparing, and implementing action plans in tribal areas.

88. Participation by the diverse groups will be enabled by an amendment to the existing legislation related to PPs to include, *inter alia.*, fishers and cascade communities. Representation of the vulnerable such as SCs and STs, as well as women and tail-end water users in the PPs will also be provided for and mandated in their functioning. While most decisions, including participating in the project will be made by the beneficiary communities, most of the apex support will come from the DPMT. Specialized agencies will be deployed to provide various support to the communities including establishing networks and linkages with the private sector, extension agencies and input and output markets.

D. Gender

89. **Addressing Gender Gaps:** In rural India, extension services typically engage with male farmers ignoring women as it is assumed that women do not manage the farm. Since women are not given due recognition as farmers, it limits their ability to access productive input. Persistent inequalities in land rights and tenure further reinforce this exclusion because women own less land than men. Women-owned operational land holdings comprise only 3.29 percent of total holdings in the project area. Assessments undertaken as part of the project SMF preparation indicate that women farmers in Odisha have limited awareness of improved agricultural technologies and hence lower adoption of CSA due to a lack of access to agricultural extension services, information and other relevant assets. In India, rural women face strong social and cultural barriers as well as direct resistance from male folks from the community and family towards social and economic liberalization, decision making and use of farming equipment. Consequently, women farmers, lack access to agricultural trainings, and their participation in PPs is constrained limiting their access to the most recent information about improved agricultural technologies. As a result, women farmers' productivity is generally lower, and they produce lower share of marketed agricultural commodities. The project will initiate extension services targeted specifically to and staffed by trained women AEs to engage and interface with women farmers during trainings and other activities. Trainings will be village based, given at times suited to the women farmers and will focus on practical skills and technologies selected and prioritized by the women in consultation with the AEs. In addition, to increase women's access to information and increase their decision-making power, the project will promote women as executive committee members of PPs in line with the provisions outlined in the Odisha Pani Panchayat Act 2002. To encourage crop diversification, and adoption of high yielding crops, the project will offer targeted support to women farmers to experiment with new crops and provide training/demonstration of relevant production technologies, and marketing arrangements.

90. The outcomes of actions that focus on closing key gender gaps in the sector will be monitored through several intermediate indicators, including: Farmers adopting improved agricultural technology - Female (CRI, Number); Increase in productivity of selected agricultural commodities supported by the



project produced by female beneficiaries (percent); Share of female beneficiary farmers' produce that is marketed (percent); and Proportion of project supported PPs with women representation (percent).

91. **Citizen engagement:** Odisha government and the project entities are committed to ensure engagement of citizens in the management of the project as it paves the way for: (i) legitimacy in decision making; (ii) designing and implementation of appropriate and responsive interventions; (iii) effective institutional and implementation arrangements; (iv) enhancing inclusion and reducing conflicts; (v) local-level capacity building leading to responsible and responsive citizenry; (vi) better-quality outcomes; and (vii) accountability. Against this backdrop, the project design has inbuilt mechanisms for ensuring citizen engagement, including: (i) Social Assessment centered consultations with all the relevant stakeholders during both designing and implementation stages; (ii) moving beyond consultations into consent in the tribal areas; (iii) sharing of all the plans and engaging in extensive discussions and deliberations with all the stakeholders, especially the poor and vulnerable communities; (iv) toll free helplines and multilayers of grievance redressal arrangements; and (v) full adoption of the country's Right to Information Act. The results framework provides for indicators on citizen engagement.

92. **Grievance Redress Mechanisms:** Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit <http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service>. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

V. KEY RISKS

93. The overall risk rating for the project is Substantial mainly because of the risk related to inclusion, especially of the vulnerable groups. The risk to the PDO arising from the political and governance situation in the country is rated low, and so is the macroeconomic risk. The risk with respect to sector strategies and policies is rated Moderate as the project is in sync with the GoO strategic thrust for the sector, including KALIA the recent preferred vehicle for accelerating agriculture growth in the state.

94. The risk arising out of the project's technical design is also rated Moderate, and this is an artefact of: (i) the project's integrated approach to intensification, diversification and climate resilience - demanding effective coordination of interventions across disparate GoO departments, which, based on experience, is a major challenge in India; and (ii) the challenges related to implementation of the "new and unfamiliar" approaches to service delivery as espoused in the design. Coordination challenges will be mitigated by strengthening the office of the APC to ensure effective coordination and integration across project activities.

95. The risk related to institutional capacity for implementation and sustainability is rated Moderate. This is because of the capacity of the several GoO agencies to implement some of the project activities and past experience of similar projects in the state, e.g. productive alliances for marketing in the case of DAFE, market intelligence in the case of OSAMB, and cascade-based planning for water resource



management in DoWR's case. In addition, sustainability prospects, especially of the irrigation infrastructure to be rehabilitated hinge on sufficient capacity and funding for future O&M. Capacity weaknesses in the key implementing agencies will be remedied through the proposed TA and capacity strengthening activities. The O&M risk will be mitigated by adopting a competitive fund allocation approach that will reward those cascades that meet agreed performance indicators, strengthening capacities of PPs and establishing a PP Support Unit within DoWR to provide more systematic and comprehensive support to PPs, in particular on O&M. In addition, O&M financing will continue to be assured through government support and farmers' contributions.

96. Fiduciary risk is rated Moderate because the FM arrangements for part of the project are mainstreamed into the State's existing systems, using the IFMS (computerized online integrated financial management system) for budgeting, fund flows, accounting and financial reporting. The SPU has acceptable and tested financial management arrangements and will be responsible for the residual expenses under the project. In addition, the SPU staff have prior experience with World Bank procurement.

97. The environmental and social risk is rated Substantial because of the diversity among beneficiaries (including the poor and vulnerable sections of the population) which renders reaching out to all sections and ensuring inclusion and equity a challenge. The TPPF will be used to ensure targeting and inclusion of the vulnerable, while support organizations to be hired at the district levels will help the project to reach out to all deserving sections of the beneficiary population.

98. Stakeholders risk is rated Moderate because the project will inevitably bypass sections of otherwise equally deserving beneficiaries as dictated by the tension between the landscape approach towards building resilience, available resources, and the GoO's desire to implement the project in 15 districts. In addition, contractualizing production and marketing of agricultural produce is bound to create a community of losers e.g. middle-men, with unpredictable consequences. The project will mitigate these risks by adapting transparent beneficiary selection criteria to be communicated *a priori* to communities and by relying on the political leadership to manage any discord contrived by middle-men.



VI. RESULTS FRAMEWORK AND MONITORING

Results Framework

COUNTRY: India

Odisha Integrated Irrigation Project for Climate Resilient Agriculture

Project Development Objectives(s)

The Project Development Objective is to intensify and diversify agricultural production, and enhance climate resilience in selected districts of Odisha.

Project Development Objective Indicators

Indicator Name	DLI	Baseline	End Target
To intensify and diversify agricultural production in selected districts of Odisha			
Increase in productivity of selected agricultural commodities supported by the project (Metric ton)		0.00	0.00
Paddy (Metric ton)		2.64	2.90
Green gram (Metric ton)		0.00	0.00
Brinjal (Metric ton)		0.00	0.00
Marigold (Metric ton)		0.00	0.00
Groundnuts (Metric ton)		0.00	0.00
Increase in productivity of selected agricultural commodities supported by the project produced by female beneficiaries (Percentage)		0.00	20.00
Increase in productivity of water use at tank level (Percentage)		0.00	20.00
Share of non-rice commodities in total production in project areas (Percentage)		33.00	38.00



Indicator Name	DLI	Baseline	End Target
Share of non-rice products in total production in project areas produced by female beneficiaries (Percentage)		33.00	38.00
Share of target beneficiaries with rating “Satisfied” or above on process and impact of project interventions (Percentage)		0.00	50.00
Share of target female beneficiaries with rating “Satisfied” or above on process and impact of project interventions (Percentage)		0.00	50.00
To enhance climate resilience in selected districts of Odisha			
Farmers adopting improved agricultural technology (CRI, Number)		0.00	28,800.00
Farmers adopting improved agricultural technology - Female (CRI, Number)		0.00	12,000.00
Farmers adopting improved agricultural technology - male (CRI, Number)		0.00	16,800.00

Intermediate Results Indicators by Components

Indicator Name	DLI	Baseline	End Target
C1. Climate-Smart Intensification and Diversification of Production			
Share of beneficiary farmers’ produce that is marketed (Percentage)		10.00	30.00
Share of female beneficiary farmers’ produce that is marketed (Percentage)		10.00	30.00
Increase in share of project beneficiary farmers with access to resilient seeds (Percentage)		15.00	30.00



Indicator Name	DLI	Baseline	End Target
Increase in share of female beneficiary farmers with access to resilient seeds (Percentage)		15.00	30.00
Community fingerling production units operating in tanks supported by the project (Number)		0.00	30.00
C2. Improving Access to Irrigation and Water Productivity			
Area provided with new/improved irrigation or drainage services (CRI, Hectare(Ha))		0.00	72,805.00
Area provided with new irrigation or drainage services (CRI, Hectare(Ha))		0.00	24,833.00
Area provided with improved irrigation or drainage services (CRI, Hectare(Ha))		0.00	47,972.00
Project-supported cascades with operational PP federations (Number (Thousand))		0.00	50.00
Share of project-supported schemes meeting at least 50% of scheme performance targets (Percentage)		0.00	50.00
Increase in area under crops that are less water demanding. (Percentage)		0.00	30.00
Proportion of project supported PPs with women representation (Percentage)		0.00	35.00
C3. Institutional Capacity Strengthening			
Government staff trained through project support (Number)		0.00	200.00
Percentage of government staff trained through project support – Female (Percentage)		0.00	50.00



Monitoring & Evaluation Plan: PDO Indicators

Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
Increase in productivity of selected agricultural commodities supported by the project	The indicator measures percentage changes in crop or fish yields. It measures yield increase from target beneficiaries who are adopting practices promoted by the project. Beyond Paddy, Green Gram, Brinjal, Groundnuts and Marigold, the project will also capture productivity changes for Black Gram, Sunflower, Tomato, Cabbage, Cauliflower, Bitter Gourd or any other crops that receive project financing.	Annual	Household Survey	Productivity (output/hectare) will be measured at baseline and after each cropping season for selected crops and aquaculture species using a household survey, and these data will be used to estimate a weighted average percent increase based on hectare/crop.	External M&E Agency
Paddy					
Green gram					
Brinjal					
Marigold					
Groundnuts					
Increase in productivity of selected agricultural commodities supported by the project produced by female		Annual	Household Survey	Productivity (output/hectare) will be measured at baseline	External M&E Agency



beneficiaries				and after each cropping season for selected crops and aquaculture species using a household survey, and these data will be used to estimate a weighted average percent increase based on hectare/crop for female beneficiaries to assess the closure of gender yield gaps.	
Increase in productivity of water use at tank level	This indicator measures crop yield per unit input of water	Annual	Household Survey/Field data collection	Data on gross production (kg) will be collected through a household survey and aggregated at the tank level. Data on surface and ground water applied (m3) will be collected at the tank level using monitoring data collected as part of Component 2. Gross production will be divided by gross water applied at the tank level and then compared with the baseline scenario to assess changes in water	External M&E Agency (production data) and SPU M&E (water applied)



				productivity.	
Share of non-rice commodities in total production in project areas	This indicator measures the proportion of total cultivated area that is devoted to other crops than rice. It is a measure of diversification away from rice.	Annual	Household Survey	A household survey will be used to collect gender-disaggregated data on the area devoted to rice and non-rice crops annually. The annual totals will be calculated by aggregating area per cropping season where multiple crops are cultivated on a single field/parcel over a single year.	External M&E Agency
Share of non-rice products in total production in project areas produced by female beneficiaries		Annual	Household Survey	A household survey will be used to collect gender-disaggregated data on the area devoted to rice and non-rice crops annually to assess the closure of a gap in women’s cultivation of non-rice crops. The annual totals will be calculated by aggregating area per cropping season where multiple crops are cultivated on a single field/parcel over a	External M&E Agency



				single year.	
Share of target beneficiaries with rating “Satisfied” or above on process and impact of project interventions	The indicator measures the share of beneficiaries who are satisfied with the relevance, timeliness, and effectiveness of the services received from the project.	Semi-annual	Household Survey	A household survey will be used to collect beneficiary perceptions on the process of project implementation and its impacts on e.g., their productivity, livelihoods, and resilience.	External M&E Agency
Share of target female beneficiaries with rating “Satisfied” or above on process and impact of project interventions		Semi-annual	Household Survey	A household survey will be used to collect female beneficiary perceptions on the process of project implementation and its impacts on e.g., their productivity, livelihoods, and resilience to assess closure of gender gaps in access to agricultural and irrigation services.	External M&E Agency
Farmers adopting improved agricultural technology	This indicator measures the number of farmers (of agricultural products) who have adopted an improved agricultural technology promoted by operations supported by the World	Annual	Household Survey	A household survey will be used to collect gender-disaggregated data on farmer adoption of climate-resilient agricultural technologies and	External M&E Agency



	<p>Bank.</p> <p>NB: "Agriculture" or "Agricultural" includes: crops, livestock, capture fisheries, aquaculture, agroforestry, timber and non-timber forest products.</p> <p>Adoption refers to a change of practice or change in use of a technology that was introduced or promoted by the project.</p> <p>Technology includes a change in practices compared to currently used practices or technologies (seed preparation, planting time, feeding schedule, feeding ingredients, postharvest storage/processing, etc.). If the project introduces or promotes a technology package in which the benefit depends on the application of the entire package (e.g., a combination of inputs such as a new variety and advice on agronomic practices such as soil preparation, changes in seeding time, fertilizer</p>			practices.	
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	<p>schedule, plant protection, etc.), this counts as one technology.</p> <p>Farmers are people engaged in farming of agricultural products or members of an agriculture related business (disaggregated by men and women) targeted by the project.</p>				
Farmers adopting improved agricultural technology - Female		Annual	Household Survey	A household survey will be used to collect gender-disaggregated data on farmer adoption of climate-resilient agricultural technologies and practices.	External M&E Survey
Farmers adopting improved agricultural technology - male		Annual	Household Survey	A household survey will be used to collect gender-disaggregated data on farmer adoption of climate-resilient agricultural technologies and practices.	External M&E Agency



Monitoring & Evaluation Plan: Intermediate Results Indicators

Indicator Name	Definition/Description	Frequency	Datasource	Methodology for Data Collection	Responsibility for Data Collection
Share of beneficiary farmers’ produce that is marketed	This refers to the proportion of total farm output which beneficiary farmers are able to market controlled for increased production.	Annual	Household Survey	A household survey will be used to collect baseline and annual gender-disaggregated data on the share of beneficiary farmers’ output that is marketed. Respondents will be asked to self-report the percentage of their overall production of each major crop that is marketed as opposed to consumed at home. A weighted average will be estimated by weighting crops based on the share of land devoted to each crop in a given calendar year, with multiple cropping areas counted once per season.	External M&E Agency
Share of female beneficiary farmers’ produce that is marketed		Annual	Household Survey	A household survey will be used to collect baseline and annual gender-disaggregated	External M&E Agency



				<p>data on the share of female beneficiary farmers' output that is marketed. Respondents will be asked to self-report the percentage of their overall production that is marketed as opposed to consumed at home. A weighted average will be estimated by weighting crops based on the share of land devoted to each crop in a given calendar year, with multiple cropping areas counted once per season. This indicator will be used to track the closure of a gender gap in access to agricultural markets.</p>	
<p>Increase in share of project beneficiary farmers with access to resilient seeds</p>	<p>This refers to the number of project beneficiaries who report increased access to resilient varieties directly promoted by the project.</p>	<p>Annual</p>	<p>Household Survey</p>	<p>A household survey will be used to collect baseline and annual gender-disaggregated data on the share of farmers supported by the project that have access to resilient seeds. Access is defined</p>	<p>External M&E Agency</p>



				here as the availability of climate-resilient seeds in their village through public or private suppliers.	
Increase in share of female beneficiary farmers with access to resilient seeds		Annual	Household Survey	A household survey will be used to collect baseline and annual gender-disaggregated data on the share of female farmers supported by the project that have access to resilient seeds to measure the closure of a gender gap in access to improved production materials. Access is defined here as the availability of climate-resilient seeds in their village through public or private suppliers.	External M&E Agency
Community fingerling production units operating in tanks supported by the project	This refers to the number of new fingerling production units established with project support.	Semi-annual	Progress Report	A fisheries cooperative survey will be completed as part of on-going project implementation monitoring and will identify the number of	External M&E Agency



				cooperatives with operating fingerling production units.	
Area provided with new/improved irrigation or drainage services	This indicator measures the total area of land provided with irrigation and drainage services under the project, including in (i) the area provided with new irrigation and drainage services, and (ii) the area provided with improved irrigation and drainage services, expressed in hectare (ha).	Annual	Project Monitoring	Periodic project monitoring of completed irrigation works.	SPU M&E
Area provided with new irrigation or drainage services	Measures in hectares the total area of land provided with new or improved irrigation or drainage services in operations supported by the World Bank.				
Area provided with improved irrigation or drainage services	Measures in hectares the total area of land provided with new or improved irrigation or drainage services in operations supported by the World Bank.				
Project-supported cascades with operational PP federations	This indicator measures the number of cascades with PPs that perform a minimum number of	Semi-annual	Reporting/Monitoring	Project reporting on the number of cascades supported to establish a Pani Panchayat	SPU M&E/External M&E



	activities e.g. water management, pay membership dues etc as is defined in the PIM.			federation will be complemented by a survey of these federations to assess whether they are meeting agreed planning/implementation targets.	
Share of project-supported schemes meeting at least 50% of scheme performance targets		Semi-annual	Survey	A survey of irrigation scheme managers (e.g., <i>Pani Panchayats</i>) will be used to monitor compliance with scheme performance targets (e.g. water allocation, meeting efficiency and cost recovery targets).	External M&E
Increase in area under crops that are less water demanding.	This indicator measures the area planted with crops that are scientifically known to consume less water than the conventional rice. This could include areas planted to less water demanding rice varieties. It measures annual increases including both Kharif and Rabi seasons	Annual	Household Survey	A household survey will be used to collect baseline and annual monitoring data on the share of total cropped area devoted to traditional and less water-intensive crops annually. The annual totals will be calculated by aggregating area per cropping season where multiple crops are	External M&E Agency



				cultivated on a single field/parcel over a single year.	
Proportion of project supported PPs with women representation	This indicator measures the number of PPs with women in the executive committee havng voice and decision making power	Annual	Surveys and field monitoring		PMU and DoWR
Government staff trained through project support	This refers to number of GoO staff whose capacity is strengthened through project support. This will measure all types of training supported by the project.	Semi-annual	Project monitoring reports	Project monitoring reports disaggregated by gender.	SPU M&E
Percentage of government staff trained through project support – Female		Semi-annual	Project monitoring reports	Project monitoring reports disaggregated by gender to measure closure of a gender gap in access to training.	SPU M&E



ANNEX 1: Implementation Arrangements and Support Plan

COUNTRY: India

Odisha Integrated Irrigation Project for Climate Resilient Agriculture

A. Project Implementation Arrangements

1. The project's institutional and implementation arrangements are informed by two main imperatives: (i) the need for timely and effective delivery of sustainable project outcomes; and (ii) the GoO desire to use OIIPCRA as a vehicle to strengthen the long-term capability of relevant institutions to deliver better services. OIIPCRA will therefore rely on existing government institutions and capacities for implementation, but also crowd-in external expertise, mainly in the form of time-bound TA to not only bridge capacity gaps during implementation, but also strengthen the capabilities of relevant GoO institutions. Project implementation will proceed through a three-tier institutional arrangement, i.e. state, district, and community level, which to a great extent mirrors Odisha's governance structure.

2. At the state level (first tier), DoWR will be the lead implementing agency, working through a SPU to be established under OCTDMS, a special purpose vehicle established under the Society Registration Act 1860. Implementation through OCTDMS confers project management with reasonable flexibility and autonomy that is necessary to facilitate quick implementation, while also ensuring that implementation is mainstreamed through government systems. Still at the state level, "Project Cells", one each, will be established in the Directorate of Agriculture and Food Production, Directorate of Horticulture and the Directorate of Fisheries to take lead in implementation of project elements in their respective mandates. In addition to providing overall project management and leadership, the SPU in OCTDMS will be take the lead in implementing project activities planned in irrigation water management. At the district (second tier) level, district administrations will be the executing agencies, while at the community (third-tier) level, beneficiaries will implement their activities through their groups, e.g. PPs, farmer interest groups (FIGs) or primary fishermen cooperative societies (PFCS). Figure A1.1 summarizes these institutional arrangements, and the PIM details the roles and responsibilities of each of these state, district and community institutions.

3. **State level:** A Project Steering Committee (PSC) chaired by the Chief Secretary, will provide overall project oversight and policy guidance, approve the project's annual work plans and budgets, and help in inter-departmental coordination by APC. PSC members will include APC, Principal Secretaries from the relevant state departments (DoWR, DAFE, DoFARD, DoPR&DW, Finance, Animal Resources) and the APC. The PSC will meet at least twice a year. An advisory panel, comprising of eminent experts, and coordinated by the APC, will provide strategic advice to the PSC. The office of the APC will be strengthened to provide strategic support to implementation as well as ensure coordination and convergence across the line departments.

4. The SPU, within OCTDMS will be responsible for managing day-to-day project implementation. The SPU, headed by a PD, will also comprise technical component coordinators (i.e. irrigation and water management, fisheries, marketing, agriculture), FM specialist, Procurement Specialist, Human Resource and Administration Officer, and Environmental and Social Safeguards Specialist. Most of the SPU staff will be seconded to the project on a full-time basis by their respective departments and any recruitments from the labor market will only be done where internal capacity is inadequate. The PD will serve as the secretary to the PSC. There will be Project Cells in Directorate of Agriculture and Food Production, Directorate of Horticulture and the Directorate of Fisheries to interface with the SPU, and district officials

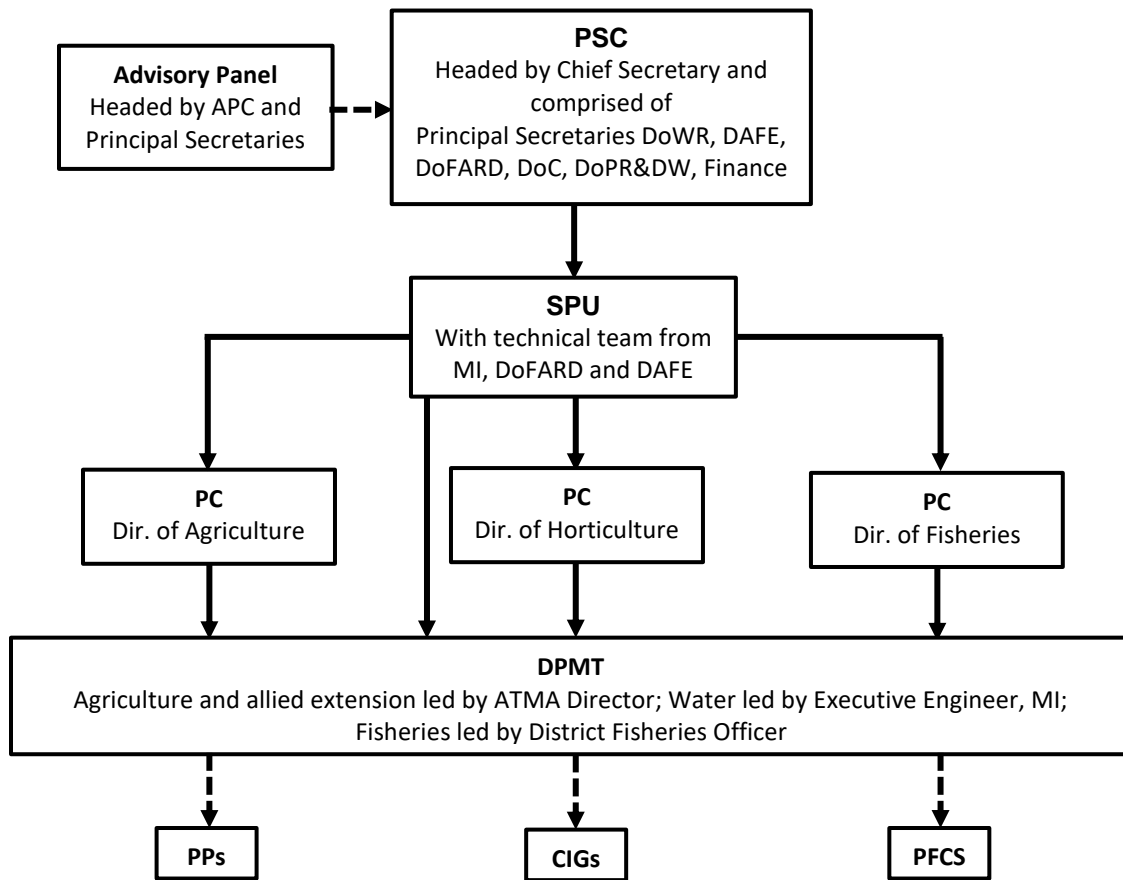


to offer guidance in implementation of project elements in their respective components.

5. **District level:** At the district level, a District Level Project Management Team (DPMT) comprising of the DC, Executive Engineer – MI, ATMA Director, Director Department of Horticulture, District Fisheries Officer, and the Executive Engineer – DoPR&DW will be constituted to execute the project. The DPMT will be chaired by the DC and will be responsible for the day-to-day operations of the project in the district and ensuring that OIIPCRA activities are included in the District Integrated Irrigation and Agriculture Plans. The DPMT will be supported by a Monitoring Cell, established by the purpose of regular tracking of project activities and preparation of status reports.

6. **Community level:** At the community level, FIGs (e.g. PPs, PFCS, FPOs etc.) with facilitation and support from private service providers as well as line departments will be responsible for implementation and management of their project – financed activities.

Figure A1.1: OIIPCRA Institutional Arrangements



B. Fiduciary

Financial Management

7. The FM arrangements have been designed to take into account the lessons learnt from the closed OCTMP and adapted to the specific requirements and institutional arrangements of the new project. The assessment conducted during preparation concludes that FM arrangements are acceptable and as part of the overall arrangements for implementing the operation, provide reasonable assurance that the



proceeds of the loan are used for the intended purposes.

8. The guiding principles in the design of the financial management arrangement for the project has been to (a) mainstream the project into the State's planning and budgeting processes; (b) use the State's Financial Management Information System (FMIS) for online allocation of project funds, application of internal checks and controls, accounting and financial reporting, to the extent feasible; (c) agreement on a robust operational framework for funding of selected business plans; and (d) put in place supplemental measures to mitigate the perceived risks of disbursement lags arising from delays in accounting of the project expend from the field level; and weak financial management capacity to monitor on a regular basis, the financial management performance under the project. With the agreed supplemental measures in place, the residual financial management risks are considered as 'Moderate'.

9. The supplemental measures agreed include: (a) put in place and retain through the life of the project, suitably qualified financial management staff at the SPU and the Project Cells in the Directorates of Agriculture and Food Production, Horticulture and Fisheries; (b) put in place acceptable internal audit arrangements at the SPU; and (c) define standard protocol for financial management performance and document the same in the FM manual agreed with the World Bank for the project. The Project Implementation Manual will provide detailed guidance to field staff on processes of selection of beneficiaries, eligibility criteria, form and content of the business plan, including the funding sources for the productive investments and its operation and maintenance, cost sharing norms, procurement and fund flow and the appraisal/approval work flows. The Bank's approval of the Operation Manual will be a pre-condition for disbursements under category 2.

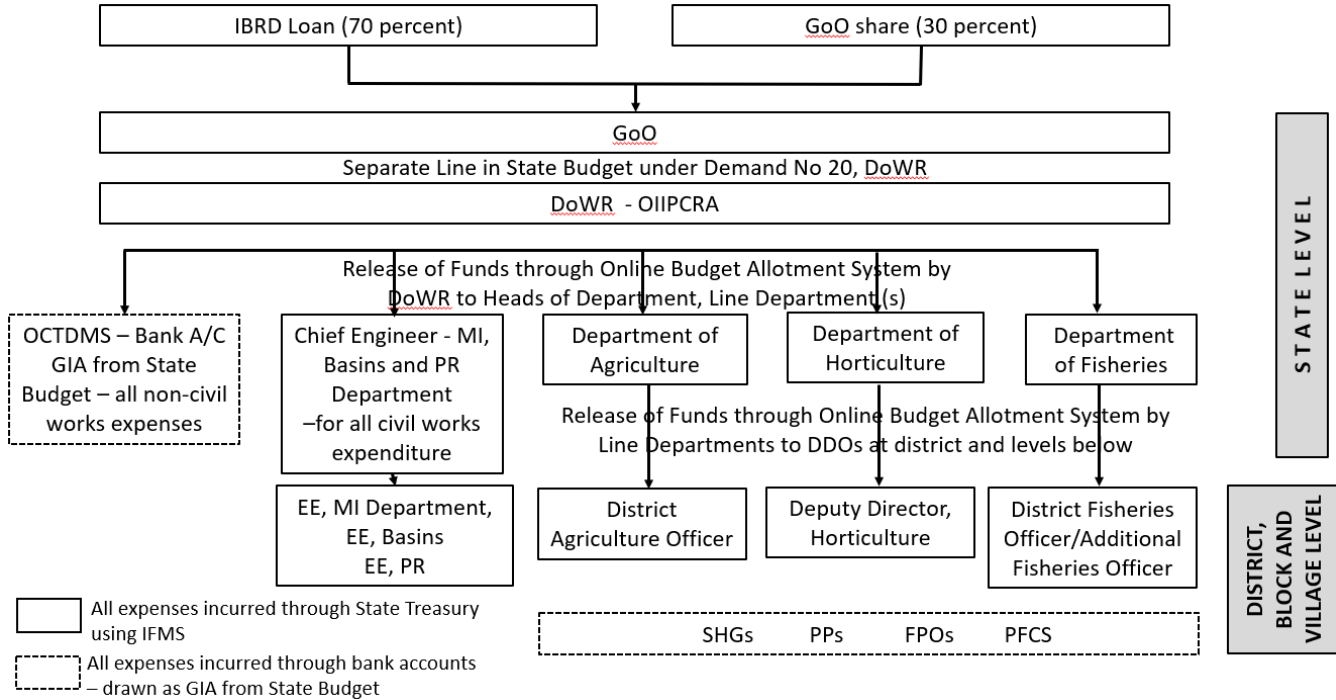
10. The agreed FM arrangements are detailed below:

- *Budgeting and Counterpart Funding:* The PD will submit the project budget estimates to DoWR after collecting the expenditure projections from other departmental authorities namely: Director of Agriculture, Director of Horticulture, Director of Fisheries etc. The project budget will be allocated as part of the DoWR budget. Project funds will be routed through the state budget; a separate budget code, 2702-01-3229- OIICPA EAP has been issued for the purpose. Separate allocations as per ST and SC Development Department guidelines will be provided in the State budget. The PD will be Budget Controlling Officer in respect of the provisions relating to project as well as the Drawing and Disbursement Officer (DDO) for all expenditures at SPU level.
- *Flow of Funds:* WB funds will be made available to the GoO through the GoI, under the standard back-to-back arrangements between the GoI and the State. After approval of the annual budget and the enactment of the Appropriation Act, the budget will be placed with the PD, and with the Chief Engineer, MI respectively for scheme related expenditures and capital work-related expenditures. The capital work related provisions will be distributed using the Works Expenditure module of IFMS. Chief Engineer, MI will further distribute the money to the executing agencies using the IFMS. The PD will further distribute the funds to the Director (s) of Agriculture, Horticulture, and Fisheries. All the above Controlling Officers will distribute the funds to their field formations responsible for implementation of the project using IFMS. The field staff of the respective departments will draw the funds from the Treasury as and when required submitting the bills and sub-vouchers, sanction orders etc. using the State extant processes. The payments relating to scheme will be credited directly to the beneficiary's account in all circumstances. Figure A1.2 shows fund flow at the state level.
- *Accounting and Maintenance of Accounting Records:* The project will use the government system of accounting. Three levels of accounting centers—State, District and field level of the respective



line departments will be required to account for and record all receipts and payments made to suppliers, contractors, support organizations, and staff, and other expenditures on, e.g., capacity building and project management. The MI will use the Works and Accounting Management Information System (WAMIS) and IFMS for preparation of bills, payment to the Contractors/Vendors, accounting of vouchers etc. as per the extant processes. The SPU will use the existing computerized systems (TALLY) to maintain the books of accounts for all OIICPRA related expenses.

Figure A1.2: Flow of Funds



- **Internal Controls, including internal audit:** Odisha General Financial Rules (OGFR) will provide the internal control framework, including internal audit processes for all expenses incurred under OIICPRA by the line departments using IFMS for accounting. For the SPU, the existing financial and administrative manual will guide the FM processes, including the delegation of financial powers. The manual provides for engagement of Chartered Account firm to conduct internal audits at quarterly/six monthly intervals and review of the same by an Audit Committee established by the governing body of OCTDMS.
- **Financial Reporting:** The PD will be responsible for preparing quarterly financial reports using agreed templates, for the project, consolidating IFMS and SPU reports. The quarterly interim financial reports (IFRs) will be submitted to the World Bank within 45 days of the close of each quarter and will form the basis for disbursements from the IBRD Loan.
- **Staffing and capacity building:** The FM staff at the various line departments, including Divisional Accountants at the Offices of Executive Engineer/s MI department will be responsible for managing the project funds. To cope with the additional workload, additional accounting staff on contract basis, will be engaged at the Directorate level and will support the existing departmental staff to ensure adequate oversight over the financial management performance under the project. The SPU will also engage and maintain through the project life adequately qualified financial management



staff to manage the accounting and financial reporting functions for the SPU and the project.

- *External audit:* Through the State Principal Accountant General, the CAG will conduct the external audit of the project related expenditure incurred at the departmental level. Statements of expenditure at all project levels will be submitted to the CAG by June 30 each year to allow adequate time for the audit, which will be conducted in accordance with ToRs agreed by the CAG for audit of WB-financed projects. Audit reports will be submitted within nine months of the end of each financial year. The SPU will engage a firm of chartered accountants to conduct the annual statutory audit as per the agreed TORs. OIICPRA will submit two sets of annual audit reports (departments and SPU) to the WB within nine months of the close of each financial year.
- *Disbursement arrangements:* The WB will finance 70 percent of project expenditures up to US\$164.5 million. Disbursement will be based on quarterly IUFRRs submitted to the office of CAAA and the WB.

Procurement

11. Procurable activities are estimated to constitute about 90 percent of the project cost. Out of the procurable budget, 60 percent is for procurement of civil works for rehabilitation of hydraulic infrastructure. The remaining procurable budget is meant to procure, consultancy services as well as goods (e.g. equipment, input, etc.) in support of technology transfer, capacity building and produce marketing.

12. Most of the procuring entities to be involved under the proposed project have experience with WB procedures - gained from OCTMP. Procurement will be carried out by SPU at state level and District Project Directors at district level with technical inputs from line departments for procurement of civil works, agriculture implements and fisheries equipment. The procurement of small value equipment and requirements needed at sub district (Block) and community level will be carried out by ATMA at district level with technical assistance from agriculture department.

13. Procurement under the project will be carried out in accordance with WB Procurement Regulations dated July 2016 Revised November 2017 and August 2018. Procurement under national procedures will be carried out based on agreed conditions with GoI, subject to additional requirements that will be specified in the loan agreement. Both procurement under international and national competitive procedures will be submitted through government e-tendering systems provided by National Informatics Center which has been assessed and deemed acceptable by the Bank. Bank Systematic Tracking of Exchanges in Procurement (STEP) will be used for monitoring of procurement activities and communication between the Borrower and the Bank. Implementing agency staff have already been trained on Procurement Regulations and STEP.

14. The SPU has prepared a draft Project Procurement Strategy for Development (PPSD) from which the procurement plan will be developed to decide fit for purpose procurement arrangements and approaches for procurement of goods, works, non-consulting, and consulting services financed by the WB. The procurement plan will be updated at least annually or as required to reflect the actual project implementation needs and improvements in institutional capacity. Based on implementation experiences from previous project and the draft PPSD, markets for goods, works and services required under the project are available within the country. Competition for works contracts averaged three bidders per package for large value contracts and more than three for small value packages. The final PPSD and procurement plan is expected to be agreed to prior to negotiations and will be updated annually during implementation.



15. The project has carried out advance procurement actions ahead of approval by the Bank which could be considered for retroactive financing. Consultants have for example been hired to prepare the PIM, EMF, SMF and PPSD, among others. Forty-three works packages with an estimated cost of INR 290 crores (approximately US\$41 million) have been advertised and should be ready for award prior to negotiations.

16. Action has been taken to mitigate procurement risks under the project and residual procurement risk is rated Moderate. Residual risks relate to: (i) low bidder participation for goods, works and services required in remote areas; (ii) limited capacity of new officials involved in the implementation of the project; and (iii) Governance risks relating to interference, fraud and corruption. Risk mitigation measure and time frame for their implementation is summarized in table below:

Table A1.1. Assessed Procurement Risks and Mitigation Measures

Risk Factor	Initial Risk	Mitigation Measure	Completion Date	Residual Risk
Limited capacity and inefficiencies resulting in delays in procurement and contract management processes	Substantial	<ul style="list-style-type: none"> Hiring of skilled procurement staff with WB procurement knowledge Monitoring through Procurement Plan and quarterly reports Use of e-Procurement and contract management tools Participation in trainings and workshops 	During the first two years of implementation	Moderate
Non-compliance with agreed procurement arrangements	Moderate	<ul style="list-style-type: none"> Training and hand-holding provided by the WB Prior and post reviews by the WB Internal and external audits 	Continuous from year 1	Moderate
Governance risks relating to corruption, interference, etc.	Moderate	<ul style="list-style-type: none"> Disclosure of procurement-related information Appropriate handling of complaints 	Continuous from year 1	Moderate
Overall Risk	Moderate			Moderate

17. **Record keeping:** All records pertaining to award of tenders, including bid notification, register pertaining to sale and receipt of bids, bid opening minutes, bid evaluation reports and all correspondence pertaining to bid evaluation, communication sent to/with the WB in the process, bid securities, and approval of invitation/evaluation of bids will be retained by the implementing agencies for two years after project closure.

18. **Procurement information disclosure requirements:** The project shall comply with the disclosure requirements stipulated in the WB’s Procurement Regulations. Accordingly, the following documents shall be disclosed on the project’s website: (i) Procurement Plan and all subsequent updates; (ii) invitations for bids for works/goods; (iii) requests for expression of interest (REOIs) for selection/hiring of consulting services; (iv) short list of consultant; (v) details of contract awards; (vi) lists of contracts following Direct Contracting, selection based on the Consultants’ Qualifications (CQS), or Single-Source Selection on a quarterly basis; and, (vii) action-taken reports on the complaints received on a quarterly basis.

19. **Oversight and monitoring by the WB:** All contracts not covered under prior review by the WB will



be subject to post review during implementation support missions and/or special post review missions, including missions by consultants hired by the WB. Bank prior review will be carried out based on Annex II of Procurement Regulations and for values of procurement as shown below:

Table A1.2: Prior review thresholds for different types of procurement

Type of Procurement	Prior Review Threshold (US\$, millions)
Works	15
Goods and non-consulting services	4
Consultant firms	2

20. **Complaint handling mechanisms:** The SPU has already established a complaint handling mechanism to address complaints/grievances from contractors/suppliers more effectively. On receipt of complaints, immediate action will be initiated to acknowledge the complaint and redress within a reasonable timeframe. All complaints during bidding/award stage as well as complaints during the contract execution along with the analysis and response of SPU shall invariably be submitted to the WB for review.

C. Project Implementation Support Plan

Strategy and Approach for Implementation Support

21. The project Implementation Support Plan is informed by: (i) lessons accruing from past Bank projects in India more generally, and Odisha in particular; and (ii) the risk profile as presented in the Systematic Operations Risk-Rating Tool (SORT).

22. A number of ex-ante risk mitigation and control measures are already part of the project design and therefore, this plan mainly focuses on provision of appropriate technical guidance through frequent missions and ex-post reviews. The objective is to offer timely, flexible and efficient implementation technical support to the GoO as well as help mitigate residual risks-especially those rated as high or substantial in the SORT (namely the technical design of the project, institutional capacity for implementation, and stakeholder risk). The strategy also encompasses the standard areas of support focus including safeguards and fiduciary aspects. The strategy will be periodically reviewed and revised as deemed appropriate.

Implementation Support Plan

23. There will be two comprehensive implementation support missions per year and these will focus on: (i) assessing implementation progress for each of the project components including the links between project activities, outputs and envisaged outcomes; (ii) providing solutions to any project implementation bottlenecks; (iii) reviewing together with the implementing agencies and their partners, the six month work plans and budgets; (iv) reviewing project fiduciary aspects including disbursement and procurement; (v) ascertaining and confirming that project activities are carried out in compliance with the agreed environmental and social safeguard procedures; and (vi) technical aspects especially those related to the modernization of hydraulic assets in cascades, produce marketing, and promoting adoption of CSA technologies.

24. There will also be a Mid-term Review (MTR) approximately halfway through implementation to take stock of implementation progress, and to assess performance against the agreed set of indicators and milestones. The MTR will also provide an opportunity to reassess major design features-if necessary- to enable attainment of project objectives. At the end of the project, an independent assessment will be



undertaken, and lessons drawn to inform future or similar operations. In addition, both the client and the Bank will conduct reviews to provide a complete and systematic account of the performance of the project and to draw lessons for future investments. Briefly, the plan with respect to technical, fiduciary and safeguards support is as outlined below.

25. **Technical support:** The Bank will mobilize and assemble an appropriate technical skills mix needed to support implementation of the project. This team will include experts from the Food and Agriculture Organization (FAO) and Consultative Group on International Agricultural Research (CGIAR) centers to bring in new knowledge on various climate change aspects.

26. **Safeguards support:** The environment and social specialists will support relevant counterpart staff in applying the agreed safeguard instruments as well as reviewing compliance and will also provide any capacity building support, where necessary. The envisaged focus of the social supervision will be on participation, inclusion and equity, while the environmental supervision will focus on the implementation of the EHS, Integrated Pest and Nutrition Management Plan (IPNMP), EMPs, and on dam safety.

27. **Financial management support:** The team will require that quarterly IUFs be submitted to the World Bank as well as the annual external audit report for review. Once every 12 months, the Bank will review other project-related information as well, such as the internal control, oversight, and reporting systems. Monitoring of actions taken on issues highlighted in audit reports, auditors’ management letters, internal audit and other reports will be done as need arises. The Bank will also provide training to project FM specialists to strengthen their capacity.

Table A1.3: Main focus of support to project implementation

Time	Focus	Skills Needed	Resource Estimate
First 12 months	<ul style="list-style-type: none"> Effectiveness/start of project activities Finalization of ToRs and procurement of specialized TA for proposed activities Preparation and approval of bidding documents for hydraulic infrastructure rehabilitation Compliance with relevant safeguards policies Scheme design and DPR preparation 	<ul style="list-style-type: none"> Agriculture Specialist (TTL) Water Resource Specialist (co-TTL) Hydrologist Agriculture Marketing Specialist Fisheries Specialist Institutional Capacity Building Specialist Procurement Specialist Financial Management Specialist Social Safeguards Specialist Environment Safeguards Specialist 	200,000
12-72 months	<ul style="list-style-type: none"> Implementation of planned activities and preparation of Annual work plans and budgets Scheme design and DPR preparation Results monitoring against set targets Fiduciary and safeguards compliance MTR Project completion and ICR preparation 	<ul style="list-style-type: none"> Agriculture Specialist (TTL) Water Resource Specialist (co-TTL) Hydrologist Agriculture Marketing Specialist Fisheries Specialist Institutional Capacity Building Specialist Procurement Specialist Financial Management Specialist Social Safeguards Specialist Environment Safeguards Specialist 	200,000 per annum



Skills Mix Required

Skills Needed	No. of Staff Weeks	Number of Trips	Comments
• Agriculture	4	2	
• Agriculture Marketing	3	2	
• Climate Change	4	2	
• Water Resource Management	2	2	
• Hydrology	4	2	
• Procurement	2	2	
• Financial Management	2	2	
• Safeguards	2	2	
• M&E	2	2	



ANNEX 2: Agri-Entrepreneur Model

COUNTRY: India

Odisha Integrated Irrigation Project for Climate Resilient Agriculture

1. The agri-entrepreneur model as conceived under the project, is designed to address farmers' challenges related to access to agricultural input and output markets, as well as narrow the current gaps in advisory service provision that constrain adoption of CSA practices. The model relies on decentralizing the provision of input/output marketing, mechanization, and advisory services through a network of locally-based rural agriculture entrepreneurs (AEs) to be created by the project. It is based on global experiences that suggest that, given the right incentives, these services can be efficiently delivered through promotion of such local entrepreneurs.
2. Under this model, an individual AE is expected to cater for the production and marketing needs of 150-250 small and marginal farmers in a cluster of 3-5 villages (or such other number of farmers and villages that would be necessary to ensure commercial viability of their operation). This will include: providing quality inputs (seeds, seedlings, micronutrients, manures and fertilizers, plant protection chemicals etc.); helping farmers with knowledge on crop and aquaculture production (e.g. production technology, weather information and market prices); providing mechanization services (farm equipment rentals) and primary processing; and linking farmers to markets e.g. through collectivization. AEs would have the latitude to offer all or just a few of the above services, depending on their individual circumstances.
3. The project will support the identification and selection of the AEs using a selection process and eligibility criteria to be defined in the Project Implementation Manual (envisaged to include business acumen, residency in a village, ownership/access to 1 acre of land and at least 2000 square feet of constructed area to serve as their business premises, minimum education qualifications, performance at interviews, etc.). After selection and acceptance into the program, the AEs will undergo training and certification at recognized institutions to enable them to embark on their ventures. Among others, indicative training to the AEs includes: (i) entrepreneurship and business planning; (ii) basics of crop production; (iii) basics of aquaculture; (iv) produce marketing; (v) farmer mechanization; (vi) organizing and managing farmer groups; (vi) relevant government schemes from which they could tap resources. Provisions will be made for refresher training of the AEs at own cost.
4. Upon successful completion of the training, the AEs will be certified and will go through an incubation phase where they would be: (i) helped to prepare business plans that address farmer needs; (ii) assisted to access financing for their business plans from ongoing relevant government programs (e.g. those funded by the Agricultural Promotion and Investment Corporation of Odisha Limited- APICOL) or from banks; (iii) linked to ongoing government programs (e.g. those offering subsidized mechanization equipment; ATMA and KVKs for collaboration on extension service provision); (iv) facilitated to meet the necessary statutory compliance requirements e.g. certification for seed and fertilizer sale; and (v) linked to suppliers e.g. of fertilizers, seeds, market information, etc. Based on experience, it typically takes 9 - 12 months for a business established by the AEs to attain scale and generate adequate revenue to fully meet their costs, so a modest stipend (roughly Rs. 5,000 per month for 12 months) and hands-on support would be offered to help their smooth transition into the business.



ANNEX 3: Economic and Financial Analysis

COUNTRY: India

Odisha Integrated Irrigation Project for Climate Resilient Agriculture

Introduction

1. OIIPRA aims to intensify and diversify agricultural production, enhance climate resilience and improve water productivity in selected districts of Odisha. This is expected to be achieved through project investments under three technical components. Investments under the “Climate-Smart Intensification and Diversification of Production” component will intensify production, strengthen farmers’ capacity to adapt to climate change stresses affecting crop and aquaculture production, diversify production, especially in *Rabi* in response to market demand, and improve farmers access to markets. Project support under the “Improving Access to Irrigation and Water Productivity” component will support the first component by improving reliability of irrigation water supply and increasing water storage capacity. The “Institutional Capacity Strengthening” component will improve overall capacity of the GoO for interdepartmental planning, coordination and implementation of cross-sectoral programs in the agriculture and water resource sectors. The “Contingent Emergency Response” component will finance eligible expenditures in case of natural or man-made crises, disasters, severe economic shocks, or other crises and emergencies in Odisha. The non-technical “Project Management” component will support implementation of the project interventions planned under the technical components.

2. Main sources of quantifiable benefits include: (i) agricultural benefits, resulting from expansion in irrigated areas and improved intensification, diversification and climate resilience of crop production; (ii) aquaculture benefits resulting from restored fish and shrimp production; and (iii) climate co-benefits resulting from adoption of improved water and farm management and CSA practices. Additionally, improved access to markets, improved marketing strategies, and adoption of improved technologies and post-harvest practices are likely to facilitate obtaining additional price premium. Such benefits are not captured, however. Instead, marketing of increased production of non-paddy crops is assumed as a key benefit to improved marketing.

Methodology and Key Assumptions

3. The economic analysis assesses the development impact of the project following the cost-benefit analysis approach. It examines incremental returns to the project investments by comparing the future without project (WoP) and future with-project (WiP) benefits and costs.

4. Agricultural benefits are estimated separately for potential expansion in irrigated areas and improved intensification, diversification and climate resilience of crop production. Major crop categories are represented by: (i) grams, mungbean and peas for pulses; (ii) mustard for oilseeds; (iii) chilli for spice crops; (iv) millet and maize for non-paddy cereal crops; (v) groundnut for legumes; (vi) cabbage, cauliflower, tomato and eggplant for vegetables; and (vii) marigold for flowers. Project investments in improved marketing are assumed to translate into marketing of increased production of non-paddy crops only, although these investments could also lead to obtaining higher prices for agricultural produce. Aquaculture benefits are estimated for a representative tank culture production of Indian major carps. Climate co-benefits are estimated for both agriculture and aquaculture operations. Overall project level returns are calculated by aggregating agriculture, aquaculture and climate co-benefits.

5. Economic and financial returns are assessed in 2019 constant prices at a discount rate of 5 percent.



Climate co-benefits are examined at both high and low shadow prices of carbon recommended in the World Bank's guidance note of September 2017. The project's returns are estimated for a period of 26 years, which corresponds to technical life of rehabilitated and modernized tanks, if adequately operated and maintained, and includes a six-year project implementation period.

6. Financial prices of locally traded outputs and inputs are converted into economic prices by deducting subsidies, duties, and taxes. Output and input prices for agricultural commodities, that are supported under the government's Minimum Support Price (MSP) and subsidy schemes, are converted using conversion factors recommended by the Ministry of Agriculture and Animal Welfare of India.⁴⁴ The financial cost of unskilled labor is converted into economic cost using a shadow wage rate conversion factor of 0.60.

7. Sensitivity analysis is undertaken to examine the project returns sensitivity to six variables: (i) a 20 percent increase in project costs; (ii) a 20 percent reduction in benefit scopes; (iii) a 3-year delay in project implementation; (iv) zero diversification towards vegetables and flowers; (v) simultaneous 3-year implementation delay and 20 percent reduction in benefit scopes; and (vi) simultaneous 20 percent reduction in benefit scopes and 20 percent increase in costs. Additionally, the sensitivity of project returns to major risk factors was tested through a Monte Carlo simulation to capture their combined effects of the projected results. Representative crop and aquaculture production models are prepared based on baseline data collected at appraisal, and secondary data published by line departments and national and state statistical and research agencies. Results and outcomes achieved under the completed OCTMP were used as basis for the WiP benefits and costs assumptions.

Project Benefits

8. **Agricultural benefits.** Main agricultural benefits are expected from expansion of irrigated areas, intensification, diversification, and improved resilience.

9. *Expansion of irrigated areas.* The project will support 128, 000 ha of agricultural land, including 53,479 ha of tank command area and 74,521 ha of agricultural lands adjacent to the tank command areas referred to as the influence area. Tank command areas are served by 532 tanks that will be rehabilitated and modernized under the project. In addition to improving technical capacity of the target tanks, the project will promote adoption of improved water and farm management practices and technologies, diversification towards less water consuming crops and drought resilience technologies, and adoption of cascade water management practices in selected tanks, where such practice could be applied. These investments are projected to increase irrigated areas both within the tank command as well as in the influence area. In terms of the tank command, in years with normal rainfall levels, the project tanks supply irrigation water to around 47,972 ha, including 44,354 ha in *Kharif* season and 3,619 ha in *Rabi* season. With project investments, irrigated areas are projected to increase to 72,805 ha within the tank command (Table A3.1).

⁴⁴ Ministry of Agriculture and Animal Welfare, Government of India, 2018, Price Policy for Kharif Crops. The Marketing Season 2017-18, New Delhi

**Table A3.1. Irrigated area expansion**

	Normal Year					
	WoP			WiP		
	<i>Kharif</i>	<i>Rabi</i>	Total	<i>Kharif</i>	<i>Rabi</i>	Total
Tank command area	53,479	7,487	60,966	53,479	33,157	86,636
Irrigated	44,354	3,619	47,972	50,805	22,000	72,805
Rainfed	9,126	3,868	12,994	2,674	11,157	13,831
Influence area	74,521	8,197	82,718	74,521	14,904	89,425
Irrigated	7,452	4,471	11,923	11,178	7,452	18,630
Rainfed	67,069	3,726	70,795	63,343	7,452	70,795
Total	128,000	15,684	143,684	128,000	48,061	176,061

10. In the influence area, around 11,923 ha is currently irrigated with pump sets majority of which are installed illegally. The project will facilitate removal of these pumps by establishing water supply from the project tanks, when technically feasible. Otherwise, it will promote adoption of micro-irrigation systems and conjunctive use of water to increase water use efficiency. Additionally, the project will promote adoption of improved and climate resilient practices and technologies. Combined improvements in the tank command, cascades as well as in the influence area are projected to increase current irrigated areas in the influence area from 11,923 ha to 18,630 ha.

11. Expansion of irrigated area is expected to fluctuate depending on rainfall levels (Table A3.2). In years when rainfall would be above the normal levels (flood), irrigated area would be 6 percent higher than in normal years within the tank command and 20 percent in the influence areas. In years with below normal rainfall levels (drought), the irrigated area is expected to be 18 percent lower than in normal years within the tank command and 30 percent lower in the influence areas. The probability of occurrence of normal (46 percent), drought (15 percent) and flood years (38 percent) is based on rainfall pattern data in Odisha between 1991 and 2015.

Table A3.2. Irrigated area in normal, flood and drought years

	WiP		
	Normal	Drought	Flood
Irrigated area (ha)			
Tank command	72,805	59,754	77,205
Influence area	18,630	13,041	22,356
Fluctuations (%)			
Tank command	100	82	106
Influence area	100	70	120
Probability of occurrence	46	38	15

12. *Intensification of crop production.* Current crop productivity levels for all crops are below agronomic potential and much below the state and national averages. The project will target productivity improvement through dissemination and demonstration of improved farm and water management and climate smart practices and technologies, and improved access to high yielding and climate resilient technologies. The project interventions are projected to increase the (current) baseline adoption rate of drought resilient technologies on 15 percent of cropped areas to 30 percent. The project will also promote diversification towards less water consuming crops such as maize and millet on 30 percent of cultivated lands. Improved access to reliable irrigation water and adoption of improved agricultural practices and technologies is expected to increase current baseline yields (weighted averages for *Rabi* and *Kharif* seasons in the tank command as well as influence areas) from 22 percent to 30 percent (Table A3.3). No productivity improvement is assumed for marigold.



Table A3.3. Crop productivity (t/ha)

Crop	WoP	WiP	Change (%)
Paddy	1.78	2.31	30
Maize	1.56	1.90	22
Millet	0.71	0.89	25
Pigeon pea	0.82	1.02	24
Groundnut	1.59	2.07	30
Gram	0.46	0.57	26
Mungbean	0.47	0.58	23
Mustard	1.14	1.42	25
Tomato	14.21	17.61	24
Cauliflower	13.08	15.89	22
Cabbage	18.59	22.93	23
Eggplant	12.00	14.40	20
Chilli	1.80	2.25	25
Flowers	9.15	9.15	0

13. The project promoted improvements are projected to increase cropping intensity (Table A3.4). In normal years, current cropping intensity within the tank command is projected to increase from 114 percent to 162 percent. In the influence area, current cropping intensity at 112 percent is projected to reach 120 percent. Cropping intensity in the total cultivated areas is expected to increase from the current 112 percent to 138 percent.

Table A3.4. Cropping Intensity (%)

	Normal Year					
	WoP			WiP		
	Kharif	Rabi	Total	Kharif	Rabi	Total
Tank command area	100	14	114	100	62	162
Irrigated	83	7	90	95	41	136
Rainfed	17	7	24	5	21	26
Influence area	100	11	111	100	20	120
Irrigated	10	6	16	15	10	25
Rainfed	90	5	95	85	10	95
Total	100	12	112	100	38	138

14. *Crop diversification.* Currently, crop production is dominated by paddy production which occupies 78 percent of the tank command and 10 percent of the influence areas. The project interventions in improved access to markets and adoption of less water consuming technologies are expected to lead to diversification towards non-paddy crops on 30 percent of cultivated areas (Table A3.5). Within non-paddy and non-vegetable crops, diversification is expected towards less water consuming cereal crops and pulses. Within vegetables, diversification is assumed towards less perishable crops such as cabbage, cauliflower, and eggplant.



Table A3.5 Cropping pattern and diversification

Crop	Cultivated area (ha)		Shift (%)
	WoP	WiP	
Paddy	55,469	61,440	11
Non-paddy crops, of which:	88,135	114,753	30
Pulses, oilseeds, other cereals,	81,927	106,791	30
Vegetables, spices, flowers	6,208	7,961	28
Gross cultivated area	143,604	176,192	

15. *Improved climate resilience in crop production.* Currently, droughts affect crop production by reducing yields by up to 20 percent and cropping areas in *Rabi* season by up to 20 percent. The project investments in technical capacity of tanks and improved water management capacities at cascade, tank, and farm levels combined with adoption of CSA practices and technologies are expected to reduce baseline drought-related productivity losses on average from 10 percent to 5 percent for all crops. Additionally, cropping intensity is assumed to be retained at 112 percent.

16. Jointly, the project investments in agriculture are estimated to generate annual incremental financial returns of Rs. 166.8 crore.

17. *Restoration of aquaculture production.* Around 1,500 ha of water spread area (WSA) is available within the project tanks, including 1,000 ha for tank culture and 500 ha for polyculture production. However, aquaculture is currently not practiced on these areas due to uncertainty about water availability and water retention period. The project will take advantage of the improved water situation resulting from tank modernization and management in the cascades, to support climate-resilient aquaculture in the rehabilitated tanks, as well as other tanks in the cascade. Key project interventions will include modernization of three fish hatcheries, establishment of portable hatcheries in 30 locations, dissemination of improved aquaculture practices, provision of basic post-harvest storage equipment, and initial production support investments (one-year production cost). As the aquaculture production would depend on availability of water to support required water retention period, the analysis assumes a low input and output production model. The analysis assumes that around 20 percent of WSA would have suitable water retention period for aquaculture in any given year and annual aquaculture output would be around 500 kg/ha. When these assumptions are applied, annual incremental financial benefits from aquaculture production is estimated at Rs. 3.5 crore.

18. *Climate co-benefits.* Expansion of irrigated as well as rainfed crop production areas and aquaculture production are expected to increase GHG emission. However, the increase will be offset by substantial reduction in GHG emissions that would result from adoption of improved water and farm management, and CSA practices and technologies. The net emissions in the project areas are estimated at -3,844,504 tCO₂-eq over the 26-year period. The annual net emissions are projected at -192,225 tCO₂-eq.

Project Costs

19. Financial base cost of the project in 2019 constant prices, inclusive of physical contingencies and exclusive of price contingencies, is estimated at Rs. 1,312 crore. Distribution of costs among components will be: (i) Climate-Smart Intensification and Diversification of Production component at 32 percent; (ii) Improving Access to Irrigation and Water Productivity component at 59 percent; (iii) Institutional Capacity Strengthening at 4 percent; (iv) Contingent Emergency Response component at zero percent; and (4) Project Management at 5 percent. Additionally, around Rs. 18 crore is projected to be allocated annually by the government for post-project management, operation and maintenance of project supported tanks. The official exchange rate at the Indian Rupee (Rs) 68.0 to US\$ 1.0 is used for conversion of the costs into



local currency.

Financial Analysis

20. *Farm level financial returns.* Baseline data on distribution of marginal, small, and large holdings⁴⁵ within the entire project areas are not available. Using state level data on size of landholdings, project investments are projected to generate incremental net returns of Rs. 7,270 per marginal farmer operating cultivating 0.57 ha of land, Rs. 20,780 per farmer operating 1.63 ha of land, and Rs. 37,620 per farmer operating on 2.95 ha of land.

21. *Project level financial returns.* The project investments are estimated to generate incremental financial returns at a financial rate of return (FRR) of 9.2 percent with financial net present value (FNPV) of Rs. 729 crore and a benefit to cost ratio (BCR) of 1.55.

22. *Financial sustainability of project investments.* Post-project management, operation and maintenance requirements of the project supported tanks is estimated at around Rs. 18 crore per year (or Rs. 3,370 per ha). Around 90 percent of these funds are expected to be financed by the government as per the current procedures. The remaining 10 percent is expected to be funded by water users through existing water service tariffs at around Rs. 50 per ha per agricultural season and membership fees.

Economic Analysis

23. When the climate co-benefits are excluded, economic rate of return (ERR) to the project investments is estimated at 10.8 percent with an economic net present value (ENPV) of Rs. 947.6 crore (US\$132 million) and BCR of 1.80 (Table A3.6). When the climate co-benefits at the low shadow prices of carbon are added, the ERR is projected to be 12.6 percent, ENPV at Rs. 1,334.9 crore (US\$186.8 million), and BCR at 2.13. When the climate benefits at high shadow prices for carbon are considered, the ERR is expected to be 14.2 percent, ENPV at Rs 1,722.3 crore (US\$241 million), and BCR at 2.45.

24. **Sensitivity analysis.** For the purpose of the sensitivity analysis, the project returns, inclusive of climate co-benefits at the low shadow prices of carbon, is assumed to be the base scenario. The results presented in Table A3.6 suggest that the project is sensitive to delays in the benefit accumulation and reduction in benefit scopes. When a 20 percent reduction in benefit scopes is assumed, the base ERR drops to 10.2 percent. An additional 20 percent increase in costs is estimated to reduce the ERR further to 8.3 percent. If implementation delays are accompanied with a 20 percent reduction in the benefit scopes, the base ERR drops to 7.2 percent. The sensitivity to changes to the project costs (individual events) is negligible. The project's sensitivity to other variables is moderate.

⁴⁵ Marginal holdings are <1 ha; small holdings are 1-2 ha; and semi-medium holdings are between 2-4 ha.



Table A3.6. Summary results of economic and sensitivity analysis

Variables	IRR (%)	NPV (Rs. Crore)	BCR
Base scenario, exclusive of climate benefits	10.8	947.6	1.80
Base scenario, with climate benefits at low price scenario	12.6	1,334.9	2.13
Base scenario, with climate benefits at high price scenario	14.2	1,722.3	2.45
Cost increases by 20 percent	12.1	1,485.0	2.04
Benefits decline by 20 percent	10.2	830.7	1.70
No diversification towards vegetables	11.6	1,124.1	1.95
Benefit accumulation delayed by 3 years	11.4	1,262.8	2.06
Simultaneous cost increase and benefits declines of 20 percent	8.3	593.4	1.42
Simultaneous benefits decline of 20 percent and 3-year delay	7.2	364.3	1.44

25. **Risk Analysis.** Based on the Monte Carlo simulation, the simulated ERRs ranged from 7.1 percent to 12.6 percent with a coefficient of variation of 11 percent. The expected ERR, estimated by the risk model at 10.5 percent can be considered robust, with the probability of the estimated ERR falling below 5 percent being negligible at less than 1 percent.



ANNEX 4: Greenhouse Gas Accounting

COUNTRY: India

Odisha Integrated Irrigation Project for Climate Resilient Agriculture

- 1. Corporate mandate.** The World Bank has adopted, in its 2012 Environment Strategy, a corporate mandate to conduct greenhouse gas (GHG) emissions accounting for investment lending in relevant sectors. The ex-ante quantification of GHG emissions is an important step in managing and ultimately reducing GHG emission, and it is becoming a common practice for many international financial institutions.
- 2. Methodology.** To estimate the impact of agricultural investment lending on GHG emission and carbon sequestration, the World Bank has adopted the Ex-Ante Carbon-balance Tool (EX-ACT), developed by FAO in 2010. EX-ACT allows the assessment of a project's net carbon-balance, defined as the net balance of CO₂ equivalent GHG emitted or sequestered as a result of project implementation compared to a without-project scenario. EX-ACT estimates the carbon stock changes (emissions or sinks), expressed in equivalent tons of CO₂ per hectare and year.
- 3.** EX-ACT captures development activities under OIIPCRA in five modules: a) land use change; b) crop production and management; c) grassland and livestock; d) inputs and further investment; and e) fisheries and aquaculture. It estimates the carbon stock changes (emissions or sinks), expressed in equivalent tons of CO₂ per hectare per year. The GHG estimation has accounted for 135 percent of the total arable land under project, which is 172,800 ha.

Project boundary and key assumptions

- 4.** The project will be implemented over a period of 6 years, covering 128,000 ha of arable land including 53,479 ha in tank command areas and 74,521 ha of agricultural lands adjacent to tank command areas. The baseline cropping intensity is 112 percent (145,920 ha) and the project proposes to increase this to 138 percent (172,800 ha), through modernization and rehabilitation of selected tanks, propagation of energy and water efficient irrigation technologies and improved agronomic practices. The baseline cropping pattern within project areas is dominated by traditional cultivation of rice (129,431 ha). Other crops include pulses⁴⁶ (6,712 ha), cash crops⁴⁷ (4,232 ha), vegetables⁴⁸ (4,144 ha), oilseeds⁴⁹ (832 ha) and other food grains⁵⁰ (569 ha).
- 5.** Several of the project interventions proposed to be implemented under OIIPCRA are likely to have carbon implications. The following are the interventions proposed to be implemented and are represented under each of the five EX-ACT modules:
 - a. Land use change:** The project will bring degraded lands under backyard gardening with the plantation of fruit trees (1,400 ha) and reduce the area under Rabi paddy with the promotion of high value vegetable crops (3,502 ha)⁵¹.

⁴⁶ Black gram, green gram and chick pea.

⁴⁷ Cotton, sugarcane, garlic and turmeric.

⁴⁸ Brinjal, cabbage, cauliflower, cucumber, green peas, green beans, potato, beans, gourds, chilli, coriander, Okra, long beans, onion, and tomato.

⁴⁹ Groundnut, mustard and sesame.

⁵⁰ Wheat, maize and finger millet.

⁵¹ Only 12 percent of arable land is cultivated during Rabi, of this 28 percent is under Paddy. Project intends to reduce 30 percent of this area which accounts to 3,502 ha.



Table A4.1. Land-use change with and without project implementation

Initial land use	Initial area (ha)	Final land use	Area transformed (ha)
Degraded lands	1,400	Perennial tree crops	1,400
Rice	3,502	Vegetables	3,502

b. Crop production and management: The project has proposed to prioritize ten crops and aims to increase their share of cultivated area during Rabi: groundnut, pulses (black and green gram), vegetables (cabbage, cauliflower, bitter gourd, brinjal and tomato), marigold and lemon grass.

- (i) Increasing cropping intensity from 112 percent to 138 percent by bringing fallow land in Rabi season under cultivation of other less water intensive crops. This is proposed to be achieved through the modernization and rehabilitation of selected tanks with comprehensive treatment of their catchments and the dissemination of improved irrigation and agronomic technologies. This would bring 26,880 ha of land previously left fallow in Rabi under cultivation. The distribution of this land under different crops as prioritized by the project is presented below:

Table A4.2. Distribution of land under different crops due to increased cropping intensity

Initial land use	Initial area (ha)	Final land use	Area transformed (ha)
Rabi fallow	26,880	Oilseeds	1,663
		Pulses	13,425
		Vegetables	3,354
		Flowers	1,000
		Other Grains	1,138
		Cash Crops	6,300

- (ii) Conversion of area under Rabi paddy cultivation (3,502 ha) into high value vegetable crops – predominant management system in these parcels of land use long-duration cultivars (130 days), with intermittent flooding and a non-flooded period of more than 180 days before cultivation. They mostly use farmyard manure as an organic amendment.
- (iii) Diversification from traditional rainfed subsistence cropping systems to high value crops and vegetables, pulses, and flowers.
- (iv) Promotion of improved agronomic practices, INM, IPM, water management, compost application and retentions of crop residue in all cropping systems, including Rice.
- (v) For rice systems remaining rice systems – there are three types of rice production systems in the project area: i) continuously flooded; ii) irrigated - Intermittently flooded and iii) rainfed rice. The project intends to promote aerobic rice and System of Rice Intensification (SRI) production methods in areas of rice that are continuously flooded (5,600 ha – Table A4.3 below).

Table A4.3. Area under different rice production systems with and without the project

Initial land use	Initial area (ha)	Final land use	Area transformed (ha)
Continuously flooded	12,593	Continuously flooded	6,993
		Irrigated – intermittently flooded	5,600
Irrigated – intermittently flooded	28,964	Irrigated – intermittently flooded	28,964
Rainfed	84,372	Rainfed	84,372



Total	125,929		125,929
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(vi) Promotion of compost as an INM practice instead of farmyard manure, along with steady rates of N:P:K application rates for productivity enhancement is proposed for rice (explained further under section d(i)).

c. Inputs and further investment:

(i) The rate of fertilizer application for Nitrogen (N), Phosphorous (P₂O₅) and Potassium (K₂O) for all crops remain unchanged.

Table A4.4. Fertilizer application rates

Crop	Fertilizer application rate (kg/ha)		
	N	P ₂ O ₅	K ₂ O
Rice	66	54	27
Oilseeds	37	37	19
Pulses	12	5	3
Vegetables	80	40	20
Other grains	28	12	7
Cash crops	80	44	24

(ii) Furthermore, the baseline irrigated, and unirrigated area treated by fertilizers and FYM/compost was considered to remain same under project scenario. Proportion of area irrigated for the priority crops are: Rice – 33.3 percent; Oilseeds – 18.9 percent; Pulses – 2.2 percent; Vegetables – 84 percent; Other food grains – 19 percent; and Cash crops – 15 percent.

- a. 90percent of irrigated rice and 81percent of unirrigated rice is treated with fertilizer.
- b. Similarly, 34 percent of irrigated rice and 52 percent of unirrigated rice is treated with organic manures.
- c. 94 percent of irrigated oilseeds and 58 percent of unirrigated oilseeds are treated with fertilizers.
- d. Also, 36 percent of irrigated oilseeds and 22 percent of unirrigated oilseeds are treated with organic manures.
- e. The reported percentage area treated with fertilizers/organic manures for oilseeds were considered for all other field crops as crop specific data was not available.

(iii) Similarly, the baseline rate of pesticide application and the proposed pesticide application rates were compared. Only 26 percent of arable land is treated with pesticides in the baseline. The project will actively advocate the use of biopesticides to reduce the use of chemical insecticides and fungicides in all cropping systems.

(iv) Project is promoting micro-irrigation (drip irrigation) in 860 ha of previously rainfed croplands, and;

(v) Construction of 850 vermi-compost pits (6,800 m²); storage structures (4,140 m²); and processing units (4,620 m²) has been proposed.

d. Fisheries and aquaculture: the project intends to provide support to climate smart inland aquaculture and has proposed to take up aquaculture in 3,270 ha of water spread area. There are no aquaculture production systems in the baseline and the project is proposing to introduce several different types of fish production systems, backed by feed production infrastructure.

6. **Regional and project characteristics.** The project region has a tropical moist climate. The dominant soil type is high activity clay (HAC) Soils. The project implementation phase is 6 years of actual



implementation and the capitalization phase is assumed to be 14 years. The 20-year implementation period is common in the use of EX-ACT and identical with the EFA analysis.

7. **Results.** The net carbon balance quantifies GHGs emitted or sequestered because of the project compared to the without-project scenario. Over the project duration of 20 years, the project constitutes a total carbon emission savings of 3,844,504 tCO_{2eq}. The annual reduction/sequestration of GHG emissions is estimated to be 192,225 tCO_{2eq}/year, and thus a total reduction/sequestration of 3,884,504 tCO_{2eq} is expected by project completion (end of 6 years or project implementation).

8. On a per hectare basis, CO₂ mitigation of 21.7 tCO_{2eq}/ha over a 20-year period is observed (i.e., from 30 tCO_{2eq}/ha emissions in the baseline to 9 tCO_{2eq}/ha emissions as a result of project interventions after 20 years: 6.5 tCO_{2eq}/ha after 6 years), which translates to a 1.08 tCO_{2eq}/ha/year GHG mitigation rate.

Table A4.5. GHG accounting results

Components of the project	Gross fluxes			Result per year		
	Without	With	Balance	Without	With	Balance
	All GHG in tCO_{2eq}					
	Positive = source / negative = sink					
Land use changes						
Other LUC	0	243,834	243,834	0	12,192	12,192
Agriculture						
Annual	-530,215	-2,266,490	-1,736,275	-26,511	-113,325	-86,814
Perennial	0	-236,880	-236,880	0	-11,844	-11,844
Rice	4,334,148	2,567,349	-1,766,799	216,707	128,367	-88,340
Inputs & Investments	1,555,888	1,171,678	-384,211	77,794	58,584	-19,211
Fishery & Aquaculture	0	35,828	35,828	0	1,791	1,791
Total	5,359,822	1,515,318	-3,844,504	267,991	75,766	192,225