Report Number: ICRR0024679

1. Project Data

Project ID P160408	**Project Name** Maharashtra PoCRA
Country India	**Practice Area(Lead)** Agriculture and Food

L/C/TF Number(s)	**Closing Date (Original)**	**Total Project Cost (USD)**
IBRD-88290	30-Jun-2024	419,937,418.93
Bank Approval Date	**Closing Date (Actual)**	
27-Feb-2018	30-Jun-2024	

	IBRD/IDA (USD)	Grants (USD)
Original Commitment	420,000,000.00	0.00
Revised Commitment	419,937,418.93	0.00
Actual	419,937,418.93	0.00

Prepared by	Reviewed by	ICR Review Coordinator	Group
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2. Project Objectives and Components

a. Objectives

The Project Development Objective (PDO) of India's Maharashtra Project on Climate Resilient Agriculture (PoCRA) as articulated in the Loan Agreement (LA, page 5) was identical to the one stated in the Project Appraisal Document (PAD, paragraph 20) and aimed to:

"Enhance climate-resilience and profitability of smallholder farming systems in selected districts of Maharashtra."

Parsing the PDO. The PDO will be parsed based on two Objectives:

1. To enhance climate-resilience of smallholder farming systems in selected districts of Maharashtra.

2. To enhance profitability of smallholder farming systems in selected districts of Maharashtra.

b. Were the project objectives/key associated outcome targets revised during implementation?

Yes

Did the Board approve the revised objectives/key associated outcome targets?

No

c. Will a split evaluation be undertaken?

No

d. Components

The PDO was supported by the following four Components:

1. Promoting Climate-resilient Agricultural Systems (appraisal cost: US$452.10 million of which US$316.47 million from IBRD, actual cost: US$496.60 million). This component aimed to strengthen the adaptive capacity of smallholder farmers to adjust and modify their production systems in order to moderate potential future impacts from climate events. It was comprised of the following three sub-components:

1.1. Participatory development of mini watershed plans to guide the design and implementation of multi-sector project interventions aimed at enhancing climate-resilience of the local agricultural systems.
1.2. Promoting the transfer of on-farm technologies and agronomic practices that enhance climate-resilience in the agricultural systems, for enhanced agriculture productivity, improved soil health, and increased water-use efficiency – and increased farm income. The project supported advisory systems and Farmer Field Schools (FFS) to promote the demonstration of climate-resilient varieties on field and provide matching grants to eligible individual farmers through a Direct Benefit Transfer (DBT) system. The component significantly contributes to climate co-benefits by mitigating GHG emissions through carbon sequestration, catchment improvement, horticulture, and soil agronomic practices.
1.3. Enhancing the management of surface water and groundwater resources in the catchment areas of the project's mini watersheds to help reduce agriculture's vulnerability to extended in-season dry spells and lower than normal annual rainfalls, through drainage line and catchment area treatment.

2. Post-harvest Management and Value Chain Promotion (appraisal cost: US$56.60 million of which US$39.65 million from IBRD, actual cost: US$70.17 million). This component aimed to support the participation of smallholder farmers in Farmer Producer Organizations (FPOs) and integration of these FPOs in value chains for crops relevant to the climate agenda, and to strengthen the supply chain for climate-resilient crop varieties in the project area. It included (i) developing smallholder-inclusive value chains for climate-resilient commodities, and (ii) overcome constraints in the seed supply chain and address shortages in the availability of stress-resistant seed varieties.

3. Institutional Development, Knowledge and Policies for a Climate-resilient Agriculture (appraisal cost: US$ of which US$23.56 million from IBRD, actual cost: US$3.48 million). This component aimed

to enhance the transformative capacity of institutions and stakeholders to promote and pursue a more climate-resilient agriculture, with strategies and policies based on strong analytical underpinnings and cutting-edge climate, water and crop modelling. It would do so by: (i) strengthening the capacity of existing institutions to design and deliver agro-technical and climate advisory services, including the revision of Strategic Research and Extension Plans (SREP), promoting an evidence-based policy dialogue on climate resilience, as well as the design and implementation of a comprehensive Information and Communication Technology (ICT) platform for the project, and (ii) establishing a Climate Innovation Center (CIC), to support local private sector capacity to scale-up technologies for a climate-resilient agri-food system in Maharashtra, with support the development and start-up phase.

4. Project Management (appraisal cost: US$56.10 million of which US$39.27 million from IBRD, actual cost: US$26.73 million). This component aimed to ensure the efficient and effective overall management of the project through a Project Management Unit (PMU) set up by the Department of Agriculture, Government of Maharashtra (GoM). The PMU would be adequately staffed with technical specialists to cover the overall project Monitoring and Impact Evaluation (M&IE) and reporting activities.

e. Comments on Project Cost, Financing, Borrower Contribution, and Dates

Project Cost. At appraisal the total project cost was estimated to be US$599.55 million. The actual cost according to the ICR Data Sheet (page ii)was US$419.94 million.

Financing. The project was financed through an IBRD Loan in the amount of US$420.00 million. The actual amount disbursed was US$419.94 million (ICR Data Sheet, page ii).

Borrower Contribution. The borrower was expected to contribute US$179.55 million of counterpart funds. The project team reported that the counterpart financing was $180.00 million.

Dates. The project was approved on February 27, 2018 and became effective three months later on May 18, 2018. The Mid-term Review (MTR) was conducted on May 16, 2022 which was four years after effectiveness. While the MTR was conducted late relative to similar World Bank-financed projects, this delay according to the project team was due to the COVID-19 outbreak and the associated restrictions. The project closed on its original closing date on June 30, 2024.

The project was restructured once (Level 2 restructuring) on July 7, 2023, when the amount disbursed was US$290.00 million, in order to revise the results framework after the baseline was updated, and to reallocate funds between disbursement categories. The ICR (paragraphs 17 and 18) explained that the revision of the end-of-project targets had no impact on the project scope and scale, but was done to ensure that the relative change remained consistent with the new baselines.

3. Relevance of Objectives

Rationale

Context at Appraisal. The State of Maharashtra has long been one of India's key economic growth engines and continues to hold this position. As the second largest state, it remains one of the most

advanced in terms of development and growth rates. Although agriculture contributes 10% to the state's economy, it remains a primary source of livelihood for 50% of the population. Agriculture is the largest consumer of water, facing increasing pressure from competing demands. Although crop productivity has increased, significant yield gaps remain. Kharif dry spells and limited groundwater availability during the Rabi season further constrain productivity. This project aimed to address sectoral challenges to reduce farmers' vulnerability to climate change, enhance their climate-resilience, and livelihoods and incomes through increasing profitability from farming systems.

Previous World Bank (WB) Experience. The project design was informed by the Neeranchal National Watershed Project (P132739) and the Himachal Pradesh Watershed Management Project (P104901). Both projects provided valuable insights on successful integration of water source, distribution and use, on improving on-farm water-use efficiency, and on increasing the productive potential of natural resources. Activities under Component 1 were also informed by the experience of the Improving Rural Livelihoods through Integrated Watershed Management project in the state of Karnataka. Also, the deign benefited from the Maharashtra Agricultural Competitiveness Project (P120836) which informed the design of component 2. Overall, the World Bank Group was well placed to provide value added support to the Government of Maharashtra (GoM) through its global experience with climate-resilient agriculture. The WB also had the capacity to work across a multi-sectoral environment, and apply cutting-edge knowledge at scale in support of changes in policies and strategies to promote climate adaptation and mitigation, and generate climate co-benefits.

Consistency with the WB Strategies. At appraisal, the PDO was in-line with the main findings of the India 2017 Systematic Country Diagnostic (SCD) which was under preparation and lays the foundation for the next Country Partnership Framework (CPF). The SCD advocated that for India sustain its growth across generations and become one of the world's largest middle class economies, the country's growth strategy would need to fully internalize the enormous constraints faced with availability of natural resources (in particular land and water), and shift to a more resource-efficient growth path. The project would be implemented in rural areas where a significant proportion of the poor live, and whose livelihood is largely dependent upon rainfed agriculture; project activities, while strengthening resilience against adverse climate events, would directly contribute to an increase in the income of these smallholder farmers.

At completion, the PDO continued to be in line with the WB's Country Partnership Framework (FY2018-FY 2022), which was still in place at completion. The CPF emphasized a resource-efficient, inclusive, and diversified rural sector, as well as improving disaster risk management and resilience to climate change. The project contributed to the CPF through supporting efficient use of agricultural resources. Additionally, the PDO supported the WB's commitment to Paris Agreement on climate change.

Consistencies with the Government Strategies/Priorities. At appraisal, the PDO was in line with Maharashtra State Adaptation Action Plan on Climate Change (MSAAPCC). The MSAAPCC sought to address the urgent need to integrate climate change concerns into the State's overall development strategy, thus assisting in building long term climate resilience and enabling adaptation to the likelihood of risks arising from climate change.

At completion, the PDO continued to be in line with the State and Government priorities in India where agriculture remains a cornerstone of policy priorities. The GoM set major agriculture sector targets in its Vision 2030. This included scaling up successful approaches from PoCRA on resilience, yield improvements, reducing cultivation costs, promoting water conservation for soil health, and enhancing value addition through strong science partnerships and digital tools. Further, the Ministry of Agriculture and

Farmers Welfare of the Government of India (GoI), proposed to replicate the PoCRA approach in three hundred of the most vulnerable districts in the country, incorporating several key elements. The relevance of the PDO was further emphasized in 2023 when the state experienced a severe drought that affected 66% of the area.

Summary of Relevance of Objectives Assessment. The PDO statement was clear, focused and pitched an adequate level of ambition. At completion, the PDO continued to be in line with WB strategy and Government and State priorities as noted above. The relevance of the PDO was further emphasized through the proposition of the Ministry of Agriculture and Farmers Welfare (GoI) to replicate the project approach in three hundred of the most vulnerable districts in the country.

Therefore, Relevance of Objectives is rated High.

Rating
High

4. Achievement of Objectives (Efficacy)

OBJECTIVE 1
Objective
To enhance climate-resilience of smallholder farming systems in selected districts of Maharashtra.

Rationale
Theory of Change (ToC). To achieve the outcome of enhancing climate-resilience of smallholder farming systems in selected districts of Maharashtra, the project supported fostering adoption of climate-resilient technologies by farmers; and strengthening institutional capacity for climate-resilient agriculture. These activities were intended to produce the following key outputs: participatory development of watershed plans, technologies and agronomic practices that enhance climate-resilience supported, and strengthened capacity and institutions for climate resilient agriculture. The successful delivery of the afore-mentioned outputs would result in realizing the following intermediate outcome indicators: strengthen the adaptive capacity of smallholder farmers to climate change, and enhancing the transformative capacity of institutions and stakeholders for climate resilient agriculture. The delivery of these intermediate results would be facilitated by farmers adopting improved technologies, improved irrigation and drainage, and mainstreaming climate resilience. The causal links from inputs to outcomes were direct, such that reported results can be fully attributed to the project. The planned activities were adequate and could be expected to comprehensively deliver the PDO if implemented successfully. A satisfactory project outcome would contribute in the long term to strengthening climate resilience against adverse climate events, resource efficient growth path, and contribute to carbon sequestration and the country's international commitments towards reducing emissions.

The ToC lacked critical assumptions that underpinned the achievement of the PDO. In a further communication, the project team explained that "that farmers would adopt climate-resilient technologies when offered clear economic incentives, decision-support tools, and demand-driven DBT financing; that

strengthened market access through FPOs would improve resilience and income; and that the Government of Maharashtra would provide strong ownership, use existing institutions, and ensure timely budgets. The PDO also assumed an effective ICT-enabled M&E system and collaboration with scientific partners to deliver sound, localized agronomic advice. Together, these assumptions on farmer incentives, institutional capacity, digital M&E, and science-based design underpinned the causal pathway from climate-smart adoption to higher resilience and profitability."

Outputs/Intermediate Results

- 1,079,700 farmers adopted improved agricultural technology substantially achieving the end target of 1,272,800 (target substantially achieved, 85% achievement rate). Also, 153,560 female farmers adopted improved agricultural technology which was below the end target of 446,000 (target not achieved).
- 667,902 hectares (ha) were provided with new/improved irrigation or drainage services exceeding the end target of 624,000 (target exceeded).
- 30,375.21 cubic meters of water resulted from improved availability of surface water for agriculture (from new farm ponds) which was below the end target of 83,900,000 cubic meters (target not achieved).
- 146,826 ha applied Good Agricultural Practices (GAPs) for improved management of saline and sodic soils (enhanced soil health) exceeding the end target of 127,600 ha (target exceeded).
- 89% of crop production area (pulses and oilseeds) were under cultivation with climate-resilient varieties exceeding the original target of 35% and the revised target of 86% (target exceeded).
- 15 Strategic Research and Extension Programs (SREP) were established with internalized climate resilience agenda fully achieving the end target of 15 (target achieved).
- 0.0 clients received services from the MH Climate Innovation Center (CIC) against the end target of 200 (target not achieved). The ICR explained that this indicator was not measured because the CIC was designed but not established. In a further communication, the project team explained that "the establishment of the Climate Innovation Center (CIC) in Maharashtra was delayed mainly because the financing arrangements required to operationalize the Center were not fully in place by the time the related World Bank project closed."
- 37,184 Climate-Resilient Agriculture Technologies (CRAT) focused farmer field schools (FFS) were organized with more than 200,000 sessions in 4,800 villages (no target provided). This included 15,501 host FFS farmers, and 490,780 ‘guest’ farmers attending, with 13% women.
- Matching grants were transferred through Direct Beneficiary Transfer (DBT) to 485,669 farmers (no target provided).
- 431,328 beneficiaries applied micro-irrigation, mainly drip and sprinkler (no target provided).
- 11,120 new farm ponds were established (no target provided).
- The project supported 29,270 ha of horticulture plantation, and 613 ha of agroforestry (no target provided), and 5337 farmers were supported on sericulture (no target provided).
- 8140 marginal and landless farmers were supported for enhanced livelihoods resilience in small ruminants, fisheries, apiculture, and poultry (no target provided).
- 59,387ha of catchment water security interventions and 1884 water conservation works were completed (no targets provided).

Outcomes

- By project completion, the water productivity at farm level increased from a baseline of 0.38 to 0.41 kg/m3 i.e. 7.9% for 5 key crops (unweighted) in project villages households, compared to a decrease of 0.41 to 0.34 kg/m3, or a reduction by 17.1% in control areas. The percentage increase in treatment (over control) therefore was 25% exceeding the end target of 20%. Water productivity at farm level was measured as a ratio of agricultural production (in kg) over evapotranspiration (in m3). This was measured from Year 3 onwards and for kharif season only.
- The Coefficient of Variation for Spatial Variability in soyabean was reduced from a baseline of CV 36 to CV 30 substantially achieving the end target of CV29. This represented a 17% decrease in variability. While the Coefficient of Variation for Temporal Variability in soyabean was reduced from CV 52 to CV 30 exceeding the end target of exceeding 38. This represented a 42.3% decrease in variability.
- The Coefficient of Variation for Spatial Variability in pigeon pea was reduced from a baseline of CV 66 to CV 52 substantially achieving the end target of 51. This represented a 21.2% decrease in variability. While the Coefficient of Variation for Temporal Variability in pigeon pea was reduced from a baseline of CV 44 to CV 42 partially achieving the end target of 36. This represented a nearly 5 % decrease in variability.
- 1,382,000 Tones/year of greenhouse gas emissions were estimated to have been reduced (compared to baseline of 232,398) as a result of climate-resilient agricultural technologies and agronomic practices introduced by the project, which fell short of meeting the end target of 4,789,515 Tones/year of greenhouse gas emissions (target not achieved).
- In total 1,365,233 farmers were reached with agricultural assets or services of which 354,960 were females. The total number exceeded the end target of 1,320,000, but the female target was partially achieved against the end target of 462,000.

Summary of Efficacy Assessment. The project successfully achieved its target of a 20% increase in water use efficiency for four out of five crops, with an overall actual achievement of 25% (PDO Outcome Indicator #1). The project also succeeded in enhancing resilience, as reflected in the reduction in farm productivity variability by strengthening farmers' capacity to adapt to adverse climatic events. Farm productivity demonstrated greater stability, particularly in mitigating extreme yield fluctuations and reducing the incidence of low yields. For core indicator crops (soybeans and pigeon peas), yield uniformity and stability improved significantly as evidenced by a reduction in the Coefficient of Variation (CV) (PDO #2) both spatially and temporally. Adoption rate of new technologies by project farmers reached 85% of the PAD target. Further, the project contributed to resilience by promoting certified climate-resilient seed varieties developed by local universities for key crops. This initiative aimed to improve seed replacement rates with high-quality seeds. The adoption of such varieties reached 89%. The project also exceeded its end target for areas with saline and sodic soils that applied Good Agricultural Practices (GAP) to manage soil salinity, including balanced fertilizer application, micronutrient dosing, micro-irrigation, and improved cropping techniques. Also, the project had a significant positive environmental effect, with a total carbon balance of -27,639,069 tCO2-eq over 20 years, equivalent to -1,381,953 tCO2-eq annually. Based on the total project area, this translated to -0.5 tCO2-eq per hectare per year. Despite these positive achievements the project fell short of achieving its intermediate targets for increasing water from improved availability of surface water for agriculture, and the CIC was not established. Also, the project fell short of achieving its PDO outcome target for GHG reduction, and the target for the Coefficient of Variation for Temporal Variability in pigeon pea was partially achieved. Overall, the ICR's body of evidence directly attributing the measured improvements in enhancing climate-resilience to the project's activities is assessed as methodologically sound and valid.

On balance, the Efficacy of the project in achieving this Objective is rated Substantial with moderate shortcomings.

Rating
Substantial

OBJECTIVE 2
Objective
To enhance profitability of smallholder farming systems in selected districts of Maharashtra.

Rationale
Theory of Change (ToC). To achieve the outcome of enhancing profitability of smallholder farming systems in selected districts of Maharashtra, the project supported improved agricultural practices that resulted in increased cropping intensity (discussed under Objective 1), and the project supported strengthening the capacity of FPOs which enabled farmers to secure preferential prices for their products, and the project supported post-harvest management and Value Chain Promotion. These activities were intended to produce the following key outputs: strengthened capacity of FPOs in climate-resilient value chains, and farmers adopting improved agricultural technologies and practices. The successful delivery of the afore-mentioned outputs would result in realizing the following intermediate outcome indicators: participation of farmers in in FPOs in value chains for climate-resilient crops and strengthen the supply chain for climate-resilient crop varieties, and strengthening the adaptive capacity of smallholder farmers to climate change. While the causal links from inputs to outcomes were direct, the inclusion of a marketing activity could have further strengthened the contribution of the project. The planned activities were adequate and could be expected to positively contribute to deliver the PDO if implemented successfully. A satisfactory project outcome would contribute in the long term to strengthening an inclusive growth path for smallholder farmers.

The ToC lacked critical assumptions that underpinned the achievement of the PDO. The same assumptions reported under Objective 1 by the project team applied.

Outputs/Intermediate Results

- 218 project-supported Farmer Producer Companies showed growth in annual profits exceeding the end target of 200 (target exceeded).
- The project supported 4,701 agribusiness proposals (through FPO DBT) of 1,698 Farmer producer companies (FPCs – of which 1,187 unique groups), 1,799 farmer interest groups (FIGs, 1173 unique groups) and 1204 women Self help groups (SHGs. 875 unique groups). Of the supported FPOs, 237 were women led.
- 2,779 custom hiring center (CHCs), 417 processing units, and 545 other agribusiness were supported no targets provided).
- 24,205 farmer took up certified seed production program on over 58,500 ha of land (no target provided).
- 8,250 training programs were conducted on sustainable agribusiness practices (no target provided).

Outcomes

- In total 1,365,233 farmers were reached with agricultural assets or services of which 354,960 were females. The total number exceeded the end target of 1,320,000, but the female target was partially achieved against the end target of 462,000.
- Net income in project areas increased from Rs. 33,000 to Rs. 75,000 (128% increase), while control areas saw a smaller rise from Rs. 38,000 to Rs. 51,000 (35% increase). The Difference-in-Difference (DiD) analysis showed an 88% increase in project areas, surpassing the 50% PDO target for income growth. For female-headed households, the income increase was 38% greater in project areas compared to control, slightly missing the end-target.

Summary of Efficacy Assessment. As noted above, the project was successful in increasing net farm income in project areas compared to control areas, but slightly missed its end target for female-headed households. This was achieved through higher income and reduced costs for farmers (nearly one-third reduction- according to the ICR, paragraph 41). On the income side, through project support, farmers were able to achieve higher productivity through increasing cropping intensity and applying improved practices including the use of better seeds. Also, participation in FPOs enabled farmers to secure preferential prices for their products. On the cost-reduction side, farmers benefited from access to Custom Hiring Centers (CHCs), which allowed use of machinery more quickly and at lower costs. Further, irrigation costs were lowered through the widespread adoption of drip and sprinkler systems, minimizing conveyance losses. These combined efforts contributed to enhanced profitability and overall economic benefits for the farmers. According to the ICR (paragraph 43) storage facilities established under the project reduced storage losses from 20% to 5%. Overall, the ICR's body of evidence directly attributing the measured improvements in enhancing profitability of smallholder farming systems is assessed as methodologically sound and valid.

Therefore, the efficacy of the project in achieving this Objective is rated Substantial.

Rating
Substantial

OVERALL EFFICACY
Rationale
Overall Efficacy is rated Substantial with moderate shortcomings. The project successfully enhanced climate-resilience of smallholder farming systems in selected districts of Maharashtra as discussed under Objective 1. However, the project fell short of achieving its PDO outcome target for GHG reduction, and the target for the Coefficient of Variation for Temporal Variability in pigeon pea was partially achieved. For Objective 2, the project was successful in increasing net farm income in project areas compared to control areas, but slightly missed its target for female-headed households.

Overall Efficacy Rating

Substantial

5. Efficiency

Economic a d Financial Analysis (EFA)

Ex-ante

- The project's economic rate of return (ERR) was estimated at 27%, with a corresponding NPV of US$ 517 million. The opportunity cost of capital was assumed at 6% (in line with other projects in India), and under an investment horizon of 15 years. The project's internal rate of return (IRR) was estimated at 24%, with a corresponding net present value (NPV) of US$ 470 million.
- A series of crop and farm budgets were developed for "With-Project" and "Without-Project" scenarios. Also, an analysis was also conducted incorporating the social value of carbon. On the basis of a net balance of -1.9 tCO2-eq per hectare and a social value of carbon starting at US$ 34.4 in 2018, the ERR was estimated at 170%.
- A series of sensitivity analyses were performed to assess the impact of a possible 30% shortfall in expected benefits, a possible 30% cost overrun, or a combination of both. Results showed that the return on the project's investment would remain above the opportunity cost of capital in the simulated scenarios.
- Overall, the PAD included a detailed EFA that justified the project investments.

Ex-post

- Overall, the project analysis (before integrating the benefits from carbon sequestration) estimated an economic internal rate of return (EIRR) of 19%, with an estimated NPV of US$612 million. The benefit-cost ratio was 1.43. A standard cost-benefit analysis of the project interventions was conducted to demonstrate that the project is financially and economically viable by comparing the 'with project' and 'without project' situations. The analysis largely followed the same approach at appraisal, but used a 20-year horizon compared to 15 years at appraisal.
- The stream of net incremental income generated by the project over a 20-year period, using a financial discount rate of 12%, yielded a financial net present value (NPV) of US$139.6 million and a financial internal rate of return (IRR) of 17%. The benefit cost ratio was 1.29.
- After incorporating the social value of carbon, and based on a net balance of -27,639,068 tCO2-eq and a social value of carbon starting at US$34.4 (at an exchange rate of US$1 = INR63.87 in 2018, to allow comparison with estimates at appraisal), the ERR was estimated at 52%.
- The sensitivity analysis tested the robustness of results to several adverse scenarios. This included a (1) reduction in net project benefits by 30%, 50% and 70% (stemming from a wide range of factors including lower adoption/higher attrition, higher input costs, lower output prices etc.), (2) external price or climate shocks that reduce the benefits every 2 or 3 years by 50%, and (3) delay in project benefits by one and two years. The results showed that the NPV remained positive under the different scenarios with an EIRR of 19% even with a 70 percent decline in project benefits. This indicated that the economic returns to project investments remain robust in even severely adverse scenarios.

Implementation Efficiency. The project was launched in 2018 and implemented over a period of six years (in line with PAD estimate) in 15 districts of the Marathwada and Vidarbha regions in Maharashtra, covering 4,210 villages affected by droughts, and 932 villages affected by saline and sodic soils. The project implementation benefited from a flexible, demand-driven approach and the use of the DBT system. According to the ICR (paragraph 47) the DBT system provided "a transparent and efficient funding mechanism, enabling high disbursement rates, full fund utilization, minimal leakages, and low transaction costs." Despite COVID-19 restrictions, the project activities were timely implemented and the project achieved close to 100% disbursement rate at completion.

Summary of Efficiency Analysis. The *ex-post ERR and IRR were both lower than the ex-ante estimates (EIRR: 19% compared to 27%, IRR: 17% compared to 24%).* That said, both rates at completion were higher than the discount rates used for the analysis as note above, indicating the project's economic profitability. Also, the inclusion of GHG benefits raised the ERR to 52%. Further, the results of the sensitivity analysis at completion showed that the economic returns to project investments remained robust even under adverse scenarios. The project also was timely implemented and achieved close to 100% disbursement rate at completion. Finally, the ICR (Annex 4) reflected a detailed and comprehensive EFA that adequately justified the project investments, and was methodologically sound to demonstrate the project efficiency.

On balance, Efficiency is rated Substantial.

Efficiency Rating

Substantial

a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal	✓	27.00	0 ☑ Not Applicable
ICR Estimate	✓	19.00	0 ☐ Not Applicable

* Refers to percent of total project cost for which ERR/FRR was calculated.

6. Outcome

Relevance of Objectives was rated High. Overall Efficacy was rated Substantial with moderate shortcomings. The project successfully enhanced climate-resilience of smallholder farming systems in selected districts of Maharashtra as discussed under Objective 1. However, the project fell short of achieving its PDO outcome target for GHG reduction, and the target for the Coefficient of Variation for Temporal Variability for pigeon pea was partially achieved. For Objective 2, the project was successful in increasing net farm income in project areas compared to control areas, but slightly missed its target for female-headed households. Efficiency was

rated Substantial. The *ex-post* ERR was higher than the discount (19% compared to 6%) and the inclusion of GHG benefits raised the ERR from 19% to 52%.

Based on the assigned ratings for the three outcome criteria (i.e. Relevance of Objectives, Overall Efficacy, and Efficiency), Outcome is rated Satisfactory.

a. Outcome Rating
Satisfactory

7. Risk to Development Outcome

The following risks could potentially impact the Development Outcome:

1. Environmental risk. This risk relates to the potential negative impacts of climate change on the development outcome. The project aimed to reduce risks from current and future climate extremes while generating income to buffer against shocks, with FPOs playing a key role in ensuring long-term sustainability. Twenty-nine resilience-enhancing production technologies, supported by ICT platforms, significantly boosted adoption rates.

2. Institutional risk. This risk relates to the institutional support and its impact of the development outcome. The project established institutional support mechanisms at various levels from state to district, FPOs, and village institutions. This ensures both technical knowledge and delivery systems for continued future activities. Also, the mainstreaming and planned scaling-up of PoCRA further strengthened confidence in sustained support, inspiring the MoA, GoI to develop a national-level program for different states, now in an advanced stage. This higher form of resilience is also captured by the state government through Project on Climate Resilient Agriculture- Phase II (P505563).

8. Assessment of Bank Performance

a. Quality-at-Entry

- **Strategic relevance and approach.** The project was strategically relevant and its PDO was in line with the WB strategy and the Government and State priorities (see Section 3 for details). The project aimed to enhance the capacity of farming systems in the most climate vulnerable districts of Maharashtra to better cope with the impact of extreme climatic events. The project was also expected to contribute to the country's international commitment to the global climate agenda.
- **Technical, financial and economic aspects.** The project design reflected a clear, focused, and realistic objective. The project featured a comprehensive design that reflected a multisectoral approach to resilience, incorporating water management, soil and land practices, and farm economics, with a focus on enhancing profitability through farmer organization engagement with markets. It also emphasized climate-resilient agriculture (CRA) that reflected three main elements: water use efficiency, improved soil management, and the adoption of climate-resilient seed varieties. Further, the project benefited from design flexibility to address diverse farmer demands

and emerging opportunities under changing climatic conditions. The design benefited from the WB experience in watershed projects in Karnataka and other agricultural commercialization initiatives across India. The PAD reflected a detailed EFA that justified the project investments.

- **Poverty, gender, and social development aspects.** The project prioritized support for marginal and small-scale farmers with less than 2 hectares of land, many of whom were near or below the poverty line. However, the ICR (paragraph 55) reported that "the poorest Scheduled Castes (SC) and Scheduled Tribes (ST) farmers, a smaller group in the project area, faced challenges accessing prepayment finance, particularly from formal channels." This indicated that the project design should have provided more focus to support Scheduled Castes (SC) and Scheduled Tribes (ST) farmers. The project design featured specific initiatives to enhance women involvement in the project activities. Several indicators were also sex disaggregated to capture women participation.
- **Environmental and Fiduciary aspects.** The project design reflected adequate environmental and fiduciary aspects.
- **Implementation arrangements.** The project was fully integrated in the GoM administration and implementation was designed to capitalize on existing GoM agencies at state, districts, sub-districts and village level. The project management was under a dedicated Project Management Unit (PMU). Overall, the implementation arrangements were adequate and took advantage of the decentralized nature of the public administration system.
- **Risk assessment.** The overall risk rating of the project was Moderate. Nine risks were identified at appraisal, of which the Institutional Capacity for Implementation and Sustainability risk and the Fiduciary risk were rated Substantial. The PAD reflected relevant mitigation measures. However, the risk related to the COVID-19 outbreak and the associated disruptions was unanticipated. Overall, the project design reflected a thorough risk assessment that reflected adequate mitigation measures.
- **M&E arrangements.** The PMU had the overall operational responsibility for planning and coordinating M&E activities to be implemented by a hired M&E consulting firm. M&E design was comprehensive covering baseline and impact assessment surveys, concurrent monitoring, to ensure high-quality, frequent reporting and tracking of progress across all project activities. The deign also included a well-designed RF that reflected deeper concepts of resilience and metrics around CSA efficiency.

Summary of Quality at Entry (QAE) Assessment. The project reflected a strategically relevant PDO. The project design featured relevant activities to achieve the stated objective. The design reflected adequate poverty and social development aspects. Also, environmental and fiduciary aspects were adequate. The implementation arrangements were adequate and took advantage of the decentralized nature of the public administration system. The project design reflected a thorough risk assessment that reflected adequate mitigation measures. Lastly, M&E arrangements reflected a comprehensive M&E design that was capable of tracking progress across all project activities.

Therefore, QAE is rated Satisfactory.

Quality-at-Entry Rating

Satisfactory

b. Quality of supervision

- The WB conducted 11 implementation support missions over the duration of the project. The Bank missions included technical scientific experts to assist with project execution and provide guidance. Also, frequent meetings with PMU monitored progress against agreed actions.
- The M&E system benefited from WB- organized thematic workshops that focused on MIS and Digital system. This emphasis on M&E, MIS, and collaboration with related agencies allowed for effective analysis and timely adjustments, refining baselines, targets, and methodologies during the Mid-Term Review.
- The WB provided consistent supervision and technical guidance. This regular and reliable support not only allowed the WB to offer frequent oversight, but also empowered the state with the confidence and flexibility to lead and innovate to build systems suitable for future mainstreaming and sustainability.

Summary of Quality of Supervision Assessment. The WB provided effective supervision and managed to successfully steer the project during the challenging time of COVID-19. The WB made timely adjustments, refining baselines, targets, and methodologies during the Mid-Term Review. Overall, the WB provided regular and reliable support that guided the project towards its successful completion.

Therefore, the Quality of Supervision is rated Satisfactory.

Based on the QAE and Quality of Supervision ratings, the overall Bank Performance is rated Satisfactory.

Quality of Supervision Rating
Satisfactory

Overall Bank Performance Rating
Satisfactory

9. M&E Design, Implementation, & Utilization

a. M&E Design

- The PAD did not include a ToC since it was not yet required by the WB at the time of appraisal. Nonetheless, the ICR included a ToC that reflected the relationship between the project activities, outputs, and outcomes. This Review outlined a ToC for each objective based on the detailed project description in the PAD and the ToC reported in the ICR (page 2, Figure 1).
- The achievement of the PDO was to be measured by five PDO outcome level indicators: 1. Increased water productivity at farm-level, 2.Improved yield stability (i.e. across time and space), 3. Net greenhouse gas emissions, 4. Farm income, by gender, and 5. Farmers reached with agricultural assets or services, by gender. The outcome indicators were relevant, measurable and directly connected to the PDO. However, the targets set at appraisal required adjustment when the baseline was updated during implementation.

- The Results Framework (RF) included 10 intermediate results indictors (IRIs) to track the different project activities and assess the achievement towards realizing the PDO. Most IRIs were relevant, measurable and connected to the stated activities.
- Overall, the M&E design was comprehensive covering all areas of baseline and impact assessment surveys, concurrent monitoring, and MIS. The design also reflected an adequate RF with relevant indicators that captured elements of resilience and metrics around CSA efficiency. However, the initial targets for GHG were overestimated, particularly regarding afforestation and the projected increase in soil biomass intensity.

b. M&E Implementation

- M&E implementation benefited from hiring capable and reliable teams to manage M&E, covering all aspects of surveys and concurrent monitoring. This ensured high-quality, frequent reporting and tracking of progress across all project activities (ICR, paragraph 65).
- By the Mid-Term Review, the results framework targets were revised based on updated survey data. Also, the methodology for cost-of-cultivation data collection and analysis was refined. These adjustments were adequate and reflected a more realistic RF that was based on updated survey data.
- Overall, M&E implementation was effective and provided a comprehensive assessment of project outcomes and the factors contributing to its achievements. However, the status and methodology used for the indicator on GHG could have benefited from more details. While the project did not track GHG emissions in the field, it could have more systematically monitored key parameters like soil carbon, fertilizer, and energy use. According to the ICR (paragraph 37) "no direct measurements were taken for soil carbon changes or emissions impacts from irrigation and fertilizer use; these effects were estimated."

c. M&E Utilization

- The project benefited from an effective M&E system which allowed close tracking of progress, activities, and expenditures, including a comprehensive Mid-Term Review (MTR). The project leveraged DBT, MIS, and other IT systems to foster positive competition among district teams through a performance index (ICR, paragraph 66).
- M&E reporting and evaluations enabled the project management to draw lessons, explore scaling-up opportunities, and identify key themes for future programs. The project team explained that "M&E evidence enabled Maharashtra to expand Climate-Resilient Agriculture Technologies to control villages using other government schemes, demonstrating early replication within project districts." Also, IA provided valuable insights for future state and national programming. Specifically, the team explained that "the project's M&E and Impact Assessment highlighted core elements for future initiatives: the importance of localized, science-based and demand-led planning; tailored climate-resilient technologies that address diverse farmer needs; stronger Farmer Producer Organizations and market linkages; and robust digital systems that enable transparency and adaptive management. They also confirmed the efficiency of the DBT mechanism, now integrated into the State's Maha-DBT system." The project also reflected a comprehensive approach to measure resilience and its connection to profitability, which could

serve as a model for other programs. However, the project could have benefited from better tracking of GHG emissions at the field level.

Summary of M&E Quality Assessment. The project benefited from a comprehensive M&E design that covered all areas of baseline and impact assessment surveys, concurrent monitoring, and MIS. The design also reflected an adequate RF with relevant indicators that captured elements of resilience and metrics around CSA efficiency. M&E implementation was effective and provided a comprehensive assessment of project outcomes and the factors contributing to its achievements. M&E utilization was evident in guiding project direction, revision of RF targets at the MTR, informing strategy development, and shaping future initiatives. However, a notable shortcoming was the lack of detailed monitoring or data collection to support an updated GHG analysis, which is a critical element of a climate oriented project.

On balance, M&E Quality is rated Substantial with moderate shortcomings pertaining to the limitation of the measurement of GHG emissions.

M&E Quality Rating
Substantial

10. Other Issues

a. Safeguards

- **Environmental Category and Safeguards.** This project was classified an environmental category 'B' (Partial Assessment). This classification was based upon the temporary and non-significant nature of most of its anticipated impacts. The project triggered two World Bank environmental safeguard policies and one social safeguard policy: Environmental Assessment (OP/BP 4.01), Pest Management (OP 4.09), and Indigenous Peoples (OP/BP 4.10). A Social Management Framework (SMF), a Tribal People Plan (TPPF) and an Environmental Management Framework (EMF) were prepared in line with the WB requirements. The EMF included an integrated pest management (IPM) plan for main crops to mitigate adverse impacts arising from use of pesticides. The EMF, SMF and TPPF were publicly disclosed by GoM on the website of Department of Agriculture and by the World Bank's Infoshop on November 30, 2017.
- **Compliance with the World Bank's safeguard policies.** According to the ICR (paragraph 68) "the project was fully compliant with all World Bank Operational Policies (OP) and had robust safeguards in place."

b. Fiduciary Compliance

- **Fiduciary Compliance.** The ICR (paragraph 70) reported that the project "experienced no negative audits or mis-procurement." The project supported the development of refined digital processing systems. This enabled financial management "to operate with considerable efficiency and

effectiveness (ICR, paragraph 70)." The financial management (FM) performance was rated Satisfactory and procurement performance was rated Moderately Satisfactory in the final ISR.

c. Unintended impacts (Positive or Negative)

None.

d. Other

The ICR (paragraph 57) noted that "the successful integration of the Village Climate Resilient Management Committee (VCRMC) and the Direct Beneficiary Transfer (DBT) system showcased significant progress. Additionally, there was a notable increase in the adoption of various innovations both within the state and beyond, reflecting the project's positive influence on broader agricultural practices and policies."

11. Ratings

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Satisfactory	Satisfactory	
Bank Performance	Satisfactory	Satisfactory	
Quality of M&E	Substantial	Substantial	
Quality of ICR	---	Substantial	

12. Lessons

The ICR included six lessons. The following three are emphasized with some adaptation of language:

1. To ensure the adoption of climate-resilient practices, farmers need to realize clear economic benefits and enhanced resilience against shocks. A demand-driven, incentivized technology package can boost both resilience and productivity, generating profits in the short, medium, and long term. This project demonstrated that significant progress could be achieved through deeper collaboration, particularly with FPOs, to strengthen economic resilience. Strengthening price stabilization mechanisms, enabling vulnerable farmers to access upfront finance, and leveraging DBT resources are crucial to overcoming investment barriers. Partnerships with progressive private sector players will be key to advancing these efforts.

2. To enhance climate resilience and mitigate GHG emissions, resource use efficiency must include better soil management, optimized fertilizer use, precision agriculture, and enhanced value chain efficiency to reduce waste. Resource use efficiency will be critical for climate

resilience, especially as climate extremes increase. Addressing soil and water efficiency is key, with PoCRA demonstrating how CSA enhances productivity, mitigation, and profitability. Future collaborations should focus on watershed and groundwater management, deepening analysis, monitoring, and participatory local planning. Understanding water reliance at the farm level is essential for identifying vulnerabilities.

3. To ensure the adoption and sustainability of climate-smart interventions, it is critical that farmers have timely access to services and inputs. Given the project's scale, a smart procurement approach was essential, with many procurement activities decentralized, involving thousands of contracts. The project's digital and DBT systems ensured that all committed funds were disbursed two months before closure, reflecting the efficiency of the procurement system and the state government's commitment.

13. Assessment Recommended?

No

14. Comments on Quality of ICR

- Quality of Evidence. The evidence base in the ICR was adequate to support the assessment of the project outcomes.
- Results Orientation. The ICR used the available data to the extent possible to discuss the achievement of the PDO.
- Quality of Analysis. While analysis of the project achievements was adequate, some areas could have received more attention including the impact of project on reducing GHG emissions.
- Internal Consistency. Various parts of the ICR were internally consistent and logically linked and integrated.
- Lessons. Lessons reflected the project experience and were based on evidence and analysis.
- Consistency with guidelines. The ICR used the standard structure defined in the Guidelines and used available evidence to justify the assigned ratings.
- Conciseness. Overall, the ICR was well written and concise, and candidly reported on most shortcomings. There was minor inconsistency. The ICR (paragraph 45) reported that the projected IRR was 22% with an NPV of US$415 million at appraisal, while the (PAD, paragraph 80) reported the IRR as 24% with a corresponding net present value (NPV) of US$470 million.

Summary of the Quality of ICR Assessment. The ICR provided a candid account of the project implementation experience. The assessment of outcomes was adequate. The lessons drawn by the ICR were relevant. Most sections were concise and reflected relevant information. Overall, the Quality of the ICR is rated Substantial.

a. Quality of ICR Rating

Substantial