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Environment and Social Management Framework

Project on Climate Resilient Agriculture in Maharashtra

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ENVIRONMENT AND SOCIAL MANAGEMENT FRAMEWORK

PROJECT ON CLIMATE RESILIENT AGRICULTURE IN MAHARASHTRA

Nanaji Deshmukh Krushi Sanjivani Prakalp

(Project of Government of Maharashtra in Partnership with the World Bank)

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Executive Summary

The primary goal of the Project on Climate Resilient Agriculture (PoCRA) was to enhance the resilience of smallholder farmers practicing rainfed farming against the impacts of climate change, ensuring stable and secure livelihoods particularly for vulnerable farming communities in 670 mini watersheds spread in 16 districts (Chhatrapati Sambhaji Nagar, Nanded, Latur, Parbhani, Jalna, Beed, Hingoli, Dharashiv, Akola, Amravati, Buldhana, Yavatmal, Washim, Wardha, Jalgaon and Malegaon subdivision in Nashik) of Maharashtra.

The project was classified as a Category B project under the World Bank's environmental classification. In collaboration with the World Bank, the Project Management Unit (PMU) developed comprehensive Environmental and Social Management Framework (ESMF) guidelines aimed at identifying and mitigating potential impacts effectively. An ESMF Audit was conducted to verify adherence to these guidelines and assess the effectiveness of mitigation measures throughout the lifecycle of the project.

Dataset from the PoCRA-MIS as well as from six questionnaire-based survey tools – i) FGDs with group of project beneficiaries (30); ii) 30 FGDs with Village Climate Resilience Management Committee (VCRMC), iii) 30 FGDs with project supported Farmer Interest Groups, iv) 30 FGDs with project supported Self Help Groups, v) In-Depth Interview (IDI) with the director of Farmer Producer Companies (45), and vi) Experts visit to project villages (12) were used to collect required data for the preparation of this ESMF report.

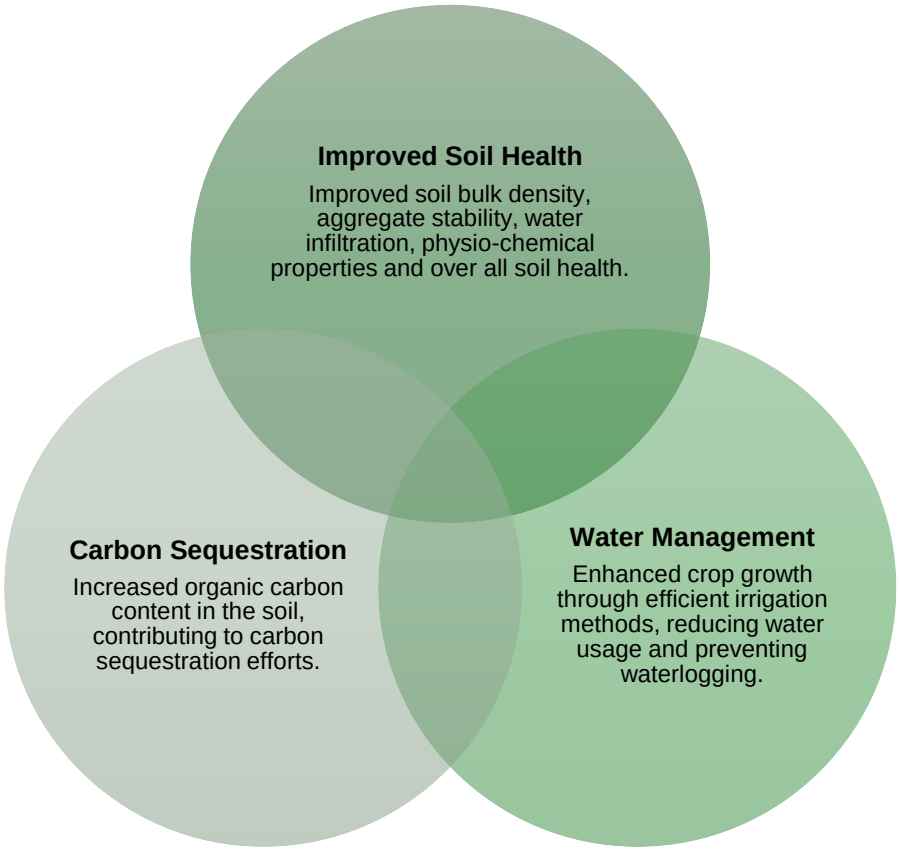
PoCRA project established institutional arrangements to ensure ESMF compliance across its components. A dedicated Project Management Unit (PMU) at the State level and a District Project Implementation Unit (DPIU) at district/sub-district levels have been responsible for monitoring project activities and ensuring adherence to environmental safeguard norms. At the village level, the Village Climate Resilience Management Committee (VCRMC) was established and capacitated to coordinate these efforts. Through the inclusive participation of villagers, the VCRMC developed village-level plans (VDPs) that were integrated at the cluster level to form mini-watershed plans. The village development plans and cluster development plans, which were in compliance with the Environmental Screening Checklist were approved and implemented under the project.

NRM planning integrated mini-watershed considerations and employed a revised water budgeting tool to identify water deficits and plan village water budgets effectively. This comprehensive approach included various soil and water conservation activities such as compartment bunding, gabion structures, contour trenches, and desilting of water storage structures. These efforts across 4,315 works covering

59,387 hectares resulted in significant improvements in soil fertility and groundwater levels through measures like recharge shafts.

37,184 FFS were organized to develop awareness among villagers to promote climate-resilient agriculture practices. It demonstrated an increase in the yield of cotton by 17%, soybean by 14%, pigeon pea by 16%, grams by 14%, turmeric by 13%, black gram by 18%, and green gram by 29% on average compared to control through the adaptation of different climate resilient cropping practices. The project promoted agroforestry and horticulture practices to increase carbon sequestration and reduce GHG emissions from the project area. Agroforestry was undertaken over 613 ha, and horticulture crops were cultivated in 29,270 ha. These activities led to carbon sequestration of 12 tonnes/acre/year and contributed to 2 million tonnes of CO_2 equivalent sequestration during the project implementation period. The project's environmental impact was evident from the significant increase in green cover and the utilization of barren land for agroforestry and horticulture, indicating substantial adoption of these practices by farmers.

The project significantly improved soil health, focusing on areas with high salinity and sodicity. The area affected by saline and sodic soils (Kharpan) across 932 villages was 3,62,587 hectares. Key interventions included raising awareness about soil salinity (94% of respondents reported awareness of salinity) and promoting Good Agricultural Practices (GAPs) to manage salinity and sodicity. GAPs were adopted on 1,46,826 hectares, surpassing the target of 1,27,600 hectares. Adoption of GAPs resulted in environmental benefits such as:



Protected cultivation covers 1,658 hectares and benefits 6,020 farmers. Key interventions included shade-nets and poly-houses that enabled off-season cultivation and improved resilience to climatic variations. The project also created awareness of the safe disposal of shade-net and poly-house materials, predominantly plastics and polymers, to prevent environmental contamination. Integrated Farming Systems (IFS) promoted by the project offered smallholder communities a dual opportunity to diversify livelihoods by integrating crops and livestock, enhancing climate resilience. Activities like backyard poultry, small ruminant rearing, apiculture, inland fishery, and sericulture have significantly

boosted income and resilience among beneficiaries. By the project's end line, there were over 5,000 beneficiaries of small ruminants (up from 2,945), 2,000+ beneficiaries of inland fisheries (up from 890), and 5,337 beneficiaries practicing sericulture across 1,860 hectares. Sericulture, particularly, aligns with SDG goals by promoting economic stability, environmental sustainability, and zero-waste practices.

Pest and Nutrient Management are critical components of the farming system due to their impact on costs, health hazards, soil health, and the environment. The project focused on IPM and INM through demonstrations in FFS. While 75% of farmers in control areas relied solely on chemicals, whereas 40% in project areas combined biological or organic methods with chemicals. The FFS also generated awareness of proper disposal of agrochemical containers, Surveillance of pest attacks, and Seed treatment to manage pesticide utilization in the area.

Vermicomposting, NADEP, mulching, intercropping, and FYM applications were promoted to enhance soil fertility. The IPM and INM practices contributed to a reduction in greenhouse gas emissions and promoted sustainable agricultural practices. They helped maintain soil fertility, reducing chemical fertilizer dependence, and improving overall soil health, thus mitigating environmental impacts associated with conventional farming practices.

The community and individual farm ponds enhanced water availability for irrigation, with 2,695 community ponds and 5,241 individual ponds (714 without lining and 4,527 with lining) constructed and successfully generated a water storage capacity of around 30,375 TCM through individual and community farm ponds across the project districts.

The project also focused on replenishing groundwater through initiatives like rainwater harvesting and surface runoff redirection. This effort improved water availability for farmers during dry spells by 13% and increased water availability for the Rabi season by 5%. These measures also contributed to an 8% expansion in cultivated land during the Kharif season, demonstrating their impact on agricultural resilience. Micro-irrigation systems, including drip and sprinkler irrigation, were widely adopted across project areas, benefiting 4,31,328 farmers over 4,88,747 hectares. These technologies not only conserve water but also reduce production costs.

Water pumps facilitated efficient water distribution for micro-irrigation, aiding 31,373 farmers, and contributing to a 24% higher increase in cultivated land for the beneficiaries. The project promoted the use of capacitors with electric pumps and BEE 5-star rated pumps, reducing energy consumption and operational costs.

The environmental audit highlighted significant achievements through the adoption of pipes (HDPE/PVC) in micro-irrigation systems and their broader impacts. Across project areas, 27,633 farmers benefited from improved water distribution systems. The beneficiaries experienced an 18% increase in cultivated land during the Rabi season, a 23% boost in production during the Kharif season, and a 15% rise in annual income, demonstrating the efficiency and effectiveness of these systems in optimizing water use. Moreover, the project emphasized knowledge dissemination and proper practices, 50.6% of respondents in project villages knew how to extend the life of pipes, compared to only 18.3% in comparison villages. Additionally, 64.6% of respondents in project villages had reported proper disposal practices for damaged pipes, highlighting enhanced waste management efforts.

Post-harvest Management and Value Chain Promotion component in the project focused on strengthening Farmer Producer Organizations (FPOs) by providing essential infrastructure and promoting sustainable practices.

Only those FPO proposals that were found compliant with Environmental Screening Checklist B (as per the EMF document) were approved under the project. This component included construction activities, hence compliance with guidelines for construction, operation, and maintenance activities was ensured

by the project. The project facilitated 4,701 proposals from Farmer Producer Organizations (FPOs), including 1,698 Farmer Producer Companies (FPCs).

The infrastructure under this component included the promotion of Custom Hiring Centres (CHCs) that provided fuel-efficient and technology-efficient (30%-time savings and 8-10% reduction in cost of cultivation) farm machinery, mechanizing an area of 8,33,700 hectares. Additionally, the project supported the construction of storage facilities, primary and secondary processing, seed processing, etc. The project assisted in the creation of 1,80,836 MT of storage capacity for various commodities and 11,560 MT for onions. FPOs utilized this infrastructure effectively, managing 2,57,532.22 MT of produce annually.

Furthermore, the project enhanced FPO capacities through training programs and exposure visits, improving governance, financial management, and operational transparency. Overall, these interventions have significantly reduced post-harvest losses, improved market access, and increased farm incomes, benefiting approximately 2,33,976 farmers directly or indirectly.

The project prioritized Agro Advisory Services, delivering timely and localized information crucial for informed decision-making and risk mitigation against climate and market uncertainties. Utilizing a GIS-based MIS, PoCRA enhanced farm productivity and income by providing tailored advisories on weather forecasts, seed varieties, IPM, INM, and sustainable agronomic practices through SMS, mobile applications, and WhatsApp messages. In project areas, 62% of farmers benefited from these services, compared to 39% in non-project areas. The project's digital infrastructure integrated APIs from various departments to deliver relevant advisories efficiently.

The training and capacity-building initiatives under PoCRA were extensive, encompassing 77,145 on-ground sessions and 11,348 online (COVID-19 pandemic) webinars. These efforts disseminated climate-resilient agricultural practices to approximately 24 lakh farmers, demonstrating the project's commitment to fostering knowledge exchange and enhancing agricultural resilience.

The project successfully integrated inclusivity and equity principles throughout its implementation. The composition of all Village Climate Resilient Management Committees (VCRMCs) was inclusive, ensuring mandated representation from SC/ST, women farmers, and women Self-Help Group (SHG) members, including marginal and small farmers. Women's participation in VCRMCs strived for 50% representation, allowing them to directly influence decision-making processes and address the needs and demands of women for climate-resilient agricultural practices. Consequently, women became actively involved in social and administrative decision-making, with 25,733 women serving as executive members in the VCRMCs. Furthermore, the committees ensured two-thirds representation from marginalized (up to 1 ha. land holdings) and small landholders (up to 2 ha. land holdings) to guarantee fair beneficiary selection and provision of just benefits at the village level.

VCRMCs worked diligently to ensure marginalized communities, including tribal groups, benefitted from the project. This included raising awareness about the Direct Benefit Transfer (DBT) system and assisting with the application process via portal/mobile. Over two million farmer applications were processed by VCRMCs. The DBT system proved highly beneficial, eliminating intermediaries and supporting small and marginal landholders, as well as landless families, in adopting climate-resilient technologies and practices. Among the DBT beneficiaries were 13,332 SC, 6,288 ST, 1,423 persons with disabilities (PWD), and 1,783 landless women, out of 5368 landless individuals. The farmer distribution included 45% small farmers, 34% marginal farmers, 20% other landholding category farmers, and 1% landless beneficiaries.

The social audit system and digitization of DBT ensured process transparency and local project ownership. Social audits were conducted in 3,874 gram panchayats with 1,68,457 stakeholders participating, including 1,24,435 males (74%) and 44,022 females (26%), demonstrating active

community engagement. Real-time information on application processing reduced system ambiguity, encouraging farmers to adopt climate-resilient activities.

Krishi Tais played a crucial role in raising awareness among small, marginal, and women farmers through door-to-door communication, sharing VCRMC meeting proceedings, motivating people to benefit from the project, and mobilizing women for Farmer Field Schools (FFS). A total of 15,501 host farmers participated in FFS, with 15% being women. Additionally, 4,90,780 guest farmers participated, with 14% being women.

Social and institutional capacity development were key to the project's success. Beyond awareness generation and training, e-Gram Sabhas were conducted to form online VCRMCs, especially during the pandemic period through a special government resolution, resulting in the formation of 764 VCRMCs.

The project also collaborated with the government's digital literacy program, Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMG-DISHA), to enhance stakeholders' IT skills. Under PMG-DISHA, 2,31,339 women stakeholders were registered in 3,071 gram panchayats, with 1,86,767 (80.73%) completing their digital literacy training. A total of 1,30,214 participants received certification after completing 20 hours of digital literacy training.

Strategic partnerships with government institutions facilitated capacity training programs, seminars, workshops, webinars, and exposure visits. Cumulatively 76,966 training and workshop events were conducted, benefiting 14,88,567 participants, including 4,12,890 (28%) women and 10,75,677 (72%) men. The interventions for Farmer Producer Organizations (FPOs) and Farmer Producer Companies (FPCs) improved marketing systems, processing, and value addition for farm produce, creating better opportunities for small and marginal farmers to access various benefits.

Through its holistic vision and overarching goal to enhance climate resilience and profitability of smallholder farming systems in the most drought- and salinity-affected regions of Maharashtra, the PoCRA project addressed several Sustainable Development Goals. The project should be commended for its large-scale promotion and adoption of climate-resilient agricultural practices while maintaining a strong focus on social inclusivity and transparency throughout its duration.

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1. Project Introduction

1.1 Background of the Project

The Government of Maharashtra approved a Project on Climate Resilient Agriculture (PoCRA) in 2018 to address the drought-related vulnerability in the agriculture sector with the support of the World Bank. The project aimed to enhance the resilience of the farmers practicing rain-fed farming and generate mitigation strategies to avoid the impacts of climate change. It envisages to ensure stable and secured livelihoods for the vulnerable farming communities in the state. The project was targeted at sustainable climate-resilient agriculture, sustainable water source augmentation, efficient use of resources, and strengthening of the value chain. Therefore, it was designed to promote better natural resources and environmental quality management. The safeguard operational policy triggered for the Environment Assessment is OP 4.01, for Pest Management OP 4.09, and for Indigenous Peoples OP/ BP 4.10. As the likelihood of the project's social and environmental negative impact is minimal, it was classified as a category B project (partial assessment) under the World Bank environmental classification of the projects. PoCRA in collaboration with World Bank has developed the Environmental and Social Management Framework (ESMF)- for environment management and social management.

1.2 Project Area

An End Term environment audit survey was conducted in the year 2024 in the 16 districts of the Project area (Figure 1). A total of 898 villages were included under the PoCRA in the study area. A questionnaire-based survey was undertaken among the beneficiaries, VCRMC, project staff, sub-divisional agriculture officer, and PoCRA-PMU to complete the end-term environmental audit of the project implementation. The data available in the DBT portal for different activities implemented under the project was collected for quantitative analysis of the project objectives.

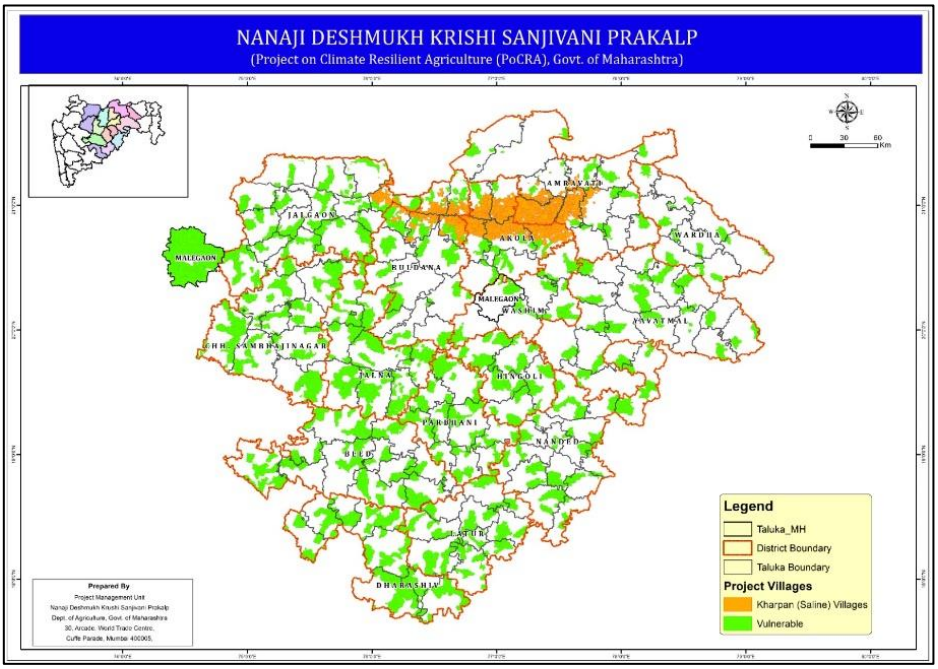

Figure 1: Project area under the present ESMF audit

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2. Policy and Legislative Framework

The project complied with central government policies and legislations and Maharashtra state policies for environmental regulations.

2.1 Central Government Policies and Legislation

The project aligns with various central government policies and legislation, including:

- **National Environment Policy 2006:** Focusing on environmental conservation and sustainable development.
- **National Water Policy 2012:** Emphasizing integrated water resource management.
- **Policy on Abatement of Pollution 1992:** Aiming to reduce pollution levels.
- **National Conservation Strategy & Policy on Environment & Development 1992:** Promoting sustainable practices.
- **National Agriculture Policy, 2000:** Addressing agricultural development.
- **The Water (Prevention and Control of Pollution) Act, 1974:** Regulating water pollution.
- **The Environment (Protection) Act, 1986:** Ensuring environmental protection.
- **The Solid Waste Management Rules, 2016, and The Plastic Waste Management Rules, 2016:** Managing waste effectively.
- **Hazardous Wastes (Management and Handling) Rules, 1989:** Handling hazardous materials.
- **Insecticides Act 1968 and Insecticides Rule 1971:** Regulating insecticide use.
- **Construction and Demolition Waste Management Rules, 2016:** Managing construction waste.
- **Policy for Abatement of Pollution, 1992:** Addressing pollution control.
- **National Research Centre for Integrated Pest Management (IPM) and National Innovations on Climate Resilient Agriculture (NICRA):** Advancing climate-resilient agriculture.

The project also adheres to specific Maharashtra state policies:

- **Water Policy 2003:** Focusing on integrated water resource development and management, public participation, and technology dissemination.
- **Maharashtra Groundwater (Development & Management) Act, 2009:** Prohibiting groundwater contamination and deep well drilling, with safety monitoring requirements.
- **Maharashtra Felling of Trees (Regulation) Act, 1964 and Guidelines for Tree Felling and Transit Permission, 2017:** Regulating tree felling and compensatory plantation.
- **Circulars of the Maharashtra Pollution Control Board on Poultry and Cattle Sheds:** Providing guidelines for poultry and cattle sheds regarding location, sanitation, and waste disposal.

Adherence to these policies ensured environmentally responsible practices being implemented in the project.

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3. ESMF Audit

The Project on Climate Resilient Agriculture (PoCRA) aimed to enhance the resilience of smallholder farming systems in Maharashtra. Classified as a Category B project under the World Bank's environmental classification, PoCRA is expected to have minimal negative environmental and social impacts, warranting a partial assessment. In collaboration with the World Bank, the Project Management Unit (PMU) has developed comprehensive Environmental and Social Management Framework (ESMF) guidelines. These guidelines were designed to ensure that any potential environmental and social impacts are effectively identified and mitigated.

The primary objective of the ESMF Audit was to evaluate whether the key concerns identified within the ESMF guidelines have been successfully mitigated. This audit aimed to verify the adherence to the outlined procedures and assess the effectiveness of the mitigation measures implemented throughout the project lifecycle.

3.1 Environment Management Framework (EMF)

The Environmental Audit has been crucial for identifying the environmental strengths and weaknesses of a project after its implementation. This audit has helped capture the progress of the project's efforts to implement the environment management plan as well as to pinpoint any gaps or deviations from the original project management plan. The EMF has outlined the responsibilities of project stakeholders, procedures for environmental safeguards screening, and strategies for enhancing institutional capacity. The key components of the EMF have included Screening of the following:

Legal and Regulatory Compliance	INM and IPM	Environmental Management Guidelines	Progress in the Capacity Building Plan	Institutional Management
- Verification of project activities for compliance with the policies of the Government of India/Maharashtra and the World Bank's safeguard policies. - Ensuring all legal and regulatory requirements have been met.	- Assessment of implementation of the Integrated Pest and Nutrient Management Plan (IPNMP) as specified in the EMF document of PoCRA. - Ensuring sustainable pest and nutrient management practices are in place.	- Checking the adherence to the environmental management guidelines outlined in the EMF document of PoCRA. - Verifying the implementation of mitigation measures and adherence to assigned responsibilities.	- Review of progress and effectiveness of the capacity building plan, which has included training and IEC (Information, Education, Communication) activities for various stakeholders. - Determining the success of capacity building efforts under PoCRA.	- Evaluation of institutional management aspects of the Environmental Management Plan as outlined in the PoCRA EMF. - Ensuring the institutions involved have been effectively managing and implementing the environmental safeguards.

3.2 Social Management Framework (SMF)

The Social Management Framework of PoCRA has been prepared considering the exclusion and vulnerabilities faced by socially deprived landholders, tribal people, indigenous people, landless, and women. It aims to reduce distress such as higher production costs, low or stagnant farm productivity, lack of market access, degrading land resources, and the impacts of climate change among vulnerable populations.

The project has envisaged extensive capacity development for small and marginal farmers as well as project functionaries. There has been an exclusive strategic focus on greater inclusion and proportionate representation of tribal populations in non-scheduled areas and their active association in project interventions in tribal-habituated areas. The project has also supported greater participation of women, with a special focus on women-specific issues across different project components, which

has helped women achieve better participation and decision-making along with benefiting from the project interventions.

For long-term sustainability and inclusion of marginal groups, the emphasis has been on the participation and involvement of community institutions not only for the identification of beneficiaries but also for their involvement in the planning, implementation, and monitoring of project activities.

The main objective of the social audit has been to understand the implementation and outcomes of various measures that have been taken to mitigate negative social impacts, such as inequalities and disparities, at various stages of the project cycle.

SMF audit has referred to the baseline and end-term data and has thoroughly studied the following:

3.3 Approach

Inclusion of MF/SF/ marginalized social groups	Tailor-made training and capacity building	Inclusion of tribal people	Citizen grievance redressal system	Transparency and accountability
• - Project implementation documents • - VCRMC records and discussions to check the selection of beneficiaries • - Social audit activities undertaken by VCRMC • - Inclusion of MF/SF/ marginalized social groups at cluster level planning through discussion with SDAO/VCRMC /KVK/PMU • - Discussion with key project staff • - Participation and decision-making by MF/SF/ marginalized social groups	• - Gender action plan documents of PMU • - Inclusion and participation of women in VCRMC, training/capacity building activities • - Participation of women in FFS, FPC, FIG, cluster level planning • - Inclusion of women across social groups in SHG, access to matching grant support/credit accessibility • - Access to farm machinery and introduction of women-friendly farm machinery	• - Representation and participation in VCRMC, • - Implementation plan of Tribal peoples' framework by PMU • - On-farm guidance to tribal people • - Training/capacity building activities conducted for tribal community • - Participation of tribals in FFS, FPC, FIG, demonstration of climate resilient agricultural systems • - Access to subsidy/credit accessibility • - Access to farm machinery	• - Grievance redressal framework at village, cluster, SDAO, DSAO, and PMU levels • - Number of grievances received from marginalised community and women in particular • - Number of grievances addressed • - Time consumed in decision making	• - Accessibility of the documents by the community • - Record keeping of VCRMC • - Suo motu disclosure of the project activities with beneficiary details through real-time Village Profile made available in public domain • - Communication of physical and financial achievements under the cluster development plan

The ESMF framework proposed by PoCRA suggests the following steps to be considered at the cluster level based on the time steps defined:

1. Review of the ESMF guideline that has been prepared and provide suggestions for modifications if any for the collation of cluster-level disaggregated data and information.
2. Review and revisit the environmental and social impacts under various components identified for implementation in the PoCRA and contextualize the unit of analysis.
3. Development of criteria for screening of interventions and categorization as high, mid, and low risk for all clusters selected.
4. Identification of mitigation measures for adverse impacts at the cluster level.
5. Checking the compliance of the ESMF with applicable legislation, policies, and regulations of the government at the Central and State levels.
6. Identify roles and responsibilities including reporting procedures.
7. Conclusion

For the above steps 1 to 4, the ESMF guideline (two volumes of EMF and one volume of SMF) was thoroughly studied to understand the scope of work under the audit. Step 5 clearly states to systematically examine the compliance with the legal, policy, and regulatory framework in the country. Details of project outputs and outcomes have been summarized, which will form the base for the audit. Proposed measures have been assessed at the unit at which analysis is undertaken. For meeting the audit objective, a list of project component-wise indicators under both EMF and SMF has been prepared for which compliance with guidelines has been checked. For data/ information on the listed indicators, in addition to what is already available through the baseline and mid-term reports or other secondary sources such as project MIS, primary data requirements for collection at the field level have been assessed. For each indicator, a key respondent (identified among key project stakeholders including beneficiaries) was identified for whom a set of compliance-related questions was designed. This set of ESMF-related questions was a part of end-term tools which were administered during end term survey. The key respondents for the audit were interviewed in the select project clusters. Based on the analysis of audit findings, and the exercise listed in steps 6 to 7 it has been concluded whether the compliance of the environment and social safeguards has been satisfactory or not.

3.4 Methodology

A total of six survey tools (one for quantitative and five for qualitative data) were designed for the end-term evaluation. Number of beneficiaries and stakeholders surveyed is as provided below:

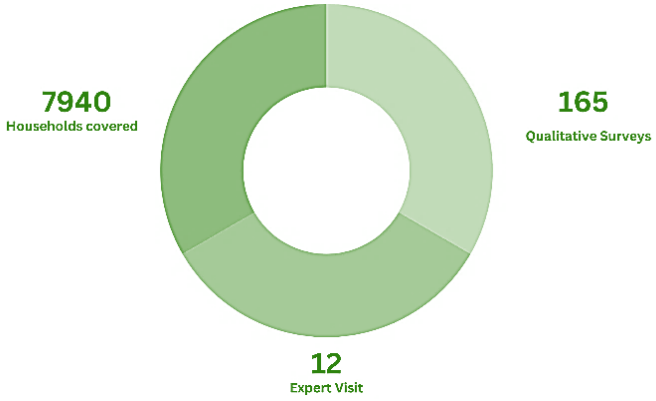

Figure 2: Survey tools used

Table 1: Quantitative and Qualitative Survey

Quantitative Survey	Project	Comparison	Total
Clusters	449	449	898
Households covered	**4,490**	**3,450**	**7,940**
Qualitative Survey			**Total**
FGDs with a group of project beneficiaries (Coverage: 30 villages)			30
FGD with Village Climate Resilience Management Committee (VCRMC)			30
FGD with project-supported Farmer Interest Groups (FIGs)			30
FGD with project supported Self Help Groups (SHGs)			30
In-Depth Interview (IDI) with Farmer Producer Companies (FPCs)			45
Total			**165**

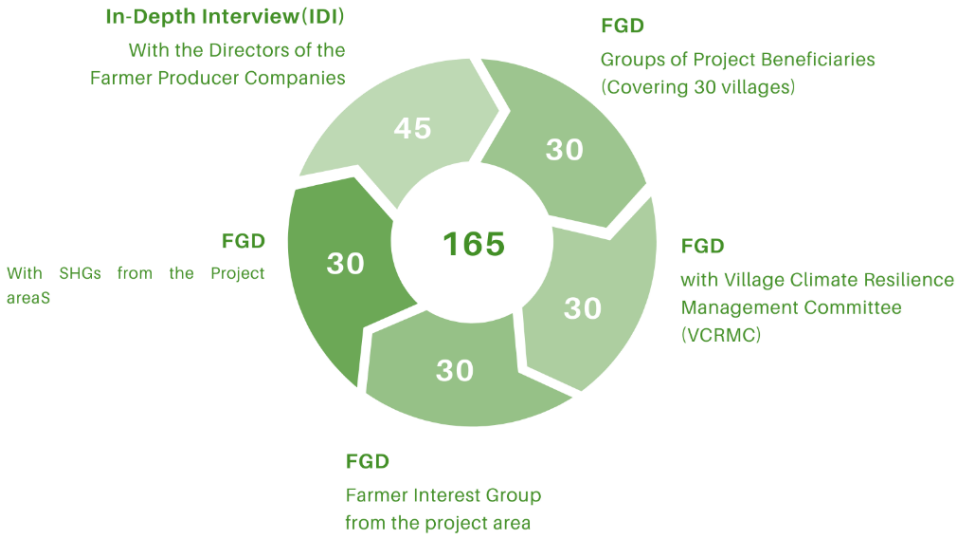

Figure 3: Qualitative surveys conducted

The key research areas related to environmental assessment that were incorporated in the household questionnaire are as follows:

Table 2: Components and Thematic questions

Component	Thematic questions
Watershed Development	Participation in community institutions Participation in the planning process Water availability, new sources of irrigation created Increase in the area under crops
Climate Resilient Agriculture	Increase in crop productivity Reduction in cost of cultivation Construction of water harvesting structures Use of moisture conservation methods Use of climate-resilient seed varieties Introduction and adoption of new technologies Diversification in crops for high-value agriculture Adoption of protected cultivation methods Use of micro-irrigation methods Soil health and related issues like salinity, sodicity, etc. Improvement in soil organic matter Plantation of fruit trees
Alternative source of Income	Increase in income through the adoption of allied activities: fisheries, backyard poultry, sericulture, etc. Participation in collectives – FPO/FIG/FPC

Component	Thematic questions
	Collective sale of produce or purchase of inputs Increase in farm income through value addition or storage
Capacity Building	Farmers Field School. Training and exposure visits. Awareness about waste disposal. Safety precautions and health concerns while using chemicals.

Questions related to the ESMF audit were a part of each survey tool to collect environmental and social impact-related data. A separate checklist of ESMF questions for key project staff especially agriculture assistants, technology-coordinators, and host farmers was prepared and administered in the villages covered under the qualitative sample. The survey also included key expert visits to the project area.

3.5 Project Development Objective and Project Components

As per the Project Appraisal Document of the World Bank, the project development objective was to enhance the climate-resilience and profitability of smallholder farming systems in selected districts of Maharashtra. The project is built around a comprehensive, multi-sector approach that focuses specifically on building climate resilience in agricultural production systems through scaling up the adoption of climate-resilient technologies and practices.

PoCRA was built around a comprehensive, multi-sector approach that focuses on building resilience in agricultural production systems while generating the following interdependent triple-win solutions:

- Enhanced water security at the farm level through the adoption of technologies for more productive and efficient use of water for agriculture, the increase in water storage capacity (surface and sub-surface), and improvement in water distribution structures to address on-farm water availability and reduce the risks associated with intra- and inter-seasonal climate variability.
- Improved soil health through the adoption of good agricultural practices to improve soil fertility, soil nutrient management, and promote soil carbon sequestration.
- Increased farm productivity and crop diversification by adopting climate-resilient seed varieties (short maturity, drought, and heat resistant, salt-tolerant) and market-oriented crops with a clear potential for income security derived from the integration of smallholder Farmer Producer Companies (FPCs) in emerging value chains.

To achieve the above project development objective, the project was operationalized through four key components and sub-components:

Table 3: Components and Objective

Component	Objective
Component A: Promoting climate-resilient agricultural systems	
A.1: Participatory development of mini watershed plans	To develop evidence-based mini watershed plans and cluster development plans
A.2: On-farm climate-resilient technologies and agronomic practices	To promote the transfer of on-farm technologies and agronomic practices that enhance climate resilience in the agricultural systems
A.3: Climate-resilient development of catchment areas	To enhance the management of surface water and groundwater resources in the catchment areas of the project's mini watersheds

Component	Objective
Component B: Post-harvest management and value chain promotion	
B.1: Promoting Farmer Producer Companies	To strengthen the capacity of Farmer Producer Organizations (FPOs)
B.2: Strengthening emerging value-chains for climate-resilient commodities	To promote the participation of FPOs in emerging value chains for climate-resilient commodities
B.3: Improving the performance of the supply chain for climate-resilient seeds	To improve the supply of seed varieties with short-duration cycles and features tolerant to drought, salinity, or heat for crops produced by small and marginal farmers
Component C: Institutional development, knowledge, and policies for a climate-resilient agriculture	
C.1: Sustainability and institutional capacity development	To strengthen the institutions associated with the project from central to local levels through capacity development
C.2: Maharashtra Climate Innovation Centre	To establish a Climate Innovation Centre (CIC) to support local private sector capacity in scaling up technologies for a climate-resilient agri-food system in Maharashtra
C.3: Knowledge and policies	To generate and disseminate cutting-edge knowledge on a range of issues related to climate-resilient agriculture and provide inputs to improve the policy and strategy framework
Component D: Project management	
Project Management	To ensure the efficient and effective overall management of the project through a Project Management Unit (PMU) established by the Department of Agriculture (GoM)

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4. ESMF Audit findings

The following section details the component-wise assessment of progress made by the project under various activities.

4.1 Component A- Promoting Climate-Resilient Agricultural Systems

A.1. Participatory development of watershed plans

The project ensured proper institutional arrangements for EMF compliance of the project components. A dedicated project team was established at both PMU and at the district/ sub-district level for monitoring of project activities to ensure compliance with the environmental safeguard norms. The VCRMC was capacitated by the District Project Implementation Unit (DPIU)

Each mini watershed Plan was formed in compliance with the Environmental Screening Checklist. Each checklist captured the different thematic components of the project like the regulatory requirements, identification of the potential environmental impacts, and verification against the list of non-permissible activities. The checklist also incorporated the baseline conditions to form a sustainable mini-watershed plan. The Village Climate Resilience Management Committee (VCRMC) coordinated the entire process through participatory approaches with the farming community, wherein the micro plans are conglomerated to form a mini-watershed development plan. This plan underwent technical vetting by the technical experts at the district level.

In several project villages, various natural resource management initiatives were carried out in accordance with the village micro-action plan created by the VCRMCs. The villagers participated in developing socially inclusive plans for resource management, agribusiness, and individual farm improvements. At the cluster level, these village-level plans were integrated to create a mini watershed plan. 5,043 village development plans and 138 cluster development plans were approved and implemented. SDG target 10.2 (empower and encourage the social, economic, and political inclusion of all, irrespective of age, sex, handicap, race, ethnicity, origin, religion, or economic or other status) is specifically addressed by this participatory development of mini-watershed. The active participation of the VCRMC in the mini watershed development project also addresses SDG 5.5 (Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic, and public life).

A.2. On-farm climate-resilient technologies and agronomic practices

A.2.1. Demonstration of climate smart agricultural activities

The project was implemented to enhance the resilience of the farmers against climatic stressors and to increase the adoption of climate-resilient agricultural practices. To ensure end-to-end knowledge dispersion of agronomical and climate-smart technologies at the grassroots level the project created a network of ground-level facilitators. This ensured that stakeholders had the necessary knowledge and skills to adopt and sustain climate-resilient practices. Farmer Field Schools are responsible for the dissemination of technological demonstrations, knowledge on climate-resilient technologies, integrated pest management, application of fertilizers, etc. which in turn has resulted in higher adoption of these technologies across the project area.

Farmers Field Schools have adopted an interactive and participatory approach to on-site learning. It was implemented at the village level, coordinated by the Village Climate Resilience Management Committees (VCRMC), and supported technically by the Agricultural Technology Management Agency (ATMA) extension staff and Krishi Vigyan Kendra (KVK) scientists.

Farmers field schools (FFS) were used in several districts to participate in the demonstration of climate-smart agronomic methods. FFS activities were set up in the fields of selected host farmers. FFS was operationalized at the village level under the coordination of the VCRMC and with the technical backstopping of ATMA, and the scientists from local KVKs. The FFS incorporated a variety of climate-

resilient agronomic practices. Contour cultivation, broad bed furrow cultivation, furrow opening, mulching, conservation tillage, biomass inclusion, integrated farming system, integrated nutrient management, and integrated pest control are some examples of this.

Climate-smart agronomic practices were shown in multiple districts through the use of farmers' field schools (FFS) The FFS integrated multiple agronomic approaches that are adaptable to climate change. Examples of this include intercropping, seed treatment, canopy management, contour cultivation, broad bed furrow cultivation, Furrow opening, conservation tillage, mulching, integrated farming systems, integrated pest control, integrated nutrient management, and so on.

In 4,800 villages, 37,184 Farmer Field Schools were conducted. 15,501 host farmers took part in FFS.

FFS demonstrated an increase in the yield of cotton by 17%, soybean by 14%, pigeon pea by 16%, grams by 14%, turmeric by 13%, black gram by 18%, and green gram by 29% on average compared to comparison area through the adaptation of different climate resilient cropping practices. A large number of FFS participatory farmers adopted different climate-resilient agriculture practices in the project area as evident.

A.2.2 Enhancement in carbon sequestration

The project promoted several agronomic practices and agriculture activities to increase carbon sequestration and reduce the GHG emissions from the project area. The carbon captured from the plantation of trees and orchards in upper catchment areas and along the contour lines has helped in increasing the soil's organic carbon content. The project intervention i.e. agroforestry has the potential to contribute to SDG 13 i.e. contribution to resilience to climate change effects. It was estimated that the project activities can avoid about 3.2 million tonnes of CO_2 equivalent carbon emissions from the project implementation area as compared to the comparison areas.

A.2.2.1 Agroforestry and horticulture plantation

The project supported the development of agroforestry in catchment areas (for an aggregate area of 613 ha) as well as fruit tree cultivation on farmland (29,270 ha), e.g. *Aonla* (Indian gooseberry), Citrus, Custard apple, Guava, Mango, and Pomegranate. Farmers were expected to establish these plantations on currently fallow or less productive cropland. The agroforestry and horticulture activities of the project led to the biomass sequestration of 12 tonnes/acre/year.

A large number of farmers in different districts have adopted on-farm agroforestry – farm border agroforestry and horticulture. A significant increase in green cover and simultaneous decrease of the barren land in the project villages compared to no project areas indicates substantial activity of agroforestry in the project villages compared to no project villages.

During the field visit, it was evident that farmers had adopted horticulture crops leaving cotton cultivation and farmers utilized barren areas for agroforestry. The agroforestry and horticulture activities in the project area accounted for about 2 million tonnes of CO_2 eq sequestration during the project implementation period.

A.2.3 Improvement of saline and sodic lands

Improved soil health was an important outcome of the project to ensure climate resilience. Various activities have been proposed in the project including agriculture practices to improve fertility, soil nutrient management and promote carbon sequestration. In addition, there was a huge focus on villages affected with high levels of salinity and sodicity.

Awareness about soil salinity

Soil salinity was a major challenge in the project area leading to loss in productivity, increased cost of cultivation, etc. Soil salinity was observed in the Purna river basin of the project area. The vertisols of the Purna Valley, which covers the districts of Amravati, Akola, Buldhana, and Jalgaon, lack any perceptible evidence of salt efflorescence on the soil surface. Plant growth is adversely affected by the

effect of excess salts on the osmotic pressure of soil solution resulting in reduced availability of water to plant roots. Salinity in the Purna river basin rendered the ground water unfit for irrigation.

The soil sodicity in the south-western part of the valley was attributed to the semi-arid climatic conditions that have induced the pedogenic process of depletion of calcium ions from the soil solution in the form of calcium carbonate, thereby resulting in an increase of both the sodium adsorption ratio (SAR) and the ESP with pedon depth.

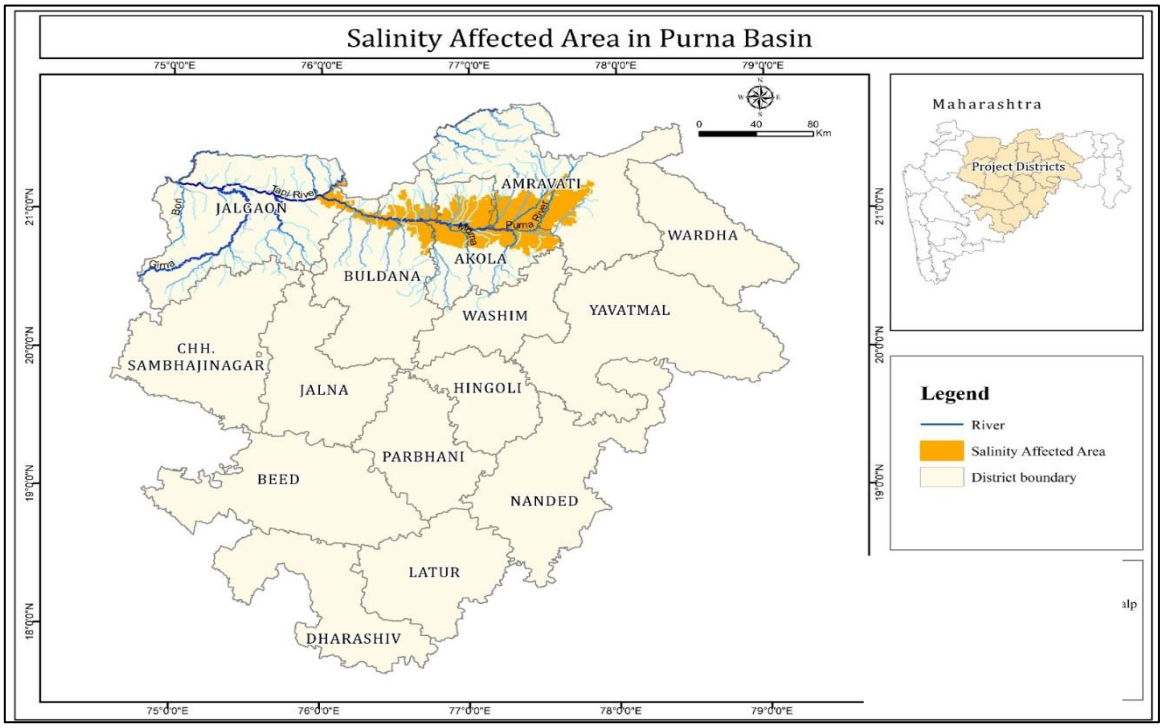

Figure 4: Salinity-affected areas in the Purna river basin

The PoCRA project aims to reduce these problems by creating awareness and disseminating the interventions to overcome and reclaim the affected soils through project activities.

The major concern of farmers regarding salinity is poor drainage and the accumulation of salts on the soil surface due to improper irrigation methods like flood irrigation. These issues have been addressed by promoting drip (8,081 beneficiaries) and sprinkler (13,394 beneficiaries) irrigation systems, which have been widely adopted by farmers in the saline tract region. The increased adoption of micro-irrigation systems has prevented the accumulation of salts on the soil surface and improved crop growth. Additionally, applying gypsum (hydrated calcium sulphate) to saline soils has effectively improved soil bulk density, aggregate stability, water infiltration, physio-chemical properties, and biomass, resulting in higher crop production.

It was reported that 94% of respondents from the project group were aware of the salinity issues due to implementation of the Project and only 6 % reported that they were not aware. Thus, as part of the project activities, there was a focus on awareness generation and agronomic practices about soil salinity in the project area. As compared to the baseline, this showed a considerable increase in awareness related to soil salinity and soil treatment. This impact was due to the discussions and training imparted during FFS.

Due to the awareness of the soil salinity-related issues in their fields, beneficiary farmers have initiated Good Agricultural Practices (GAP). It was recorded that the micro-irrigation practices (28%) had the highest adoption rate among the listed practices. This indicates that the farmers in the region find micro-irrigation to be a highly effective method for managing saline-sodic soil. Micro irrigation helps reduce water usage and avoids water logging, which is particularly beneficial in saline conditions. It was followed by the application of a balanced dose of NPK (19%).

The use of balanced fertilizers (Nitrogen, Phosphorus, and Potassium) suggested that farmers were focusing on improving soil fertility and crop nutrition, which can be crucial in managing saline soils. Gypsum and fly-ash application was adopted by 12% of respondents, to amend saline and sodic soils by improving soil structure and reducing sodium content. Similar to the application of NPK (12%), the use of micronutrients indicated that farmers were aware of the need for comprehensive soil nutrition management.

Other practices followed were taking salt-tolerant field crops like cotton (8%), stopping flood irrigating crops to avoid water logging in the field (7%), avoiding taking salt-sensitive crops such as vegetables and fruit crops (6%), and taking up NRM (Natural Resource Management) Works (5%). Only a small fraction (2%) of farmers were not adopting any treatment, indicating a general awareness and willingness to implement GAP to manage saline and sodic soils. This data suggests a proactive approach among farmers in the saline and sodic soil region towards adopting various GAPs promoted by the Project.

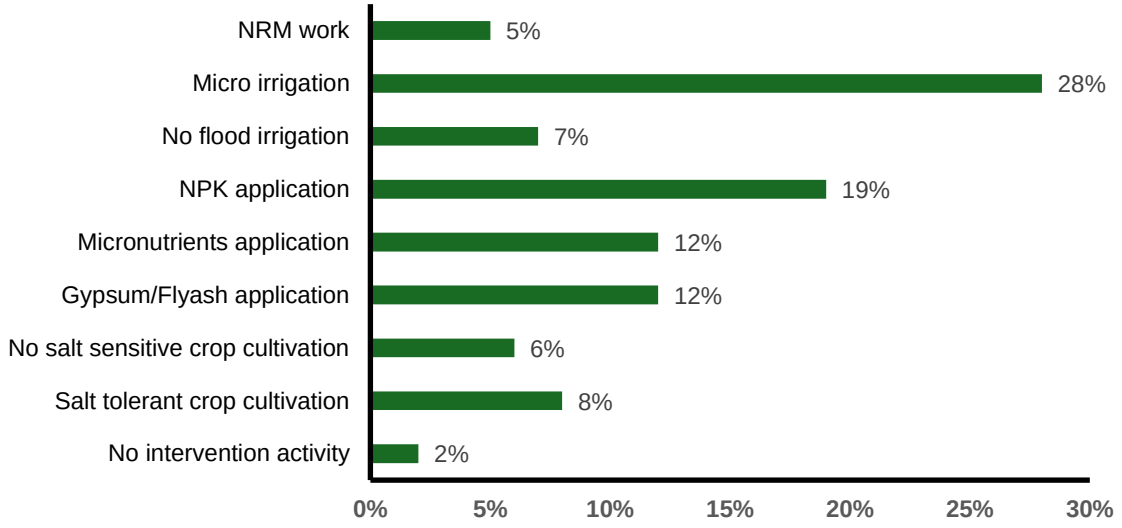

Figure 5: Adoption of good agricultural practices in Kharpan region

Good agricultural practices were demonstrated and supported for farmers through various project activities in Kharpan villages, such as Farmer Field Schools, and by project interventions. The total area affected by saline-sodic soils (Kharpan) across 932 villages was 3,62,587 hectares. GAPs were adopted on 1,46,826 hectares, surpassing the target of 1,27,600 hectares.

A.2.4 Soil health improvement

The project area had experienced soil degradation related to soil salinity, and topsoil runoff which reduced the soil fertility and productivity. Soil is the second largest store of carbon in the earth after the Oceans. Thus, focussing on carbon sequestration can improve soil health parameters.

Acknowledging this salient point, PoCRA emphasized good agronomic practices to improve soil fertility, and soil nutrient management, and promote soil carbon sequestration. Optimum soil health reinforces climate resilience by sustaining agricultural productivity, safeguarding ecosystems, and securing farmer livelihoods in the face of climatic challenges.

A.2.4.1 Awareness of techniques for soil erosion issues

The end-term survey data indicated that a large percentage of respondents were aware of techniques to control soil erosion. 46% of the respondents in the project area were aware of techniques that can be implemented to solve issues related to soil erosion as compared to 14% in the Comparison area.

This suggested that awareness of techniques to solve soil erosion issues was more prevalent in the project villages compared to the comparison villages. The increased knowledge about soil erosion in project villages can be attributed to the capacity building session and outreached through FFS.

A.2.4.2 Compost production units (Vermi, NADEP, and Organic input)

The rationale behind promoting vermicompost and NADEP units was to help farmers become self-sufficient in terms of on-farm management of plant nutrients and avail good quality compost to aid crop cultivation and improve soil health. This holds significance as approximately 80% of the farmers adopting these measures belonged to the vulnerable sections possessing limited purchasing power to procure costly inputs.

During the end-term survey, it was found that after the uptake of the compost units, expenditure on chemical fertilizers was reduced by 23%. 70% of the surveyed beneficiaries reported improvement in soil health, post-adaptation of PoCRA composting units.

A.2.4.3 Broad Bed Furrow (BBF) technique

The Broad Bed Furrow (BBF) technique in agriculture involves creating raised beds (broad beds) separated by furrows. This method improves water management by allowing excess water to drain away, reducing waterlogging and soil erosion. Adoption and practice of this method had grown manifold between the baseline and end line. As per the MIS records, BBF was implemented by 2,055 farmers. During the baseline survey, 4% of farmers had adopted this technology, whereas during the end-line survey, 23% of the farmers reportedly practiced it to ensure optimum soil moisture in their fields and better crop yields.

BBF proved particularly useful as a majority of the respondents (in 59% of cases) said that the use of BBF technology was of acute help in preventing crop damage during periods of heavy rain. The respondents stated that in 57% of cases, it aided moisture conservation, while in 56% of cases it improved crop production.

A.2.4.4 Conservation tillage

With an aim to conserve the most valuable natural resource like soil, the project has made conscious efforts to promote conservation agriculture with a special focus on zero tillage practices. The project has introduced regenerative agriculture as an intervention to ensure soil conservation and to regenerate, contribute, and support ecosystem services. The project conducted dedicated FFS to promote zero tillage practice, which was adopted by over 3,000 farmers in the project district.

A.2.5. Protected cultivation

Protected cultivation under the PoCRA project played a crucial role in mitigating the impacts of climate variability. This intervention was used to enhance the resilience and sustainability of the farming system against climatic adversities by enhancing crop productivity and promoting resource efficiency by incorporating tools like water budgeting, pest management, etc. which ensured building the resilience and adaptability of farmers. Protected cultivation under the PoCRA project leveraged advanced agricultural technologies such as shade-nets, and poly-houses, to create controlled environments that address microclimate variability. This method enables the cultivation of off-season fruits and vegetables and enhances farmers' adaptability to climate contingencies. The project has implemented this intervention covering 1,659 ha and 6,020 beneficiaries, shade-nets were disbursed to 5,874 beneficiaries covering 1,624 ha and poly-houses were disbursed to 146 beneficiaries covering 35 ha.

A.2.5.1. Disposal of the end-life materials of Shade-net/Poly-house

The material used for the construction of shade-net/poly-house largely consists of plastics and polymer materials which need safe disposal to avoid any environmental contamination of micro-plastic.

About 51% of respondents using shade net/ poly-house in the project area were aware of guidelines for safe disposal of shade-net/ poly-house material after the end of the life as compared to 28% of the respondents of shade-net/poly-house users in control areas.

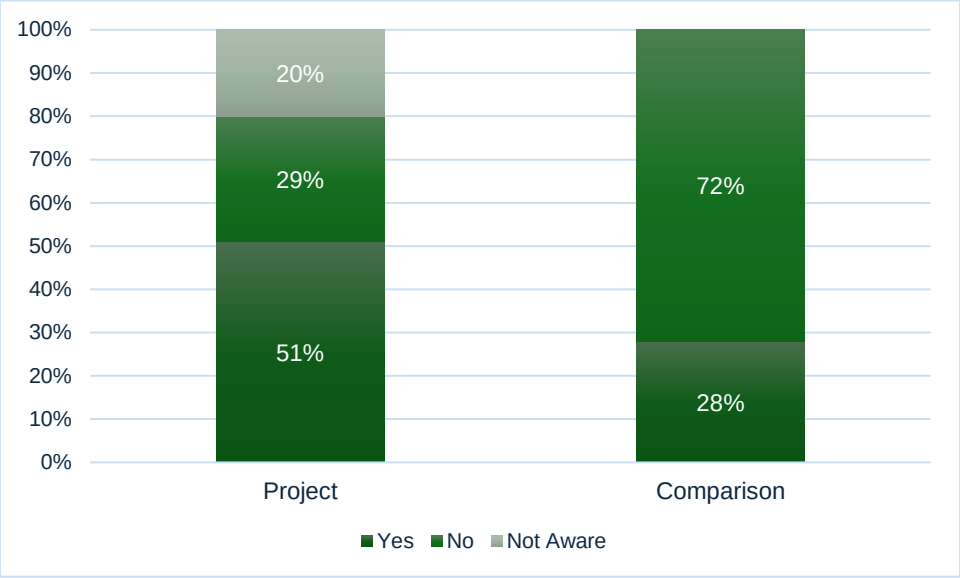

Figure 6: Awareness of safe disposal of end life materials of shade-net/ polyhouse

A.2.5.2 Integrated farming systems

Integrated Framing Systems present a dual opportunity for smallholder communities to diversify their livelihood by integrating diverse crops and livestock in the traditional farming system and at the same time making them climate resilient. IFS optimizes the use of resources like water, and the optimum utilization of soil and nutrients through diversified farming activities which reduces waste and enhances the overall productivity.

Activities like backyard poultry, rearing of small ruminants, apiculture, inland fishery, and sericulture have been highly useful to marginal as well as landless beneficiaries helping them to increase and diversify their income. The adaptation strategy has enhanced the livelihood resilience among the 5,000+ beneficiaries of small ruminants during the end line compared to only 2,945 during midline, 2,000+ beneficiaries of inland fisheries during the end line compared to only 890 during midline beneficiaries of sericulture at the end line, 350+ beneficiaries of apiculture and 200+ beneficiaries' backyard poultry under the project. This shows there has been a significant increase in the number of people adopting integrated farming systems.

The integrated farming system not only increased the productivity of the unit area but also increased the net profit of the beneficiary farmers. Thus, the integrated farming component addresses SDG 2.3 (double the agricultural productivity and incomes of small-scale food producers).

A.2.5.3 Sericulture

Sericulture, the cultivation of silkworms for the production of silk, presents a viable and strategic agricultural practice that aligns with the objectives of the project. Sericulture presents an opportunity to diversify the livelihoods of the farmers and simultaneously make them climate resilient. This practice significantly contributed to the economic stability, environmental sustainability, and resilience of smallholder farming communities in the region. By encouraging the practice of sericulture, the project creates an opportunity for economic development and an increase in the standard of living. Sericulture was practiced by 5,337 beneficiaries covering 1,860 ha of the project area.

Sericulture can provide employment opportunities to different categories of people and thus it addresses SDG targets 8.2 (achieve higher levels of productivity of economies through diversification, technological upgrading) and 8.3 (promote development-oriented policies that support productive activities, decent job creation, entrepreneurship) Additionally, sericulture is a sustainable activity with zero wastage and mostly organic, thus the sericulture activity is also attributable to SDG target 12.5 (substantially reduce waste generation through prevention, reduction, recycling, and reuse).

A.3 Climate-resilient development of catchment areas

Awareness of water conservation

As an entry point activity, the project carried out a participatory microplanning process in each project village ensuring the involvement of all stakeholders in the village. This process helped to create awareness about the project objectives in general and about the importance of water security and water conservation in particular. Computation of village water balance was one of the fundamental activities taken up by the project to generate consensus about the conservation of the most important natural resource.

It was observed that the percentage of respondents who were trained about the importance of water conservation is higher in project villages (31%). It suggests that the training about the importance of water conservation is more prevalent in the project villages as compared to the comparison villages.

Natural Resource Management

Natural Resource Management (NRM) is essential in the PoCRA project to ensure sustainable agriculture and resilience to climate change. By managing water, soil, and biodiversity effectively, NRM maintains long-term agricultural productivity and prevents land degradation.

The planning for NRM in the project is considered the mini-watershed cluster. A revised water budgeting tool conceived with the help of IIT helped in identifying the water deficit and planning the water budget for the village. All potential NRM interventions were identified through a detailed planning exercise which included a scientific assessment of rainfall, gradients, run-off, cropping pattern, livestock availability, etc.

Table 4: Activity-wise soil and water conservation works

Activity-wise soil and water conservation works				
S. No	**Activity Name**	**No. of Works**	**Area (ha)**	**Water Storage Capacity (TCM)**
1	Compartment /graded bunding	2,384	58,567.72	26,355.47
2	Composite Gabian Structure-RC Pardi	88	0	528
3	Construction of Cement Nala Bunds	239	0	1,434.00
4	Construction of Earthen Nala Bunds	17	0	85.00
5	Construction of Loose bolder Structures	31	0	3.10
6	Continuous Contour trenches Model 5-8 (0.30 m)	5	29	13.05
7	Continuous Contour trenches Model 5-8 (0.45 m)	8	211.74	95.28
8	Deep Continuous Contour trenches (CCT)	25	291.79	131.31
9	Desilting of old water storage structure	852	0	3,669.03
10	Farm Pond with inlet & Outlet on E class Land	3	0	75.00
11	Gabian Structure	15	0	7.50
12	Individual farm pond-BJS	26	0	58.80
13	Recharge Shaft	176	0	92.27
14	Recharge Shaft with Recharge Trench	437	0	255.95
15	Trench Cum Mound (TCM)	9	287.16	62.31
Grand Total		**4,315**	**59,387.41**	**32,866.08**

It is evident that the NRM works helped in arresting the excess runoff in the catchment area, reducing soil erosion and aiding in the restoration of soil fertility. Through works such as the recharge shaft, the groundwater levels were also restored.

Individual and community farm pond

The project has adopted a systematic approach to the withdrawal of ground water with adequate attention to sustainability, and improvement in water efficiency and conjunctive water use (both ground

and surface run off). The available water (ground and surface) in project districts is influenced by the flow from upstream, small-scale community-based irrigation systems, existing farm ponds, run off, water conservation recharge structures, and most importantly the optimal groundwater withdrawal potential in an area. The project has supported the development of 2,695 community farm ponds 714 individual farm ponds without lining and 4,527 individual farm ponds with lining which positively impacted groundwater recharge.

Farm Pond	Number	Water Storage (TCM)
Community Farm Pond	2,695	13,942.00
Individual Farm Pond without Lining	714	1,138.92
Individual Farm Pond with Lining	4,527	8,990.80
Farm Pond lining	3,158	6,264.32
BJS Farm Pond	26	39.17
Total	**11,120**	**30,375.21**

The project group witnessed a rise in their land cultivated during the Rabi season by 66%. This improvement in land utilization experienced by the project group underscores the effectiveness of farm ponds in enhancing water availability for irrigation.

A.3.1 Construction of groundwater recharge structures

A.3.1.1 Recharge of open dug wells/ bore wells

Groundwater irrigation plays a crucial role, accounting for about 65% of the total irrigated area, with part of the project area being inherently saline in nature with low hydraulic conductivity, the available ground water is unfit for cultivation of crops, hence low cropping intensity was observed in the region. The region also had uncertainty in the spatial variability of the availability of groundwater, which led to the farmers being extremely vulnerable to the climatic variability factors, thus, the introduction of new techniques and interventions pertaining to ground water recharge and watershed management was extremely crucial to ensure the practice of sustainable agriculture.

The project involved initiatives to recharge open-dug wells, enhance groundwater levels, and ensure sustainable water availability. Techniques such as rainwater harvesting and directing surface runoff into wells were employed, effectively replenishing groundwater reserves. By prioritizing well recharge, the project addressed the issue of groundwater depletion, promoting long-term water security for agriculture. This measure helped maintain a consistent water supply for irrigation, supporting continuous agricultural activities and mitigating the adverse impacts of droughts and water scarcity on farming communities.

Given that open-dug wells are a major water source for horticulture plantations, the recharging activity significantly impacted farming systems with plantations. The project supported the construction of open-dug wells in safe watershed zones besides recharging activities. The project area has facilitated the recharging of 588 open-dug wells and 1,939 new open-dug wells were developed under the project.

It was recorded in end term survey that 13% of the surveyed farmers in the project village experienced improved water availability during dry spells, and 5% reported increased water availability for the Rabi season. Additionally, there was an 8% expansion in cultivation area during the Kharif season for farmers in the project village. The recharge of open-dug wells and bore wells emerged as a critical component, enhancing agricultural resilience and productivity.

A.3.2 Micro irrigation systems

Implementing micro irrigation in the PoCRA project is essential for addressing water scarcity, improving crop productivity, enhancing climate resilience, and promoting economic and environmental

sustainability. By leveraging the benefits of efficient water use, increased yields, and reduced costs, micro irrigation supports the overarching goals of PoCRA to build a climate-resilient agricultural system. Micro-irrigation is also utilized to arrest topsoil runoff which in turn protects the farmers from soil degradation and soil erosion.

In pursuit of the development objective to enhance climate resilience at the farm level, the project deliberately invested in optimizing water efficiency for agriculture. Recognizing that micro-irrigation techniques contribute to increased water productivity and substantial irrigation water savings, the project actively promoted the adoption of micro-irrigation methods, including drip and sprinkler irrigation on a large scale. Under the project, farmers received assistance to encourage the uptake of drip and sprinkler systems, resulting in water conservation and improved yields. These micro-irrigation interventions precisely delivered water, minimizing wastage and enhancing overall efficiency. Additionally, these measures helped conserve water, reduce soil erosion, suppress weed growth, and elevate crop yield and quality by maintaining optimal moisture levels. The project has supported 4,31,328 beneficiaries across 4,88,747 ha through the micro-irrigation systems.

The adoption of micro-irrigation technologies was about 67% in project villages. The project's success in promoting adoption can be attributed to better access to improved technologies, increased awareness of their benefits, and targeted interventions to encourage their use.

One of the significant achievements of PoCRA was the widespread adoption of micro-irrigation technologies by more than 431,328 farmers across the project area. This intervention resulted in water savings, increased water-use efficiency, reduced soil erosion, and improved soil health parameters.

A.3.2.1 Drip irrigation systems

Drip Irrigation technology involves irrigating the root zone through emitters fitted on a lateral tube or inserted within the tubing as an emitting pipe. This method ensures the slow release of water in droplets, minimizing evaporation and runoff, while precisely controlling moisture levels for crops. Drip irrigation offers several advantages, including water conservation, reduced soil erosion, and improved crop yield and quality by maintaining optimal soil moisture levels.

Under this sub-component, farmers received financial subsidies and technical assistance to install and maintain these systems, making them accessible and affordable. Additionally, the project conducted extensive training and capacity-building programs to educate farmers about the benefits and proper implementation of drip irrigation. According to the MIS data, the project supported 2,27,491 farmers covering 2,82,481 ha.

In the End Term Survey, an increase in cultivated land from 1.25 to 1.57 acres per farmer was observed in Project areas, indicating a 26% rise. Similarly, the control area saw a 24% increase, from 1.04 to 1.28 acres per farmer. These results suggest that drip irrigation contributed to higher land cultivation in project areas. Moreover, the project group experienced additional benefits, including reduced water wastage, optimized use of fertilizer and pesticides, and minimized reliance on additional inputs compared to the control group, which was more accustomed to conventional irrigation methods.

A.3.2.2 Sprinklers

The sprinkler irrigation system played a crucial role as a micro-irrigation component within the project. It gained significant popularity among beneficiaries due to its effectiveness in water distribution and crop management. Sprinkler systems deliver water through a network of pipes with strategically placed nozzles, simulating rainfall by spraying water over the crops. This method ensures uniform coverage, reduces water wastage, and allows for precise control over-irrigation. Farmers appreciated its ease of use, adaptability to various crop types, and positive impact on overall agricultural productivity. The project has supported the instalment of sprinklers to 2,03,837 farmers across 2,06,266 ha.

During the End Term Survey, data from a sample of 1,456 households in the project group and 1,278 in the comparison group were analysed to find the impact of the sprinkler system. It was observed that the increase in land area cultivated during the Rabi season in the post-period was 9% higher in the project group compared to the comparison group. This difference allowed us to isolate the effect of the

PoCRA intervention. Additionally, there was an 18% increase in annual income among project beneficiaries.

Beyond the expansion of cultivated land, production, and income, a significant impact on production costs was also observed. Specifically, the use of sprinkler irrigation systems led to a 10% reduction in energy costs for the project group, whereas the control group experienced only an 8% reduction. These findings underscore the practical effectiveness of the PoCRA intervention on the ground.

Sprinkler irrigation has made significant strides since its inception. Over 2,03,837 farmers have adopted this technology, covering a cumulative area of 2,06,266 hectares. The total disbursed amount for implementing sprinkler systems stands at INR 395.74 crores. This widespread adoption underscores the positive impact of sprinkler irrigation in enhancing water-use efficiency and supporting sustainable agricultural practices.

A.3.2.3 Water pumps

Pumps play a critical role in irrigation systems, particularly in the context of micro-irrigation methods such as drip and sprinkler irrigation. These systems rely on pumps to transport water from its source to the crops, ensuring a controlled and steady flow. Pumps provide the necessary pressure to deliver water precisely where it's needed directly to the root zone of crops. This precision minimizes wastage and optimizes water use. By efficiently distributing water, pumps contribute to water conservation. They reduce losses due to evaporation and runoff, ensuring that every drop counts. Moreover, Pumps enable uniform water distribution across the field. This uniformity promotes even crop growth and minimizes stress due to uneven moisture levels. The data from 198 households in the project and 295 in the comparison group were analysed on adopting water pumps as an irrigation technology using a difference-in-difference approach. According to MIS records the project aided 31,373 farmers in getting access to water pumps

The project group exhibited a 24% higher increase in cultivated land compared to the comparison group. This difference allows us to attribute the effect directly to the PoCRA intervention. During the Rabi season, there was an increase in production within the project group. Notably, this effect was substantial because the yield in the comparison group decreased by almost 45%. Without water pumps as a climate-resilient technology, crop production would have faced significant losses. The healthy 48% increase in yield observed in the project group speaks to the effectiveness of water pumps. They played a pivotal role in maintaining crop productivity despite challenging conditions.

The project, with a technological partnership with the Indian Institute of Technology (IIT) Mumbai, had undertaken a study on energy usage by farmers and it was revealed that there is a need to enhance the efficiency of electric pumps by supplementing the pumps with capacitors. The project could create awareness about the capacitors among the farmers through various IEC means. There is adoption of this energy efficiency tool among the beneficiaries of water pumps as well as other farmers.

Figure 7: Project snapshot on awareness about capacitors for electric pumps

A.3.2.4 Pipes (HDPE/PVC)

Pipes are essential components of micro-irrigation systems, including drip and sprinkler irrigation. They form a network that delivers water directly to the root zone of plants, ensuring minimal wastage and optimal distribution. Farmers received financial assistance and subsidies to cover the costs of installing micro-irrigation systems, making them more affordable and accessible. The project offers technical support and training programs to educate farmers on the benefits and proper maintenance of these systems. This includes guidance on selecting the right type of pipes and ensuring their efficient use. The project has supported 27,633 farmers for this intervention.

242 households in the project group and 363 in the comparison group were used in the analysis. The increase in land area cultivated (Rabi) in the post-period was 18% higher than the comparison group, we are thus able to isolate the effect of the PoCRA intervention. Similarly, there was a 23% increase in production during the Kharif season and a 15% augmenting effect on annual income. The impact mechanisms are likely related to efficiency as compared to manual labour, using pipes to transport water from the source to the field is both faster and involves less wastage of water, thus helping farmers maximize their yield.

The project group saw a 46% increase in Land area cultivated during the Rabi season, going from 1.40 to 2.04 acres per beneficiary. In the summer season, however, their cultivated land saw an increase of 17%, from 0.40 to 0.46 acres. The comparison groups saw an increase in both Rabi and summer season by 28% and 22% respectively increasing from 1.17 acres to 1.49 acres in Rabi and 0.15 acres to 0.18 acres in summers. These increases indicate that pipes significantly enhanced water distribution and land utilization.

Awareness of increasing the life of the pipes

In the project villages, 50.6% of the respondents reported knowing how to increase the life of pipes, while 39.6% do not have this knowledge, and 9.7% are unsure. In the comparison villages, only 18.3% of the respondents reported knowing how to increase the life of pipes, while a majority (61.7%) do not have this knowledge, and 14.8% are unsure. It suggests that knowledge about how to increase the life of pipes is more prevalent among respondents in the project villages compared to those in the comparison villages. It has been observed that the respondents from the project group were positioning the pipes underground to avoid exposure to sunlight and extreme temperatures to increase the longevity of the pipes. This difference could be attributed to various factors, such as targeted training programs, awareness campaigns, or the dissemination of best practices in the project villages.

Awareness of disposal of used pipes

In response to a question on the disposal of damaged pipes for irrigation in a proper manner, in the project villages, 64.6% of the respondents reported properly disposing of damaged pipes used for irrigation, while 27.7% do not dispose of them properly, and 7.8% don't know if they dispose of the pipes in a proper manner. While, in the comparison villages, only 28.0% of the respondents reported properly disposing of damaged pipes used for irrigation, while a majority (59.8%) do not dispose of them properly, and 12.1% don't know if they dispose of the pipes in a proper manner. This difference could be attributed to various factors, such as increased awareness about the importance of proper waste management, the availability of appropriate disposal facilities, or the implementation of specific guidelines or programs promoting proper disposal in the project villages due to the impact of the PoCRA project.

The significantly higher percentage of respondents not disposing of damaged pipes properly in comparison villages highlights the need for increased efforts to raise awareness about the environmental impact of improper disposal and to provide the necessary infrastructure and support for proper waste management in those areas. Encouraging the adoption of sustainable practices and providing education on the proper disposal of agricultural waste could help mitigate the potential negative effects on the environment and public health.

Impact of Climate Resilient Development of Catchment Area on the Project

1. **Increase in surface, and groundwater storage capacity as compared to the baseline.** With the construction of farm ponds, community ponds, nala deepening, cement nala bundhs, graded bunding, and water recharging structures, there is an increase in surface water and a rise in the groundwater level along the constructed activities. Groundwater level is available at 6 m -10 m depth along the nalas where cement nala bundhs have been constructed.

   In the project area, 11,120 farm ponds (both individual and community ponds of various sizes- with and without lining) were constructed. These ponds can store surface water up to 30,375 TCM. In addition, cement nala bundhs have been constructed across various nalahs. Water is stored upstream of these bundhs. NRM activities, like CCT, graded bunding, continuous contour trenches, deep trenches, recharge shafts, desilting of old water storage structures, ponds in e-class land, etc have been constructed. In addition to the recharge of groundwater, surface water is also available to farmers for irrigation. Hence, out of 32,866 TCM water storage capacity so generated through NRM works, part of it is available as surface water for irrigation, and remaining water, recharges the groundwater. An overall surface water storage capacity of 63,241 TCM has been created through farm ponds and NRM activities of the project.

2. **Change in cropping pattern as compared to baseline.** Due to the increased storage capacity of water, more farmers can cultivate Rabi crops as compared to the baseline. Hence rabbi irrigated area has increased as compared to the baseline.

3. **Increase in water use efficiency and water productivity with respect to baseline.** The water productivity of the crops has increased from 0.38 kg/m^3 during baseline to 0.41 kg/m^3 in the end term. There is an increase of 7.89% in the water productivity.

4.2 Component B: Post-Harvest Management and Value Chain Promotion

The project focused on developing the capacity of FPOs to;

- Enable them to reach more people and perform more effectively.
- Align income and growth levers, such as training on climate-smart technologies and sustainable agricultural practices, providing infrastructure, and facilitating access to credit

Under the agribusiness component, custom hiring centres (CHCs) were promoted as a major activity with an objective of contributing to climate co-benefits by encouraging the use of fuel-efficient and

technology-efficient farm machinery and equipment for pre- and post-harvest farm activities. The project also supported the construction of collection centres with primary processing and storage facilities. Additionally, secondary processing units, such as flour mills, dal production, oil extraction, juice production, and frozen pulp production, were supported.

The audit comprised of checking compliance with the EMP checklist provided in the EMF document. Each approved DPR was made in compliance with the EMP checklist, which in turn ensured appropriate site selection, legal and regulatory compliance, the presence of proper health and safety measures, the safe discharge of water from the project activity area, proper waste management, etc.

B.1 Promoting Farmer Producer Companies

Small and marginal farmers (SMFs) constitute nearly 85 percent of all farmers in Maharashtra[1]. Owning 47 percent of the total cultivated area[2], the average landholding of this segment is just 1.48 acres[3]. The fragility of SMF livelihoods is exacerbated by risks of climate change, absence of timely crop advisory, limited access to inputs, credit, post-harvest services, and market linkages. EMP checklist was followed during the formation of the FPOs.

A total of 4,701 proposals from Farmer Producer Organizations (FPOs) were assisted under the project. These proposals included 1,698 Farmer Producer Companies (FPCs), 1,799 Farmer groups (FGs), and 1,204 Self-help groups (SHGs). All the proposals/project reports were found to be compliant with the environmental checklist.

B.1.1 Capacity building

The project aimed to enhance the knowledge and skills of beneficiary participants across various aspects of agribusiness, including business development, project concepts, silage making, warehouse management, and post-harvest technologies. Additionally, the exposure visits provided practical insights to FPCs and SHGs. The diverse training programs catered to different stakeholders, fostering sustainable agribusiness practices. Details of some of these programs are provided below;

- Seven training sessions on business development strategies for SHGs, FPCs members, and project officials with 252 participants.
- A session on developing concepts for agri-business projects for officials with 62 participants.
- An online training program on silage making for livestock feed preservation.
- Training sessions on warehouse management for FPOs attended by 139 participants.
- One training on post-harvest onion storage technology with 84 participants.
- 8,047 field-level trainings conducted at PD-ATMA for master trainers for disseminating knowledge at the grassroots level.
- About 205 Exposure Visits for FPCs/SHGs to give practical learning experiences to the beneficiaries.

B.2: Strengthening emerging value-chains for climate-resilient commodities

It is imperative to facilitate farmer organizations with the necessary infrastructure to reap the benefits of community and cumulative efforts. The project supported a total of 47 agribusiness activities. Some of these activities were widely implemented by the FPOs. Details of these activities are as follows;

Custom Hiring Centres (CHCs): Custom Hiring Centres (CHCs) were supported to enhance the productivity of various crops grown in the project area by providing farm implements to small and marginal farmers on a rental basis. A total of 2,779 Farmer Producer Organizations (FPOs) received support, and the financial assistance provided to these CHCs. Approximately 8,33,700 hectares of land were mechanized through CHCs, leading to reduced labor dependency in agricultural operations and

[1] Marginal and small farmers are those with less than 1 hectare (2.47 acres) and between 1 and 2 hectares (2.47 to 4.94 acres) of land respectively.

[2] Operated area includes both cultivated and uncultivated area, provided part of it is put to Agricultural production during the reference period.

[3] Dept of Agriculture and Farmers Welfare, GoI. 10th Agricultural Census 2015-16 (provisional estimates)

improved efficiency of farm implements (approximately 300 Ha/CHC). 40 % of the respondents believe that CHC is a viable business)

- Survey shows that 30% time saving was achieved by using modern machinery through CHC
- There was an 8 -10 % reduction in the cost of cultivation for farmers.

Godown/ Storage structures (Onion Storage Unit, Seed Processing Unit, Seed Storage/ Godown/ Drying yards): Infrastructure support was provided to create storage facilities at the FPC level for grain, seed, and onion storage. The seed infrastructure was also strengthened and supported by providing assistance to FPCs for constructing seed storage godowns, seed processing units, and drying yards. A total of 960 FPO proposals received support, with financial assistance amounting to INR 112.14 Crore. Approximately 1,80,836 MT of storage capacity was created to store Soybean, Cotton, Pigeon pea, and Gram on a seasonal basis, serving as both seed and grain storage. Additionally, 11,560 MT of storage capacity was specifically allocated for onions.

The FPOs supported under the project have utilized 89,723.8 metric tons (MT) of storage capacity for soybeans, followed by 77,206 MT for pigeon pea and 87,026 MT for other commodities like onion, turmeric, etc. As compared to the 'No Project Scenario', the cumulative storage capacity utilized by all supported FPOs was 2,57,532.22 MT, keeping in mind that this capacity was used multiple times throughout the year for various commodities against the created capacity. This shows the FPOs' effective utilization of storage capacity reflecting their ability to manage and store agricultural produce efficiently. Also, the project's focus on creating storage infrastructure has enabled FPOs to handle different commodities effectively.

B.3: Improving the performance of seed supply chain

The project also financed the establishment of seed hubs and strengthened the capacity of key stakeholders in the seed supply chain for short-duration, drought, salinity, and heat-tolerant varieties. FPOs that were interested in the seed production business were supported for the establishment of seed drying, processing, and storage facilities. The project supported 24,205 beneficiaries for seed production covering around 58,510 ha.

Impact of post-harvest management and value chain promotion

Activities under this component fall in the low to moderate environmental risk category, mainly due to the inclusion of construction activity related to primary and secondary processing centres and storage structures. All activities undertaken in this component were found to be compliant with the EMF checklist for construction activities as well as for operation and maintenance.

The survey viewed FPO sustainability across the three axes of organizational capacity, service provision to farmers, and financial viability. It is observed that project interventions have contributed to strengthening the FPO systems and processes. Project-supported FPOs have improved matrices across key parameters such as governance, administration, business planning, financial management, and the use of technology to ensure transparency and accountability of operations. The project's efforts in facilitating post-harvest support have resulted in reduced post-harvest losses, better market access, and improved farm income.

Through this intervention, FPOs have developed a larger base for revenue generation and are on the way to emerging as profitable entities. The number of farmers who directly or indirectly benefited through the agribusiness activities under the project was 2,33,976. The project through its intervention ensured a reduction in post-harvest losses.

4.3 Component C: Institutional Development, Knowledge and Policies for a Climate-resilient Agriculture

Agro advisory services

Timely information customized to local needs plays a pivotal role in informed decision-making and mitigates various risks including climate risk by taking precautionary measures for crop protection, financial risk by maintaining the demand-supply gap, market access, etc.

The Project has been at the forefront of providing necessary information to farmers which helped them in efficient crop management and market information. It has implemented a GIS-based MIS system to improve overall farm productivity and income enhancement. The project provided specific advisory related to;

- Farm-related services: weather information, seed varieties, IPM, INM, sustainable agronomic practices, etc.
- Market-related services: proximity to markets, price information, availability of storage space

These advisories were made available to the farmers both via website and through SMS. PoCRA could leverage its digital infrastructure to access a number of APIs from the weather department, marketing data, agriculture department, and revenue dept. to make relevant advisories available to the farmers.

In the PoCRA region, 62% of farmers had access to agro-advisory services in project areas, compared to only 39% in comparison areas. The Agriculture Department was the major source of agro advisory, benefiting 51% of farmers in project areas and 32% in comparison areas. Friends and relatives were also a significant source, with 38% of farmers in project areas and 27% in comparison areas relying on them. Other useful modes of advisory included SMS, mobile applications, and WhatsApp messages. Most farmers preferred to access agro advisory weekly. The services were found useful and relevant by 45% of farmers in project areas, compared to 25% in comparison areas.

Training and capacity building

The comprehensive analysis of MIS data reveals a robust educational outreach effort within the PoCRA project. From the project's initiation until March 31, 2024, a commendable total of 77,145 training sessions and workshops have been conducted. These sessions disseminated knowledge pertaining to diverse climate-resilient agricultural practices, benefiting approximately 14 lakh farmers.

In addition to the on-ground training, the project also conducted 11,348 online webinars to connect to the farmers during the COVID pandemic period. These virtual sessions extended the reach of training efforts, benefiting an additional 9 lakh farmers, underscoring the PoCRA project's success in establishing a conducive environment for knowledge transfer within farming communities.

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5. Integrated Pest and Nutrient Management

Maharashtra has gone through a series of droughts since 1971, before the project interventions the use of fertilizers and pesticides was not as prevalent in the project area as compared to the national average.

IPM promotes the use of environmentally friendly pest control methods, reducing reliance on chemical pesticides. This helps in protecting soil health, water quality, and biodiversity, which are crucial for sustainable agriculture. IPM further reduces the cost of pest management for farmers by minimizing the need for expensive chemical pesticides. It encourages the use of cost-effective and sustainable pest control measures, which can lead to better economic returns for farmers.

Pest and Nutrient Management are very crucial components of the farming system for the following reasons.

- Fertilizers and pesticides form a major component of the cost of cultivation
- Health hazards related to the use of these chemicals
- Impact on soil health and human health
- Impact on the environment associated with improper disposal of containers and packets

Project interventions supported individual farmers and producer organizations, potentially influencing the application of pesticides. The Environmental and Social Management Framework (ESMF) included an integrated pest management (IPM) plan for major crops grown in the project area, aimed at mitigating adverse impacts arising from the use of pesticides.

The ESMF survey assessed the environmental and social impacts of PoCRA activities, ensuring sustainable and inclusive project implementation. Key findings of the survey are as follows;

5.1 Awareness of integrated pest management

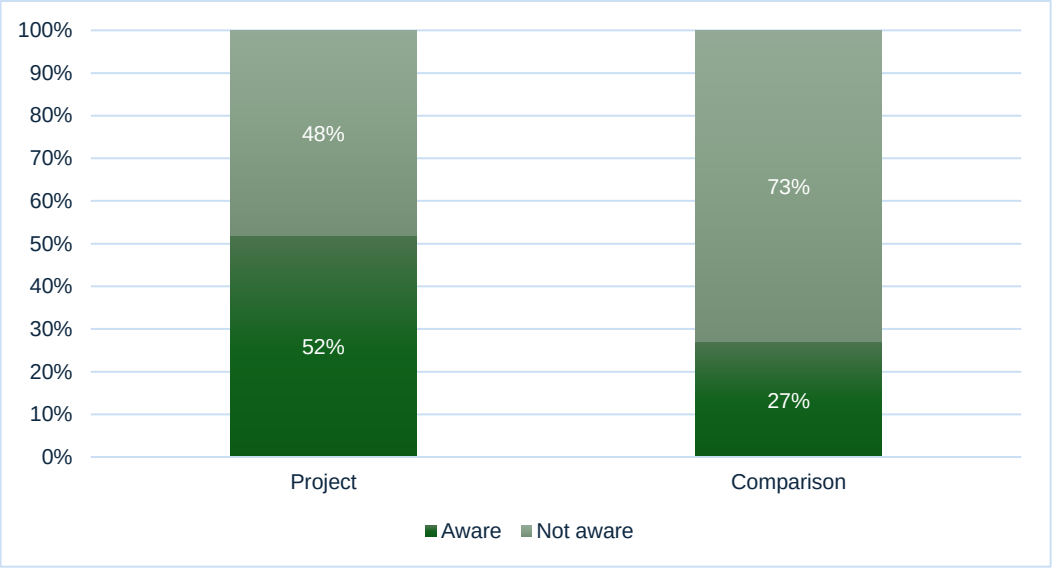

Figure 8: Awareness of integrated pest management

The above graph showcases the knowledge base of the respondents in both the Project implementation area and the control area. Through the PoCRA interventions, community awareness is 52% as compared to 27 % in the comparison area. This shows a significant rise in community engagement and a higher community consciousness regarding the project.

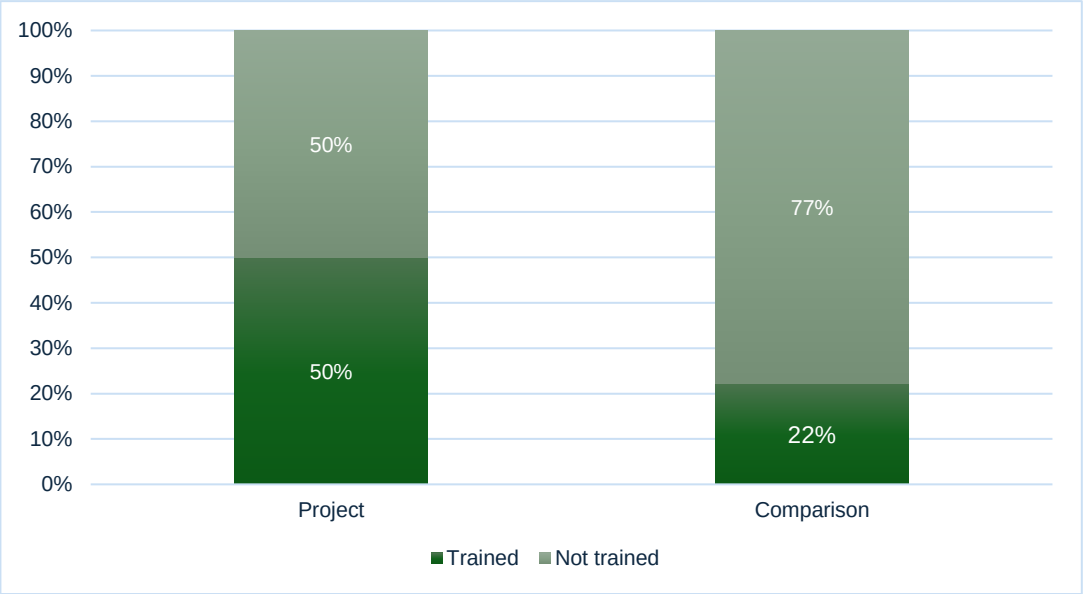

Figure 9: Farmers received training on integrated pest management

The survey data on IPM reflected an increase in the frequency of hands-on training and field demonstrations to bridge the gap between knowledge and practical application through the project interventions. 50% of the respondents in the project area have received training compared to the 22% in the control area. The training program significantly improved participants' knowledge and skills in sustainable agriculture and climate resilience.

It has been observed that farmer field schools play a major role in the conduction of training in the project area, around 75% of respondents from the project area received training from the FFS, the agricultural department along with the Krishi Vigyan Kendra played a great role in imparting the training in the control area, 8% and 69% of the respondents of the controlled group have been trained by Krishi Vigyan Kendra (KVK) and the agricultural department respectively.

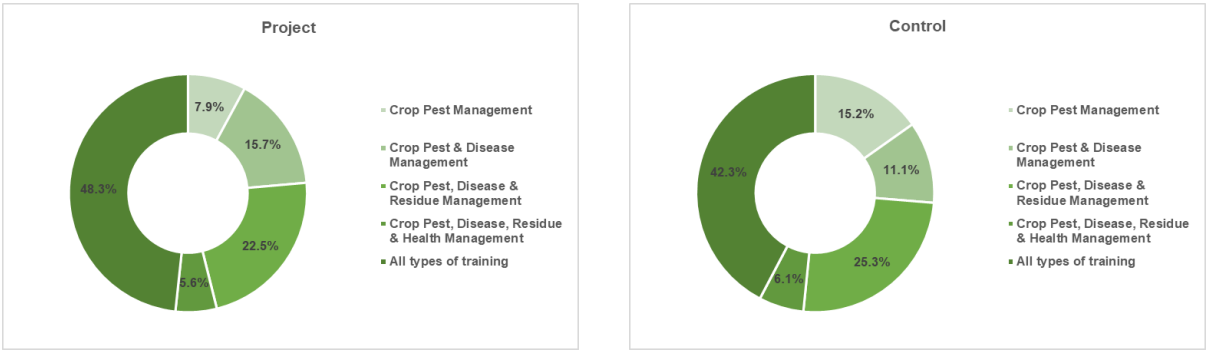

Figure 10: Topics of training

The respondents were trained by the project both in project group (48.3%) and the comparison group (42.3%) on all the aspects such as crop pest management, crop disease management, crop residue management and health and safety management.

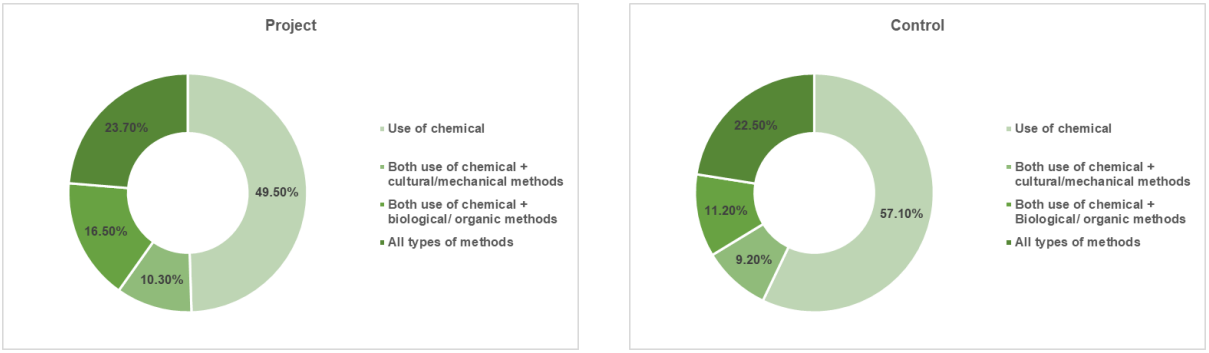

Figure 11: Methods used for IPM in the fields

The respondents in both the project (49.5%) and comparison (57.1%) groups have reported the use of chemicals as a major mitigation method for pest management, but it has been observed that the use of chemicals is less in the project area as compared to the control area. It can also be observed that through the project inventions i.e. training sessions and awareness sessions, a switch to biological and organic methods is being practiced. The respondents are practicing biological and organic methods in combination with chemical methods and mechanical methods. 16.5% of respondents in the project area are practicing the use of both chemical and organic methods.

5.2 Treatment of crop residue

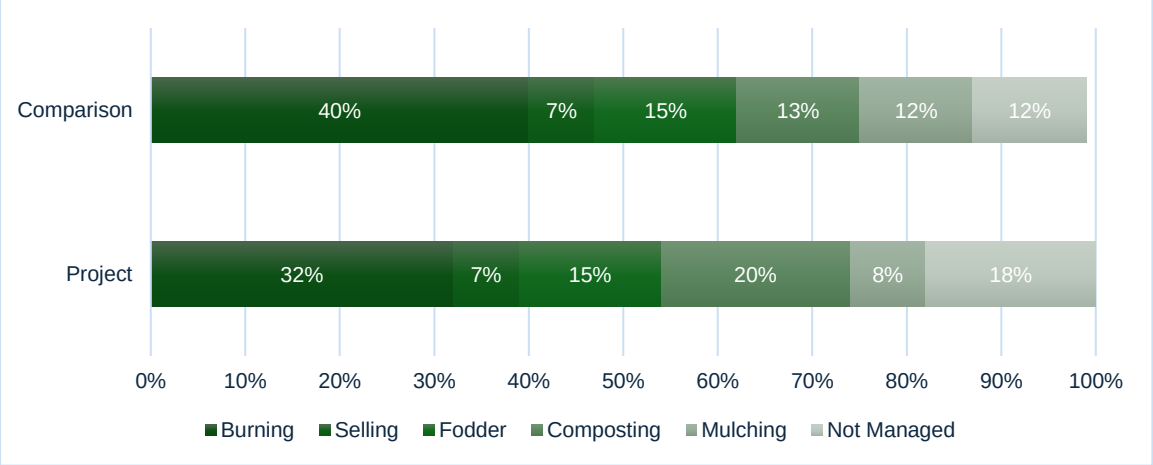

Figure 12: Usage of crop residue

Significant improvements were observed in the adoption of climate-resilient agricultural practices through reducing the carbon footprint generating farming operations, thus contributing to climate change mitigation. 20 % of the project respondents and 13 % of the control respondents have switched to the preparation of compost as a usage of crop residue, agronomical practices like preparation of animal feed (15% of the project respondents), preparation of mulch (8% of the project respondents) are being practiced in the project area in comparison to the 12% of the control population preparing mulch from the crop residues. Hence it can be inferred that through the project intervention, a change in the mindset of the community towards organic processes has been instilled as an outcome.

Disposal of empty containers and packages of agrochemicals

Around 25 % of respondents from the project area were highly aware of the proper disposal practices and the importance of environmental conservation, disposal of pesticide bottles by selling to junk dealers, or recycling/ reusing fertilizer boxes for other purposes, such as storage or makeshift containers.

5.2 Awareness of Surveillance of Pest Attacks

The survey results show that the percentage of respondents who reported surveillance of pest attacks in their village was significantly higher in project villages (62%) compared to comparison villages (32%). While the percentage of respondents who reported no surveillance of pest attacks was much higher in comparison villages (66%) than in project villages (37%). This indicates that surveillance of pest attacks was more prevalent in the project villages compared to the comparison villages.

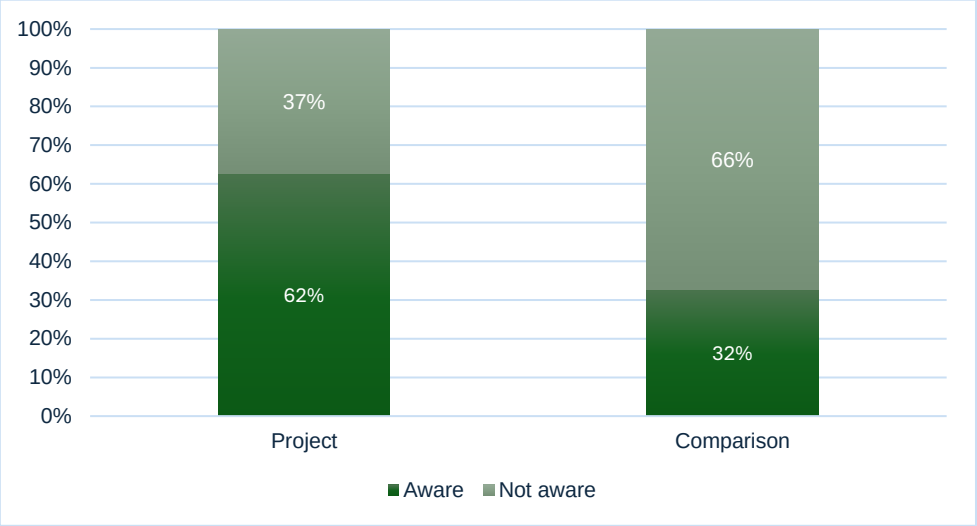

Figure 13: Awareness of pest surveillance of pest attack

5.3 Change in Pest Incidence before and during Project Period

It was observed that the incidence of pest attacks reduced since the baseline survey. The percentage of respondents who experienced a change in the intensity of pest attacks before the inception of the Project was significantly higher in project villages (74%) compared to comparison villages (47%).

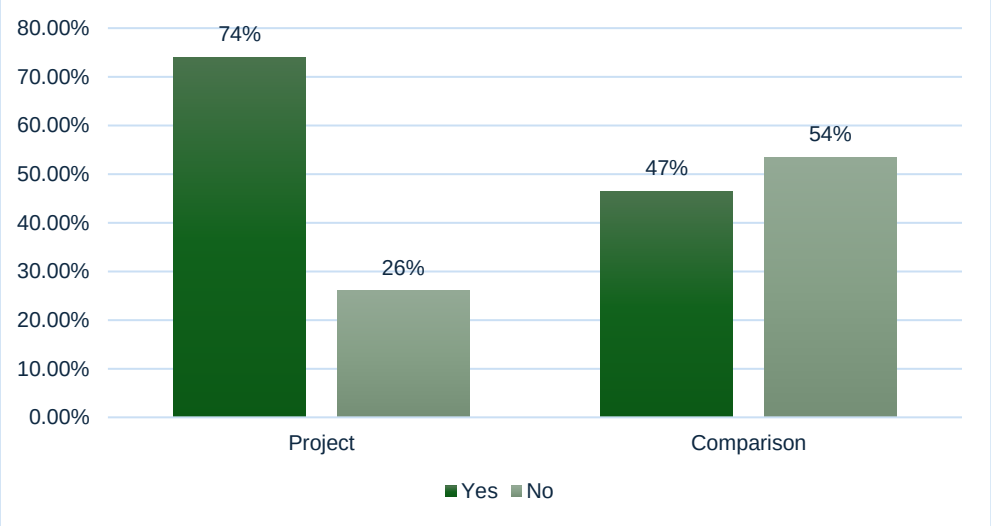

Figure 14: Change in pest incidence

The survey data suggests that a higher proportion of respondents in the project villages have experienced a change in the intensity of pest attacks over pre-project time compared to those in the comparison villages. This difference can be attributed to the project interventions as differences in agricultural practices, and environmental conditions along with the implementation of pest management strategies in the project villages.

5.4 Seed Treatment to Avoid Pest Attack

In the project villages, 60% of the respondents reported undertaking seed treatment to avoid pest attacks, while 40% did not undertake any seed treatment. In the comparison villages, only 28% of the respondents reported undertaking seed treatment to avoid pest attacks, while a majority 72% do not undertake any seed treatment. This suggests that the practice of seed treatment to avoid pest attacks is more prevalent in the project villages compared to the comparison villages.

Seed treatment demonstration

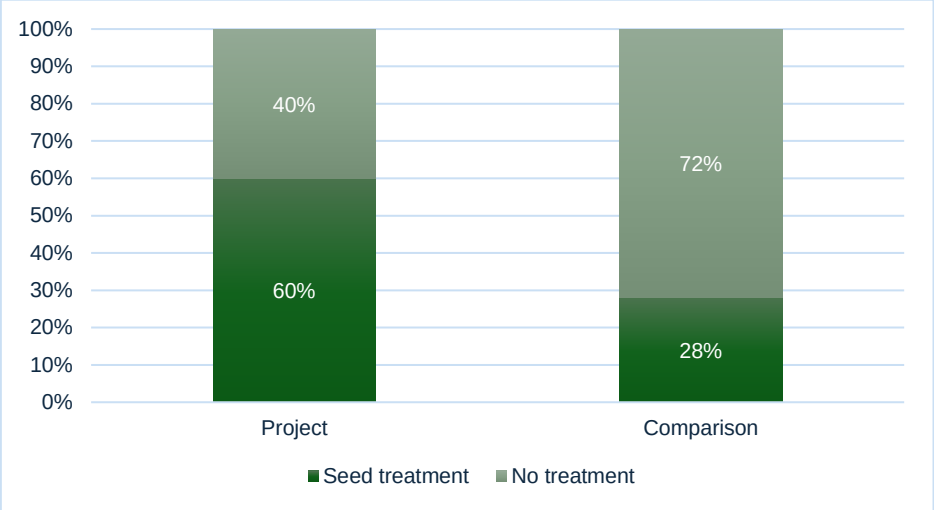

Figure 15: Seed treatment to avoid pest attack

5.5 Awareness of Weather Information and Pest Management

The End Term Survey data indicates that 42% of respondents use a mobile app for weather information and pest management in the Project category and 37% of respondents in the Comparison category.

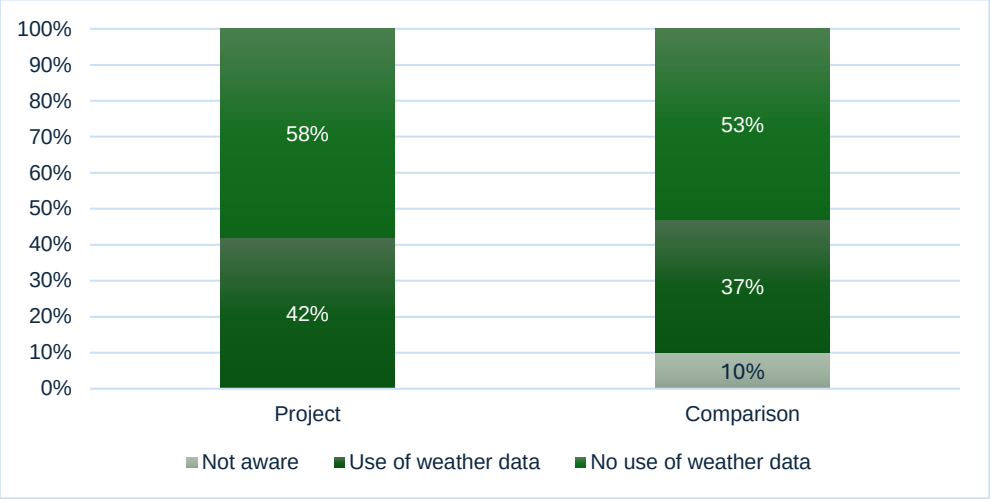

Figure 16: Weather information and pest management

5.6 Improved Pest Management

An essential aspect of the PoCRA project was the integration of pest and disease management. The End Term survey included questions for farmers regarding their practices in this regard. During the endline survey, 25% of farmers reported that pest attacks were the primary reason behind crop damage (across project and comparison groups).

Within pest/insect management measures, pesticides remained the most common intervention (75% of farmers in the Comparison group and 85% in the Project group). Local remedies like *Jeevamrut* or *Beejamrut* extracts were utilized by only 4% of the project sample. Trap crops ranked as the second most common measure, adopted by around 15-20% of farmers.

Notably, 40% of farmers in the project group reported using some biological/organic methods for pest management, compared to 34% in the comparison group. This difference could be attributed to the learnings gained from numerous demonstrations conducted by the 37,184 farmer's field schools. Both groups took considerable precautions while using fertilizers: approximately 90% bathed after spraying, and 75% covered their noses and eyes with face masks during spraying, reflecting the emphasis placed by the project implementation team on disseminating safety precautions related to pesticides.

Demonstration of safety measures during spraying

While less common than pest attacks, diseases also significantly contributed to crop damage: 13% and 11% in project and comparison areas, respectively, reported diseases as the main cause. The primary diseases affecting farmers included wilt (27% in the project, 14% in the comparison), leaf spot (20%), rust (15%), and mosaic (20% in the project, 31% in the comparison). Once again, chemical agents were

widely used by almost every farmer to counter diseases, while about 15% of both groups combined organic/biological methods with chemicals.

Among surveyed beneficiaries, only about 4% were found to use bio-pesticides in the study area.

The project established synergies with the CROPSAP (Crop Pest Surveillance and Advisory Project) mechanism of the Department of Agriculture Departments, for pest surveillance to disseminate advisories based on the economic threshold level of the pest so that the right mix of preventive and curative measures could be undertaken by the farmers. Farmer's field schools were an integral part in the outreach drives to the farmers, through various training and capacity-building sessions the farmers were trained on various protective and preventative measures to combat pest attacks.

5.7 Improved Nutrient Management

In addition to pest management, nutrient management is essential for improved crop productivity and reducing diseases in the crops. Soil testing is very important for understanding the nutrient composition and for nutrient management of the soil. Another way of ensuring the quality of soil is through intercropping, where complementary crops are sown alongside. Farmers were also asked about how they dealt with crop residue after harvesting the crops. The End term survey data related to the prevalence of different INM practices and identifies trends in their adoption as presented as follows:

- **Seed treatment** was one of the most commonly used INM measures, with 25.64% (1,150 cases) of farmers adopting it in the project group compared to 23.66% (1,019 cases) in the comparison group.
- **Vermicomposting** showed an adoption rate of 7.66% (330 cases) in the project group and 9.22% (397 cases) in the comparison group. This suggests growing awareness and acceptance of vermicomposting as an effective INM practice.
- **NADEP composting** adoption rate is almost similar in both the groups with 5.34% (230 cases) in the project group and 5.64% (243 cases) in the comparison group.
- **Mulching** was used by 4.04% (174 cases) of farmers in the project group and slightly more at 4.43% (191 cases) in the control group. This indicates a marginally higher recognition of mulching benefits.
- **Green manuring** adoption is found to be 3.62% (156 cases) in the project group and 3.41% (147 cases) in the comparison group.
- **Inter-cropping** is adopted by 11.07% (477 cases) in the project group as compared to 7.34% (316 cases) in the comparison group.
- **Farmyard manure** remained the most widely used INM measure. Adoption is 40.87% (1,761 cases) in the project group and 34.80% (1499 cases) in the comparison group.
- **Legumes** saw an adoption rate of 6.68% (288 cases) in the project group to 4.90% (211 cases) in the comparison group.
- **Cover crops** were adopted by 2.44% (105 cases) of farmers in the first project, dropping to 2.02% (87 cases) in the second. This slight decline suggested a reduced emphasis on cover cropping.

INM practices contribute to a substantial reduction in greenhouse gas emissions.

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6. Compliance with Various Environmental Aspects

A large umbrella of legislation covers the national government and state government's response to environmental challenges. The project scrupulously followed the legislation and guidelines of policies and legislations such as the Environmental Protection Act (1986), State Water Policy (2003), the Maharashtra Water Resources Regulatory Authority (MWRRA) Act, the Maharashtra Groundwater (Development and Management) Act (2009), etc.

Village Development Plans (VDPs) served as a tool for Environmental Awareness and compliance as well as planning for the environment. The project aimed from its very inception to spread environmental awareness among all stakeholders in the project area. With this in mind, the process of participatory planning in all villages was initiated, Water scarcity, soil health, ground water restoration, integrated plant health practices, natural resources management, and good practices to mitigate environmental pollution were embedded into the mobilization process for the VDPs. This process helped spread awareness about environmental issues as well as established the environment and climate as central themes in the planning and execution of the project.

The below table represents the General Environmental Screening of the project.

Table 5: General Environmental Screening of the project

Environmental Aspect	Suggested Mitigation Measures	Compliance by the Project
Site selection and materials	• The site selected for the activity must not be in areas that are: wildlife conflict areas, waste dumpsites, highly polluted/contaminated land or water areas, natural drainage courses, or areas prone to floods. • Ensure that material required for the construction of bunds, nala bunds, water harvesting structures, etc., is procured on-site or from authorized quarries.	• None of the NRM construction activity sites were near wildlife areas, archaeological conservation areas, waste dumpsites, highly polluted or contaminated land or water areas, natural drainage courses, or flood-prone areas. • Materials for the construction of the NRM structures were not sourced locally; instead, contractors provided the required raw materials.
Resource conservation	• Adopt water conservation practices (e.g., use of efficient irrigation methods such as drip and sprinkler irrigation, mulching, alternate furrow irrigation, etc.). Avoid wastage and over-consumption of water (e.g., avoid crops that are water-intensive, avoid over-extraction of groundwater). • Adopt renewable energy alternatives where feasible (e.g., solar lights, solar pumps, etc.). • Adopt energy-efficient agri-machinery (e.g., BEE 5-star rated pumps).	• It was observed that the use of micro-irrigation among the beneficiary farmers was on an inclining trend. Through micro irrigation, the project helped 4,31,328 farmers covering 4,88,747 ha. • The project has facilitated the use of pumps powered by electricity. The PoCRA project ensured that only BEE 5-star rated pumps were used by the beneficiaries.
Pollution control	• Ensure that all vehicles have a valid Pollution Under Control certification. • Ensure that all generator sets (diesel, petrol, kerosene, LPG, CNG) meet the 'CPCB noise and emission control standards for Generator Sets'.	• All vehicles used during the construction of NRM structures had valid Pollution Under Control certifications. • No information related to noise and emission control standards for the generator sets used in the

Environmental Aspect	Suggested Mitigation Measures	Compliance by the Project
	• Ensure that noise-generating activities meet the CPCB prescribed 'Ambient Standards in respect of Noise'. • Avoid the release of wastewater into water bodies, streams, etc., without any treatment. • Ensure that all wastewater meets the 'CPCB General Standards before disposal. Ensure that all machinery conforms to noise standards. Compost organic wastes. Avoid burning of wastes (crop residues, leaf litter, plastic wastes, etc.). • Dispose of non-biodegradable wastes at locations specified by the local government body (e.g., proper disposal of waste plastic mulch).	construction activity was available. • In the guideline to the VCRMC and Agriculture Assistant, it was mentioned that the noise levels during the construction activities were maintained within the CPCB-prescribed standard limit. However, no clear dataset was available or maintained. There was no specific on-site monitoring of the machinery used for the NRM structures in relation to noise standards. • There was not much wastewater from the construction sites that required pre-treatment before being discharged into local water streams. • Some amount of waste burning was observed in the project area however it was also noticed that there is a switch to alternative use of crop residue like mulching/ composting etc. • Awareness was created through a training session conducted by the Farmers Field School on the safe disposal of used plastic bottles, fertilizer bags, pesticide containers shade-net materials, mulching plastics, etc, however, it was noticed that the value chain of proper disposal has not been established.
Air quality	• Construction activities (especially excavation work) will be undertaken in the dry season. • Periodic monitoring of air quality, including noise levels, will be undertaken during the construction phase.	• Construction activities were carried out during the dry season. The disturbed area of the soil stockpile was kept moist throughout the construction period to reduce dust emissions. • However, no air quality monitoring was conducted around the construction sites during the construction period.
Biodiversity conservation	• Avoid the felling of existing trees. • Avoid cultivation/rearing of exotic species of animals or plants.	• During the project activities, there were no reported tree-felling activities. • Additionally, the implementation of agro-forestry activities in the project deliberately avoided rearing exotic species.
Health and safety	• Adopt prescribed safety practices, including the use of personal protection equipment (PPE), for	• During the survey, it was discovered that most of the beneficiary farmers used

Environmental Aspect	Suggested Mitigation Measures	Compliance by the Project
	handling, storage, use, and disposal of pesticides (refer to Pest Management Plan). • Adopt prescribed safety practices, including the use of personal protection equipment (PPE), for handling any machinery. • Ensure that all pits, holes, water storage structures, etc., must be adequately secured to prevent accidental falls.	protective safety gear while handling pesticides. • However, no clear information was recorded regarding PPE use during the operation of machinery in the agricultural field. • In most cases, no fencing was found around water storage structures such as wells and farm ponds.

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7. Environmental Audit for Value Chain Infrastructure

Evaluation of measures to remove or reduce the potential negative environmental impacts of Activity B - Post-Harvest Management and Value Chain Promotion are given in the following table:

Table 6: Potential negative environmental impacts of Activity B

Environmental aspect	Impact	Project implementation
Site selection	• Improper location can have multiple impacts on sustainability, biodiversity, disaster-proofing, etc.	• None of the sites selected for the activity were in areas that were wildlife conflict zones, waste dumpsites, highly polluted or contaminated land or water areas, natural drainage courses, or flood-prone regions.
Felling of trees and clearing of vegetation	• Loss of green cover including trees	• No tree felling was reported during the construction of the value chain infrastructure.
Construction materials	• Unregulated quarrying can result in over-extraction, impact on natural drainage, soil erosion, loss of aesthetic appeal of the landscape, etc. • Over-extraction of water for construction could lead to local scarcity.	• The construction material was arranged by the contractor. Based on bills presented to the disbursing authorities, it can be concluded that material was purchased from authorized quarries as reflected by the royalty submission to the government. • Water extraction was limited during the implementation of the construction activity.
Pits and boreholes	• Risk of falls into unsecured pits, boreholes, etc.	• The boreholes were deep, but there was no security fencing around the pits or bores.
Health and safety	• Risk of accidents at the worksite.	• Personal protective equipment (PPE) and First Aid Kits were found at the site during the visit.
Air quality	• Dust emissions from excavation. Emissions from vehicles and machinery, dust, etc., may lead to air pollution. High noise levels from construction activities may lead to noise pollution. • Air and water pollution from processing units (grain and pulse processing, flour mills, etc.)	• Construction activities, especially excavation work, took place during the dry season. Adequate measures were taken to protect the topsoil. However, no air quality data during the construction phase of the value chain infrastructure was available • All manufacturing processes were complying with the relevant CPCB standards, including industry-specific standards for grain

Environmental aspect	Impact	Project implementation
		processing, flour mills, paddy processing, pulse milling, or grinding mills. In cases where industry-specific standards are not relevant or available, compliance was with the CPCB general guideline.
Water quality	• Runoff and release of untreated wastewater may pollute nearby water bodies.	• The value chain infrastructure did not have a water treatment facility. However, no such activities were present which would lead to the release of pollutants to water bodies.
Waste Management	• Pollution and health impacts due to improper disposal of wastes such as open dumping, burning, unauthorized recycling, etc.	• No hazardous waste was generated during the construction activities.
Energy consumption	• Equipment and machinery that is not efficient will lead to energy wastage and higher operating costs.	• It was ensured that all machinery or equipment used in the infra unit would be BEE 4 or 5-star rated.

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8. Social Management Framework and Safeguards

The project followed the World Bank's social safeguard policy about 'Indigenous Peoples OP/BP 4.10'. In the project, the social safeguards have been ensured through strategies developed under the social assessment and Social Management Framework (SMF) along with the Tribal Peoples' Planning Framework (TPPF). The social assessment and SMF were conducted in a consultative and participatory manner with the representatives of all the stakeholders i.e. small, marginal, and women farmers, scheduled caste and tribal community, PWD, and subject experts. Their views and concerns were incorporated into SMF and TPPF. The social code of practice and guidelines developed under these frameworks were integrated into the project planning process and executed during the implementation phase at the village, sub-divisional, district, and state levels.

The Social Management Framework (SMF) is crafted with careful consideration of the main concerns of diverse stakeholders and their contributions concerning various project aspects. A social assessment study[4] had been conducted before the preparation of SMF to better understand and address social development issues and ensure the accomplishment of the key outcomes – inclusion, cohesion, equity, security, decentralization, and accountability. The SMF strived to reduce the distress such as higher production costs, low or stagnant farm productivity, lack of market access, degrading land resources, and impacts of climate change among the vulnerable population such as landless, SC/ST communities, and small and marginal farmers among others.

Also, the TPPF was prepared to safeguard the people from the tribal communities. The TPPF tried to ensure the tribal were adequately consulted and took an active part in the process of preparation, implementation, and monitoring of project activities and the project benefits were equally accessible to the tribal population, and they were provided with special assistance as per the prevailing laws and policies because of their unique cultural identities.

8.1 Methodology of SMF Audit

A mixed method approach was adopted entailing both quantitative household surveys and qualitative surveys (Focus Group Discussions and Key Informant Interviews) to conduct SMF audits. As part of the exercise, transect walks were conducted by the experts which helped in understanding the socio-economic conditions of the village community, access to resources, and the usage and management of the assets created under the project. Furthermore, informal interviews and field visits were conducted in the villages to build rapport with the community and gain insights into the challenges faced by the beneficiaries and the obstacles in project implementation. A thorough analysis of the relevant data from the MIS was also carried out. These approaches allowed researchers to better understand social issues from multiple perspectives.

The samples well represented different categories of farmers, particularly small and marginal farmers. In the household survey, around three-fourths of the household samples belong to small and marginal farmers having a land size less than 2-hectare Landholding size.

[4] Summary of social management and tribal people plan strategy (https://mahapocra.gov.in/)

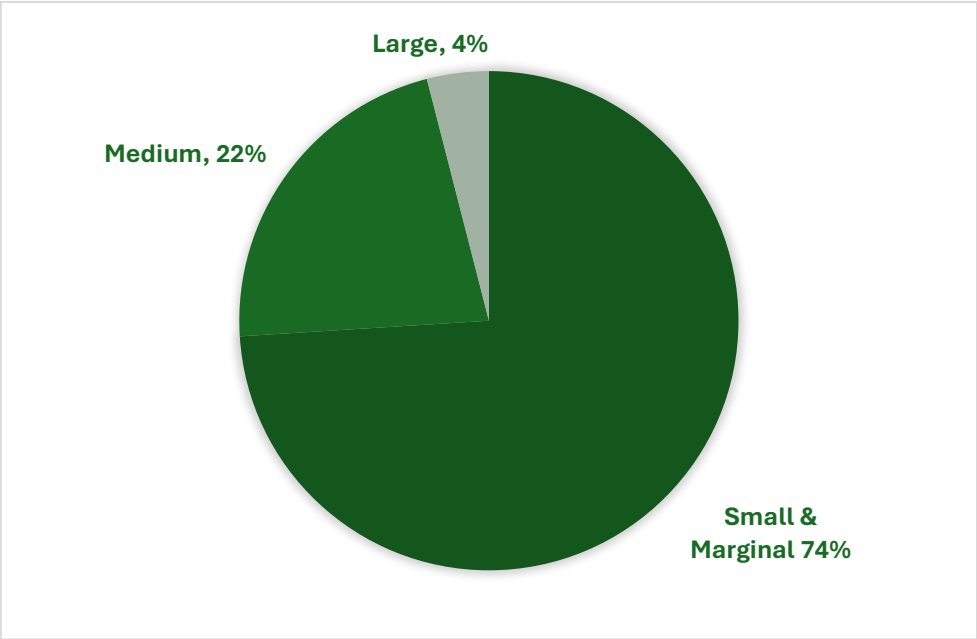

Figure 17: Coverage of different types of farmers in household survey

8.2 Social Inclusiveness and Equity

To achieve a comprehensive impact in any development initiative, it is crucial to ensure it reaches all segments of society, ensuring that benefits reach even the most vulnerable. Social inclusion involves enhancing the terms of engagement for individuals and groups in society, and enhancing the capabilities, opportunities, and dignity of those disadvantaged due to their identities. Reflecting this principle, the project placed significant focus on addressing the needs of small and marginal farmers in the targeted areas.

Adhering to the practice of social inclusion, the project strived for inclusivity and equity by covering the vulnerable social categories which included landless individuals. The demand-driven project maintained inclusiveness by just benefit distribution, where priority was given to SC, ST, Women, and PWD. The vulnerable sections of the village were prioritized while availing benefits under the project by providing a specific rule-based, digital prioritization. The order of the prioritization approach was SC, ST, women, and PWD farmers.

The project also supported greater participation of women with a pre-eminent focus on women-centric training and interventions. For long-term sustainability, the project focussed on the inclusion of marginal groups and deeper engagement with community-led institutions and collectives to ensure they play a pioneering role not only in the identification of beneficiaries but also through their involvement in the processes of planning, implementation, and monitoring of the project activities.

Inclusion of women and vulnerable communities in agribusiness

The project demonstrated gender inclusivity with 1,68,383 men and 64,221 women members across supported FPOs. Additionally, 237 Women FPOs have been supported, comprising 201 SHGs, 26 Women Farmer Groups, and 10 FPCs, reflecting a commitment to female empowerment in agriculture.

Efforts were made to generate employment for the concerned individuals by bringing them within the fold of agriculture-allied income-generating activities and promoting livelihood avenues. Under the integrated farming system and espousing the principle of social inclusion, the project sought to provide financial assistance and support for activities such as small ruminants, backyard poultry, sericulture, apiculture, inland fishery, development of shade-net and poly-house, farm ponds and irrigation systems, etc. to create self-sustaining livelihood opportunities for the landless,

vulnerable women, small and marginal farmers, tribal communities, widows, physically challenged and SC/SC communities. Owing to such efforts, 1,783 landless female beneficiaries were covered, comprising 1,708 small ruminants, 93 backyard poultry, and 8 apiculture beneficiaries.

Participation of Scheduled Caste communities in project activities

While comprising a significant section of the village population, discrimination, prejudice, and historical practices have hindered the benefits of erstwhile development programs from reaching many of the lower caste members. Thus, one of the major objectives of the project was adequate representation and participation of the vulnerable groups like SC and ST in all project-led activities. With this as a guiding principle, a host of activities were undertaken, specifically targeting SC and ST communities.

To begin with, one progressive male and one progressive female farmer from SC or ST communities in the villages were represented in their respective VCRMC[5]. Secondly, the SC and ST farmers were able to participate and access their needs through the Village Development Plan (VDP)[6]. Thirdly, given the project focused on the small and marginal farmers, its activities under the integrated farming system created self-sustaining livelihood opportunities for the SC and ST communities covering activities like backyard poultry[7], small ruminants[8], sericulture[9], apiculture[10] , and inland fishery[11].

Similarly, the use of FFS for technology dissemination resulted in better coverage of SC and ST farmers having marginal/small land holdings[12]. The project also motivated SC and ST farmers to adopt protected cultivation (shade net, poly house), the provision of priority criteria through a DBT matching grant[13] , and also facilitated providing linkage to credit facilities. The SC and ST farmers adopted micro-irrigation systems on their farms[14]. Lastly, the project promoted equal opportunity and accessibility by including SC and ST farmers in the use of farm machinery through a Custom hiring centre at the project-supported FPOs[15].

The inclusion of women and vulnerable farmers under the project was evident from the social category-wise Direct Benefit Transfer (DBT) coverage which comprised 13,332 SC, 6,288 ST, 1,423 PWD, and 1,783 landless women beneficiaries.

While it was heartening to witness a high and satisfactory level of participation from the SC and ST communities in project activities, an area of concern stemmed from the less-than-desirable level of participation among the SC/ST women. Going forward, it would be beneficial if the institutional mechanisms developed by the project reiterate the importance of attending the VCRMC meetings. In addition, putting in place measures like allotted slots during VCRMC meetings where these women can voice their concerns to the wider member audience and sensitizing the male members to become enabling agents in greater participation of women in all such communitarian bodies would give a fillip to women empowerment.

During the planning processes, most often special needs of SC and ST communities were assessed, and attempts were made to integrate them into the implementation processes. Major benefits availed by progressive SC and ST farmers were support for micro-irrigation systems (drip/sprinkler). They did not face any hurdles in pre-sanction or fund disbursement. Farmers also reported an increase in their farm yields due to micro-irrigation. One concern raised was that farmers received reimbursement only after the completion of activity and submission of bills. However, they were constrained by a lack of resources (cash in hand) to invest upfront since they were already

[5] Guidelines for VCRMC (https://mahapocra.gov.in/)
[6] Guidelines for Micro-planning (https://mahapocra.gov.in/)
[7] Guidelines for backyard poultry (https://mahapocra.gov.in/)
[8] Guidelines for small ruminants (https://mahapocra.gov.in/)
[9] Guidelines for sericulture (https://mahapocra.gov.in/)
[10] Guidelines for apiculture (https://mahapocra.gov.in/)
[11] Guideline for fishery (https://mahapocra.gov.in/)
[12] Guidelines for FFS (https://mahapocra.gov.in/)
[13] Guidelines for DBT (https://mahapocra.gov.in/)
[14] Guidelines for micro-irrigation (https://mahapocra.gov.in/)
[15] Guidelines for farmer producer organisations (https://mahapocra.gov.in/)

hindered by other expenses like land preparation, buying of saplings, and labor costs among others. They were finding difficulties in mobilizing institutional credit for upfront payment. Despite this, short-coming the project supported[16] 485,669 farmers. Further, most of the farmers lacked any savings/cash in hand to avail this benefit. SC and ST farmers expressed a desire to avail benefits of poly-house and shade-net, but stated that it required a much higher amount of investment, and it became difficult for them to take it up at the individual level. The Agriculture Assistant stated that the response of poly-house and shade-net in villages dominated by tribal populations was poor.

Scheduled area and tribal development

The inclusive strategy of the project ensured addressing the interest of the tribal community in the Scheduled Areas. The project covered tribal communities in 132 villages in nearly 20% of the total 59 scheduled talukas spread across four districts viz. Amravati, Jalgaon, Nanded, and Yavatmal. Of the total 5,043 villages, nearly 2.6% of the villages with PESA Gram Panchayats covered by the project reflect the inclusion of tribal farmers for their socio-economic development. The project intervention in these scheduled areas benefited the tribal farmers directly as also the dispersed tribal families in non-scheduled areas, through the wider project-induced development.

8.3 Transparency to Achieve Social Empowerment

PoCRA ensured transparency through multiple channels. The project emphasized transparency, accountability, openness, and the disclosure of information to the community to achieve social empowerment. Some of these measures are elaborated below:

Community-driven social audit

Social auditing was a cornerstone of PoCRA's approach, which served as a tool for measuring, understanding, and improving the project's social and ethical performance. It aligned the project objectives with reality, bolstering governance, transparency, and accountability. The social audit process involved various stakeholders, including marginalized groups, ensuring their voices were heard.

The Village Climate Resilient Committee (VCRMC) coordinated social audits for benefits distributed via Direct Benefit Transfer (DBT) and community assets created under Natural Resource Management (NRM) activities. Out of 3,959 VCRMCs, 3,874 eligible gram panchayats conducted social audits, with 1,68,457 stakeholders participating. This included 1,24,435 males (74%) and 44,022 females (26%), highlighting active community engagement.

These audits, conducted during Gram Sabha meetings, were documented and signed by the Agriculture Assistant and the Sarpanch. The "Gram Krishi Sanjeevani Vikas Darshika," a live document available at www.mahapocra.gov.in, disclosed village-level benefits. Physical verification of assets by VCRMC members ensured transparency and accountability.

Ease of access to information

A dedicated website (www.mahapocra.gov.in) provided comprehensive information on the project's rationale, approach, manuals, implementation strategies, funding, and activities. Regular updates on the website maintained public awareness and engagement.

Robust grievance redressal mechanism

A robust grievance redressal mechanism was established to ensure that stakeholders' voices were heard and addressed promptly, enhancing the project's integrity and efficacy. At the administrative level, the Project Management Unit (PMU) in Mumbai oversaw the documentation of all decisions, issuing guidelines and instructions digitally and physically, whenever necessary. At the district level, the District Superintendent of Agriculture Office (DSAO) coordinated project activities through a dedicated unit. Sub Divisional Agriculture Office (SDAO) replicated this structure, ensuring consistent implementation at the village level. The VCRMC disclosed project activities, beneficiary selection, and water balance through public displays and awareness campaigns. Regular training and workshops at various levels enhanced stakeholder capacity and project implementation.

The citizen engagement grievance redressal mechanism in the project ensured structured procedures. Project staff grievances followed contractual terms and government rules, overseen by a committee led by the Project Director with at least one female member. Village-level conflicts were resolved through VCRMC and Gram Sabha. SDAO managed conflicts among GPs and service providers, with appeals lying to DSAO. Stakeholders could submit grievances via designated channels, including the CM Helpline, and direct communication with Agricultural Officers at district and subdivision levels. At the village level, conflicts were resolved through the Village Conflict Resolution and Management Committee (VCRMC) and Gram Sabha. Unresolved issues were escalated to the Sub-Divisional Agriculture Officer (SDAO) and District Superintendent Agriculture Officer (DSAO). Additionally, written grievances were collected in field boxes at public locations within each VCRMC/Gram Panchayat for resolution during committee meetings.

8.4 Community Ownership and Accountability – The Critical Role of VCRMCs

Active participation and ownership of the project were ensured at the execution level through various strategic measures. The Village Climate Resilient Agriculture Committee (VCRMC), established under the Maharashtra Gram Panchayat Act, 1959, acts as the nodal development committee of the Gram Panchayat. Through the constitution of VCRMC, the project established a decentralized implementation

process through the existing Panchayati Raj System. VCRMC consisted of 17 members of which 13 members were executive and 4 members were non-executive. A key feature of the committee, aiming for inclusivity, pertained to two-thirds of its members being small or marginal landholders; and one-third of the members belonging to their respective Gram Panchayats. The representation of women members in the committee was at least 50%. A mention must be made of the notable efforts undertaken during the COVID-19 period through a special GR, whereby 764 VCRMCs were constituted through online Gram Sabha.

In the project's lifespan, the VCRMCs have ensured the active participation of the farming community in the project interventions and established ownership, accountability & transparency at the gram panchayat level. These VCRMCs have been empowered to make decisions relating to the approval of the applications submitted by the farmers seeking financial support for the farm-based interventions from the project. The VCRMCs, in turn, processed over 2 million farmer applications of the registered stakeholders on the DBT portal.

All such efforts and measures, went a long way in promoting independent functioning of a pioneering intervention whereby a local body instrument directly identified the beneficiaries, assisted in preparing participatory village micro-plans, executed community works as per the approved annual action plan, and maintained the assets, carrying out processes of due diligence and accountability at the grassroots.

The committee also acted as a subject of social audit by submitting itself to the scrutiny of the Gram Sabhas. The social audit process helped to ensure better implementation and monitoring of the activities. A grievance redressal mechanism was established at the village level which enabled the resolution of a majority of issues emerging during the implementation of the interventions.

Social Audits and Participation

The Village Climate Resilient Committee (VCRMC) coordinated social audits for the benefits distributed via Direct Benefit Transfer (DBT) and community assets created under Natural Resource Management (NRM) activities. 3,874 gram-panchayats conducted social audits, wherein 1,68,457 stakeholders participated. This included 1,24,435 males (74%) and 44,022 females (26%), highlighting active community engagement.

Following the letter and spirit of the law, all of the VCRMC members were oriented and trained to handle the approval process, documentation, social auditing, and maintenance of the assets and provide necessary information as per the Right to Information Act. The project conducted village 'Aam Sabhas' before Gram Sabhas especially for the women, to increase their social participation and empower them to better adopt the climate resilient agriculture technologies. This ensured the inclusion and mainstreaming of the women farmers in the agricultural activities.

This project directly drew women into the social and administrative decision-making process through 50% (25733 women members) of executive members in the committee. In the project areas, there were 64% women Sarpanch who were actively involved in the project's implementation process. It must be appreciated that the project ensured the involvement of local governance which proved to be significant for sustainable interventions to build resilience. The project consciously provided reservations for deprived sections of the society such as SC, ST, VJNT/NT, and OBC to avoid elite capture in the committee meetings and to ensure that all voices were heard while ensuring just benefit distribution in the project area. Additionally, 2/3rd representation from the marginal (up to 1 ha. land holdings) and small landholders (up to 2 ha. land holdings) in village committees were guaranteed to ensure just beneficiary selection at the village level.

Field visits revealed that VCRMC meetings were conducted on a monthly basis and the main activities undertaken included a review of the project's progress in the respective villages, guidance to farmers regarding application for grants through portal/mobile, approval of application, payment information and liaising with department for timely payments.

All the 25 VCRMCs with whom the FGDs were undertaken indicated to have improved the decentralized application process, digitization, and female mobilization through Krishi Tais in the project villages resulting in timesaving, ease of access, and increase in women farmer participation.

The key documents maintained were records of meetings, visitor registers, and documents related to individual applications. Agriculture assistants attended all meetings and maintained the minutes of the said meetings. Appreciably, no major conflicts were reported amongst VCRMC members. The project successfully ensured the maintenance of various display boards with the list of VCMRC members, their contact details, the status of subsidies, village water budget, etc., for the benefit of the target farmers, maintaining transparency in the project's communication at the village level. The VCRMCs were established with mandated representations from SC/ST/marginal and women farmers and women SHG members. Such significant representation from all sections, provided an opportunity to advance gender-responsive and socially inclusive governance processes, enabling women and marginalized to exercise their rights. Moreover, the decentralization of the implementation process of the project brought about transparency, accountability, and use of digital media. This ensured the benefits of the project also reached the most vulnerable sections of the society including small and marginal holders and women farmers. Such diverse representation from all sections fostered gender-responsive and socially inclusive governance processes as well as empowered women and marginalized groups to exercise their rights. Such a well-rounded approach ensured that the project's benefits reached the most vulnerable sections of society, including small and marginal landholders and women farmers.

The table below represents the composition of VCRMC.

Table 7: Composition of VCRMC

S. No	Member's Name and Work	No. of Members	Post
A) Executive Members			
1.	Sarpanch	1	Ex-Officio President
2.	Deputy Sarpanch	1	Ex-Officio Member
3.	Gram Panchayat Members (Male 1, Female 1)	2	Member
4.	Progressive Farmers (Gen 1, SC/ST/NT/VJNT 1)	2	Member
5.	Female Farmers (Gen 1, SC/ST 1, NT/VJNT 1)	3	Member
6.	Farmer Producer Groups/ FPO representative	1	Member
7.	Women Self Help Group representative	1	Member
8.	Agri- Allied business farmer	2	Member
A)	**Total Executive members**	**13**	
B) Non-Executive Members			
9.	Agriculture Assistant (Technical)	1	Ex-Officio Member
10.	Gram Sewak/ Village Development official	1	Member Secretary
11.	Cluster Assistant	1	Joint Secretary
12.	Krishi Tai	1	Extension Worker
B)	**Total Non-Executive members**	**4**	

8.5 Participatory Microplanning Process

The participatory micro-planning process was a key feature of this project not only to understand the risk and vulnerability due to climate change but also to plan adaptation strategy at the local level. The Microplanning Process (MLP) initiated by the project right at its inception helped enhance community participation in building resilience to address climate vulnerability. Microplanning involved all stakeholders in the village, making it a transparent and participatory exercise. It was considered as planning based on identified local requirements and gaps. A participant-led approach at the micro level also ensured the inclusion of marginalized communities. The approach followed under the project identified interlinkages and synergies amongst the different components related to the agriculture systems. It also created a strong ownership of the project.

The village-level micro plan was developed in a participatory manner in three phases viz:

- **Pre-Preparation Phase** was comprised of the process of village identification, collection of basic information, preparation of resource materials as modules & formats, village maps; orientation of field officials, and training of trainers and facilitators.
- The second phase of **participatory micro-planning process** included the socio-economic information and secondary information gathering, resource mapping, target group discussion, value chain mapping, planning based on the needs of stakeholders, gram sabha approval of village development plan inclusive of gender-specific concerns raised in women's-centric Aam sabhas.
- In the third phase of the microplanning process **technical vetting of the Village Development Plan (VDP)** was conducted by a team of technical experts including an Agricultural Assistant, an agricultural officer, and SDAOs. Based on the technically vetted plan, DPR was prepared by SDAOs. The technical vetted VDP receives approval from the District Coordination Committee.

The Village Development Plan (VDP) served as the basic unit of planning, detailing the activities under project components implemented in the village. Microplanning was conducted in 5,043 villages (including specific micro plans for PESA Gram Panchayats), and 5,043 Village Development Plans were prepared. These plans were duly approved by the District Coordination Committee and were executed in the project area.

While asking whether they were aware of the micro-planning exercise conducted in their village, around three-fourths of the eligible respondent households reported that they had awareness about the micro-planning exercise conducted by VCRMC. The awareness was slightly higher among SC and ST households depicting that the information has percolated into the vulnerable community.

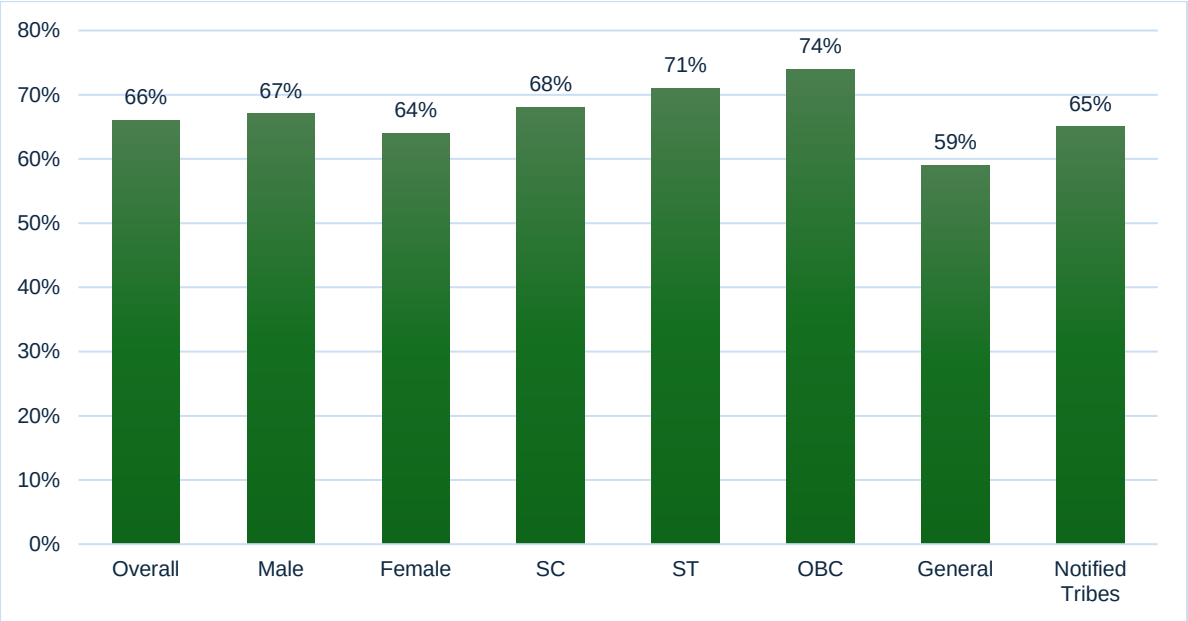

Figure 18: Awareness about micro-planning in the village

When asked whether their family members participated in the micro-planning exercise conducted in their village, nearly half of the respondents reported that they had participated. The participation level was higher among SC and notified tribal community than the overall average again reflecting the emphasis on equity aspects in the project.

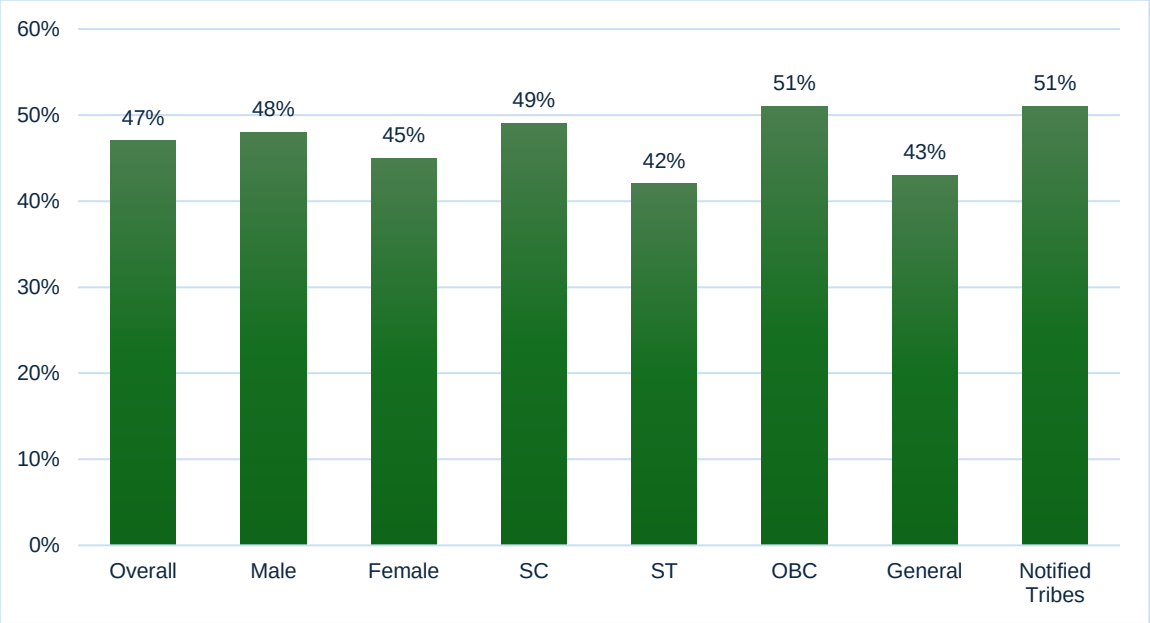

Figure 19: Participation in micro-planning

Consultative processes with tribal communities during micro-level planning

A specific micro-planning process in Scheduled Areas was prepared to ensure inclusive criteria which were instrumental in bringing in transparency and accountability in project implementation for tribal communities in particular. The project has ensured that the vulnerable people get the maximum benefit of the project thus SC/ST, women, and PWD were given priority in beneficiary selection in all the project activities.

To ensure the free, prior, and informed consultation with the Indigenous Peoples' Communities at each stage of project preparation and implementation, a Specific MLP exercise in Scheduled Area (PESA) was conducted in accordance with Tribal People's Planning Framework for overall development of the tribal people. As a result, 350 specific micro plans were developed which took into account local and culturally compatible contexts of scheduled areas.

As a social program driven by transparency and accountability, PoCRA by design, tried to incorporate an end-to-end digital solution, which helped citizens explicitly gain access to benefits. Real-time information about digital files was available to them which enhanced the transparency. Digitization also helped a large number of farmers to access digital services. The increased faith in the governance system was a by-product of the digital system.

The project ensured the participation of women farmers by prioritizing them within the FIFO (First In, First Out) system embedded in the software. This approach allowed women farmers to automatically receive benefits through systematic prioritization. The integration of auto-prioritization tools for social categories and FIFO systems represented a blend of technology and social dimensions aimed at delivering social justice effectively.

8.6 Digital Outreach

The digital outreach successfully overcame social barriers to reach women. The IT system enabled transparent and accountable governance and service delivery, ensuring a minimal number of grievances. This itself was indicative of the satisfaction of farmers and other stakeholders. The project's digital system created a ready human resource that remained in the village, serving as a knowledge and extension agent. Digitally equipped field workers and officials ensured the engagement of farmers and communities through the aggressive adoption of Information Technology.

The user-friendly, responsive, and transparent process promoted a seamless and paperless approval mechanism for applications, incorporating inclusiveness criteria within the system. The digital platform facilitated project monitoring and provided real-time updates via SMS to all stakeholders. The Aadhaar-linked accounts of beneficiary farmers received funds directly. The project developed various apps and portals to ease work, leveraging data to create an 'Office on Mobile' for extension functionaries.

The IT system supported microplanning at the village level, and the MLP app helped develop comprehensive Village Development Plans (VDP). The IT system ensured minimal disruption to project activities during the COVID-19 pandemic, resulting in substantial efficiency gains and keeping project management costs below 8% of the total project expenditure.

8.7 Direct Benefit Transfer (DBT) – The Most Powerful Impact

Maharashtra has been one of the pioneers in adopting Direct Benefit Transfer (DBT) under various schemes. The project adopted the same process of fund channelization to individual beneficiaries through DBT. It facilitated small and marginal landholders, as well as landless families, in adopting climate-resilient technologies, practices, and livelihood systems while making necessary investments in their farms. These investments were supported by the project both technically and financially. Subsidies s were provided to stakeholders through the DBT system. The project developed a portal and mobile application to facilitate easy registration and application by farmers, ensuring a seamless, end-to-end automation of the decision-making process.

Under the project's IT initiative, three modules were developed within the DBT portal. The first is the Farmer Module, a portal for farmers to register and apply for financial assistance under the project. The second is the NRM Module, designed for village-level communities to apply for financial assistance to carry out natural resource management (NRM) works as per the Village Development Plan. The third module is the FPO Module, dedicated to Farmer Producer Organizations (FPOs), Farmer Producer Companies (FPCs), and Self-Help Groups (SHGs) to apply for financial assistance to implement their business plans related to post-harvest processing, seed supply chains, and Custom Hiring Centres (CHCs).

A unique feature of the DBT application caters to a transparent approval mechanism, which allows beneficiaries to monitor the status of their applications in real-time. This paperless approval process eliminates intermediaries and establishes the credibility of the implementation agency.

Direct benefit distribution benefited various social categories: Scheduled Castes (SCs) constituted 2.7% (13,332) of beneficiaries, Scheduled Tribes (STs) made up 1.3% (6,288), and people with disabilities (PWD) accounted for 0.3% (1,423), while farmers from the general category represented 96% of the beneficiaries. Additionally, the distribution across different types of farmers included 45% (2,20,478) small farmers, 34% (1,64,477) marginal farmers, 20% (95,346) other landholding category farmers, and 1.1% (5,368) landless beneficiaries.

Among the 485,669 farmers who received subsidies through the DBT mechanism, women represented 20.7% (1,00,554) while men constituted 79.3%. The higher participation of men in farm-related activities can be attributed to land ownership and their decision-making roles within families. Nevertheless, a significant sum amounting to 22% of the total disbursed amount accrued to female farmers under the project. Around 20% of the 6,96,269 applications were for individual assets. The project benefited a substantial number of female farmers in the intervention areas through this initiative.

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9. Farmer Field Schools (FFS) to Support Women and Vulnerable Community

The traditional extension system in agriculture was not without challenges. The project responded to these by creating an innovative structure of “barefoot” facilitators, trained in extension work, to focus on a massive outreach endeavour. FFS is a participatory and interactive on-site learning approach that emphasizes observation-based learning. The FFS focused on the transfer of Climate Resilient Technologies, encouraging female farmers to learn innovative agriculture technologies and reduce drudgery.

FFS also provided a link between the women farmers and technical institutions through an extension worker. Women farmers/groups were specifically involved in the production and dissemination of bio-fertilizers and natural pesticides like Neem Extract. With technical backstopping by the National Institute of Plant Health Management (NIPHM), the innovative farmers established On-farm Bio-fertilizer production units to reduce the need for chemical fertilizers. The silage preparation training was conducted to prepare fodder and reduce manual collection from fields, decreasing the greater involvement of female labour. The mechanization of food and grain processing also helped women in reducing their drudgery.

FFS Facilitator guiding the farmer about the preparation of neem seed extract

Farmer Field Schools (FFS) were participatory, group-based learning approaches where farmers, often in small groups, learned practical skills and techniques through hands-on activities and field demonstrations. Farmer Field Schools (FFS) were established in villages by VCRMC to bridge the gap between progressive farmers and others in the community. A total of 15,501 host farmers participated in FFS, with 15% (2,327) being women. Additionally, 4,90,780 guest farmers participated, with 14% (67,644) being women.

While asking about participation level in FFS, the majority of the farmers were found to have participated in FFS. The participation level was higher among women, SC, and ST farmers again depicting equity aspects of the project.

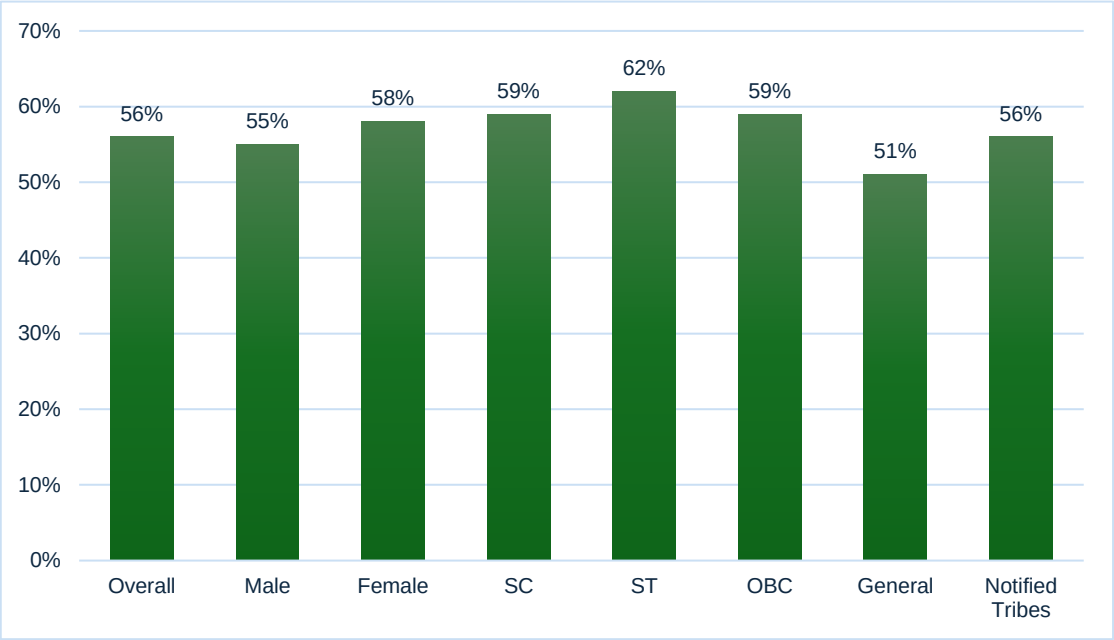

Figure 20: Participation in farmer field school

Respondents noted that the project significantly enhanced farmers' understanding of technologies related to preparation and cultivation, including the use of improved seed varieties, proper land preparation, and efficient fertilizer usage in several villages. It is observed through the end-term survey that the expenditure on chemical fertilizers reduced appreciably after the uptake of the compost units among the farmers. This holds significance as approximately 80% of the total 3,829 farmers (as per project MIS) adopting these measures belonged to the vulnerable sections possessing limited purchasing power to procure costly inputs[17]. The study districts were predominantly characterized by horticulture plantations (mango, guava, custard apple, sweet lime, watermelon, pomegranate) and seasonal vegetables. Other crops grown included cotton, soybean, and pigeon pea during the kharif season, and chickpea, wheat, and jowar during Rabi.

As a result, the majority of project applications focused on supporting micro-irrigation systems (drip/sprinkler) and horticulture plantations. Beneficiaries expressed satisfaction with these interventions, highlighting their contribution to water conservation and crop protection during periods of low water availability in the dry season. These technologies also contributed to increased productivity and farm income. Furthermore, farmers reported expanded acreage during the Rabi season due to project interventions such as farm ponds, tube wells, and the adoption of sprinkler and drip irrigation systems, including PVC pipes. Some small farmers even ventured into sericulture, benefiting from the advantages of micro-irrigation systems.

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[17] PoCRA End Term Report at Pg. 77 and project MIS data on compost units

10. Income Resilience among Project Beneficiaries from Vulnerable Community

Income resilience among project beneficiaries was a significant achievement. The project successfully reduced yield variability, stabilized income, created employment opportunities for youth and mitigated seasonal migration to some extent. These efforts enhanced the coping mechanisms of vulnerable farmers, leading to increased resilience in project villages. Particularly noteworthy were the efforts of PoCRA in capacitating farmers with Agromet advisories and promoting the adoption of climate-resilient agriculture technologies and seed varieties. This had a tangible impact on net farm income, as evidenced by the end-term survey findings. Notably, there was an appreciable 38% increase in net farm income observed in households headed by women. This underscored the project's success in empowering women farmers and improving household economic stability through sustainable agricultural practices and targeted support initiatives.

11. Contribution of PoCRA in Achieving Women Empowerment

The project ensured compliance with the gender action plan which is an integral part of the Social Management Framework. The project ensured the active participation of women during the implementation process and decision-making by 50% representation of women in VCRMC. Priorities were geared towards the vulnerable categories viz. SC, ST, Women and PWD, the nomination of female mobilizer *'Krishi Tai'* at the village level, coverage of landless and women for benefit distribution through direct benefit transfer, women-centric FPO/FPC/SHGs, FFS female host farmer and guest farmers, etc.

Drudgery reduction refers to the alleviation or lessening of strenuous and repetitive manual labour in agricultural or other work settings. In the project area, despite most land being owned by male farmers, women actively participated in a wide range of farming operations often without recognition. These activities frequently involved high levels of drudgery, making any reduction in such labour a direct empowerment step for women farmers and agricultural labourers. Therefore, the project focused on farm mechanization and the distribution of farm tools through Custom Hiring Centres (CHCs). These centres not only facilitated access to agricultural equipment but also promoted employment by encouraging rural women and youth to provide these services to farmers on rent. The project successfully supported the establishment of over 2,779 farmer groups to operate CHCs, which are now providing essential services to small farmers. Operations include pre-tillage, tillage, sowing, and threshing, significantly reducing drudgery for farmers, particularly women, and lowering production costs. CHCs have also contributed to increased farm income, and their technology-inclusive services have proven beneficial in addressing vulnerabilities, especially in areas prone to long dry spells.

Benefits of using CHCs

From the survey data of 52 households accessing CHCs, the total cost of hiring farm machinery for pre-sowing, sowing, inter-culture, harvesting, and threshing operations was estimated at around Rs. 3,000/- per acre in project areas. The average cost invested on similar farm machineries by all the surveyed farmers of key crops for control villages was Rs.3,865/- per acre. This reflects that renting farm machinery from the CHCs was beneficial for the farmers. It was evident that the CHCs could reduce nearly 23 % of the cost of renting farm machinery in the project villages. Given the efficiency of project implementation for agribusiness interventions, it was observed that nearly 80% of these 52 households did not face any challenge in accessing the facilities from the CHCs, while the rest of them reported minor process-related problems. Apart from reduced hiring cost of farm machineries at CHC, data showed that 62% of the CHC users expressed a reduction in drudgery, 85% of them saved on labour costs, and 81% of them saved time on the critical farm operations by utilizing the machinery available at CHCs.

Moreover, access to farm implements through CHCs enabled women farmers to adopt climate-resilient practices such as in-situ conservation of soil and water, crop diversification, and timely planting.

Effective measures to reduce drudgery in the project area included several key initiatives. Farm mechanization, improved farm tools and equipment assistance, and the adoption of advanced agricultural and soil conservation practices were central to these efforts. These practices included using climate-resilient seed varieties, seed treatment, bio-compost, vermicompost, mulching, Integrated Pest Management (IPM) measures such as bio-pesticides, yellow strips, insect traps, and Biological Control Agents (BCA), as well as Integrated Nutrient Management (INM) measures like organic manure and bio-fertilizers.

These initiatives were supported by capacity-building programs which proved effective in reducing drudgery, particularly among women farmers. They also contributed to increased cropping intensity, enhanced precision, and punctuality in utilizing crop inputs, and minimized losses at various stages of

crop production. Farm mechanization significantly boosted overall productivity and production while achieving the lowest possible cost of production. These combined efforts aimed to improve agricultural efficiency and sustainability while easing the physical burden on farmers, thereby fostering more inclusive and resilient farming practices.

11.1 *"Krishi Tai"* for mobilising women farmers

The objective of the mobilisation process was to encourage and enable the participation of key stakeholders in achieving project objectives. Through mobilisation and technical support, the farming community was empowered to enhance adaptation, build resilience, and increase environmental awareness. This included fostering the adoption of the latest technologies aimed at improving productive potential and profitability within the farming system while ensuring the sustainability of the existing ecosystem. The process aimed to create a conducive environment for stakeholders to actively engage and benefit from sustainable agricultural practices, thereby fostering long-term agricultural viability and community resilience.

The project adopted a gender-sensitive approach by prioritizing the needs of women stakeholders in both the planning and implementation phases. This was facilitated through the deployment of 'Krishi Tai' (women mobilizers) at the village level. These Krishi Tais, nominated by VCRMC, worked closely with district mobilization officials, cluster assistants, and various stakeholders including the agriculture department, Krishi Vigyan Kendra (KVK), and Gram Panchayats. A total of 4,135 Krishi Tais were engaged across project villages. They played a pivotal role in mobilizing women to participate in Farmer Field Schools (FFS) and Self-Help Group (SHG) meetings, disseminating project information through home visits, encouraging community members to avail project benefits, and providing guidance on climate-resilient technologies and agribusiness activities.

The project also focused on building the capacity of Krishi Tais through exposure visits and training sessions. Equipped with comprehensive knowledge of their roles and responsibilities, these mobilizers actively participated in all VCRMC meetings, ensuring effective coordination and implementation of project activities at the grassroots level. Their involvement contributed significantly to empowering women in agriculture and fostering inclusive community development.

Information, Education, and Communication (IEC) for Krishi Tai:

Case study:

"Collective success of project supported FPO/FPC"

In Sawana village from Hingoli district, Shiv Parvathi Shetkari Gat, comprising of 15 small and medium farmers was established in the year 2021. Agriculture is the mainstay of the village and the main crops grown are soybean and pigeon pea during kharif and chickpea, wheat and jowar during Rabi.

The benefits availed by the FPC from the project are support for establishing godown (warehouse), procuring cleaning and grading machine and acquiring transportation vehicle. The members incurred an expense of 60 lakhs of which nearly 35 lakhs were contributed by the project. They did not prefer to avail any bank loan. The godown is rented to small and marginal farmers for Rs 3 per quintal for a month. The main motive as stated by the members is not to make any big profit through rent but help the fellow farmers who otherwise run the risk of distress sale. Therefore, they just make a profit of around Rs. 5,000/- to 6,000/- per month. This storage facility has served as a replacement for home storage techniques resulting in reduced post-harvest losses for farmers due to spoilage or pest infestation. Moreover, it has helped in stabilisation of prices by adjusting demand and supply. The most important benefit realized from the project support is the grading machine.

Bhim Sawant, one of the active members of the FIG state that *"Earlier the farmers in the village used to sell their produce to wholesale merchants and agree to whatever price they were quoting, now with access to the grading machine things have changed. We sell our first quality produce directly in the main market and earn better profits".*

However, the members stated that the maintenance of grading machine is expensive and hence they charge Rs 150 per quintal. Hence, this service is mostly availed by large farmers to grade soybean, chickpea, wheat and pigeon pea.

Another service of FIG that is popular among large and medium farmers is the transportation vehicle which is charged Rs 12 per kilometre. Farmers use this service to transport their produce to the main vegetable/fruit/grain market in Hingoli. Earlier the transport services in the village were controlled by few people and charges were levied for both distance (Rs 13/km) and weight of the produce (Rs 100/quintal).

Another project supported FIG – Sri Goreshwar Shetkari Ghat in Goregoan of Hingoli district provided the much-needed drying yard facility to the local farmers. They charged only a nominal rent of Rs 3 per quintal to turmeric, which provide to be beneficial to small and marginal farmers. This FIG consisted of 15 members comprising of small and medium farmers and two landless labourers. The FIG was started in the year 2021 and got support for ware house and drying yard facility from PoCRA. The members incurred an expense of 40 lakhs of which nearly 24 lakhs were contributed by PoCRA.

In Umri village of Nanded district, the service of grading and cleaning machine provided by project supported - Maruthi Farmer Producer Company is popular among all farmers. They charge Rs 100/ Quintal for Chick pea and Soybean. This FPC comprising of 10 members stated that after grading the farmers earned an increased income of 10 to 25 % as compared to selling of their produce without grading.

A common denominator observed in all the FIG/FPC is the increased confidence of member farmers in handling post-harvest management and value chain promotion. This has also increased their visibility in the village commanding a higher respect and self-esteem. A noteworthy aspect is that the FIGs employed landless for cleaning and maintenance of the physical infrastructure and the machinery/ equipment. Moreover, they also took pride in benefiting the small and marginal farmers of the village stating that the living standards of the vulnerable groups has increased with better income and savings.

12. Social and Institutional Capacity Development

Capacity Development is a precursor for the success and sustainability of any development project, community group, or institution. The project acknowledged the need to support and train farmers and village communities responsible for project implementation and execution at the field level so that they could reach their potential capacity. The project capacity-building events organized beyond 'training' programs involved a holistic approach that encompassed human resource development, organization development, system/institutional development and cooperation, and network development. All these processes were seen as a continuum enabling stakeholders, functionaries, implementers, and policymakers to enhance their knowledge and skills and to develop the required orientation and perspectives leading to more effective performance of their roles and responsibilities.

A special initiative was taken by the project to conduct E-Gram sabha to constitute the online VCRMC. The project coordinated with the government's digital literacy program and imparted digital literacy to the stakeholders in collaboration with Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMG-DISHA) to strengthen their capacity to use various IT devices and operate computers. In the project, under Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMGDISHA), a total of 2,31,339 women stakeholders were registered in 3,071 Gram Panchayats of which 1,86,767 (80.73%) women completed their digital literacy training. A total of 1,30,214 participants received their certificate after successful completion of 20 hours of digital literacy training.

For training and capacity building, the project design established collaborations with research institutions and universities leading to improved dissemination of knowledge among the stakeholders such as Extension Management Training Institute (VANAMATI), Pune, NIRD Hyderabad, Banker's Institute for Rural Development (BIRD), a subsidiary of NABARD, Regional training institutes (RAMETI), Indian Council of Agriculture Research (ICAR), New Delhi; National Bureau of Soil Survey & Land Use Planning (NBSS & LUP), Nagpur; Indian Institute of Technology (IIT), Mumbai; State Agriculture Universities (PDKV, VNMAU & MPKV); Tata Institute of Social Science (TISS), Mumbai; YASHADA, Pune etc. The synergy in building the capacity and knowledge management aided the selection of appropriate technologies for dissemination, and selection of varieties for recommendations and ensured a higher adoption of the recommendations in the project.

A total of 76,966 events of training and workshops were conducted in the project. Across various training and workshops, 1,488,567 participants benefitted through capacity-building programs. The female participants were 4,12,890 (28%) and the male participants were 1,075,677 (72%). The topics in these training and workshops included Spraying Techniques with Safety Measures, technology dissemination, Krishi Sanjeevani Saptah celebration, International Nutritious Cereal Programme, social audit exercise, VCRMC member's orientation, Kharif hangam preparation, Krishi Tai orientation, etc.

205 exposure visits were conducted benefiting 4,218 stakeholders. Of the total beneficiaries, 3,130 were male (74%) and 1,088 were female (26%). Exposure visits were conducted at inter-district and inter-state levels by the VCRMC members and farmers. The exposure visit included a visit to Saguna Bagh and C. Sambhaji Nagar for SRT centre, zero tillage; Beekeeping Project Chakur; Krishi Mahotsav, C. Sambhaji Nagar; SHG Wardha for Tool Bank management, Vikel te Pikel, SMART project Pune; Sericulture Management; Soil & water management Darewadi village and Hiware Bazar, Agriculture fair Pune etc.

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13. Sustainability and Safeguard

The project was meticulously designed with a focus on fostering community ownership and building social capital at the village level to ensure the sustainability of climate resilience practices, technologies, and services beyond the project duration. Through training sessions, workshops, and exposure visits, stakeholders were empowered to adopt and maintain climate-resilient agricultural technologies. An institutional mechanism was established, characterized by both vertical and horizontal linkages across various levels. This framework aimed at enhancing the capacity of farmers and grassroots organizations to effectively implement climate-resilient agriculture practices, thereby achieving stability in agricultural productivity and income. Crucially, partnerships were forged with district and block-level functionaries, ensuring continued accessibility and availability of support to beneficiary farmers in the future. This collaborative approach is expected to sustain the wide-ranging interventions of the project and further enhance agricultural resilience in the project areas.

The project ensured the long-term sustainability of assets created through its interventions by planning for their transfer to Gram Panchayats after project completion. Gram Panchayats shouldered the responsibility for maintaining community assets and managing project-related records and registers. Meanwhile, individual beneficiaries continued to maintain their respective assets, ensuring sustained benefits and promoting community ownership of project outcomes. This approach aimed to uphold the enduring impact of the project on local development and livelihoods.

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14. Special Outreach Efforts during Pandemic Period

During the COVID-19 pandemic, the project faced significant challenges like the rest of the world, especially in maintaining economic and business activities during lockdowns. Given that most project activities required onsite work, the Project Management Unit (PMU) and field staff had to innovate to engage stakeholders effectively despite restrictions on physical movement.

To overcome these challenges, the project leveraged IT tools to reach out to farmers and stakeholders, particularly to prepare for the upcoming Kharif season. The PMU conducted numerous interactive sessions via Zoom and Microsoft Teams with various field officials, including DSAOs, SDAOs, project specialists, account officers, TAOs, CAOs, agriculture assistants, cluster assistants, and Krishi Tai. Between April and May 2020 alone, over 350 online meetings were organized to review project progress, plan for the Kharif season, compute water balances, prepare Micro Level Plans, and organize webinars.

Key topics covered in webinars and online meetings included roles and responsibilities of FPO/FPC members and SHGs, leveraging Farmer Field Schools (FFS) for extending climate-resilient farming practices and managing saline soils. Notably, sessions like "Computation of Village Water Balance" in collaboration with an IIT team and interactions with farmers on FFS were broadcast live on the project's YouTube channel. Participants' questions were addressed during the sessions, with the remaining queries addressed later via consolidated responses uploaded to the project website and shared through SMS links.

Furthermore, feedback from attendees was collected via dedicated forms to continually enhance the quality and relevance of future sessions. These efforts underscored the project's commitment to adapt and continue its mission of supporting agricultural resilience and community engagement during challenging times.

Case Study:

"Success through Shade-nets"

An effective approach towards combating climate vulnerability and employment generation

Krishna Farkade, a young farmer from Tapovan village in Jalna district, initially grew vegetables like chili and tomato on a small scale. In 2019, he learned about PoCRA and applied for a shade net to better utilize his land. He aimed to produce exotic vegetables for five-star hotels. Within two months, he received pre-sanction for the shade net, and after post-work verification, he was granted 7.42 lakhs by the project for the shade-net system and piping materials, contributing only 3 lakhs from his own pocket to complete the work on 0.5 acres.

Krishna Farkade, however changed his mind to grow exotic vegetables when he got a lucrative offer from Anantha Vegetable Seeds Private Limited where he agreed for a buy back arrangement to produce only chilli seeds of a high yielding variety. In the buyback arrangement the nursery expenses are borne by the company, while the charges of labour, fertilizer, pesticides and maintenance are taken up by Krishna. Due to polyhouse, he is able to harvest 1 quantal of chillies every six month and the seeds are sold to the company for 4,000/kg. Last year alone he made a profit of 4 lakhs.

An important highlight of this success story of shade net is not just the profit earned by Krishna but the employment opportunity it has created for women. Around 20 women are employed to do artificial pollination which is a skilled labour and hence fetches them a daily wage of more than 300 Rs. This wage is much higher than the normal agricultural wages the women in the region earn as labourers. Training to do artificial pollination was conducted by the seeds company.

Due to the nature of their high wages, the women get maximum support from their families to manage their household chores. Savitri Bai, a young mother happily stated that "My mother-in-law is fully supportive of my job. She takes care of my 2-year-old daughter while I am away. Moreover, she helps me in the kitchen and makes sure that I am not overburdened with household chores". It could be stated that this shade net activity supported by PoCRA has caused a spin-off effect in the region where unskilled women labour force would like to embrace the new knowledge of artificial pollination which would in turn fetches them better wages in the labour market.

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Case Study:

Transforming Cotton to Cloth – The Jagruti SHG Initiative in Wardha

Wardha District, nestled in the valley of the Wardha river, is in Maharashtra's Nagpur plains.

The district's agricultural profile is dominated by cotton cultivation spread over 227,623 hectares. Against this backdrop exists the Self-Help Group (SHG) "Jagruti" from Rohana village, composed of Schedule Tribe (ST) women, which has emerged as a transformative force. Formed in 2017 under the Maharashtra State Rural Livelihood Mission, Jagruti SHG's members have embarked on an ambitious project to convert raw cotton into cloth, leveraging the district's cotton abundance. The Jagruti SHG consists of 11 women who have acquired 5 handlooms through PoCRA. By sourcing cleaned cotton balls from the Sewagram Farm to Fashion Centre, the SHG processes these into approximately 2,000 meters of cloth monthly. This operation is projected to generate ₹5,60,000 in revenue, yielding a net profit of ₹2,09,200.

Seeing the endeavours of these women, one is reminded of the pre-Independence era, when the *Charkha* became a symbol of an aspiration to gain self-sufficiency and a burning desire to achieve freedom. The women of Jagruti group espouse the ideas of self-sufficiency, empowerment and a yearning to break away from the shackles of poverty with renewed vigour.

Miss Reena Gadekar, Chairman of Jagruti SHG, was inspired after attending a training session on solar charkha cloth production at Nivedita Nilyam in Gopuri, Wardha. Recognizing Rohana's significant cotton cultivation and the potential for minimal competition in handloom production, Reena saw a unique opportunity to capitalize on local resources. This vision catalysed the SHG's entry into the textile industry, underscoring a blend of traditional cotton usage and modern business acumen. The primary objectives of the project are to create an alternative income source for SHG members and to produce cotton fabric material from raw cotton. The SHG strives to establish a sustainable business model that not only provides employment but also fosters economic growth within the community.

The project has empowered SHG members to transition from wage labourers to businesswomen, enhancing their social standing and self-identity, especially as women belonging to vulnerable sections. The initiative has achieved a substantial yearly turnover and significant net profit, demonstrating the economic viability and potential for scalability.

Jagruti SHG's cotton-to-cloth project highlights the potential for rural women's groups to innovate within traditional industries, driving economic and social change through strategic use of local resources and modern techniques.

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15. Component-wise Social Safeguard Compliance

Table 8: Component-wise social safeguard compliances

Activity	Activity (With Reference to Planning Outcome / Baseline)	Compliance
Participatory Development of Mini Watershed Plans Sub-Activity Preparation of Cluster-Level Plans	• Needs assessment of farmers of different social and land-holding categories, including women farmers in general and tribal women in particular. • Segregated plan prepared by project component / sub-component / activities covering of inclusion of ST/SC farmers, women farmers, and HHs belonging to marginal and small holding categories.	• The Capacity Enhancement Need Assessment (CENA) exercise was conducted by the Tata Institute of Social Sciences (TISS) and stakeholder-specific need assessment and proposed capacity enhancement trainings were carried out focused on VCRMC members, small & marginal farmers, landless, women, youth, Krishi Tai, FPO/FPC/SHG members, PESA GP/VCRMC members and tribal community. • In 5,043 eligible villages micro-planning was conducted and the 5,043 Village Development Plan was prepared, duly approved by the District Coordination Committee, and executed in the project area. Of the total plans, 350 specific micro plans were prepared for PESA gram panchayats. The VDP included social and environmental safeguard measurements and ensured the inclusion of activities to cover all social categories.
Demonstration of climate resilient agronomic practices (CRAP) dry land farming Sub-Activity Farm Field School (FFS) for Technology Dissemination	• No. of FFS in Scheduled Areas. • No. of women farmers having demonstration plots. • No. of farmers exposed to FFS for learning and adoption of practices.	• 2,814 FFS were organized in Scheduled Areas. • 2,327 women farmers had demonstration plots. • 4,90,780 farmers learned and adopted Climate Resilient Agriculture Technologies (CRAT).
Enhancement in Carbon Sequestration	• Total area (in Ha.) covered under	• The project covered a total of 29,883 hectares under agroforestry and

Activity	Activity (With Reference to Planning Outcome / Baseline)	Compliance
Sub-Activity **Agroforestry- farm periphery/ small block**	plantation; plantation / agro-forestry in Scheduled Areas. • No. of SC/ST and women farmers covered under agro-forestry	horticultural plantation, with 1,127.65 hectares of this area located in Scheduled Areas, emphasizing sustainable agricultural practices and livelihood improvement in the targeted regions. • Under agroforestry and horticultural plantation, cumulatively 45,168 farmers benefited, of which 1,154 were SC farmers, 540 were ST farmers and 9,433 were female farmers.
Improvement of saline and sodic lands **Sub-Activity** • **Demonstration of Technology for Salinity Management** • **Farm Field School (FFS)** • **Water Pumps; Sprinklers**	• No. of farmers participated and adopted soil improvement practices; women farmers participated in the demonstration and adopted the practices • No. of farmers, by social and holding categories supported with pumps, farm ponds, and sprinklers. • No. of farmers get awareness about adopted soil improvement practices.	• The project organized 6,238 Farm Field School sessions for 1,00,000 farmers in saline & sodic areas. In saline and sodic lands, 14,220 women farmers participated in the demonstration and subsequently, adopted the practices under FFS. • The project supported 13,847 farmers with pumps, farm ponds, and sprinklers. 3,987 marginal farmers and 6,933 small farmers benefited from soil improvement practices, of which 2,546 were women farmers, 799 farmers belonged to the Scheduled Caste category and 121 farmers belonged to the Scheduled Tribe category. • Through FFS sessions, awareness of issues on soil salinity and sodicity increased significantly. Out of the total 165 sampled Kharpan villages in the project area, 61% of the respondents reported awareness of the issue, compared to 48% at the baseline, demonstrating the effectiveness of these educational efforts.

Activity	Activity (With Reference to Planning Outcome / Baseline)	Compliance
Protected Cultivation **Sub-Activity** **Shade net house;** **Polyhouse.** **Planting Material**	• Total number of farmers from various categories supported with protected cultivation and planting materials out of which no. of women farmers.	• A total of 6,062 farmers were supported through the project with protected cultivation and planting materials, including 1,492 women. This included 2,317 marginal farmers and 2,892 small farmers who benefited from these activities. • Out of the total beneficiaries, 84 farmers from the Scheduled Castes and 25 farmers from the Scheduled Tribes also availed the benefits of the protective cultivation. • These efforts aimed to empower farmers across different categories and promote sustainable agricultural practices in the project area.
Integrated Farming Systems **Sub-Activity** **Promotion of Small Ruminants; Backyard Poultry; Sericulture; Apiculture; Inland fishery;** **Other agro-based Livelihood**	• No of farmers, by social and holding categories supported the integrated farming system of which total no. of women farmers involved/supported with integrated farming system (by category);	• The project ensured that widows, single women, persons with disabilities (PWD), and landless individuals were included in alternative livelihood programs to generate additional income. Activities such as the promotion of small ruminants, backyard poultry, sericulture, apiculture, and inland fishery were specifically targeted at landless stakeholders to safeguard their livelihood avenues. • Out of a total of 5,368 landless beneficiaries, 1,783 landless females benefited from these initiatives, with 1,708 adopting small ruminants, 93 engaging in backyard poultry, and 8 participating in apiculture. • A total of 13,231 farmers received benefits under the integrated farming system where 3,810 were small farmers; 2,564 were marginal farmers; 1,485 belonged to other landholding categories, and

Activity	Activity (With Reference to Planning Outcome / Baseline)	Compliance
		5,368 were landless beneficiaries.
Soil Health Improvement Sub-Activity Vermicompost and NADEP Units; **Organic input production unit**	• Number of farmers, by social and holding categories supported/having vermicompost / NADEP unit • Number of women farmers having/supported with vermicompost / NADEP unit (by category). • Number of farmers / their collectives/women groups having an organic input production unit	• The project conducted demonstrations on Soil Health Improvement activities, focusing on Vermicompost, NADEP Units, and Organic input production. A total of 3,829 farmers adopted soil health improvement practices. Of the total beneficiaries, category-wise benefits disbursed to: • The female beneficiaries were 590. • In terms of the Landholding category, the project supported 1,305 marginal farmers and 1,809 small farmers. • 74 Scheduled Caste (SC) and 26 Scheduled Tribe (ST) farmers also benefited from these initiatives aimed at enhancing soil health and promoting sustainable farming practices in the project area.
Catchment Treatment and Drainage Line Treatment **Sub-Activity Continuous Contour trenches; Construction of Loose Bolder; Earthen Nala, Cement Nala Bunds**	• Total area treated and no. of farmers accessed benefit of soil and water conservation. • Area covered under soil and water conservation in tribal habitations / scheduled areas;	• Under the activity of Catchment Treatment and Drainage Line Treatment, the project focused on implementing Continuous Contour trenches, constructing Loose Boulder and Earthen Nala, and building Cement Nala Bunds. A total area of 59,387 hectares was treated under soil and water conservation works. The activities were carried out on fields of 77,338 farmers, comprising 58,364 male farmers (75.47%) and 18,974 female farmers (24.53%). • Notably, 4,616 hectares of these conservation works targeted tribal habitations and scheduled areas, emphasizing sustainable land management practices in these regions.

Activity	Activity (With Reference to Planning Outcome / Baseline)	Compliance
Construction of new water harvesting structures **Sub-Activity** **Construction of Community Farm ponds; Individual Farm Ponds (with/without lining); Open Dug Well**	• New water harvesting structures constructed/ renovated in inaccessible pockets, and tribal habitations and farmers benefitted. • Number of SF / MF / WF and tribal farming families supported with farm ponds and dug wells. • Number of farmers (of the total) accessed institutional credit, average worth of credit;	• Based on microplanning and potential area treatment plans, 12,676 farmers constructed new water harvesting structures under the project. These included Community Farm Ponds, Individual Farm Ponds with or without lining, and open-dug wells, aimed at improving soil moisture content and increasing water availability. The project's interventions have facilitated the irrigation of over 24,273 hectares of land through these multiple irrigation structures. Out of the total beneficiary farmers, category-wise disbursement was - • 3,115 female farmers undertook new water harvesting structure activity. • 341 Scheduled Caste (SC) and 178 Scheduled Tribe (ST) farmers participated in constructing these assets. • 2,617 marginal farmers and 6,988 small farmers enhanced irrigation potential through the newly constructed water harvesting structures on their fields.
Micro irrigation systems **Sub-Activity** **Drip and Sprinkler irrigation systems**	• Number of small, marginal, and women farmers and tribal farming families having drip/sprinkler irrigation. • Area (In Ha. area) of such families/households covered under drip/ sprinkler irrigation system.	• A total of 3,99,832 farmers benefited from drip and sprinkler systems, including 1,83,255 small farmers and 1,38,165 marginal farmers. Among them, were 8,673 Scheduled Caste (SC) farmers and 4,665 Scheduled Tribe (ST) farmers as well as 86,484 women farmers. • The project covered 2,82,481 hectares under drip irrigation and 2,06,266 hectares under sprinkler irrigation, significantly contributing to sustainable agriculture and water management in the region. Social category and land

Activity	Activity (With Reference to Planning Outcome / Baseline)	Compliance
		holding wise area covered under drip & sprinkler irrigation system were as follows: i. Scheduled Caste – 9,919 ha. ii. Scheduled Tribe – 5,487 ha. iii. Women farmer – 96,986 ha. iv. Small farmer – 2,26,153 ha. v. Marginal farmer – 1,53,792 ha.
Protective Irrigation **Sub-Activity** **Water pumps & carrying pipes**	• Number of farmers having water lifting devices, including women farmers and farmers from the ST/SC community.	• Under the main activity of Protective Irrigation, focusing on Water Pumps and Carrying Pipes, the project supported 45,178 farmers. This initiative primarily benefitted 14,595 marginal farmers and 22,018 small farmers by providing water pumps and pipes. Additionally, 1,380 Scheduled Caste (SC) farmers, 677 Scheduled Tribe (ST) farmers, and 8,078 women received subsidies for protective irrigation, ensuring equitable access and support across various demographics for sustainable agricultural practices.
Component (B) Climate Smart Post-Harvest Management and Value Chain Promotion		
Support to existing FPCs **Sub-Activity** **Preparation of development plan of FIG/FPO/FPC** **Strengthening of existing FIG/FPO/ FPCs** **Developing market linkages**	• Number of FPCs having business development plans. • Number of FPOs are benefited • Number of women farmers associated in FPC • Coverage of FPO members received capacity building initiative.	• The agribusiness activities were supported to strengthen the post-harvest management and value chain development of crops in the project area to maintain food security and generate employment. A total of 4,701 Business Development Plans from Farmer Producer Organizations (FPOs) received assistance under the project, benefiting 86,480 female members and 2,40,745 male members. • The project supported 1,698 FPCs, 1,799 Farmer groups (FGs), and 1,204 Self-Help Groups (SHGs),

Activity	Activity (With Reference to Planning Outcome / Baseline)	Compliance
		encompassing 1,68,383 male and 64,221 female members. • The number of farmers who directly or indirectly benefited through the agribusiness activities under the project was approximately 3,75,204. Notably, 237 of the total project-supported FPOs were women-led. PoCRA's focus on gender and vulnerable farming communities is also evident through the survey of 335 households that have accessed the agribusiness services through these FPOs. It is observed that nearly 14% of women and 17% of vulnerable members including 13% of NT, 2% of SCs, and 2% of STs used these agribusiness services. These efforts aimed to enhance livelihoods and promote sustainable agriculture among tribal communities. • 8,047 FPO members benefitted through various capacity-building programs and 464 master trainers were trained, who subsequently conducted field-level training on various topics, contributing to capacity-building and knowledge dissemination among stakeholders involved in rural development initiatives.
Establishment of Custom Hiring Centres	• Number of CHCs given in project-supported FPO • No. of business development plans covered under farm mechanization in tribal areas. • Increase/reduction in the cost of cultivation due to farm mechanization. • Total area covered under	• A total of 2,779 CHCs were established under the project-supported Farmer Producer Organizations (FPOs). • In tribal areas, the project supported 46 proposals, benefiting 1,013 beneficiaries. • It is evident through primary data of 52 HH assessing CHCs that the CHCs reduced nearly 23% cost of renting farm machinery resulting in reduced cost of cultivation. Apart from reduced hiring

Activity	Activity (With Reference to Planning Outcome / Baseline)	Compliance
	farm mechanization	cost of farm machinery at CHC, data showed that 62% of the CHC users expressed a reduction in drudgery, 85% of them saved on labor costs, and 81% of them saved time on the critical farm operations by utilizing the machinery available at CHCs. • Approximately 8,33,700 hectares of land had the potential to be mechanized through CHCs, aimed at reducing labor dependency in agricultural operations and enhancing the efficiency of farm implements, with an average of 300 hectares per CHC.
Support to FIG/FPO/FPCs for product aggregation, handling, transformation & marketing	• No. of business plans supported by the project • Infrastructure support provided to FPO	• Primary & Secondary processing activities were undertaken by FPOs, and 417 business development plans were supported by the project. • Robust infrastructural support to create the storage facilities at the FPO level was given for grains, seed, and onion storage, etc. These FPOs were supported for building seed storage godowns, seed processing units, and drying yards. A total of 960 FPO proposals were supported. • Additionally, approximately 1,80,836 metric tonnes of storage capacity was created for storing soybean, cotton, tur, and gram on a seasonal basis for both seeds and grains. • Specifically, 11,560 metric tonnes of storage capacity was created for onions, with an average of 200 metric tonnes per onion storage structure, enhancing storage capabilities for agricultural produce. • The project supported 545 Farmer Producer Organizations (FPOs) for initiatives such as Refrigerated

Activity	Activity (With Reference to Planning Outcome / Baseline)	Compliance
		Vans, Vegetable/Fruit Carriers/Vehicles, Goat Breeding Centres, Geranium Oil Distillation Plants, Vermicomposting Projects, Sericulture Units, and Oil Extraction Units, with financial assistance amounting to 60.86 crore rupees provided. • Additionally, the project facilitated the creation of 550 metric tonnes of capacity for Refrigerated Vans or Vegetable/Fruit Carrier/Vehicles.
Production of foundation & certified seed of climate-resilient varieties	• Number of SF / MF / WF and from ST/SC community covered under seed multiplication. • Total number of farmers covered under seed production; Quantum of seeds produced, and percent of demand met, and no. farmers are supplied with	• 10,832 small farmers; 4,054 marginal farmers; 4,911 women farmers; 144 Scheduled Tribe (ST) and 302 Scheduled Caste (SC) farmers received support under the seed multiplication initiative. • 24,205 farmers received the project's support to produce foundation & certified seed of climate resilient varieties covering 58,510 ha. area. • Under the project's initiatives and constant support, 50,000 MT of seed were produced by the farmers in the project area.
Development of seed hub- infrastructure support **Sub-Activity** **Seed Processing Equipment; Training of seed producer farmers; Strengthening of seed quality testing facility**	• No. of seed processing, storage infrastructure, and related facilities.	• Under the seed hub infrastructure development initiative, the project disbursed monetary sums for 155 proposals covering seed processing units, seed equipment, sheds/drying yards, and storage/godowns. Additionally, 140 Farmer Producer Organizations (FPOs/FPCs) established seed processing units with a capacity of 35,060 metric tonnes, enhancing seed processing and storage capabilities to support agricultural productivity and seed

Activity	Activity (With Reference to Planning Outcome / Baseline)	Compliance
		security in the region.
Component (C) Institutional Development, Knowledge, and Policies for a Climate-resilient Agriculture		
Capacity Building Sub-Activity **●Training needs assessment, Design & Module Preparation; Training of Project Officials/experts, Farmer's Friend, VCRMC** **●Exposure Visits**	• Identification of capacity-building needs of different categories of stakeholders. • Thematic areas of training/exposures and coverage of persons from different operational levels.	• A Capacity Enhancement & Need Assessment (CENA) study was conducted to identify the training and capacity enhancement needs of the stakeholders, including farmers, members of the FPOs, VCRMC, and project officials. Specific training needs of women, tribal communities, and youth were assessed. The major thematic areas of training, workshop & exposure visits covered topics such as the orientation of the project, ESMF criteria, and guidelines, Water Budgeting exercise, Horticulture training, Broad Bed Furrow (BBF) technique, SRT technology, seed production, *Vikel te Pikel* (crop production as per market demand) Digital literacy, appropriate use of pesticide & fertilizer for soil health improvement, Life for Environment, Krishi Sanjeevani Saptah, Kharif Hangaam Baithak, Apiculture & Sericulture Training, Administration & Account Managementt. of VCRMC, Spraying Techniques with Safety Measures, technology dissemination, Krishi Sanjeevani Saptah celebration, International Nutritious Cereal Programme, social audit exercise, VCRMC member's orientation, Kharif hangam preparation, Krishi Tai orientation etc. • In the project, a total of 76,966 training events and workshops were conducted, benefiting 14,88,567 participants through capacity-building programs. Among them, 4,12,890 were

Activity	Activity (With Reference to Planning Outcome / Baseline)	Compliance
		female participants (28%) and 10,75,677 were male participants (72%). Additionally, 4,218 stakeholders benefited from 205 exposure visits, with 3,130 males (74%) and 1,088 females (26%) among the total beneficiaries. Overall, the project reached 89,858 unique beneficiaries through its various initiatives.

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16. Conclusion and Way Forward

16.1 Conclusion

The PoCRA project developed comprehensive Environmental and Social Management Framework (ESMF) guidelines to ensure that any potential environmental and social impacts were effectively identified and mitigated. The project made sure that the right institutional framework was in place to guarantee that the project's components complied with the ESMF. The Village Climate Resilience Management Committee (VCRMC) coordinated the entire project implementation at the village level through participatory approaches with the farming community. The mini watershed development plan prepared by the VCRMC with rich knowledge of the region, supported to improve the resilience of the villages to better manage and adapt to shortage of water. The village-centric Farmers Field Schools involving progressive farmers of the region, experts from KVKs, ATMA, and other agricultural institutions supported to improve the awareness of the farming community in the PoCRA project villages towards climate-smart agriculture with social and environmental compliance.

The project promoted several agronomic practices (e.g. integrated pest management, integrated nutrient management, integrated farm management, etc.) and agriculture activities (e.g. horticulture, water management, postharvest management, etc.) to increase carbon sequestration and reduce greenhouse gas emissions from the project area. The integrated pest management system has promoted awareness of biopesticide uses among the farmers, while integrated nutrient management decreased the chemical fertilizer uses in the project areas compared to the comparison areas in the household survey. It was estimated that the project activities avoided about 3.2 million tons of CO_2 eq carbon emissions annually from the project implementation area as compared to the comparison areas. The adoption of protected cultivation practices like Shade-net and Polyhouse has increased the resilience of farmers towards climate vulnerability and pest attacks.

Project interventions of *in situ* water management through micro-irrigation systems (i.e., sprinkler and drip irrigation) along with management of open dug wells have increased the water use efficiency in the project area by 8%, compared to the baseline scenario. The project has undertaken activities to manage the excess crop residues (through mulching and composting), and safe disposal of plastic and polymers (used in shade-net, polyhouse, pipes, mulch, etc.) after their end-of-life through the soil nutrient management practices in ESMF.

The farmers were aware of reducing the crop residue burning and reusing disposals to improve the quantity and quality of their produce. The project has taken several awareness-building programs for the safe use of pesticides and chemical fertilizers resulting in farmers improving on adapting to the safe use guidelines. The post-harvest management infrastructures developed under the project improved the resilience of farmers to protect the products from climate extremes.

The project activities have successfully ensured inclusiveness and equity. The composition of all the VCRMC was inclusive of the mandated representations from SC/ST/women farmers, mostly from marginal and small farmer categories. VCRMCs were actively working to ensure that the marginalized community (including the tribal communities) benefitted from the project, through awareness generation regarding the DBT system and facilitating the application process through portal/mobile.

VCRMC members (including women) received capacity-building training on various aspects such as roles and responsibilities, project implementation, application processes, and procedures, climate-resilient farming systems, social inclusiveness criteria, and agricultural and irrigation practices among others. Moreover, women's representation in VCRMC was more than 50%, where they directly participated in decision-making processes, which in turn helped in representing the needs and demands

of women in achieving climate-resilient agricultural practices. Women also gained confidence in public speaking after becoming VCRMC members.

Project's integrated farming system interventions like goat rearing, backyard poultry, apiculture, horticulture nurseries, and other SHGs income generating activities proved to be boon for creating self-sustaining livelihood opportunities for the landless, vulnerable women, small and marginal farmers, tribal communities, widows, PWD, and SC/ST communities. Krishi Tais played a vital role in community mobilization, disseminating project information, and mobilizing women for Farmer Field Schools (FFS), supported by ongoing training in community engagement and climate-smart agricultural practices.

Direct Benefit Transfer (DBT) emerged as a transformative intervention that eliminated the involvement of middle people and supported small & marginal landholders and landless families to adopt climate-resilient technologies, practices, and livelihood systems and make necessary investments on their farms. Since there was no upper limit for the number of beneficiaries from each village, a sense of unhealthy competition did not exist among farmers.

The major benefit availed by SC/ ST farmers was support for micro-irrigation systems (drip/sprinkler) for horticulture plantations. These technologies have led to water conservation and saved crops during water scarcity in the dry season. In addition, it has increased productivity and farm income.

The social audit system and digitization of DBT ensured transparency of the process and procedures and local ownership of the project. Transparency was maintained in all activities/developments (pre-sanction, sanction, training, etc.) and was communicated to the beneficiary through WhatsApp groups/Krushi Tai which were specifically created under the project. Moreover, real-time information about the processing of applications was available to the applicants which sustainably reduced the ambiguity of the system. This encouraged farmers to adopt different climate-resilient activities under the project.

Social and institutional capacity development played a crucial role in the effective implementation of the project. The capacity-building initiatives moved beyond the awareness generation and training programs and encompassed conducting e-Gramsabha to constitute the online VCRMC. The project also coordinated with the government's digital literacy program in collaboration with Pradhan Mantri Gramin Digital Saksharta Abhiyan (PMG-DISHA) to strengthen the capacity of stakeholders to use various IT devices and operate computers. Strategic partnerships were forged with various government institutions for conducting capacity training programs seminars, workshops, webinars, and exposure visits.

The interventions for FPO/ FPCs which was a congregation of several hundred farmers aided in climate-smart post-harvest management and value chain promotion. It promoted a better marketing system, processing, and value addition for farm produce through institutional mechanisms. The spin-off effect was better opportunities for small and marginal farmers since they could avail themselves of different benefits provided by FPO/FPC.

Field-level support of project staff and agro-advisory helped to generate awareness of climate-resilient agriculture practices among the farmers. Having many benefits, the project could provide, the project also faced certain challenges like land ownership in the case of women farmers, participation of women and vulnerable farmers in FFS training, and lack of upfront cost to initiate in case of project pre-sanction.

The PoCRA project has addressed several SDGs like

- SDG1 (Digital financial services through the DBT portal can help people to eliminate poverty)
- SDG 2.3 (Double the agricultural productivity and incomes of small-scale food producers)

- SDG 5.5 (Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life)
- SDG8.2 (Achieve higher levels of economic productivity through diversification, technological upgrading)
- SDG 10.2 (Empower and encourage the social, economic, and political inclusion of all, irrespective of age, sex, handicap, race, ethnicity, origin, religion, or economic or another status)
- SDG 12.5 (Substantially reduce waste generation through prevention, reduction, recycling, and reuse)
- SDG 13 (Contribution to resilience to climate change effects)

The project intervention yielded positive social and environmental impact since it was planned, implemented, and designed with environmentally and socially effective implementation practices. Further, given the positive impacts of the project, it needs to be scaled up in other parts of the state and country with required changes as per the local conditions to promote climate-resilient agriculture. This project not only promoted climate-resilient agricultural practices but also ensured and supported social inclusivity with transparency.

16.2 Way Forward

1. **Scaling up successful practices**
    - Successful practices and technologies demonstrated by PoCRA should be scaled up to other regions facing similar climatic challenges to ensure broader adoption of climate-resilient agricultural practices.
2. **Continuous Monitoring and Evaluation**
    - To sustain positive impacts, continuous monitoring and evaluation should be conducted. Regular audits and assessments will help identify areas for improvement and ensure compliance with environmental and social safeguards.
3. **Enhanced capacity building**
    - Ongoing training and capacity-building programs for farmers, community institutions, and project stakeholders should be strengthened. This will empower them with the knowledge and skills needed to maintain and enhance climate resilience in agriculture.
4. **Policy integration**
    - Insights and lessons learned from PoCRA should be integrated into state and national agricultural policies to mainstream climate resilience into broader agricultural development strategies.
5. **Community participation and ownership**
    - Continued emphasis on community participation and ownership is crucial. Engaging local communities in planning, implementation, and monitoring ensures the sustainability and relevance of interventions.
6. **Promotion of climate-resilient value chains**
    - Strengthening climate-resilient value chains and supporting Farmer Producer Companies (FPCs) in their agribusiness ventures will enhance market access and income security for smallholder farmers.

7. **Improved water management**

    - Continued focus on improving water use efficiency through micro-irrigation systems and the creation/renovation of water bodies will ensure sustainable water management practices.

8. **Sustainable infrastructure development**

    - The development of infrastructure for value addition and post-harvest management should continue to receive support to enhance the profitability and sustainability of agricultural practices.

Overall, the PoCRA project has established a strong foundation for sustainable and climate-resilient agriculture in Maharashtra. By building on the successes and addressing the challenges, the project can continue to deliver substantial environmental and social benefits, contributing to the long-term resilience and prosperity of the farming communities.

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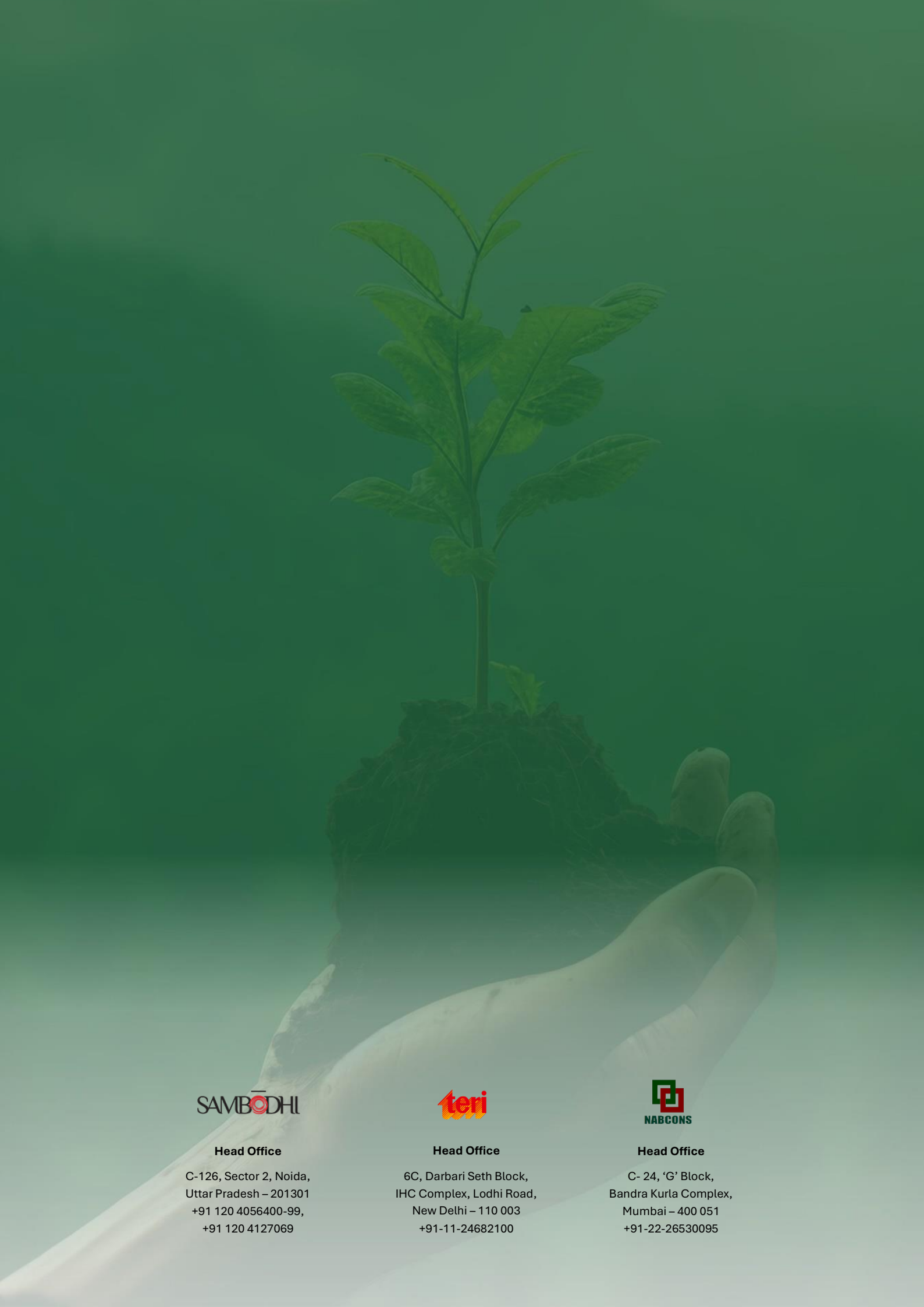

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