SUB-NATIONAL CLIMATE ACTION ON ADAPTATION

Monitoring, Evaluation, and Learning Framework for the State of Odisha

India Phase II

Supported by / Prepared for
ICAT (UNOPS)

Initiative for Climate Action Transparency - ICAT

Subnational Report and MEL Framework for Odisha

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1. Introduction

It is well established that in the global context, climate change is one of the most pressed issues humankind is facing. Efforts to mitigate climate change as well as increase resilience to better manage its impacts are being taken by both developed and developing countries. A large developing country such as India is extremely sensitive to weather vagaries and climate, given substantial dependence of its population on climate-sensitive sectors for a living. Adaptation to reduce the associated risks to a changing climate and its extremes thus becomes critical in the process. However, there are gaps in the understanding of the risks and their distribution across different regions. Granular information that may assist in decision making though exists is pocketed and may not be available in the form and format that can be used for effective action.

Monitoring and evaluation for risk reduction has not been considered as of yet. There are donor-driven programmes of multilaterals that are now being implemented which have started to integrate this in the process of the implementation of the various interventions that these multilaterals are supporting in the country. India's policy landscape on climate change dates back to 2008 with the introduction of the National Action Plan on Climate Change (NAPCC), which, to start with included eight missions with a focus on both mitigation and adaptation. The missions on agriculture, water and Sustaining Himalayan Ecosystem have a clear focus on adaptation. The Mission on Green India while encourages sequestration is seen to also draw on co-benefits for adaptation by improving livelihoods. Following the NAPCC, at sub-national scales the states have developed their state action plans on climate change which had been done couple of years back and are currently being revised.

Besides the plans specifically designed to address climate change, there are developmental programmes that have the potential to contribute to adaptation, but they have not been revised considering climate risks. Climate proofing of development programmes is a clear area of interest. There are some Centre- and state-led initiatives that have been initiated in the recent past to support pure adaptation interventions. This includes work being supported under the State Specific Action Plans (SSAPs) of the National Water Mission, the National Innovations on Climate Resilient Agriculture (NICRA), projects supported under the National Adaptation Fund for Climate Change (NAFCC) and the Programme on Climate Resilient Agriculture (PoCRA).

While these projects have been established, monitoring and evaluation frameworks that indicate the progress in work related to these projects are needed. The Initiative Climate Action and Transparency on Adaptation (ICAT-A) seeks to identify some of these projects that are being implemented in the country to develop frameworks for monitoring, evaluation, and learning from the processes of implementation that are underway.

The Initiative on Climate Action Transparency (ICAT) aims to support countries with custom- made tools and methodologies to create frameworks for effective reporting on climate action while adhering to the country's development priorities. Globally, monitoring and evaluation frameworks are being developed to track the progress of development programmes. They are considered as standardized tools which assist in reporting outputs, outcomes and impacts of a project and help in establishing accountability. Monitoring and evaluation in adaptation projects not only help in tracking the progress of interventions but also point out needs for adjustments. They

help countries arrive at understanding whether they are doing the right things, doing them correctly and what could have been done differently. Effective frameworks can help governments understand:[1]

- Successful adaptation actions which reduce vulnerability
- Addressing urgent adaptation needs
- Results of climate policies
- Increase in resilience of communities

The present document entails details of the Odisha adaptation initiatives. The case study in Odisha prioritizes the water sector initiatives being promoted for adaptation, focusing on the initiatives and schemes aimed towards the accruing benefits of water conservation on enhancing livelihoods and increasing the resilience of local communities. Along with these adaptation initiatives, it also takes into account the mapping of the financial and implementing stakeholders in the state for the implementation of a monitoring, evaluation, and learning (MEL) framework and of future adaptation initiatives.

1.1 ICAT-A Approach for Stakeholder Engagement

- **Scales of Engagement**

Since adaptation is locally oriented and has to be context specific, there is a need to engage stakeholders at all possible levels of the implementation. An effective implementation of any climate change adaptation intervention requires engagement at various scales, starting from individuals to institutions, both horizontally and vertically oriented. The various scales, as indicated below, are based on the kind of adaptation intervention being planned/ implemented:

- **National:** Central Government, other relevant entities in the implementation of these projects, private sector, research institutions, academia and non-governmental organizations (NGOs), financial institutions
- **Subnational:** State relevant departments, state research institutions, private sector, academia, NGOs, financial institutions
- **Local:** Community-based organizations, gram panchayats, village-level committees
- **Beneficiaries:** Can be divided on the basis of the social strata: type, class, and caste
  - » Type: Households/ individuals groups (farmers, fisher-folk, forest-dependent communities, coastal communities (any other if applicable)
  - » Class: high-, mid, and low-income groups
  - » Caste: General categories, SCs/ STs

The objective of interactions is to understand and co-produce information that further assists in the learning process of how the implementation is carried out.

[1] Details available at <https://www.adaptationcommunity.net/wp-content/uploads/2020/05/Adaptation-Briefings-2-Monitoring-and-Evaluation-of-Adaptation-An-Introduction.pdf>

- **Mode of Engagement**

The mode of engagement would primarily vary according to the type of stakeholder being taken into consideration and the type of information that needs to be extracted. For instance, key person interviews and one-to-one interactions are generally done for interactions with various institutions to garner information on the nature of the intervention, roles, and responsibilities in implementation and understanding the barriers and bridges for implementation. Community interactions are also conducted to understand their perspectives on the nature of impact and the interventions being carried out or proposed. Group discussions, FGDs, Surveys are common modes of engagement and collation of information from the beneficiaries.

2. Description of the Sub-national Action on Adaptation in the State of Odisha, India

Odisha is an eastern Indian state with 480 kilometres of coastline exposed to Bay of Bengal (Figure 1). It is located at 20.9517°N and 85.0985°E, covering 4.7% of India's land mass.[2] Approximately 42 million population resides in the

Figure 1 Odisha state in India

[2] Details available at <http://climatechangecellodisha.org/pdf/State%20Action%20Plan%20on%20Climate%20Change% 202018-23.pdf>

state across 30 districts having almost equal male and female representation.[3] Geomorphologic divisions include five regions—the Odisha Coastal Plain in the east, the Middle Mountainous and Highlands Region, the Central plateaus, the western rolling uplands, and the major flood plains. In terms of poverty-related indicators, it ranks ninth as per multi-dimensionally poor index (MPI) with 29% of population multi-dimensionally poor.[4]

The agriculture sector contributes mainly to the economy of the state. Although there has been a decline in the share of the agriculture sector from 37% in 1992–93 to 21% in 2017–18 but the number of people involved in agriculture is still high. More than 55% population is engaged in agriculture and allied activities.[5] The sector has contracted over time due to the occurrence of disasters such as COVID-19, floods and cyclones, and AMPHAN in the past.[6]

Odisha has been classified into 10 agro-climatic zones. The tropical climate of the state is marked by high humidity, high temperature, short and mild winters, and medium to high rainfall characteristics. Since the state faces sub-humid climate as per Thornthwaite's classification and Aw Tropical savannah climate as per Koppen's climatic classification, the region is deficit of winter rains. The state is dependent on monsoon for its water resources. About 230.76 billion cubic metres (BCM) of precipitation is received under normal conditions, of which 78% of rainfall occurs during June to September.[7]

Figure 2 indicates the population distribution in Odisha across 30 districts of which Nuapada district in which the adaptation action is being studied constitutes a smaller share of 1.45% of the total population of the state.

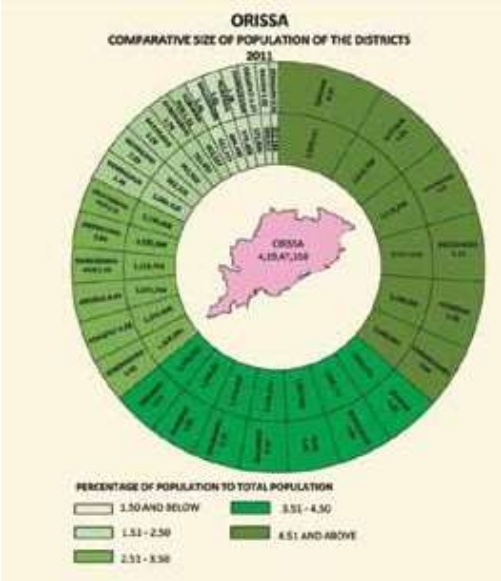

Figure 2 District-wise population in Odisha (2011)

[3] Details available at <http://www.orienvis.nic.in/index1.aspx?lid=343&mid=1&langid=1&linkid=234#:~:text=Total%20population%20of%20Orissa%20as,18%2C660%2C570%20while%20females%20were%2018%2C144%2C090>

[4] Details available at <https://www.niti.gov.in/sites/default/files/2021-11/National_MPI_India-11242021.pdf>

[5] Details available at <https://link.springer.com/chapter/10.1007/978-981-15-9335-2_9>

[6] Details available at <https://finance.odisha.gov.in/sites/default/files/2021-02/Economic_Survey.pdf>

[7] Details available at <http://moef.gov.in/wp-content/uploads/2017/08/Odisha.pdf>

2.1 Climate Change Risks and Impacts in Odisha

The state is facing a change in climate patterns with erratic rainfall inducing both floods and drought in different parts. Besides, its vulnerability due to geographical location, excessive dependency of water sector on Indian monsoon also makes it prone to climate change. This is largely due to variation in river flow with increase in frequency/intensity of extreme climate events such as floods, droughts, and cyclones. The hilly regions are vulnerable to flash floods, leading to sand casting and degradation of topsoil. The erratic rainfall pattern has affected both agriculture and the fishery sectors in the district.[8] Since the region largely practices paddy cultivation, a water-consuming crop, the agriculture sector is highly likely to be affected due to the vagaries in weather conditions.

The climate vulnerabilities of the Odisha state to various climatic and non-climatic factors are detailed in the State Action Plan on Climate Change (SAPCC) Phase-II report.[9] However, some snapshots of the same are illustrated below:

1. **Hydro-met vulnerability**

There have been irregularities in the rainfall pattern since the 1960s with all districts mostly recording below normal rainfall. The normal 120 days of monsoon rain in the state have also been reduced to 60-70 days with increased rainfall intensity of around 200-250 mm, leading to flooding. This monsoon variability is also affecting agricultural crops mainly during Rabi season due to reduced residual moisture of the soil.

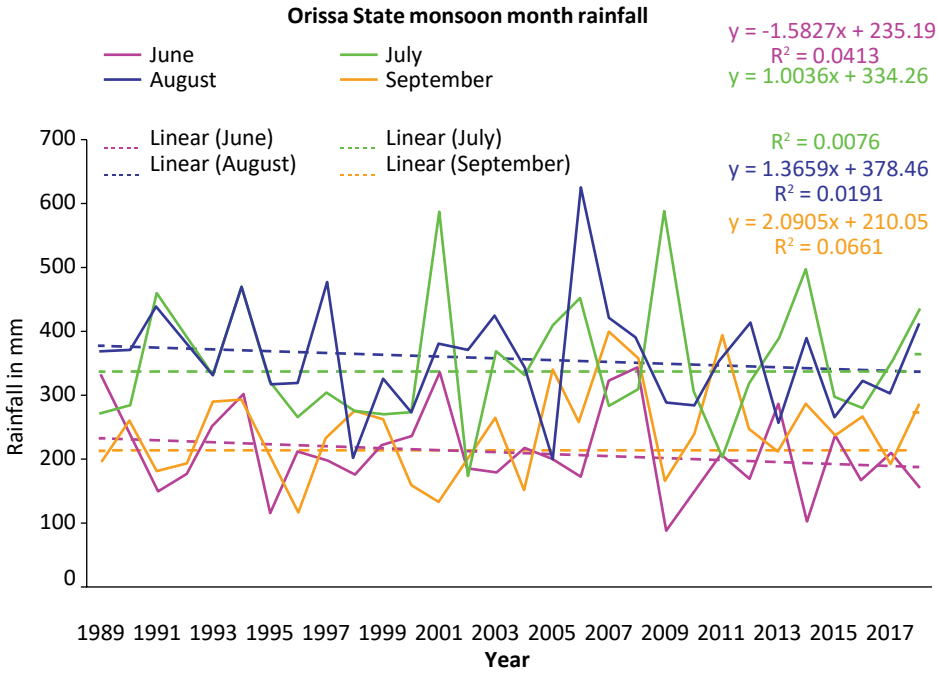

Figure 3 Monsoon month rainfall trend from 1989 to 2017 for Odisha

[8] Details available at <http://climatechangecellodisha.org/pdf/State%20Action%20Plan%20on%20Climate%20Change% 202018-23.pdf>

[9] Details available at <http://climatechangecellodisha.org/pdf/State%20Action%20Plan%20on%20Climate%20Change% 202018-23.pdf>

2. Temperature Rise

The state experiences the natural phenomenon of Nor'westers or Kala Baisakhi due to strong heating of land mass during mid-day. This phenomenon intensifies by mixing with warm moist air mass from the Bay of Bengal resulting in damages to several horticultural crops. To prospect the change in mean annual temperature, computational study conducted as per SAPCC Phase-II report shows that north-western, western, and south-western parts of the state shall face highest rise in temperatures by 2100 whereas coastal region will remain relatively less warm even though it clearly breaches the 2°C barrier (Figure 4).

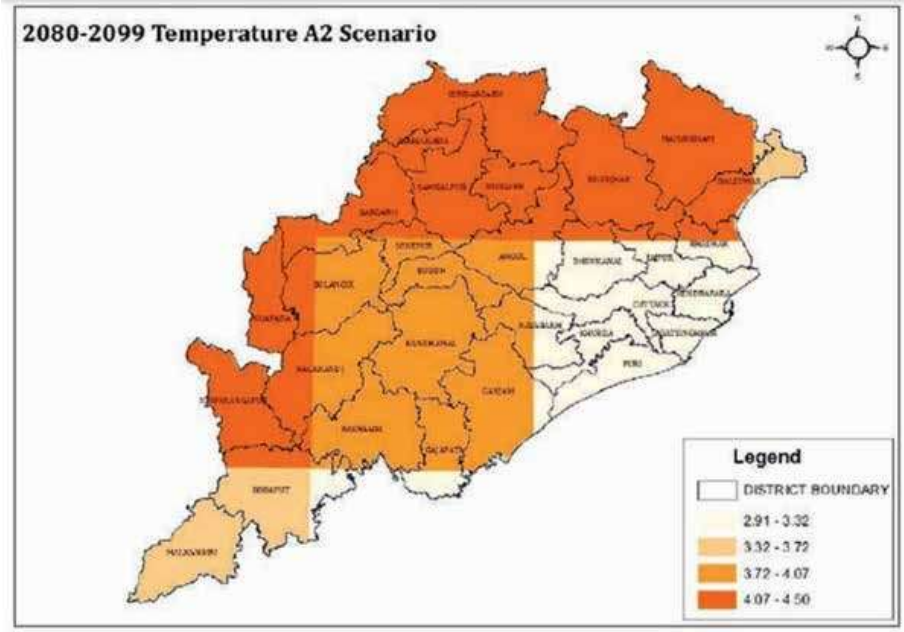

Figure 4 Long-term prediction (by 2100) of projected change in mean annual temperature under A2 Scenario in Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (AR5), Odisha (degrees Celsius)

Source SAPCC Report Phase-II

3. Heat wave

From 1991-2000, the frequency of heat waves in Odisha has been increasing with huge loss of lives and livelihoods.[10] To cope up with its impact, preparedness measures have been adopted which has largely reduced casualties butstill the state is recording a good number of casualties each year. The Figure 5 indicates how recent decades have seen peaks with regard to heat waves being generated, however, the data needs a closer examination for certainyears where it exceeds the number of days in a month.

[10] Details available at <https://www.sciencedirect.com/science/article/pii/S2212094716300792>

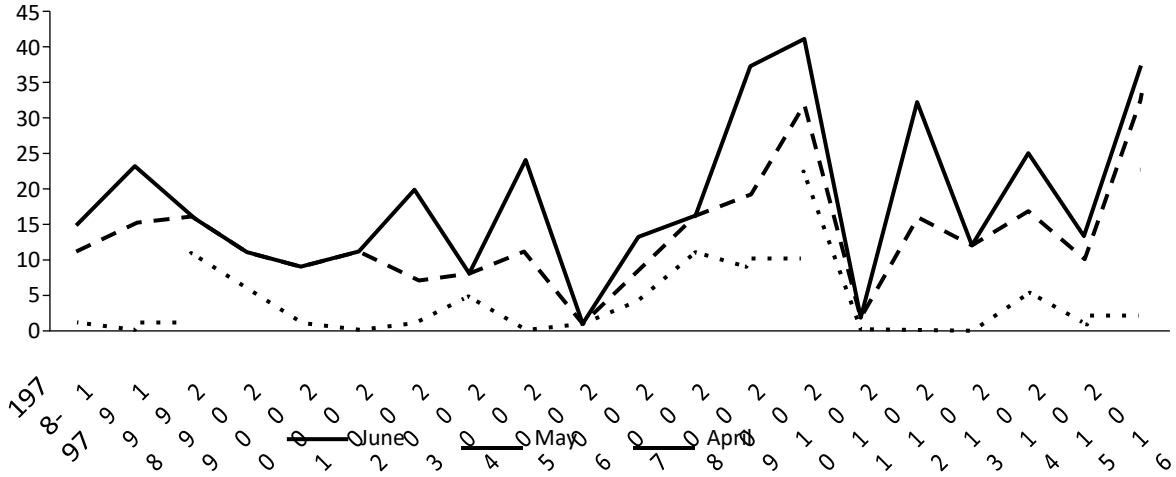

Figure 5 Year-wise number of heat wave days in Odisha

Source Details available at <https://www.researchgate.net/figure/Year-wise-number-of-heat-wave-days-in-Odisha_fig2_331905620>

4. Sea-level rise and coastal vulnerability

The eastern coast of India is comparatively low lying. About 292 km of coastline of the state has experienced high rate of sea-level change of more than 1.0 mm/y.[11] According to the recent study,[12] present sea-level rise is expected to increase up to 13.4 mm in 2020 and 80.5 mm in 2030 along the coast of Odisha. Figure 6 shows the change in shoreline from 2015 to 2030 wherein blow ups depict the high-erosion zones varying from 0.5 to 1 km. The increase in the sea-level rise shall contribute to increase in coastal flooding, erosion, and saltwater intrusion into surface and groundwater.

5. Flood

Odisha ranks fifth in the flood-prone states of India. An area of 33,400 km^2 in the state is affected from flood. Cyclonic winds and tidal flows are one of the contributors to flooding in coastal regions, causing loss of life and damage to property and crops, thereby affecting food security and livelihoods (Mishra, *et al*. 2010). It is predicted that severe flooding may result due to climate change, deforestation, and faulty flood control planning.[13] Moreover,it is also observed that the extent of traditional flood zone is increasing.

[11] Details available at <https://www.researchgate.net/publication/215730022>

[12] Details available at <https://www.sciencedirect.com/science/article/pii/S2590061722000102>

[13] Details available at <http://climatechangecellodisha.org/pdf/State%20Action%20Plan%20on%20Climate%20 Change%202018-23.pdf>

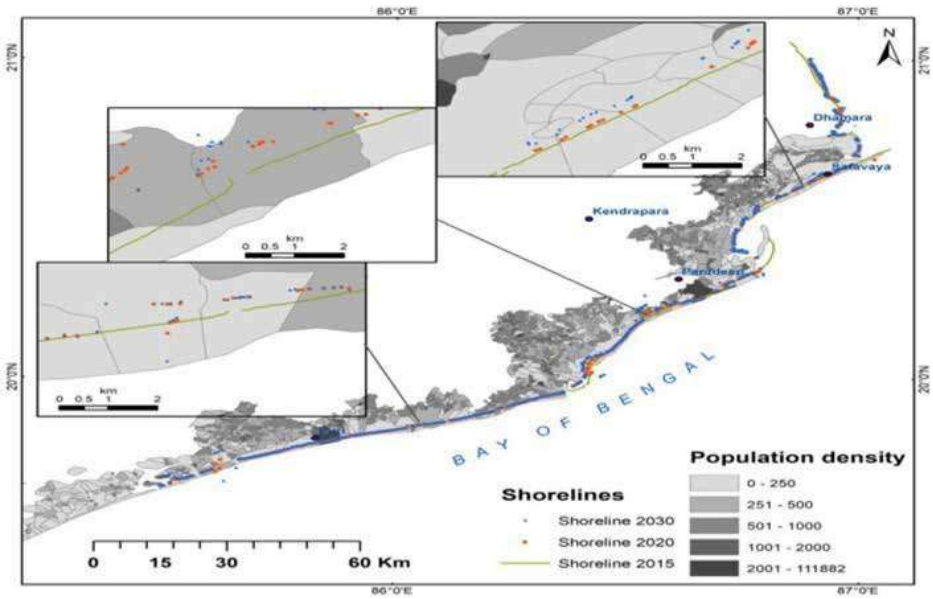

Figure 6 Prediction of shoreline change for the years 2020 and 2030 based on baseline of 2015 shoreline

Source Details available at <https://www.sciencedirect.com/science/article/pii/S2590061722000102>

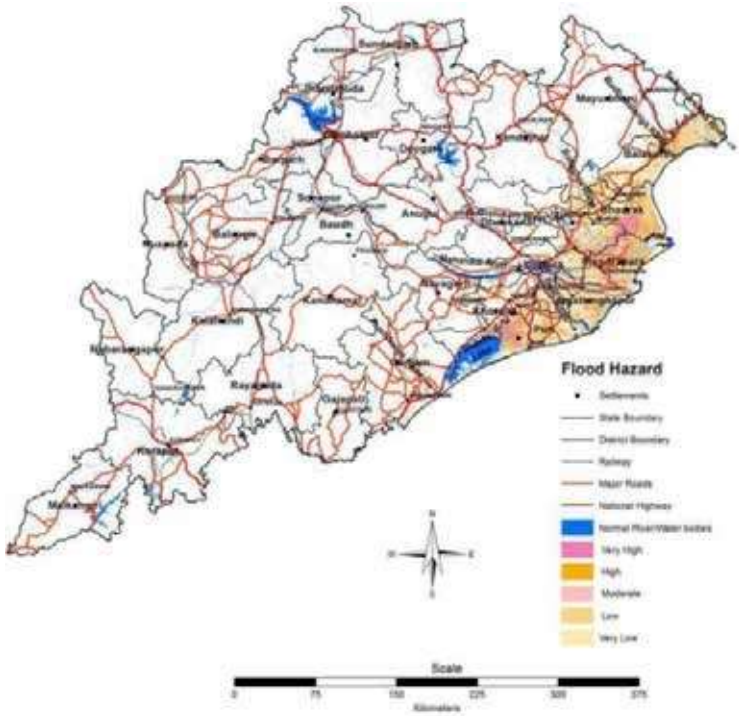

Figure 7 Flood Hazard Map of Odisha State

Source Flood Hazard Zonation Atlas, Odisha, 2019

6. Drought

The periodicity of drought in the state is once in every five years. The probability of occurrence of drought is generally during the Kharif season, affecting the paddy cultivation. The drought-prone districts of the state include Bolangir, Bargarh, Nuapada, Kalahandi, and Phulbani. There has been sharp decline in agricultural production and farm incomes, reduction in opportunities for rural employment.[14]

As per the study[15], the probability of occurrence of various categories of drought in Odisha is shown in Figure 8 indicates how the probability of droughts are likely to change and increase in both frequencies and intensities to be observed.

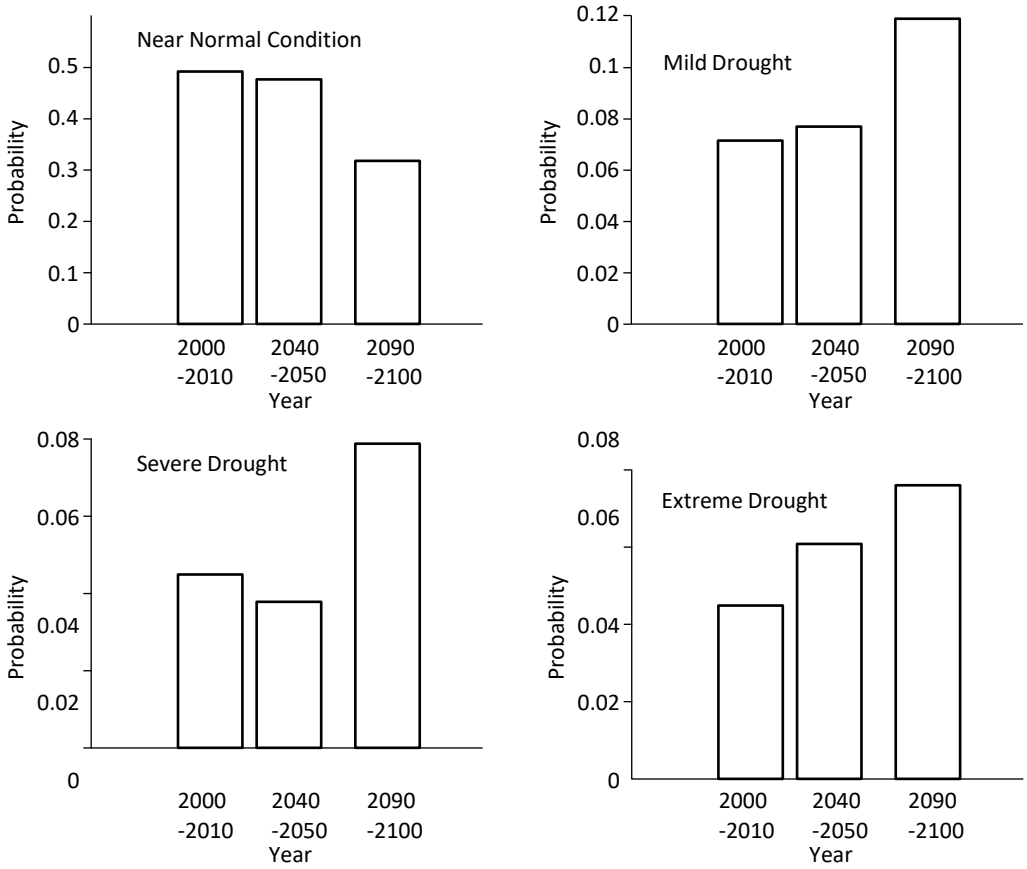

Figure 8 Probability of occurrence of drought in Odisha from 2000-2100

Source Details available at <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2006WR005351>

[14] Details available at <https://www.osdma.org/preparedness/state-drought-monitoring-cell/#gsc.tab=0>

[15] Details available at <https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2006WR005351>

7. **Cyclone**

The *Fifth Assessment Report* by IPCC predicts increase in the frequency and intensity of tropical cyclones in Odisha. This is likely to have an impact across all sectors in Odisha including agriculture. The crop losses incurred due to cyclones would also affect the financial capacity of the farmers.

Figure 9 Wind and cyclone-prone areas of Odisha

2.2 Adaptation Intervention in Odisha under the National Adaptation Fund Climate Change

The project titled "Conserve water through the management of run-off in the river basin to reduce vulnerability and enhance resilience for traditional livelihood in Nuapada district" is a National Adaptation Fund for Climate Change (NAFCC)-funded project in the state of Odisha. While the funding is routed through a central agency, the interventions implemented by the state are specific to its needs and requirements.

The selected sub-national study to develop the MEL framework for climate action transparency relates to the Jonk River basin which lies in the Nuapada district. The case study district, Nuapada has a hot and moist sub-humid climate with undulating terrain. The district receives about 1352 mm of mean annual rainfall and experiences a mean maximum temperature up to 37.8°C during summer and a mean minimum temperature of 11.9°C in winter. The soil type is categorized as red, mixed red, and black.[16] There is a wide variation in climate

[16] Details available at <https://agriodisha.nic.in/Home/AGROCLIMATICZONES>

patterns in the district. It is classified under the multi-hazard zone which is a water-stressed and drought-prone region lying in the western and south-western parts of Odisha. The river basin feeds in several non-perennial streams some of which have become defunct due to the inconsistency in the monsoons of the region and have resulted in the change of their course. Other challenging factors aggravating climate impacts include lower soil moisture retention and water harvesting, poor run-off management affecting the vegetation and economy in the area, altering the socio-economic character of the region. The variability in the rainfall pattern has led to poor employability, causing people to migrate with increase in trafficking.[17]

The initiative promotes adaptation in the water resource sector and complies with the objective of the National Water Mission of the NAPCC and water-related streams of the SAPCC. Besides, it targets poverty alleviation initiatives of the region to reduce poverty and social imparity aimed towards addressing the discussed concerns.

The project was initiated in 2017 and is expected to be completed in the year 2022 as per the interaction with the stakeholders. The project aimed at building water harvesting structures, that is, check dams in the command area of the Jonk River basin, targeting water conservation through run-off management to reduce the vulnerability of the agriculture sector and enhance livelihood resilience.

As part of the project's objectives, the construction of water conserving structures such as check dams along a river stream in Jonk River basin is underway as per interactions with the Water Resources Department and is expected to complete by 31 March 2022. These are being built across eight villages forming three gram panchayats (local village-level government) in the Nuapada block. The details of the project location are listed in Table 1 while Figure 11 shows the location of check dams on Jonk River basin.

Table 1 Details of project location

Check dam	Stream	Village	Block	Catchment area in km^2	Length in metre	Ayacut (in hectare)
Budhipali check dam	Kharkhara Nalla	Budhipali	Nuapada	115	60	50
Parsadadar dam	Kharkhara Nalla	Parsadadar	Nuapada	123.5	65	45
Parkod check dam	Kharkhara Nalla	Parkod	Nuapada	127.5	68	

Source DPR-NAFCC

[17] Details available at <http://moef.gov.in/wp-content/uploads/2017/08/Odisha.pdf>

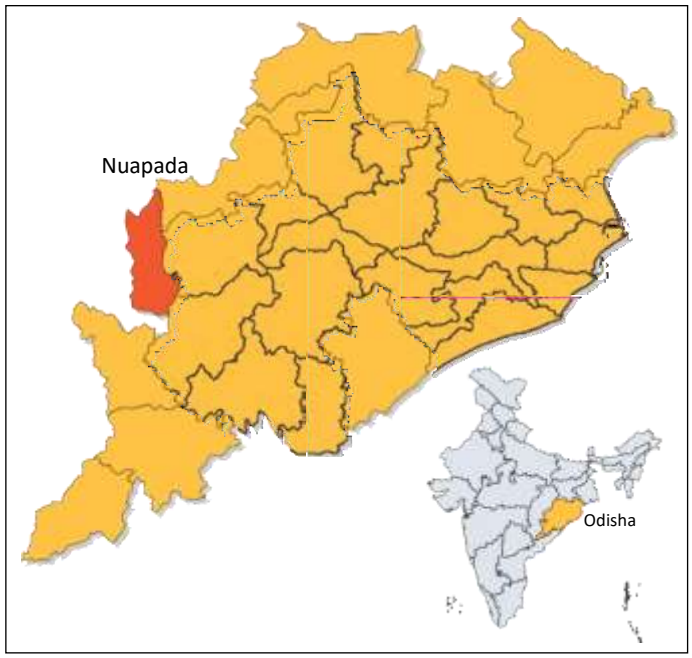

Figure 10 Location of district Nuapada in the state of Odisha

Figure 11 Location of check dams on a stream of Jonk River within Nuapada district

Pictures 1, 2, 3, and 4 show the site visits conducted to understand the overall progress in the implementation of the adaptation action as well as undertake stakeholder consultations and assess the capacity needs of the various stakeholders.

Picture 1 Water harvesting structure, that is, check dam constructed across a stream of Jonk River in Nuapada district

Picture 2 Site of rainwater harvested for agriculture purposes

Picture 3 Plantation of horticulture crops near check dams using drip irrigation system

Picture 4 Installation of solar panels near check dam supplying electricity for drip irrigation system

2.3 Governance Structure

The project is governed by a range of entities at the national, state, and local levels. It is studied given the need for stakeholder assessment for the monitoring and evaluation of the project. Table 2 details the multi-tier structure indicating the agencies and their nature of involvement.

Table 2 Governance structure	
Governance structure	**Entities**
Funding agency	Ministry of Environment, Forests and Climate Change (MoEF&CC), Government of India, under the National Adaptation Fund for Climate Change (NAFCC)
National executing entity	National Bank for Agriculture and Rural Development (NABARD)
Nodal executing agency	Department of Water Resources, Government of Odisha
Project executing entity	Minor Irrigation Department Climate Change Cell
Beneficiaries	Inhabitants of along the river basin of Jonk River (a tributary of Mahanadi) in Nuapada affected by both drought and flood.

Source Stakeholder consultations and Revised Detailed Project Report: NAFCC

2.4 Description of the Project Components of the Adaptation Intervention

The project has six major components along with expected outputs, outcomes, and impacts (Table 3). The objective is to protect the natural streams near the basin aiming to reduce the impact of climate variability through adoption of water harvesting structural measures which will provide diversified livelihood options to enhance livelihood security and use of renewable energy to promote more efficient use of water. Further, these components aim to build capacity of pani panchayats[18] strengthening water management by developing linkages with them, and to also develop resource materials and tools for monitoring of climate change adaptation and mitigation co-benefits. Currently, only two out of the six components have been completed while rest are in the nascent stages of their implementation.

The funding for the project is released by NABARD, which is the national implementing entity for NAFCC projects. The total budget for this project is INR200,000,000. This had been planned to achieve with 53% budget in investment activity, 27% in capacity building activity, and 20% in project management activity.

[18] The pani panchayats or water user association of Odisha are farmer-led bodies engaged in water management and its equitable distribution at the local level.

Table 3 Components: activity-output-outcome-impact

S No.	Project/programme components	Expected concrete outputs	Expected outcomes	Quantitative impact	Qualitative impact
1	Protection of the natural streams near the basin undertaking structural measures such as check dams based on future climate variability analysis along the basin for checking run-off and use measures for both drought and flood control endemic to the area.	• Check dams in the Jonk basin to protect the natural spring • Enhance the command to 145 ha (at least 95% of the potential) • Provide farm- level water management through drip and sprinkler in stressed areas	Reduced risks of adverse impacts of climate change (drought and flood) in water and agriculture sectors and rejuvenation of hill stream for long-term sustainability	Construction of 3 check-dams in the Jonk basin Enhanced command to 145 ha (at least 95% of the potential)	Water conservation and natural recharge of groundwater aquifers
2	Diversify livelihood from paddy monoculture and introduce horticultural crops (fruits and vegetables)	At least 500 farmers take additional horticultural crops in the command area after paddy based on the water-use efficiency	Poverty alleviation, livelihood security an enhanced awareness of community on efficient water-use in the economic activity	At least 500 farmers take additional horticultural crops in the command area after paddy based on the water-use efficiency	Reduced livelihood vulnerability Enhanced Food and nutritional security
3	Link fishery and poultry as part of livelihood diversification initiative	• Fishery activities are taken up in the command and farm ponds • User associations to work with about 100 number of landless people to involve them in fishery activities • Backyard poultry unit established	Enhanced adaptive capacity through livelihood diversification from non-land-based activity as well as fishery, especially for the landless	User associations to work with about 100 no of landless people to involve them in fishery activities Backyard poultry unit established	Income and nutrition security

Table 3 Components: activity-output-outcome-impact

S No.	Project/programme components	Expected concrete outputs	Expected outcomes	Quantitative impact	Qualitative impact
4	Solar pumping system for efficient use of water in select crops based on vulnerability	pilot programme on solar pumping to be introduced and 15 units made operational for efficient use of water	Reduced dependence on fossil fuel and efficient management of water in the stressed region	Pilot programme on solar pumping to be introduced and 15 units made operational for efficient use of water	Emission reduction in agriculture sector
5	Achieving sustainability by linkages with pani panchayats for water management	3 Number of pani panchayats to be formed and capacity of the members enhanced on issues relating to climate risk and vulnerability related to water and efficient use of water.	Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level	Three pani panchayats to be formed and capacity of the members enhanced on issues relating to climate risk and vulnerability related to water and efficient use of water.	Capacity building of pani panchayats
6.	Develop resource material and tool for monitoring of the climate change adaptation and mitigation co-benefits	• Modules on climate adaptation at the local level to be developed for the pani panchayats. • The adaptation benefit and mitigation co-benefits to be determined through concurrent monitoring • Knowledge products/best practice documents developed	Maximized multi-sectoral, cross-sectoral benefits/co-benefits to meet the challenges of water and food security	Modules on climate adaptation at the local level to be developed for the PP Knowledge products/ best practice documents developed	Enhanced resource use efficiency for monitoring of climate change at various level

Source Detailed project report (DPR-NAFCC)

Expected Beneficiaries

Community living in the settlements along the Jonk River basin in Nuapada district who are affected by drought and flood would be the direct beneficiaries of the project.

3. Key Stakeholders for the Adaptation Intervention: identification of stakeholders, roles, and responsibilities

3.1 Stakeholder identification

The key stakeholders with their roles and responsibilities identified for implementation of the interventions are enlisted in Table 4. TERI team conducted in-person consultations with officials and representatives from various departments in the Odisha such as NABARD, Minor Irrigation department, Agriculture Science Centre (Krishi Vigyan Kendra or KVK), Department of Agriculture, Fishery, Horticulture and Veterinary. The team also visited the intervention sites including check dams and interacted with farmers practising diversified livelihoods who are direct beneficiaries of the project.

The nodal executing agency is the Department of Water Resources (DoWR) which coordinates with MoEF&CC and the national implementing entity, NABARD. The Minor Irrigation Department under the DoWR acts as the project executing agency at the river basin/district level, leading the project activities. The project cycle is supported by NABARD who monitors and conducts routine inspections of the project sites and records the output-based financial progress of the project. There is no other monitoring and evaluation of the project activities. Since the project design is multi-faceted, it is supported by other district departments for implementation namely horticulture, veterinary, fishery, agricultural extension wings (KVKs), Odisha Renewable Energy Development Agency (OREDA), and Odisha Livelihood Mission (OLM).

Table 4 Roles and responsibilities of relevant stakeholders

S. No.	Stakeholder	Role of stakeholder in the project implementation
1.	MoEF&CC	• Financing • Objective of the entity is to increase channelization of NAFCC funds towards adaptation-oriented projects. • Regulates NAFCC fund disbursement for project implementation
2.	NIE (NABARD)	• Project cycle support • Project monitoring at district level • Objective of the entity is to increase channelization of NAFCC funds towards adaptation-oriented projects • Regulates NAFCC fund disbursement for project implementation
3.	Department of Water Resources	• Nodal executing agency • Support in capacity building through training programmes in eight villages

Table 4 Roles and responsibilities of relevant stakeholders

S. No.	Stakeholder	Role of stakeholder in the project implementation
4.	Minor Irrigation Department	• Project executing agency responsible for implementation of project components at the district level
5.	Agriculture Science Centre (KVK)	• Provision of horticulture crops like mushroom to promote diversified livelihood • Support in capacity building through vocational training programmes for small, poor, and landless farmers on poultry farming to control them to work as bonded labourers along with construction of demonstration units to serve the purpose.
6.	Department of Agriculture	• Awareness generation among the farmers • Create awareness about the monetary benefits of utilizing water, funded under NAFCC scheme to cultivate cash crops
7.	Department of Fishery	• Promotion of fishery activities among farmers to support diversified livelihood. • Provision of fingerlings and feeds to the farmer • Up-skilling of individual beneficiary and the self-help groups to practice scientific fishery
8.	District Horticulture Department	• Involve migrating farmers in horticultural activities • Encourage farmers to practice horticulture crops • Provision of different seeds and saplings to the farmers along with fertilizers, medicines, sprayers, crate, and different horticultural tools and implements
9.	CTRAN	• Partner agency to develop baseline and conduct assessment of adaptation benefits and co-benefits
9.	OLM (DRDA)	• Implement livelihood activities such as 'Mo Upakari Bagicha' or Organic Nutrition in eight villages • Provide different vegetable seeds with fruits saplings such as banana, moringa, papaya, and lemon
10.	Veterinary Department	• Selection of the beneficiaries like poor and landless people from eight villages of the project area • Conduct training programmes for farmers about animal husbandry practices and awareness generation about its benefits in sustaining livelihood • Provision of medicines, feeds, and vaccines to the beneficiaries • Selection of farmers for goat farming, poultry and duck farming
11.	Odisha Renewable Energy Development Agency (OREDA)	• Provide expert knowledge base and assist in solar pumping for efficient use of water
12.	Community	• Direct beneficiary of the project

Source DPR and stakeholder consultations

3.2 Stakeholder Analysis: relevance and impact

The impact of the relevant stakeholders is assessed using the stakeholder matrix. TERI has prepared this matrix based on stakeholder consultations with a focus to identify their impact and influence on the overall progress of implementation of the project. Figure 12 represents the analysis conducted which shows that most of the stakeholders have high impact and high influence on the project. Stakeholders that plan, monitor, and implement actions at the basin/district level were indicated to be more influential compared to the others since it was mentioned that they were directly involved in achieving and implementing the project-objectives. These stakeholders, largely departments, were responsible for conducting training programmes, providing resources and expert knowledge to the water user associations with an attempt to increase the uptake of the on-ground interventions.

The Minor Irrigation Department, as the project executing entity, played a vital role in the implementation of the project components monitored by NABARD. The other departments supported through technical resources and form an integral part of these components. The project executing agencies and supporting departments were found to have a high influence and high impact due to their close involvement in the execution of the project. The MoEF&CC is mainly involved in disbursement of funds monitored by NABARD, therefore possess high impact on the project interventions but low on-ground influence of overall progress of the work. The direct beneficiary of the project, that is, farmers have high influence since they receive the benefits from the construction of check dams. The sectoral vulnerability of the project is assessed by a consulting partner, CTRAN who provided the technical knowledge base for the development of the project but was not involved in the decision-making process.

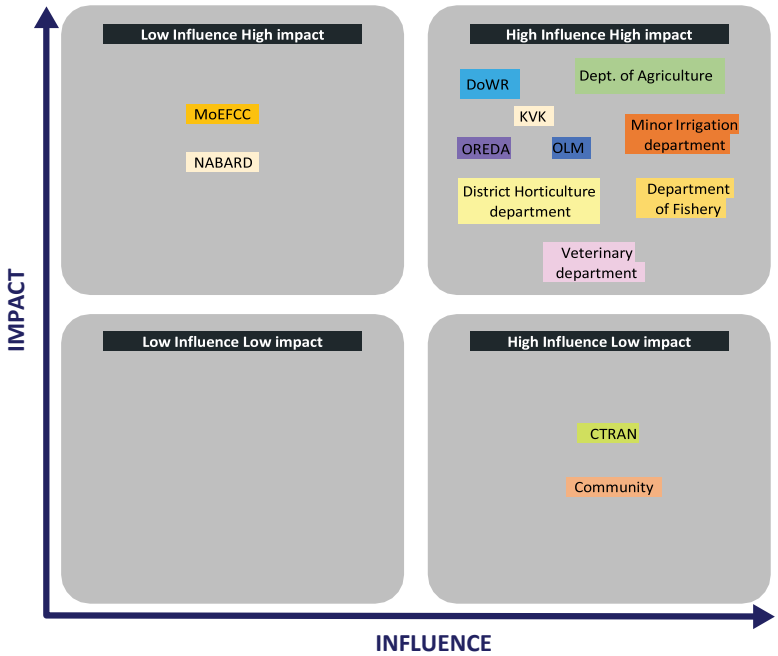

Figure 12 Stakeholder interest and influence mapping

Source TERI, based on stakeholder consultation

Table 5 Stakeholder interest and influence mapping

S. No.	Stakeholder	Stakeholder influence	Stakeholder impact on intervention
1.	MoEF&CC	Low	High
2.	NIE (NABARD)	Low	High
3.	Department of Water Resources	High	High
4.	Minor Irrigation Department	High	High
5.	Agriculture Science Centre (KVK)	High	High
6.	Department of Agriculture	High	High
7.	Department of Fishery	High	High
8.	District Horticulture department	High	High
9.	CTRAN	High	Low
10.	OLM (DRDA)	High	High
11.	Veterinary Department	High	High
12.	Odisha Renewable Energy Development Agency (OREDA)	High	High
13.	Community	High	Low

Source TERI, based on stakeholder consultation

4. Proposed Monitoring, Evaluation, and Learning Framework for the Adaptation Intervention

To prepare for and adapt to the long-term consequences of climate change, there is a growing emphasis on the use of monitoring and evaluation (M&E). The M&E processes are designed to cater to the two overarching functions of accountability and learning and support strategic and effective investment of finances and resources to maximize impact of activities and interventions in the context of climate change action (STAP 2017). As funding towards climate change action is picking up pace and is expected to scale up in the near future, ensuring the effectiveness, efficiency and equity of interventions/projects/programmes is important.

In the context of climate change action, particular emphasis is being given to using M&E for learning and improving throughout the duration of the implementation of the intervention. The approach of monitoring, evaluation, and learning has gained traction as it caters to the objective of managing the uncertainty, context-specificity, and complexities of adaptation interventions.

The implementation guidelines of the NAFCC lay out the mechanism for reporting, monitoring, and review. The state government and the executing entities are required to periodically report the progress to the national implementing entity, that is, NABARD. The NABARD is in turn responsible to apprise the national-/state-level steering committee of the status and progress of the project. During the implementation of the project, the NABARD is responsible for carrying out field monitoring visits at regular intervals and maintain digital data of the progress of the projects. This data must be maintained for a period of at least 10 years from the date of completion.

The outcome parameters as described in the NAFCC Framework include the following:

- Reduced risks and adverse impacts of climate change in water and agriculture sectors.
- Human development, poverty alleviation, livelihood security, and enhanced awareness.
- Cross-sectoral benefits and co-benefits addressing challenges of food and water security.
- Strengthened individual and institutional capacity to minimize risks linked with climate- induced socio-economic and environmental losses.
- Improved awareness and ownership of processes at local level aimed at adaptation and climate risk reduction.
- Enhanced adaptive capacity within relevant development and natural resources sectors
- Enhanced ecosystem resilience.
- Diversified livelihoods and income sources for vulnerable people in target areas.
- Improved regulatory and policy landscape promoting and enforcing resilience measures.

4.1 Monitoring of the Adaptation Intervention

To understand what outputs, output indicators, outcomes and outcome indicators might be important in mapping the progress of the project, discussions were undertaken with stakeholders to arrive at a suitable MEL framework for the project interventions. TERI has taken a no objection certificate (NoC) (Annexure A) from the state to allow for development of the MEL Framework which can later be shared with both NABARD and the state executing agency to use as a format for M&E their project. The details of the project components along with their key outputs, outcomes and impacts of the framework are enumerated here.

Component 1: Protection of the natural streams near the basin undertaking structural measures such as check dams, based on future climate variability analysis along the basin for checking run-off and use measures for both drought and flood control endemic to the area.

The first component targets the water conservation measures required to control the impact of climate change. This aims to harvest the rainfall, control water velocity, conserve soil, and improve yield of adjacent agricultural land through construction of check dams on a stream of the Jonk River basin. The output and outcome indicators are selected to monitor the impact of the adopted water conservation measures tackling the effects of climate variability. These are described below along with the units of measurements to quantify the impact.

Component 1: Protection of the natural streams near the basin undertaking structural measures such as check dams, based on future climate variability analysis along the basin for checking run-off and use measures for both drought and flood control endemic to the area.		
Climate risk: flood, drought, heat wave		
Outcome 1	**Outcome indicators**	**Unit of measurement**
Reduced risks of adverse impacts of climate change (drought and flood) in water and agriculture sectors and Rejuvenation of hill streams for long term	• Deaths due to drought/flood	Number
	• Proportion of land under mono-cropping versus multi-cropping	Per cent
	• Change in cropping intensity due to increased availability of water through water harvesting structures	Per cent
	• Percentage of land practising under crop diversification which serve as an alternative economic opportunity to farmers	Per cent
	• Change in income due to adoption of various cropping techniques	Per cent
	• Number of hill streams rejuvenated which leads to reduced water stress	Per cent
	• Productivity gains due to increased water availability and different cropping practices	Yield per hectare
	• Improvement in water-use efficiency with change in area covered under drip and sprinklers	Water Use Efficiency, which is yield of crop produced per unit of water used in irrigation
Outputs	**Output indicators**	**Unit of Measurement**
Output 1.1 Three check dams in the Jonk basin to protect the natural spring	• Number of check dams constructed to harvest rainwater	Number
	• Change in spring discharge due to recharge of groundwater	Cubic feet per second
	• Improvement in the recharge downstream	Metre below ground level
	• Change in access to water	Volume per unit time

Component 1: Protection of the natural streams near the basin undertaking structural measures such as check dams, based on future climate variability analysis along the basin for checking run-off and use measures for both drought and flood control endemic to the area.		
Output 1.2 Structural measures of climate proofing the canal and stream implemented and command area increased at Khakhara nala	• Number of structures constructed on canals for climate proofing	Number
	• Number of structures constructed on streams for climate proofing	Number
	• Change in command area from construction of water harvesting structures	Hectare
	• Lining and strengthening of embankments to reduce seepage	Per cent
	• Number of farmers covered under piped irrigation network	Number
	• Change in area of land under irrigation due to climate proofing the canals and streams	Hectare
Output 1.3 Provide farm-level water management through drip and sprinkler in stressed areas	• Change in area covered under micro-irrigation (drip and sprinkler) for enhanced water-use efficiency	Hectare
	• Reduction in water requirements per unit of land covered	Cubic feet per second
	• Change in income by practising farm-level water management	Per cent
Impact	**Impact indicator**	**Unit of Measurement**
Water conservation and natural recharge of groundwater aquifers	• Change in groundwater table due to increased percolation	Metre below ground level

Component 2: Diversify livelihood from paddy monoculture and introduce horticultural crops (fruits and

vegetables)

The second component targets the diversification in livelihoods to adapt to the impact of climate change. This aims to meet the challenges of food security in the region through climate- resilient cropping system with integration of vegetables and fruits to also ensure nutritional security for people. The output and outcome indicators are selected to assess the impact of diversified livelihood opportunities in enabling adaptive capacity against the prevailing climate risks. These are described below along with the units of measurements to quantify the impact.

Component 2: Diversify livelihood from paddy monoculture and introduce horticultural crops (fruits and vegetables)		
Climate risk: monsoon variability, temperature rise, flood, and drought		
Outcome 2:	**Outcome indicators**	**Unit of measurement**
Poverty alleviation, livelihood security Enhanced awareness on efficient water uses in the economic activity	• Change in incomes of farmers after taking additional (horticulture) crop in the command area	Per cent
	• Households aware about efficient water use in the economic activities	Number
Outputs	**Output indicators**	**Unit of Measurement**
Output 2.1 Area under horticulture increased	• Change in area under horticulture crops	Hectare
	• Number of farmers practising mixed cropping/ intercropping	Number
Output 2.2 Enhanced crop production due	• Change in horticulture crop yield with increase in soil moisture content	Tonne per hectare
to availability of adequate moisture	• Change in the production of horticulture crops	Million tonnes
Impacts	**Impact indicators**	**Unit of Measurement**
Reduced livelihood vulnerability Enhanced food and nutritional security	• Total households practising both paddy and horticulture crops	Number
	• Reduction in number of poor households due to adoption of mixed cropping	Number

Component 3: Link fishery and poultry as part of livelihood diversification initiative

The third component targets mixed farming model to ensure livelihood security especially for agricultural labours and landless people. The output and outcome indicators are listed below to assess the impact of diversified livelihood opportunities in enabling adaptive capacity against the climate risks along with the units of measurements to quantify the impact.

Component 3: Link fishery and poultry as part of livelihood diversification initiative		
Climate risk: monsoon variability, flood, drought		
Outcome 3	**Outcome Indicators**	**Units of measurement**
Enhanced adaptive capacity through livelihood diversification from non-land-based activity as well as fishery, especially for the landless households	• Change in non-farm income from non-land-based activity and fishery	INR
	• Change in non-farm income of the landless households from non-land-based activity	INR
	• Farmers/landless taking up fishery activities under this project/programme	Number
	• Change in share of fishery activities after project implementation	Per cent
	• Change in number of fishermen	Number
	• Number of landless households who've taken up scientific poultry	Number
Outputs	**Output indicators**	**Unit of Measurement**
Output 3.1 Households are included in fishery activities through water user association	• Change in number of members in water user association due to initiation of this project	Number
	• Change in number of farm ponds with the involvement of water user association	Number
Output 3.2 Common interest groups are formed for poultry community. Poultry is proposed under self-help groups and community duck rearing is proposed for each check dam.	• Number of common interest groups formed for poultry	Number
	• Common interest groups practising fishery and poultry as a part of livelihood diversification initiative	Number

Impact	Impact indicators	Unit of Measurement
Enhanced livelihood security, food and nutritional security	• Net profit per unit area from poultry and fishery ensuring livelihood security	INR
	• Improved availability and access to diverse and nutritious diet providing food and nutritional security	Yes/No

Component 4: Solar pumping system for efficient use of water in select crops based on vulnerability

The component 4 aims to maximize multi-sectoral benefits through integration of solar pumping and drip irrigation in high value crops to meet the challenges of water and food security. The output and outcome indicators are selected to monitor the impact of adopted water conservation measures tackling the climate variability. These are described below along with the units of measurements to quantify the impact.

Component 4: Solar pumping system for efficient use of water in select crops based on vulnerability		
Climate risk: flood, drought, temperature rise		
Outcome 4:	**Outcome indicators**	**Unit of measurement**
Reduced dependence on fossil fuel and efficient management of water in the stressed region	Number of farmers using solar pumping to reduce the crop vulnerability with uninterrupted power supply	Per cent
	Decrease in electricity sourced from fossil fuels for agriculture produce	Per cent
Outputs	**Output indicators**	**Unit of measurement**
Output 4.1 Solar pumping system for efficient use of water in select crops based on vulnerability	Number of farmers with access to solar pumping	Number
	Number of solar pumping sets for efficient water use	Number
	Number of awareness generation/capacity development activities on the use of solar pumping	Number
Output 4.2 Policy briefs and knowledge products, videos produced capturing the lesson	Number of knowledge products produced (20 policy briefs to be produced, AV documentation) to promote awareness on the water efficient management systems	Number
	Awareness of farmers about solar pumping system	Per cent
	Water management awareness programmes broadcasted on television/social media, etc.	Number
	Number of local TV channels broadcasting videos of best practices of efficient water management system in water stressed region	Number
	Frequency of best practices videos broadcast on local TV channels promoting efficient water management system	Daily/weekly/ monthly
Impact	**Impact indicators**	**Unit of measurement**
Emission reduction in agriculture sector	Reduction in use of fossil fuels used in agriculture sector due to adoption of renewable energy sources for irrigation	Improvement of environmental parameters specially air quality
	Decrease in electricity sourced from fossil fuels for agriculture produce	

P	er centPer cent	Descriptive, AQI
	with the usage of renewable energy	

Component 5: Achieving sustainability by linkages with pani panchayats for water management

This aims to strengthen awareness and ownership of adaptation and climate risk reduction processes at local level. The component targets to build the capacity of community-based institution (pani panchayat/village committee) practising environmentally sustainable cropping. The output and outcome indicators are selected to assess the impact of linkages locally through capacity building for ensuring sustainability in agricultural practices. These are described below along with the units of measurements to quantify the impact.

Component 5: Achieving sustainability by linkages with pani panchayats for water management		
Climate risk: flood, drought, temperature rise, monsoon variability		
Outcome 5	**Outcome indicators**	**Units of measurement**
Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level	Population implementing response actions to meet the challenge of water stress	Per cent
Higher awareness on water-use efficiency	Total number of households trained on water conservation practices	Number
Outputs	**Output indicators**	**Unit of measurement**
Output 5.1 Coverage of targeted beneficiaries and sensitization to link to pani panchayat	Households linked with pani panchayats	Number
	Pani panchayat meetings conducted weekly/ monthly	Number
	Trainings/awareness generation programmes regarding water-use efficiency practices	Number
	Number of workshops conducted for capacity building of members of pani panchayat on efficient water management	Number
Output 5.2 Training and capacity building of members at district/block level	Trained farmers/landless people for promoting water-use efficiency practices	Number
	Number of exposure visits conducted to generate awareness on water efficient practices	Number
	Number of farmers participating in exposure visits	Number

Impact	Impact indicators	Unit of measurement
Capacity building of pani panchayats	Command area benefitted/linked with pani panchayats after conducting training and awareness programmes at district/block level	Hectare

Component 6: Develop resource material and tool for monitoring of the climate change adaptation and mitigation co-benefits

The last component targets capacity building of members of pani panchayats. This is to promote climate adaptation at the local level through formulation of modules developed for them. The adaptation benefit and mitigation co-benefits are aimed to be determined through concurrent monitoring knowledge products/best practice documents developed. The output and outcome indicators are selected to assess the impact of resource materials developed for monitoring of the climate change adaptation and mitigation co-benefits. These are described below along with the units of measurements to quantify the impact.

Component 6: Develop resource material and tool for monitoring of the climate change adaptation and mitigation co-benefits		
Climate risk: flood, drought, temperature rise, monsoon variability		
Outcome 6	**Outcome indicators**	**Units of measurement**
Maximized multi-sectoral, cross-sectoral benefits/co-benefits to meet the challenges of water and food security	Percentage of sectors using adaptation/mitigation response actions to adapt and mitigate the impact of water stress	Per cent
	Number of training programmes/workshops conducted on awareness regarding climate change, adaptation, and mitigation	Number
Outputs	**Output indicators**	**Unit of measurement**
Output 6.1 Community resource persons mobilization	Percentage of community aware on the adaptation/ mitigation measures	Per cent
Output 6.2 Material and processes, toolkits monitoring and verification and process documentation	Models, methods, programmes, and audio-visual materials on the values and threats to the area due to climate risks	Number
	Modules on climate adaptation/mitigation developed	Number
Impact	**Impact indicators**	**Unit of measurement**
Enhanced resource use efficiency for monitoring of climate change at various level	Inclusion of MEL framework for regular monitoring and evaluation of the impact of climate change-related projects/programmes at all levels	Yes/No
	Departments using MEL framework for monitoring of adaptation and mitigation interventions to track the	Number

Table 6 is a compilation of the MEL framework covering all components of the adaptation intervention.

Table 6 Proposed MEL framework for Odisha state

Climate risks	Project components	Outputs	Indicators	Outcomes	Indicators	Impacts	Indicators
Flood, drought, heat wave	Component 1: Protection of the natural streams near the basin undertaking structural measures such as check dams, based on future climate variability analysis along the basin for checking run-off and use measures for both drought and flood control endemic to the area.	Output 1.1 Three check dams in the Jonk River basin to protect the natural spring	Number of check dams constructed to harvest rainwater	Reduced risks of adverse impacts of climate change (drought and flood) in water and agriculture sectors and rejuvenation of hill streams for long term	Number of deaths due to drought/flood	Water conservation and natural recharge of groundwater aquifers	Change in groundwater table due to increased percolation
			Change in spring discharge due to recharge of groundwater		Proportion of land under mono-cropping versus multi-cropping		
			Improvement in the recharge downstream		Change in cropping intensity due to increased availability of water through water harvesting structures		

Table 6 Proposed MEL framework for Odisha state							
Climate risks	**Project components**	**Outputs**	**Indicators**	**Outcomes**	**Indicators**	**Impacts**	**Indicators**
			Increase in access to water		Percentage of land practising crop diversification which serve as an alternative economic opportunity to farmers		
					Change in income due to adoption of various cropping techniques		
					Number of hill streams rejuvenated which leads to reduced water stress		
					Productivity gains due to increased water availability and different cropping practices		
					Improvement in water-use efficiency with change in area covered under drips and sprinklers		

Table 6 Proposed MEL framework for Odisha state

Climate risks	Project components	Outputs	Indicators	Outcomes	Indicators	Impacts	Indicators
		Output 1.2 Structural measures of climate proofing the canal and stream implemented and command area increased at Khakhara nala	Number of structures constructed on canals for climate proofing				
			Number of structures constructed on streams for climate proofing				
			Increase in command area from construction of water harvesting structures				
			Lining and strengthening of embankments to reduce seepage				
			Number of farmers covered under piped irrigation network				
			Change in area of land under irrigation due to climate proofing the canals and streams				

Table 6 Proposed MEL framework for Odisha state							
Climate risks	**Project components**	**Outputs**	**Indicators**	**Outcomes**	**Indicators**	**Impacts**	**Indicators**
		Output 1.3 Provide farm-level water management through drip and sprinkler in stressed areas	Change in area covered under micro-irrigation (drip and sprinkler) for enhanced water-use efficiency				
			Reduction in water requirements per unit of land covered				
			Change in income by practising farm-level water management				
Monsoon variability, temperature rise, flood, and drought	Component 2: Diversify livelihood from paddy monoculture and introduce horticultural crops (fruits and vegetables)	Output 2.1 Area under horticulture increased	Change in area under horticulture crops Number of farmers practising mixed cropping/ intercropping	Poverty alleviation, livelihood security Enhanced awareness on efficient water uses in the economic activity	Change in incomes of farmers after taking additional (horticulture) crop in the command area Households aware about efficient water use in the economic activities	Reduced livelihood vulnerability Enhanced food and nutritional security	Total households practising both paddy and horticulture crops Reduction in number of poor households due to adoption of mixed cropping

Table 6 Proposed MEL framework for Odisha state

Climate risks	Project components	Outputs	Indicators	Outcomes	Indicators	Impacts	Indicators
		Output 2.2 Enhanced crop production due to availability of adequate moisture	Change in horticulture crop yield Change in the production of horticulture crops				
Monsoon variability, flood, drought,	Component 3: Link fishery and poultry as part of livelihood diversification initiative	Output 3.1 Households are included in fishery activities through water user association	Change in number of members in water user association due to initiation of this project Change in number of farm ponds with the involvement of water user association	Enhanced adaptive capacity through livelihood diversification from non-land-based activity as well as fishery, especially for the landless households	Change in non-farm income from non-land-based activity and fishery Change in non-farm income of the landless households from non-land-based activity Farmers/landless taking up fishery activities under this project/programme Change in share of fishery activities after project implementation Change in number of fishermen Number of landless households who've taken up scientific poultry	Enhanced livelihood security, food and nutritional security	Net profit per unit area from poultry and fishery ensuring livelihood security Improved availability and access to diverse and nutritious diet providing food and nutritional security

Table 6 Proposed MEL framework for Odisha state							
Climate risks	**Project components**	**Outputs**	**Indicators**	**Outcomes**	**Indicators**	**Impacts**	**Indicators**
		Output 3.2 Common interest groups are formed for poultry Community. Poultry is proposed under self-help groups and community duck rearing is proposed for each check dam.	Number of common interest groups formed for poultry Common interest groups practising fishery and poultry as a part of livelihood diversification initiative				

Table 6 Proposed MEL framework for Odisha state

Climate risks	Project components	Outputs	Indicators	Outcomes	Indicators	Impacts	Indicators
Flood, drought, temperature rise	Component 4: Solar pumping system for efficient use of water in select crops based on vulnerability	Output 4.1 Solar pumping system for efficient use of water in select crops based on vulnerability	Number of farmers with access to solar pumping Number of solar pumping sets for efficient water use Number of awareness generation/ capacity development activities on the use of solar pumping	Reduced dependence on fossil fuel and efficient management of water in the stressed region	Number of farmers using solar pumping to reduce the crop vulnerability with uninterrupted power supply Decrease in electricity sourced from fossil fuels for agriculture produce	Emission reduction in agriculture sector	Reduction in use of fossil fuels used in agriculture sector due to adoption of renewable energy sources for irrigation Decrease in electricity sourced from fossil fuels for agriculture produce Improvement of environmental parameters specially air quality with the usage of renewable energy

Table 6 Proposed MEL framework for Odisha state							
Climate risks	**Project components**	**Outputs**	**Indicators**	**Outcomes**	**Indicators**	**Impacts**	**Indicators**
		Output 4.2 Policy briefs and knowledge products, videos produced capturing the lesson.	Number of knowledge products produced (20 policy briefs to be produced, AV documentation) to promote awareness on the water efficient management systems				
			Awareness of farmers about solar pumping system				
			Water management awareness programmes broadcasted on television/social media, etc.				
			Number of local TV channels broadcasting videos of best practices of efficient water management system in water stressed region				

Table 6 Proposed MEL framework for Odisha state

Climate risks	Project components	Outputs	Indicators	Outcomes	Indicators	Impacts	Indicators
			Frequency of best practices videos broadcast on local TV channels promoting efficient water management system				
Flood, drought, temperature rise, monsoon variability	Component 5: Achieving sustainability by linkages with pani panchayats for water management	Output 5.1 Coverage of targeted beneficiaries and sensitization to link to pani panchayat	Households linked with pani panchayats Pani panchayat meetings conducted weekly/ monthly	Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level Higher awareness on water use efficiency	Population implementing response actions to meet the challenge of water stress Total number of households trained on water conservation practices	Capacity building of pani panchayats	Command area benefitted/ linked with pani panchayats after conducting training and awareness programmes at district/ block level
		Output 5.2 Training and capacity building of members at district/block level	Trainings/ awareness generation programmes regarding water-use efficiency practices				

Table 6 Proposed MEL framework for Odisha state							
Climate risks	**Project components**	**Outputs**	**Indicators**	**Outcomes**	**Indicators**	**Impacts**	**Indicators**
			Number of workshops conducted for capacity building of members of pani panchayat on efficient water management				
			Trained farmers/ landless people for promoting water-use efficiency practices				
			Number of exposure visits conducted to generate awareness on water-efficient practices				
			Number of farmers participating in exposure visits				
Flood, drought, temperature rise, Monsoon variability	Component 6: Develop resource material and tool for monitoring of the climate change adaptation and mitigation co-benefits	Output 6.1 Community resource persons mobilization	Percentage of community aware on the adaptation/ mitigation measures	Maximized multi-sectoral, cross-sectoral benefits/ co-benefits to meet the challenges of water and food security	Percentage of sectors using adaptation/ mitigation response actions to adapt and mitigate the impact of water stress	Enhanced resource-use efficiency for monitoring of climate change at various levels	Inclusion of MEL framework for regular monitoring and evaluation of the impact of climate change related projects/ program

Table 6 Proposed MEL framework for Odisha state

Climate risks	Project components	Outputs	Indicators	Outcomes	Indicators	Impacts	Indicators
					Training programmes/ workshops conducted on awareness regarding climate change, adaptation, and mitigation		Departments using MEL framework for monitoring of adaptation and mitigation interventions to track the climate risk reduction at various levels
		Output 6.2 Material and processes, toolkits, monitoring and verification and process documentation	Models, methods, programme and audio-visual materials on the values and threats to the area due to climate risks Modules on climate adaptation/ mitigation developed				

4.2 Evaluation of the Adaptation Intervention

Evaluation of climate adaptation projects and programmes has been recognized critical for assessing the overall relevance, coherence, efficiency, effectiveness, sustainability, and impact. The OECD defines evaluation as "The systematic and objective assessment of an on-going or completed project, programme or policy, its design, implementation, and results. The aim is to determine the relevance and fulfilment of objectives, development efficiency, effectiveness, impact, and sustainability. An evaluation should provide information that is credible and useful, enabling the incorporation of lessons learned into the decision-making process of both recipients and donors" (OECD 2002).[19]

Likewise, in a paper by Gregorowski and Bours, the authors build on the OECD definition (Development Assistance Committee Working Party on Aid Evaluation 2002), and define evaluation as the process which can be used to determine the exact worth or contribution of a policy programme or institution—adopting a systematic and objective analysis of development interventions.

Evaluation is conducted to measure the overall progress of the interventions through outcome/result indicators.

Outcome indicators of the proposed MEL framework include both qualitative and quantitative indicators which can be evaluated through ladder-based approach, score cards and narratives/expert judgement periodically.

Indicators that identify the continuous progress achieved in terms of the goals and objectives of the adaptation intervention are evaluated through Ladder based approach. These can be qualitative or quantitative. These indicators tend to be iterative in nature, and periodic evaluation processes seek to understand if these indicators show positive progress over time. They also help us identify challenges and shocks to the project, by assessing if certain indicators are not progressing as anticipated, and enable us to carry out course correction actions to ensure the success of the project.

Evaluation of more permanent changes from the impacts of the project, such as behavioural or landscape changes, may be qualitative or quantitative. For instance, a quantitative method may involve the number of people adopting a certain type of behaviour. This may also be measured using a scorecard which helps in mapping the result as 'Yes,' 'No' or 'Partial' and may be represented using '2', '1' or '0' for evaluation purpose and may be analysed using a weightage. On the contrary, qualitative techniques for mapping behavioural change would involve use of expert judgement/narratives or use of pre and post surveys. In case of narratives, scoring for each sub-indicator is aggregated to produce an overall score for each outcome indicator. This method then provides a quantitative interpretation of the score. Such a scorecard approach enables us to understand the impact of the project, and whether the outcomes envisaged by the theory of change have been achieved by the project. Scorecard approaches can also help in course-corrections or for expanding the scope of the project, by identifying barriers, co-benefits, and opportunities during the project.

Other tools and techniques of evaluation would include economic assessments such as a cost benefit analysis, social evaluation methods like surveys as well as other technical methods such as geo-tagging or photo verifications of achieved targets. Economic assessments would also help in prioritization of adaptation options, whereas other methods help drive accountability and course correction regarding the achieved targets of the projects. Social evaluation methods can similarly assess the impact of the project on local stakeholders, establishing if positive impacts have been felt by the local communities and helping drive tangible change at the grassroots level.

[19] Details available at <https://www.oecd-ilibrary.org/docserver/58665de0-en pdf? expires=1663052010&id=id&accname=guest&checksum=5EA1C2058387772B572ED8F63C87BF3F>

Project component	Outcomes	Indicators	Evaluation method/approach
Component 1: Protection of the natural streams near the basin undertaking structural measures such as check dams, based on future climate variability analysis along the basin for checking run-off and use measures for both drought and flood control endemic to the area	Reduced risks of adverse impacts of climate change (drought and flood) in water and agriculture sectors and rejuvenation of hill streams for long term	Number of deaths due to drought/ flood	Ladder based
		Proportion of land under mono-cropping versus multi-cropping	Ladder based
		Change in cropping intensity due to increased availability of water through water harvesting structures	Ladder based
		Percentage of land practising Crop diversification which serve as an alternative economic opportunity to farmers	Ladder based
		Change in income due to adoption of various cropping techniques	Ladder based
		Number of hill streams rejuvenated which leads to reduced water stress	Ladder based
		Productivity gains due to increased water availability and different cropping practices	Ladder based
		Improvement in water-use efficiency with change in area covered under drips and sprinklers	Ladder based
Component 2: Diversify livelihood from paddy monoculture and introduce horticultural crops (fruits and vegetables)	Poverty alleviation, livelihood security	Change in incomes of farmers after taking additional (horticulture) crop in the command area	Ladder based
	Enhanced awareness on efficient water uses in the economic activity	Households aware about efficient water use in the economic activities	Ladder based

Project component	Outcomes	Indicators	Evaluation method/approach
Component 3: Link fishery and poultry as part of livelihood diversification initiative	Enhanced adaptive capacity through livelihood diversification from non-land-based activity as well as fishery, especially for the landless households	Change in non-farm income from non-land-based activity and fishery	Ladder based
		Change in non-farm income of the landless households from non-land-based activity	Ladder based
		Farmers/landless taking up fishery activities under this project/ programme	Ladder based
		Change in share of fishery activities after project implementation	Ladder based
		Change in number of fishermen	Ladder based
		Number of landless households who have taken up scientific poultry	Ladder based
Component 4: Solar pumping system for efficient use of water in select crops based on vulnerability	Reduced dependence on fossil fuel and efficient management of water in the stressed region	Number of farmers using solar pumping to reduce the crop vulnerability with uninterrupted power supply	Ladder based
		Decrease in electricity sourced from fossil fuels for agriculture produce	Ladder based
Component 5: Achieving sustainability by linkages with pani panchayats for water management	Strengthened awareness and ownership of adaptation and climate risk reduction processes at local level	Population implementing response actions to meet the challenge of water stress	Ladder based
	Higher awareness on water-use efficiency	Total number of households trained on water conservation practices	Ladder based
Component 6: Develop resource material and tool for monitoring of the climate change adaptation and mitigation co-benefits	Maximized multi-sectoral, cross-sectoral benefits/ co-benefits to meet the challenges of water and food security	Percentage of sectors using adaptation/mitigation response actions to adapt and mitigate the impact of water stress	Ladder based
		Number of training programmes/ workshops conducted on awareness regarding climate change,	adaptation, and mitigation

Ladder based

5. Conclusion and Way Forward

The climate vulnerability of Odisha to disasters such as cyclone, drought, and floods has gravely affected the agriculture sector with increasing water stress in the region. The large dependence on agriculture for income generation in the state, as well as the presence of significant amount of poverty has created a poverty trap that significantly contributes to livelihood vulnerability. Water stress along with flooding due to heavy rainfall juxtapose the region to two different climate extreme events in addition to challenges of pressing social issues like loss of livelihoods. The adaptation intervention implemented by the state, therefore, possesses potential to address the prevailing climate-related issues in the state as well as provide social and economic security.

Furthermore, behavioural and policy changes are required that would look into incentivizing water management practices, as well as the maintenance of rural check dam infrastructure. Specific measures are also required to address unregulated growth of vegetation and eutrophication in the waterbodies. Another important aspect about project implementation and monitoring is the need for a standardized set of terminologies and parameters to identify at-risk regions for interventions, as well as promoting a shared and coherent understanding of the nature of the waterbodies among the stakeholders in different regions.

Lastly, based on the discussions with the relevant stakeholders from different department officials, it was noted that the project despite having features for monthly reporting on financial aspects, it lacks a robustand transparent monitoring and evaluation framework for tracking climate change adaptation which not only includes tracking financial progress but also covers physical progress in implementation, thereby indicating overall reduction to imposed climate risks and helps build resilience over time. There is a need for continuous stakeholder engagement for developing an effective MEL framework and conducting capacity building and training programmes for key stakeholders. Such stakeholder engagement will be continued as part of the ICAT process for knowledge sharing and documentation and for receiving feedback for developing the MEL framework, and TERI will be conducting capacity-building and training programmes for the key stakeholders in the Government of Odisha as per the capacity needs assessment. In the future, the learnings from such stakeholder consultations and capacity-building workshops can be implemented at departmental levels of the nodal agencies of the state to be incorporated into all projects and activities in the state. By having a robust and inclusive MEL framework in place, that can be tailored to fit all requisite projects and activities, the state can ensure that the impacts of various interventions and policies are properly monitored; along with providing key learnings about any further requirements to ensure inclusive and complete development across the agricultural sector in Odisha.

The proposed M&E framework is grounded in the local context, it recognizes the heterogeneity of needs and maintains the local relevance. Lessons will be drawn from this exercise form the foundation for the development of the sector-level M&E at the national scale, with the framing of a more generalized framework that is flexible enough to consider the contextual needs of individual states.

References

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Annexure

No Objection Certificate from the Government of Odisha

By e-mail - faiza.jamal@teri.res.in

GOVERNMENT OF ODISHA
DEPARTMENT OF WATER RESOURCES

No. 31145 /WR, Dated 6/12/2021
WR-LI-SCH-0030-2021

From
Smt. Madhusmita Sahoo, I.A.S.,
Deputy Secretary to Government.

To
Faiza Jamal,
Project Associate, Earth Science & Climate Change division, CGER Area,
The Energy and resources Institute (TERI).

Sub: Regarding No Objection Letter (NOC) for taking up NAFCC & GCF Projects for research oriented collaboration under ICAT-TERI.

Madam,

In inviting a reference to your e-mail dated 10.11.2021 on the subject cited above, I am directed to convey 'No Objection' and willingness to share information related to NAFCC project titled "Conserve water through management of runoff in Jonk river basin to reduce vulnerability and enhance resilience for traditional livelihoods in Nuapada district" and GCF project titled "Ground water recharge and solar micro irrigation to ensure food security and enhance resilience in vulnerable tribal areas of Odisha" for research oriented initiative under ICAT-TERI partnership to develop MEL (Monitoring, Evaluation & Learning) of adaptation action under the two projects with the condition to share the draft results/ reports with us before officially releasing & publishing it.

Yours faithfully,

Deputy Secretary to Government

Memo No. 31146 /WR, Dated 6/12/2021
Copy forwarded to the P.S. to Principal Secretary to Govt., DoWR for kind information of Principal Secretary.

Deputy Secretary to Government

Memo No. 31147 /WR, Dated 6/12/2021
Copy forwarded to the PD,OCTDMS/Project Director,NAFCC/CE,MI/EE,Khariar MI Division for kind information and necessary support in sharing information.

Deputy Secretary to Government