Framework for development of MEL Tool: Case Studies in Agriculture, Telengana State

INDIA

Developed by:
The Energy and Resources Institute (TERI)

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Background and Introduction

It is well established that climate change is one of the largest issues facing humankind globally. 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, India is extremely sensitive to weather vagaries and climate, given huge 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 very critical in the process. However there are gaps in understanding of the risks and its distribution of it 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 8 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 is 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 (SSAP) 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).

Under the ICAT Phase I initiative, the State of Telengana had been identified to select case studies for the development of the frameworks for monitoring, evaluation and learning on adaptation. To begin with the Agriculture sector has been chosen. Approach included identifying interventions on adaptation that were underway in the State and given the State interest also identify development interventions that can be climate proofed for which frameworks can be considered.

CASE A: Climate Proofing of State Interventions

Description of case

The National Mission on Sustainable Agriculture (NMSA) was formulated to enhance agricultural productivity particularly in the rain-fed areas with focus on integrated farming, soil health management, water use efficiency and resource conservation.

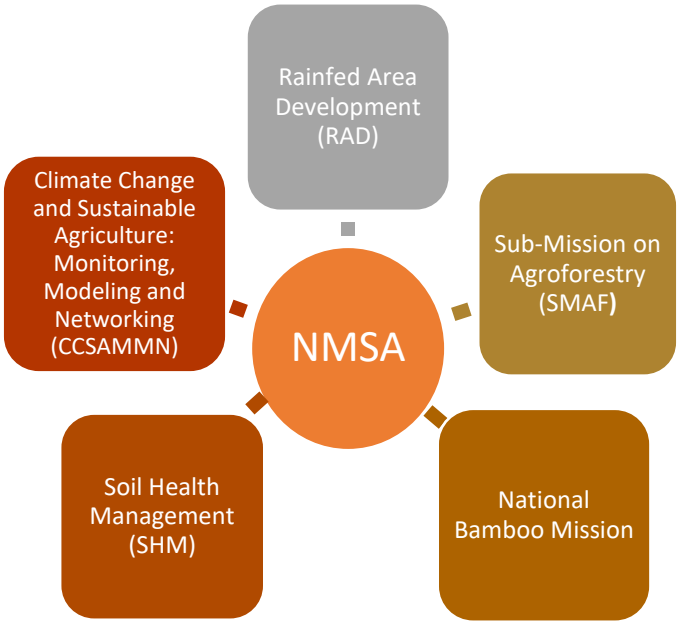

Figure 1: Major components/activities under NMSA[1]

The Rainfed Area Development Programme is one of the major component under NMSA that was launched in 2011-12 as a sub-scheme under Rashtriya Krishi Vikas Yojana (RKVY). It aims at improving the quality of life of farmers' particularly the small and marginal farmers' by offering a multifaceted package of activities to maximize the farm returns for augmenting their food and livelihood security (Guidelines for RADP, 2011). This programme spreads across all the states and union territories of India, covering more than 700 districts and an area of about 99,236.23 hectares in the financial year 2018-19[2]. As per the data for the financial year 2018-19, there are 31 districts of Telangana under the umbrella of RADP. These districts cover an area of about 4,671 hectares with a total of 61 clusters in the respective districts[3]. Similarly the proposed area to be covered under RADP in the financial year 2019-20 is projected to be around 3575 hectares that is pending for approval by the central government (AAP, 2019-20). The pattern of funding assistance for this programme is in the ratio 60:40, where the former is central assistance and the latter one is the state funding. For 2018-19, an amount of Rs. 10.50 crore has been tentatively allocated as a central share for the implementation of the programme in Telangana[4].

The programme focuses on integrated farming systems (IFS) which includes multi-cropping, rotational cropping, inter-cropping, mixed-cropping practices. In continuation it will also establish suitable farming systems mainly by assimilating several components of agriculture such as crops, horticulture, livestock, fishery, forestry with agro based income generating activities that will aid in maximizing farm returns for sustaining livelihood and also mitigate the impacts of extreme weather events. Along with this, a cluster based approach of 100 hectare or more shall be espoused to derive visible impact of convergence and inspire local participation[5].

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[1] https://nmsa.dac.gov.in/frmComponents.aspx
[2] https://nmsa.dac.gov.in/RptAAPState.aspx
[3] https://nmsa.dac.gov.in/RptAAPDistrict.aspx?iMQfmQnVenOj1CorzIeNe+tvADlZOXvOb3N+V5I9UKQXI/BqeiiPpofUTkIdKPW5qB2iI2EDEywpxSNR84PscxWTbCmCa1y4M2h8+zHA/w279Y7M7Sb0vV8ucR/ijtKLVtAVZY9ZzU4VKlCVL7s4WihLkGjI9T6AoRmwWKmYyO1MRDfmfHvryqKCeiHu7/p6dgxZsxh+COupxs1hPdeko5H3iRQFuMuqAbVdAXxjK7Y=
[4] https://nmsa.dac.gov.in/Uploads/SanctionOrder/20180508044845509-6.pdf
[5] https://nmsa.dac.gov.in/frmComponents.aspx

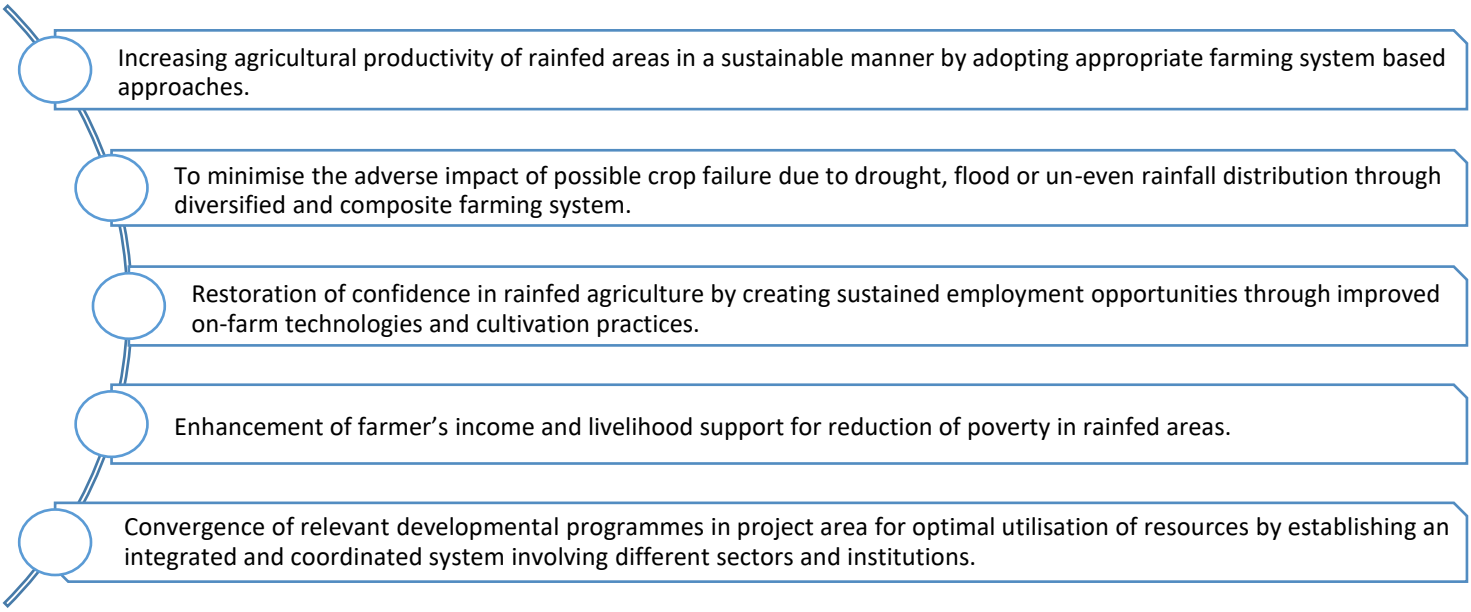

Figure 2: Objectives of RADP
***Source: Rainfed Area Development Programme (RADP),* 2013**

Institutional structure

RAD is a centrally mandated programme under the Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India. The State Agriculture Department is the nodal agency for the implementation of RADP which will be in a project mode. As per the guidelines, a state-wise or district-wise RADP projects are to be drafted for approval by the State Level Sanctioning Committee. The Principal District Agriculture Officer/ Joint Director along with Agricultural Technology Management Agency (ATMA) are assigned the responsibility to ensure coordination in the project preparation and execution. State Agricultural Universities (SAUs), Indian Council of Agricultural Research (ICAR) centres and other professional institutes/agencies are deployed in the project formulation and implementation which include tasks of development of model framing systems suitable to the agro-ecology of a district for demonstration purposes.

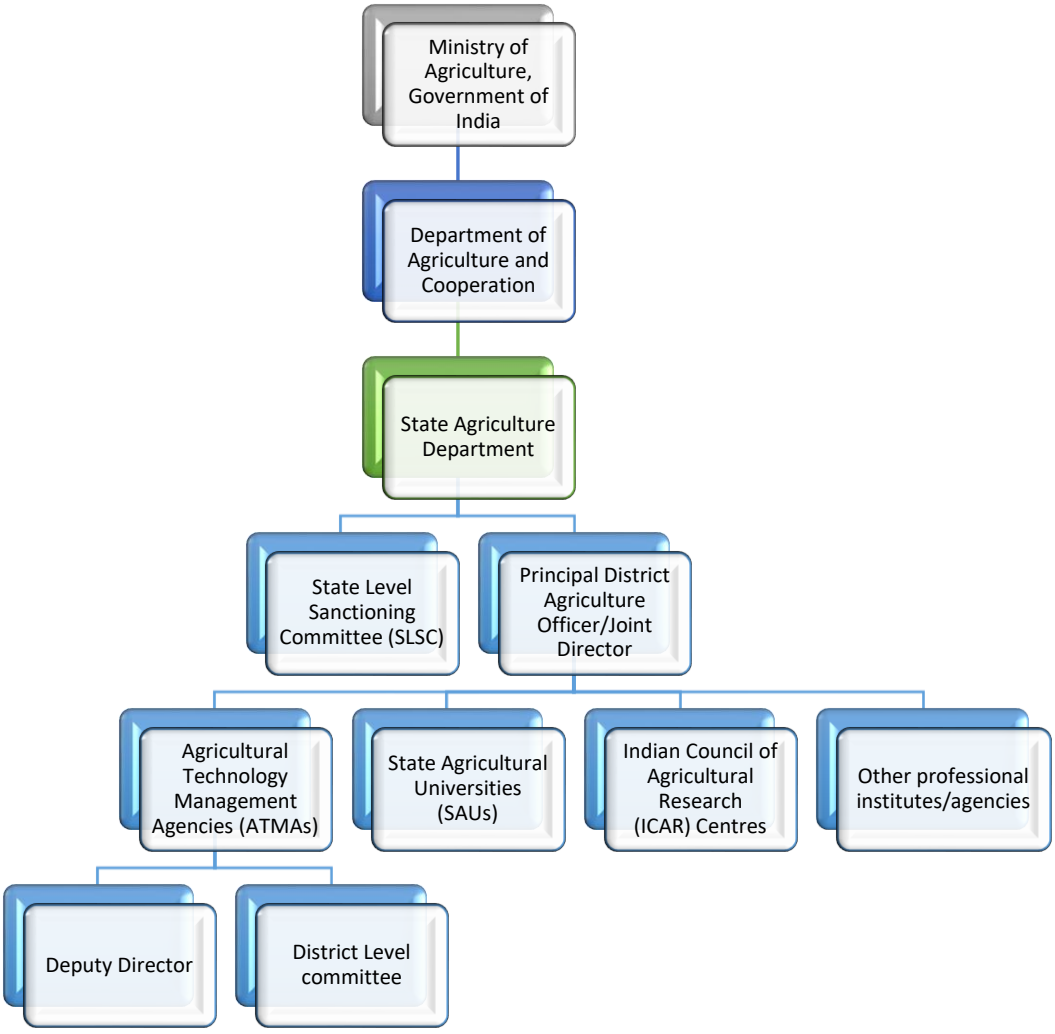

Figure 3: Institutional Structure of RADP
Source: Guidelines for RADP, 2011

Framework for Monitoring, Evaluation, Learning

The performance of RADP proposes monitoring through the RKVY Database and Management Information System (RDMIS) that has been developed for RKVY projects. This will also inculcate periodical field visits, verifications, and review undertaken by the State and District Nodal Agencies. There will also be an annual desk review at the Department of Agriculture and Cooperation for assessing and evaluating the performance of the programme.

Overall Objective	**Outputs**	**Indicators**				**Outcomes**	**Impacts**
		Social Indicators	**Economic Indicators**	**Technological Indicators**	**Bio-physical Indicators**		
The programme aims at promoting integrated farming system (IFS) emphasizing on multi- cropping, inter-cropping and mixed cropping practices to improve the quality of small and marginal farmers' life in maximizing their farm returns for enhancing their food and livelihood security.	Increase in agricultural productivity of rainfed areas by adoption of appropriate farming system based approaches/ by adoption of diversified and composite farming systems	No of farmers exposed/ trained on multi-cropping techniques	Percentage change in Incomes	Use of Multi-cropping practices	Area under multi cropping practices	Rise in agricultural productivity in a sustainable manner by adoption of appropriate farming system based approaches	Improved agricultural productivity in rainfed areas
		Income enhancement	Productivity gains	Number of ponds/ other water conservation structures built	Enhancement of water conservation in farms	Reduction in crop failures by adoption of diversified and composite farming systems	Enhanced resilience of agricultural production to climate variability
		Income enhancement	Reduced water requirement per unit of land covered	Area covered under micro irrigation	Use of water saving techniques for irrigation		
	Restoration of confidence in rainfed agriculture	Percentage farmers trained on different techniques Number of capacity building and training programmes conducted	Improved Incomes	Percent improvement in adoption of techniques	Improvement in productivity	Raising farmers' awareness and establishing employment opportunities	Improved knowledge and awareness among the farmers to adopt rainfed agriculture

Bibliography

Guidelines for Rainfed Area Development Programme (RADP). Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, March 2011. Available at: https://www.indiawaterportal.org/sites/indiawaterportal.org/files/Guidelines-for-rainfed-areas-development-programme-%28RADP%29-Department-for-Agriculture-and-Cooperation%20%282011%29.pdf

Rainfed Area Development Programme (RADP). (2013). 401547.

Telangana Agriculture Anuual Action Plan, 2019-2020. Available at: http://agri.telangana.gov.in/Action_Plan.php

CASE B: Resilient Agricultural Households

Telangana, a state formed on 2nd June 2014 is situated in the southern part of India. It is predominantly a semi-arid state characterized by a hot and dry climate. The Agricultural activities are an important part of the economy which supports about 55% of the population (DPR). As the crop production is largely dependent on south-west monsoon for irrigation, the sector is extremely sensitive to any change in climatological variables. The increase in instances of severe drought in the recent past has therefore led to decline in agricultural production. The decline in the agricultural production trends has been apparent despite an increase in the net sown area. Mahabubnagar is geographically the largest district in the State of Telangana covering a geographical area of 18.43 lakh ha. Agriculture forms the mainstay of the district with the main crops being Rice, Maize, Cotton, Castor, Redgram and Jowar. The district frequently experiences water stress and crop losses due to unfavorable weather conditions. The district is primarily dependent on south-west monsoon and experiences large variation in the amount of rainfall received seasonally. It is therefore called a ‘rain shadow district’ and is one of the most drought prone districts of Telangana. The soil being dominated by Chalka type (70%) which has a poor water retention capacity further hampers the agricultural productivity in such water stress conditions. Livestock is another important sector particularly for the rural population that is rearing various livestock resources like dairy animals, backyard poultry and extensive sheep flock. The increased incidences of drought events have led to occurrence of diseases, impaired growth and reproduction process and malnourishment due to indirect impacts on the pastoral lands and fodder production systems. Such conditions adversely affect livelihood of farmers dependent on agriculture and livestock especially the small and marginal that constitute almost 83% of the farming community.

Description of case

The Resilient Agricultural Households through Adaptation to Climate Change is a four year project initiated in 2016 by the Environment, Protection, Training and Research Institute in association with Department of Agriculture, Professor Jayashankar Telangana State

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Agricultural University NABARD and ICRISAT under National Adaptation Fund for Climate Change, Ministry of Finance (MoF). The overall objective of the project is to enhance the livelihoods of the farming communities based in the Mahabubnagar district of Telangana by making agriculture more resilient to climate change. During the preparation of the Detailed Project Report the project targetted 3 clusters in the district of Mahabubnagar namely Jadcherla, Bijinapally and Ghanpur. However after Telangana was formed as a separate geographic entity, the clusters of Jadcherla, Bijinapally and Ghanpur were reorganized as a part of Nagarkurnool, Mahabubnagar and Wanaparthy districts respectively. The objectives of the project are stated as under:

- Promoting and implementing science based suitable climate smart adaptation strategies such as developing farm ponds, promoting drought and heat tolerant crop varieties, micro-irrigation, inter-cropping etc. for resilience of agricultural households to climate variability and change
- Developing and implementing an information system for providing seasonal climate forecast and weather based agro advisories for farmers
- Enhancing the capacities of stakeholders for implementing and sustaining the climate change adaptation strategies
- Improving the alternate livelihoods options such as livestock rearing, vermicomposting and value chain integration (e.g. decentralized dal mill, millet processing unit), etc.
- Mainstreaming adaptation strategies into policies and programmes through better Knowledge Management and Sharing

The abovementioned objectives have a clear focus on enhancement of climate resilience backed by an amalgamation of scientific assessments like analysis of climate, vulnerability analysis and other participatory ground level assessments which clearly qualifies it as an adaptation project. In this light, the project receives funding from the National Adaptation Fund on Climate Change (NAFCC). For the defined objectives, a package of climate adaptation strategies are being offered along with several livelihood enhancement alternatives with a 75% subsidy provided to more than 2000 most climate vulnerable households.

Box 1: RAH Project Snapshot

Name of Project: Resilient Agricultural Households through Adaptation to Climate Change in Mahbubnagar district, Telangana

Name of Executing Entity: Environment Protection Training and Research Institute (EPTRI), Government of Telangana, Gachibowli, Hyderabad

Project/Programme Objective/s: To enhance the livelihoods (income and nutrition) of the farming community in targeted villages of Mahbubnagar district, Telangana through implementing climate resilient agricultural interventions

Project Duration: 4 years

Start Date: 1st March, 2016 (tentative)

End Date: 29th February, 2020 (tentative)

Amount of Financing Requested: (Rs.): 25,00,61,238

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Institutional structure

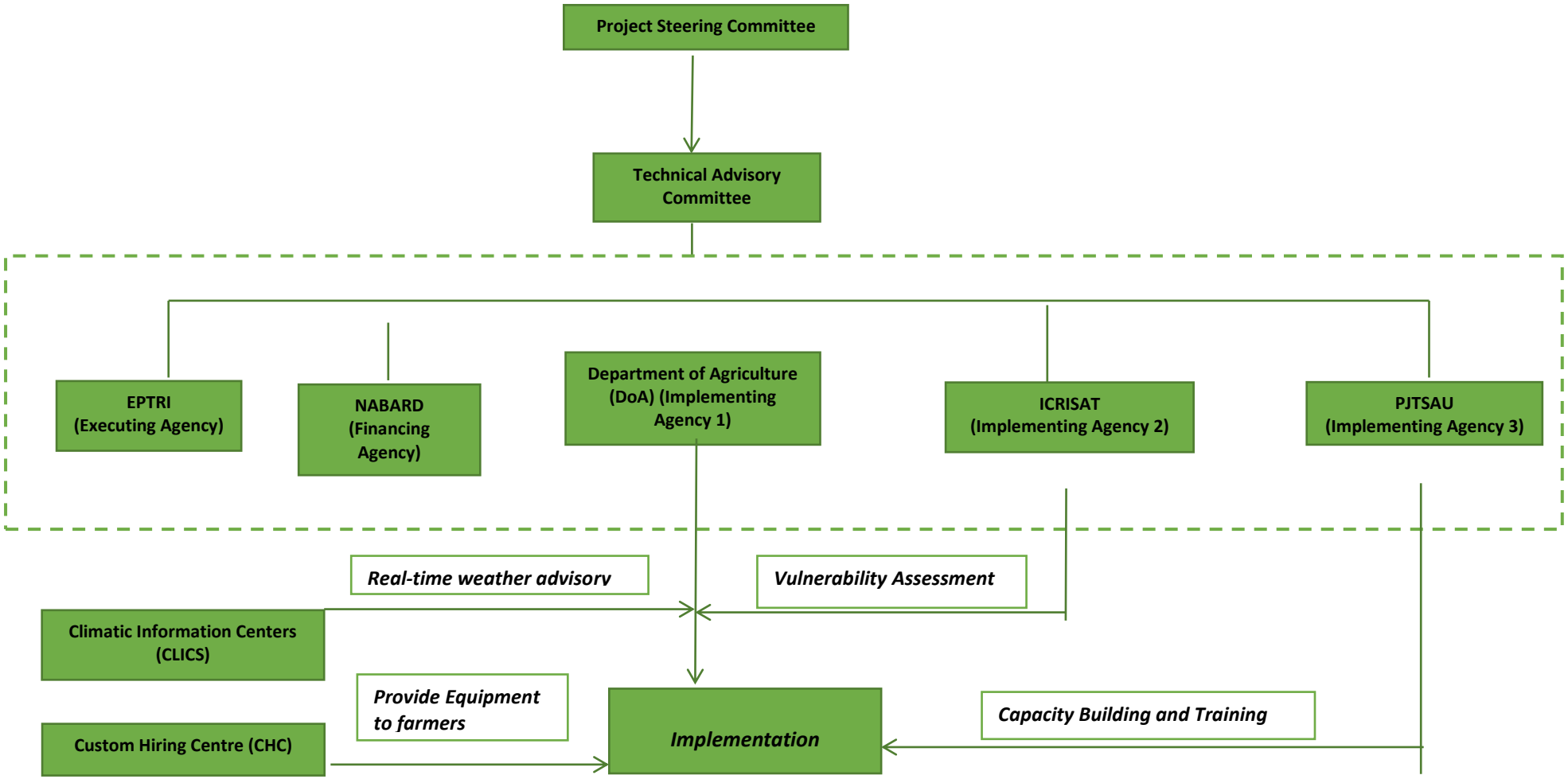

Figure 4: Institutional Roles and Responsibilities under RAH project

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The Figure above outlines all the institutions involved in RAH along with their designated responsibilities. Project implementation is led by Environment Protection Training and Research Institute, Government of Telangana (EPTRI).The Project Steering Committee (PSC) headed by the Chief Secretary provides financial and technical advisory on implementation of the project followed by a review based on the progress of work. The Technical Advisory Committee (TAC) comprising of representatives from EPTRI, DoA, ICRISAT and PJSAU consultatively prepare the project implementation plan, review its progress and oversee the physical and financial progress of project.

The key executing entity i.e. EPTRI is the strategic decision making body also responsible for fund management i.e. timely disbursal of funds to for respective activities, project management and coordination that involves harmonization of inputs from all entities along with financial evaluations with Ministry of Finance and development of knowledge products with other institutions involved. EPTRI is responsible for all the contractual agreements and fund utilization monitoring and fund disbursement. NABARD is the financing entity responsible for allocating NAFCC funds which are channeled through the Ministry of Finance and Ministry of Environment, Forest and Climate Change.

The Department of Agriculture is one of the implementing entities that undertakes climate change adaptation measures in the target villages and beneficiary households in consultation with the other two implementing agencies namely ICRISAT and PJTSAU. ICRSAT has been assigned with the responsibility to conduct all the scientific climate change assessments like updation of climate scenarios, assessing vulnerability of different districts and seasonal climate forecasting. The primary role of PJTSAU is to understand the varying capacities of communities and line departments and augment it through training and awareness building activities.

The on-ground implementation process also receives inputs from PJSAU for capacity building requirements, ICRISAT for Monitoring and Evaluation of project outcomes, Custom Hiring Centers (CHC) for providing farm machinery and Climatic Information Centers for providing real time weather advisory to farmers.

Framework for Monitoring, Evaluation, Learning

The process of Monitoring and Evaluation (M&E) under RAH is managed by ICRISAT that prepares and circulates templates to each stakeholder for assessing the progress of work under their respective components. Once the individual stakeholder reports are prepared, ICRISAT takes charge of compiling them and monitoring the progress against the set outputs, indicators and timelines in every year of the project cycle. The compiled report is then submitted to the Project Steering Committee twice every year.

The Evaluation process of the project with respect to the outputs and outcomes is conducted twice during the entire project period. The mid-term evaluation is conducted after the first phase implementation of adaptation strategies in 500 farm households. The second/final evaluation is planned towards the end of the final year of the project after the second phase of implementation. The final evaluation report near to the end of the project duration will be based on first hand information collected in line with the proposed indicators through farm/household level surveys. The final

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evaluation will attempt to assess the gender differentiated impacts of the interventions on the ground.

The outputs and outcomes of RAH have been clearly identified based on the objective defined under each component.

Component 1: Finalizing household level adaptation interventions: (Baseline Household Survey, Finalization and communication of adaptation interventions for each target community and household)

> This component aims at improving the understanding of the stakeholders regarding climate change with intent to identify specific vulnerabilities and implement adaptation interventions. It included baseline surveys of 8000 farm households in the selected three clusters which have been identified as most vulnerable to climate change impacts.

Component 2: Developing and implementing the Information System for 'seasonal climate forecast' and 'weather based agro advisories'

> This component focuses on providing seasonal climate and agro advisories to farmers in the selected target districts with intent to support the decision making of farmers on their cropping practices prior to any unfavorable change in the expected climatic condition.

Component 3: Enhancing capacities of stakeholders for developing and implementing climate change adaptation strategies

> This component focuses on enhancing capacities and making all stakeholders including the department staff and communities to increase their awareness on implications of climate change in the district as well as seek their participation for adoption of climate resilient intervention planned as a part of the project.

Component 4: Implementation of the suitable portfolio of adaptation strategies to climate change in the target villages and farm households

> This component includes capacity building of the Department of Agriculture, Telangana staff to implement the adaptation measures effectively on ground.

Component 5: Knowledge management and mainstreaming of adaptation strategies

> This component focuses on creation and dissemination of knowledge generated throughout the project timespan including vulnerability assessments, capacity building manuals, implementation guidelines etc.

As a part of the results framework detailed under the DPR, clear and measurable indicators have been selected to monitor the progress of each output and outcome. The performance of activities is monitored using these indicators against a fixed baseline. The information generated through the monitoring and evaluation process is used for strengthening decision the technical and financial decision making under each component.

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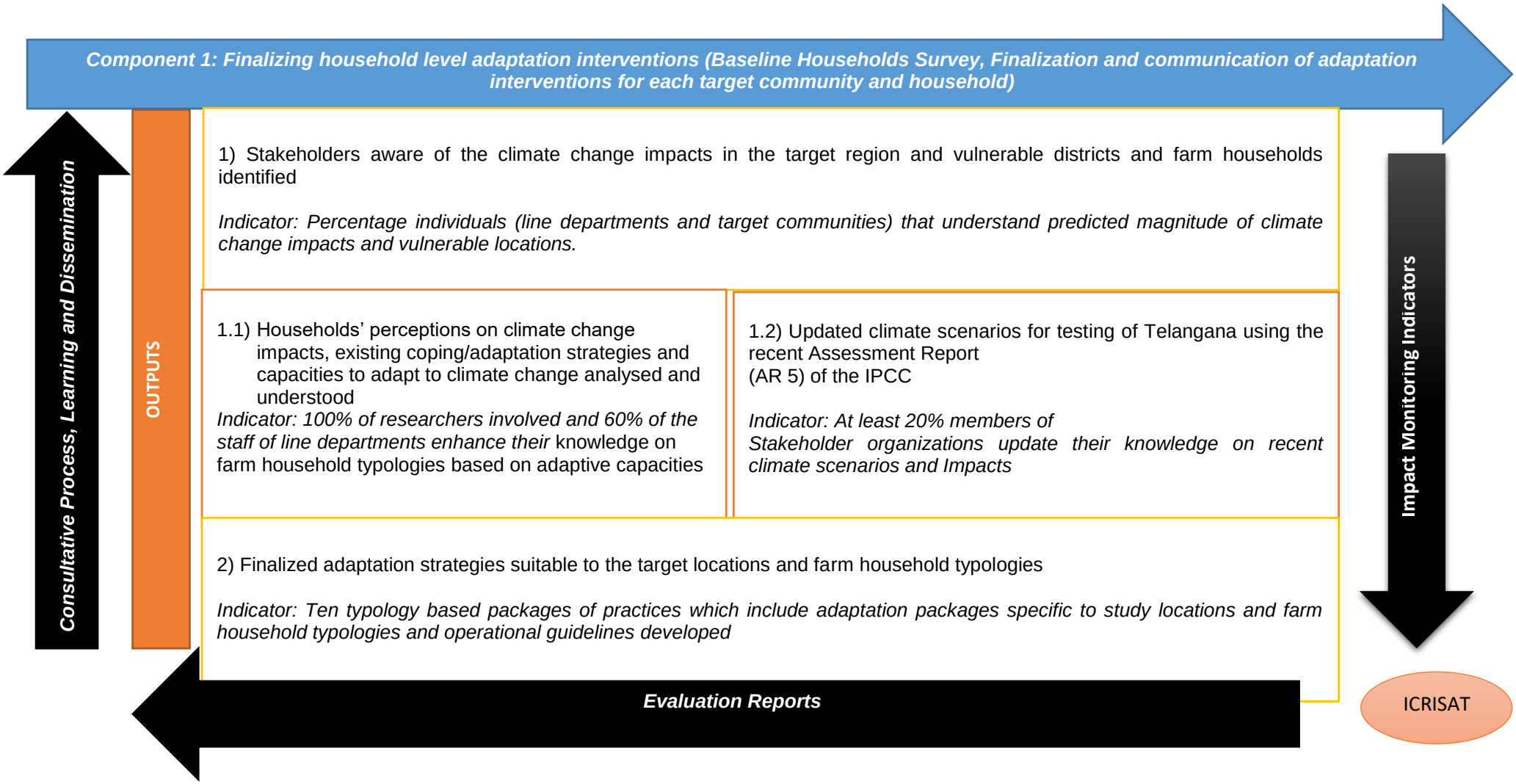
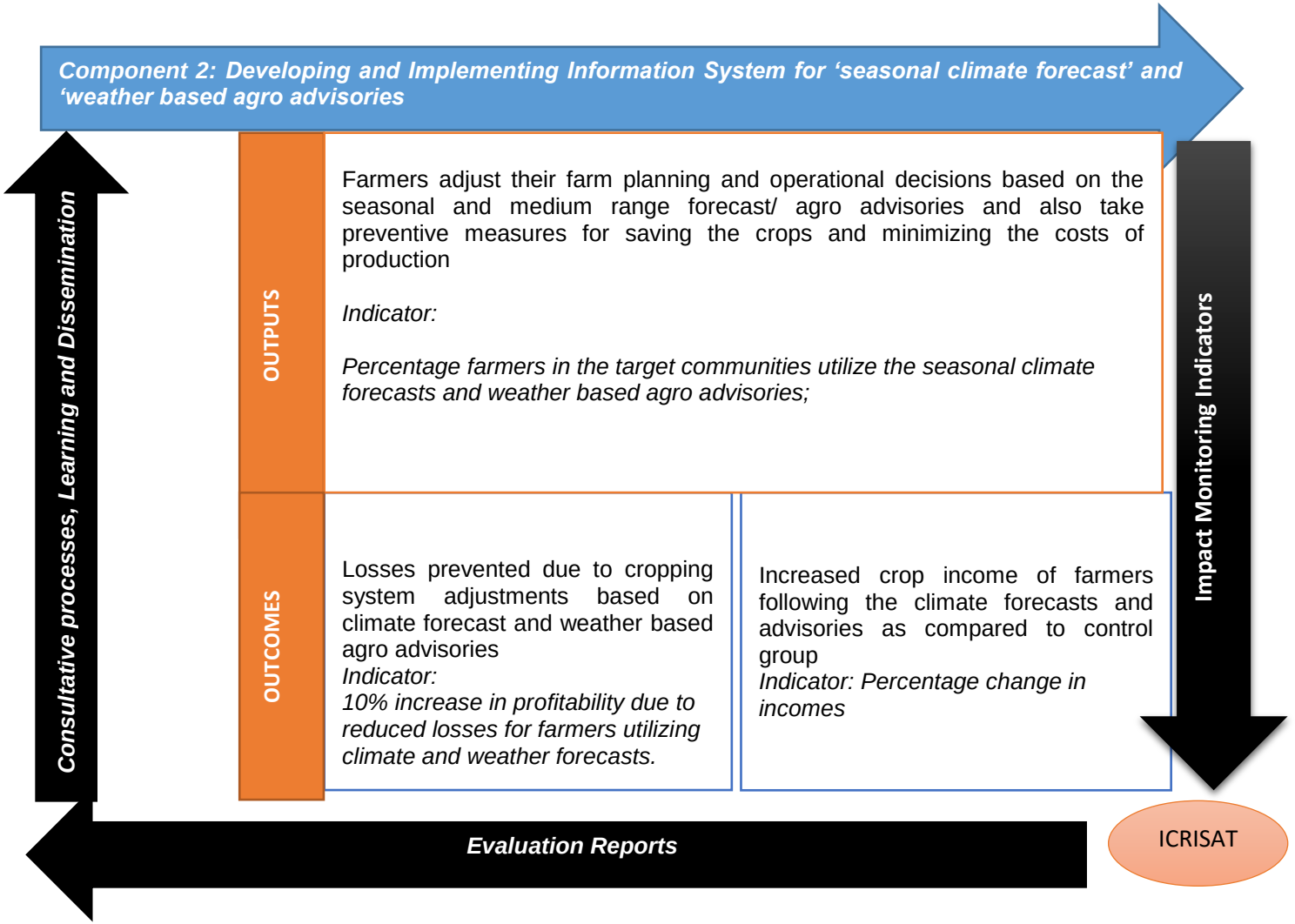
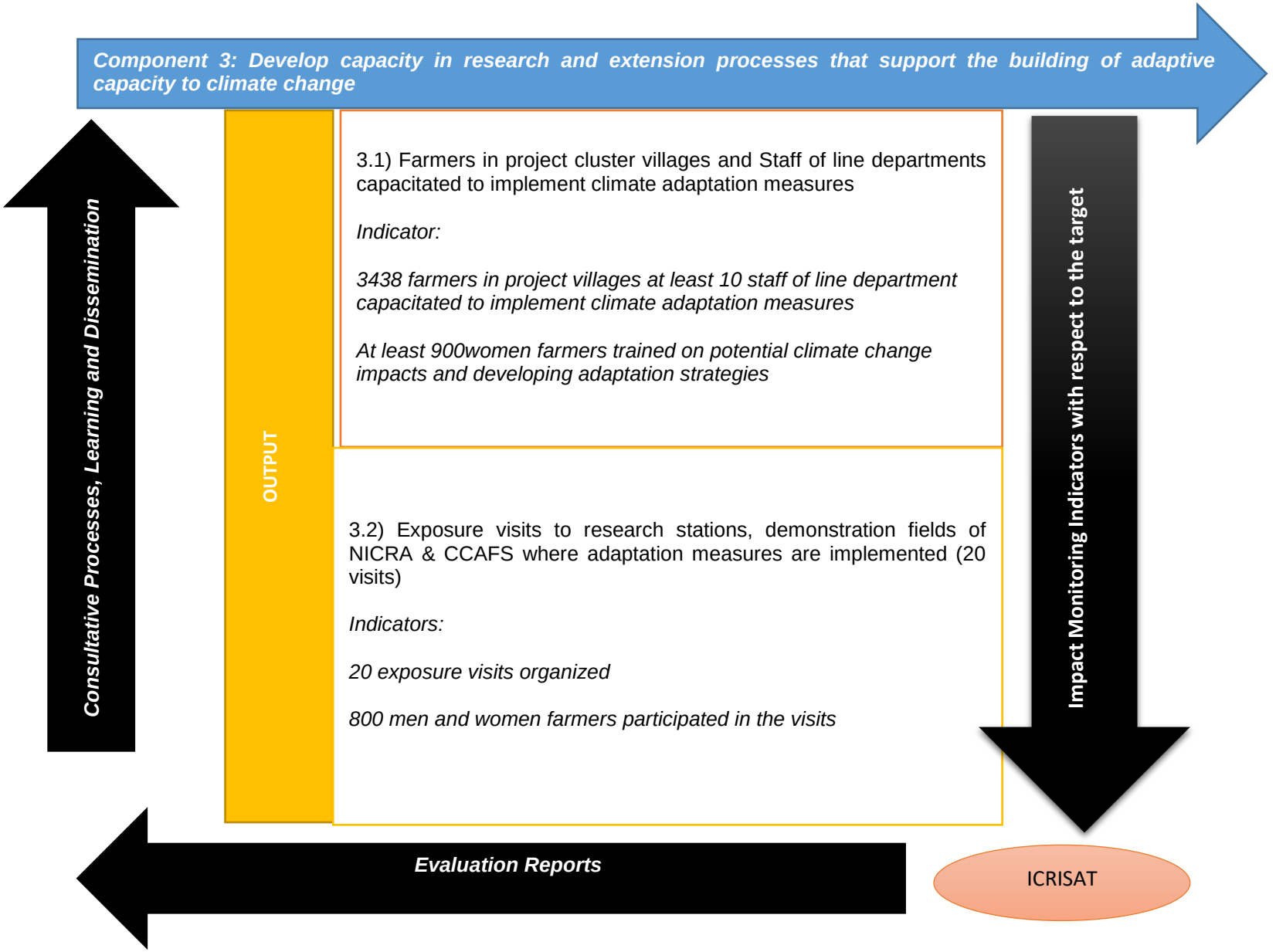
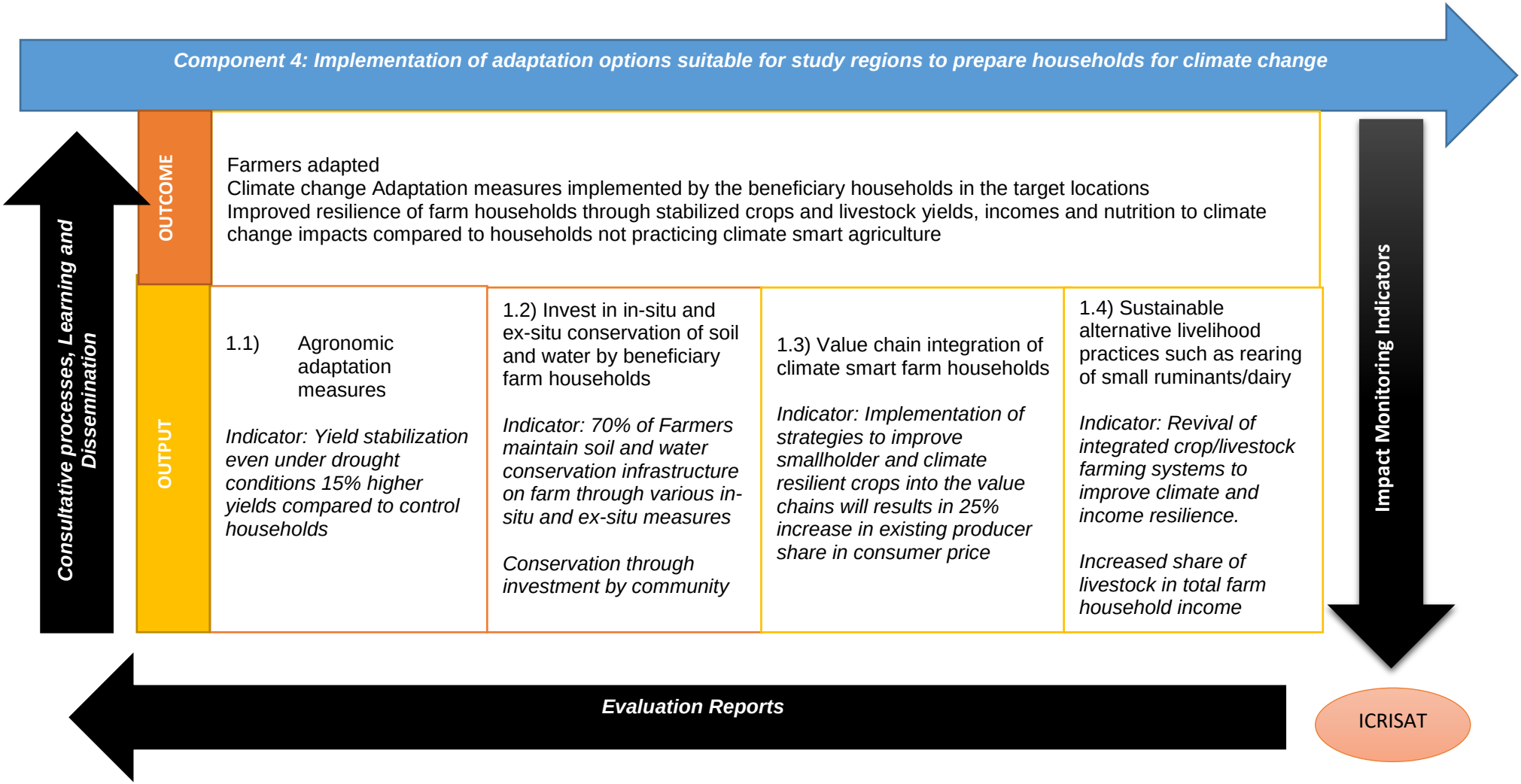
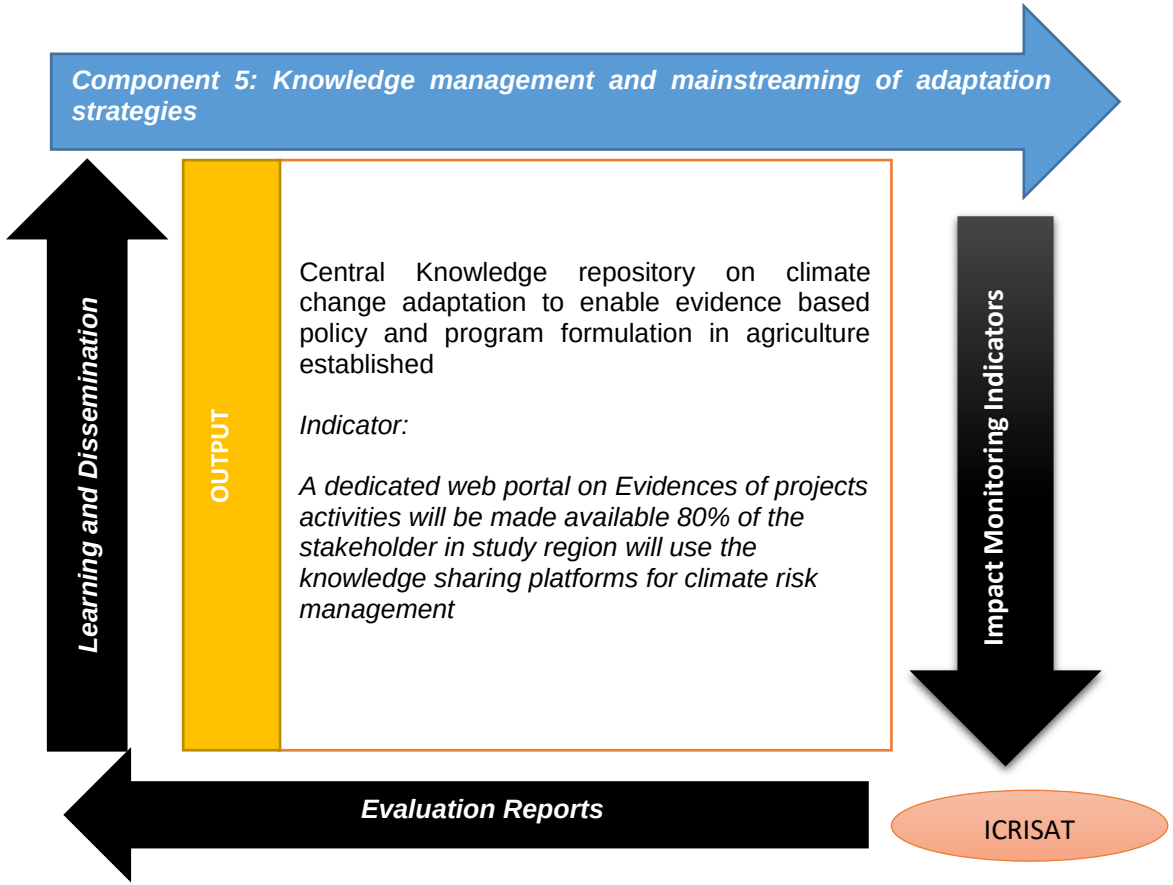

Component 1: Finalizing household level adaptation interventions (Baseline Households Survey, Finalization and communication of adaptation interventions for each target community and household)
Consultative Process, Learning and Dissemination
OUTPUTS
1) Stakeholders aware of the climate change impacts in the target region and vulnerable districts and farm households identified
Indicator: Percentage individuals (line departments and target communities) that understand predicted magnitude of climate change impacts and vulnerable locations.
1.1) Households' perceptions on climate change impacts, existing coping/adaptation strategies and capacities to adapt to climate change analysed and understood
Indicator: 100% of researchers involved and 60% of the staff of line departments enhance their knowledge on farm household typologies based on adaptive capacities
1.2) Updated climate scenarios for testing of Telangana using the recent Assessment Report (AR 5) of the IPCC
Indicator: At least 20% members of Stakeholder organizations update their knowledge on recent climate scenarios and Impacts
2) Finalized adaptation strategies suitable to the target locations and farm household typologies
Indicator: Ten typology based packages of practices which include adaptation packages specific to study locations and farm household typologies and operational guidelines developed
Impact Monitoring Indicators
Evaluation Reports
ICRISAT


Component 2: Developing and Implementing Information System for 'seasonal climate forecast' and 'weather based agro advisories
Consultative processes, Learning and Dissemination
OUTPUTS
Farmers adjust their farm planning and operational decisions based on the seasonal and medium range forecast/ agro advisories and also take preventive measures for saving the crops and minimizing the costs of production
Indicator:
Percentage farmers in the target communities utilize the seasonal climate forecasts and weather based agro advisories;
OUTCOMES
Losses prevented due to cropping system adjustments based on climate forecast and weather based agro advisories
Indicator:
10% increase in profitability due to reduced losses for farmers utilizing climate and weather forecasts.
Increased crop income of farmers following the climate forecasts and advisories as compared to control group
Indicator: Percentage change in incomes
Impact Monitoring Indicators
Evaluation Reports
ICRISAT


Component 3: Develop capacity in research and extension processes that support the building of adaptive capacity to climate change
Consultative Processes, Learning and Dissemination
OUTPUT
3.1) Farmers in project cluster villages and Staff of line departments capacitated to implement climate adaptation measures
Indicator:
3438 farmers in project villages at least 10 staff of line department capacitated to implement climate adaptation measures
At least 900women farmers trained on potential climate change impacts and developing adaptation strategies
3.2) Exposure visits to research stations, demonstration fields of NICRA & CCAFS where adaptation measures are implemented (20 visits)
Indicators:
20 exposure visits organized
800 men and women farmers participated in the visits
Impact Monitoring Indicators with respect to the target
Evaluation Reports
ICRISAT


Component 4: Implementation of adaptation options suitable for study regions to prepare households for climate change
OUTCOME
Farmers adapted
Climate change Adaptation measures implemented by the beneficiary households in the target locations
Improved resilience of farm households through stabilized crops and livestock yields, incomes and nutrition to climate change impacts compared to households not practicing climate smart agriculture
OUTPUT
1.1) Agronomic adaptation measures
Indicator: Yield stabilization even under drought conditions 15% higher yields compared to control households
1.2) Invest in in-situ and ex-situ conservation of soil and water by beneficiary farm households
Indicator: 70% of Farmers maintain soil and water conservation infrastructure on farm through various in-situ and ex-situ measures
Conservation through investment by community
1.3) Value chain integration of climate smart farm households
Indicator: Implementation of strategies to improve smallholder and climate resilient crops into the value chains will results in 25% increase in existing producer share in consumer price
1.4) Sustainable alternative livelihood practices such as rearing of small ruminants/dairy
Indicator: Revival of integrated crop/livestock farming systems to improve climate and income resilience.
Increased share of livestock in total farm household income
Consultative processes, Learning and Dissemination
Impact Monitoring Indicators
Evaluation Reports
ICRISAT


Component 5: Knowledge management and mainstreaming of adaptation strategies
Learning and Dissemination
OUTPUT
Central Knowledge repository on climate change adaptation to enable evidence based policy and program formulation in agriculture established
Indicator:
A dedicated web portal on Evidences of projects activities will be made available 80% of the stakeholder in study region will use the knowledge sharing platforms for climate risk management
Impact Monitoring Indicators
Evaluation Reports
ICRISAT

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Proposed Monitoring and Evaluation Framework

While the monitoring and evaluation indicators in the Detailed Project Report are already outlined, however other indicators that capture the physical, social and economic impacts generated by the project on the target side can also be consideerd. A comprehensive framework mentioned as under is therefore suggested below which attempts to capture the project progress holistically.

S No.	Project Programme/Component	Expected Concrete Outputs	Indicators	Outcomes	Indicators	Impact
1	Finalizing household level adaptation interventions (Baseline Households Survey, Finalization and communication of adaptation interventions for each target community and household)	Understanding and analysis of Households' perceptions on climate change impacts, existing coping/adaptation strategies and capacities to adapt to different climate change scenarios	Number of Researchers and line department staff understand farmers' knowledge on climate change and their existing coping and adaptation practices.	Climatic vulnerability and scenarios of the targeted region updated	Number of members of line departments government research institutions and local NGOs trained on updating climate scenarios	Stakeholders aware of the climate change impacts in the target region an accordingly adaptation interventions will be implemented
			Integration of Knowledge of farm household typologies based on adaptive capacities integrated into development of adaptation strategies by researchers and line department staff		Report on climate change scenarios published and shared	
		Vulnerability assessment of households to identify target beneficiaries households	Vulnerability assessment reports prepared, published and disseminated	Stakeholders aware of the climate change impacts in the farm households identified;	Percentage of members in stakeholder organizations (line departments and target communities) understand and agree to the predicted magnitude of climate change impacts and vulnerable locations/groups	
		Identifying concrete adaptation interventions based on area specific vulnerabilities	Implementation guidelines for selected adaptation measures to adapt climate change impacts based on farm house hold typologies developed (viz., agronomic , soil and water management, integrated farming value chain interventions) and communicated	Finalized adaptation strategies suitable to the target locations and farm household typologies	Implementation guidelines for selected adaptation measures to adapt climate change impacts based on farm house hold typologies developed (viz., agronomic , soil and water management, integrated farming value chain interventions) and communicated	

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	Project Programme/Component	Expected Concrete Outputs	Indicators	Outcomes	Indicators	Impacts
2	Developing and implementing Information System for 'seasonal climate forecast' and 'weather based agro advisories'	Seasonal climate forecast provided for the target villages	Percentage of farmers receiving climate forecast	Farmers adjust their farm planning and operational decisions based on the climate forecast	Positive response rate of farmers about the use weather and agro based advisories	Adaptation strategies suitable to the target locations and farm household typologies finalized
		Improved Weather based agro advisories through ICT	Establishment of weather based agro advisory mechanism/system	Take preventive measures for saving the crops and minimizing the cost of production and reduce risk of crop failure and income loss	Amount of Losses prevented due to cropping systemadjustments based onclimate forecast andweather based agro Advisories	
3	Enhancing capacities of stakeholders for developing and implementing climate change adaptation strategies	Training and capacity building modules/ manuals for agronomic, NRM and economic adaptation measures developed and piloted	Number of trainings organised Number of capacity building manuals prepared	State government officials and farmers will be trained to implement climate change adaptation measures	3438 farmers in project villages at least 10 staff of line department capacitated to implement climate adaptation measures	Staff of line departments and farmers in Telangana capacitated to implementation of climate adaptation measures
		Capacity building workshops for stakeholders conducted	Number of capacity building workshops organised		At least 900women farmers trained on potential climate change impacts and developing adaptation strategies	

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	Project Programme/ Component	Expected Concrete Outputs	Indicators	Outcomes	Indicators	Impacts
4	Implementation of the suitable portfolio of adaptation strategies to climate change in the target villages and farm households	Micro irrigation in high value crops	Number of drip irrigation systems installed	Increased crop productivity, Increase in money savings from use of MI	Enhancement of crop yield (kg/hectare) in MI areas	Improvement of resilience of farm households to the projected climate change impacts such as drought, heat waves etc. with increase in social and economic benefits
			Number of sprinkler irrigation system installed			
			Percentage of farmers covered under micro-irrigation			
			Area of land covered under microirrigation		Average money savings due to adoption of micro-irrigation	
		Farm ponds	Number of individual farm ponds created	Increase in crop water use efficiency	Decrease in the amount of water used per unit of crop production	
			Number of community farm ponds created			
			Increase in Surface water storage capacity from new farm ponds			
		Bore-well recharge structures	Number of water recharge structures constructed	Water availability increases due to groundwater recharge	Rise in the level of groundwater	
		Popularisation of pulses /oil seeds cultivation	Awareness generation activities carried out for promoting drough resistant crops	Growth of drought resistant crops like pulses/oil seeds	Increase in the net sown area of pulses	
					Increase in the net sown area of oil seeds	
		Adoption of practices such as Backyard poultry	Number of farmers adopting backyard poultry practices	Backyard poultry offers an alternative source of livelihood	Increased in the income of farmers due to sale of poultry products	
		Small ruminants	Number of sheep being reared by beneficiaries	Reduce dependency on crops by exploring alternate source of livelihood	Income generated from rearing small ruminants	
			Number of goats being reared by beneficiaries			
			Percentage of landless, tribal and women beneficiaries rearing small ruminants			
		Inclusion of fodder crops in the system/ fodder trees on bunds plantation, silage	Area covered for fodder production		Income generated from production of fodder crops	
		Vermicomposting	Coverage of use of vermi composting practice	Increase in the productivity of soil	Amount of worm biomass produced	
					Increase in soil water retention capacity	
				Open access to knowledge-sharing platforms (portals, repository)	80% of the stakeholders in study region use the knowledge sharing platforms for climate risk management	

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Sno.	Project Programme/ Component	Expected Concrete Outputs	Indicators	Outcomes	Indicators	Impacts
		Designing of weather based crop insurance product	Demonstration of weather based crop insurance product	Adoption of weather based crop insurance products	Number of farmers taking up weather based crop insurance	
5	Knowledge management and mainstreaming of adaptation strategies	Central knowledge repository on climate change adaptation to enable evidence based policy and program formulation in agriculture	Central knowledge repository in place	Convergence of policies in programs that influence adaptation behaviour of farmers		Knowledge based advisory system integrated into climate change adaptation strategies at various levels
				Open access to knowledge-sharing platforms (portals, repository)	80% of the stakeholders in study region use the knowledge sharing platforms for climate risk management	

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References

Telangana State Portal. 2019. Available at https://www.telangana.gov.in/about/districts

FAO. 2019. Available at http://www.fao.org/india/fao-in-india/india-at-a-glance/en/

Case C: National Innovations on Climate Resilient Agriculture (NICRA)

Case description

NICRA is a network project of the Indian Council of Agricultural Research (ICAR) launched in February, 2011 which is being coordinated by Central Research Institute for Dryland Agriculture (CRIDA). The aims of the project were to enhance climate resilience agriculture through strategic research and technology demonstration which covers agricultural and horticultural crops, fisheries livestock and natural resource management.

Objectives of the project are:

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies.
- To demonstrate site specific technology packages on farmers' fields for adapting to current climate risks.
- To enhance the capacity of scientists and other stakeholders in climate resilient agricultural research and its application.

The programme attempts to develop and promote climate resilient technologies in agriculture which will address vulnerable areas of the country. The outputs of the scheme will help the districts and regions prone to extreme weather conditions like droughts, floods, frost, heat waves, etc. to cope with such extremes. Although the target area of the scheme are all climatically vulnerable regions of the country, small and marginal farmers in rainfed, coastal and hill areas will benefit more in view of the focused attention in these regions.

The project targets about 151 climate vulnerable districts of India through 121 Krishi Vigyan Kendras (KVK) that are organised under 11 KVK Zones which are further managed by Agricultural Technology Application Research Institutes (ATARIs).

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Activities that fall under the four key components namely *strategic research, technology demonstration, capacity building and knowledge management and sponsored and competitive grants* have been taken up under the initiative.

Brief description of the key components

Strategic research on mitigation and adaptation: Focused programs are taken up on different commodities on adaptation and mitigation such as Natural Resource Management, Crops, Pests and disease dynamics, Livestock, Fisheries & Energy Efficiency. A detailed assessment on vulnerability of different agro-climatic zones of the country is also planned.

Technology Demonstration

This component is being implemented in farmer participatory mode in the climatically most vulnerable districts of the country through 121 Krishi Vigyan Kendras (KVKs) spread across the country in 28 States & one Union Territory. Under this component, an integrated package of proven technologies is demonstrated in one village in each district for adaptation and mitigation of the crop and livestock production systems to climate variability based on the available technologies.

The interventions are categorized in four modules viz. natural resources, crop production, livestock and fisheries and institutional interventions. According to the need of the specific village based on the detailed exercise of finding climatic vulnerability (drought/floods/heat wave/frost/cyclone) and the available technology options specific interventions are suggested. The interventions are selected from each of the module and an integrated package from all the modules is formulated. This makes most of the farmers covered with one or more of the interventions in order to demonstrate a discernible effect.

Capacity building and knowledge management

Under this component, capacity building programs are planned for different stakeholders. For scientists on the latest tools and methodologies of climate change research; capacity building of senior faculty through short term exposure visits, participation in international symposia; training programs for extension functionaries of the states, policy makers, NGOs and farmers to generate awareness on climate change; Co-operatives and insurance companies on climate risk assessment and modeling.

Sponsored and competitive grants

Under this component, research proposals are invited from identified institutions/ scientists to fill up critical research gaps. Research proposals addressing critical gaps of national importance

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not covered in the main project and highly location specific regional climate variability issues which have a major bearing on the productivity of principal crops in that region are being funded under this component inviting proposals from identified institutions or through an open invitation on competitive basis from institutions/individuals.

Discuss the related institutional and governance structures

The on ground implementation of interventions under NICRA happens largely under the Technology demonstration component. Therefore, the institutional and governance structure of this component has been detailed out below. The list of stakeholders and their responsibilities have been outlined below:

- **Ministry of Finance (MoF):** The funding for NICRA implementation is provided by MoF to the Ministry of Agriculture. The initiative receives funding under the National Mission on Sustainable Agriculture of MoA.
- **Ministry of Agriculture (MoA):** The High level Monitoring Committee established under the Department of Agricultural Research and Education (DARE) which is housed in the MoA is responsible for the reviewing the progress of work being carried out under NICRA. The review meeting is conducted once every 6 months. The MoA team consisting of the Director General, Deputy Director General and Assistant Director General coordinates with the Director, CRIDA during the review process.
- **ICAR-CRIDA:** A separate NICRA Cell has been established in CRIDA that receives and manages funds disbursed from MoF. In addition to financial management, the institute also coordinates activities while seeking inputs from the institutions involved both for proper planning and implementation of the program.
- **7 ICAR core institutes** on Crops, livestock, Fisheries, Soil, Water and Pests & Diseases
- **Agricultural Technology Application Research Institutes (ATARI):** Responsible for evaluating the program as well directing funds to Krishi Vigyan Kendras.
- **Krishi Vigyan Kendra (KVK):** The KVK serve as an implementing entity that directly work with the farmers to identify location specific farm technology, conducting technology demonstrations, organising trainings for technology use and awareness creation.
- **State Agricultural Universities:** With the collaboration of KVK, the State Agriculture Universities has been doing problem analysis, monitoring, assessment of impact.
- **Village Climate Risk Monitoring Committee (VCRMC):** It is a local decision making body constituted by several people from that particular village. It works towards

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mobilising village communities by organising demonstration and awareness activities and also evaluates activities conducted under the program.

- **Village Panchayat:** Inform the village community about the programe and gather them for any extension activity with the collaboration of village level committee
- **Custom Hiring Centres (CHC):** Each village has an institution that rents the required farm equipment to the farmers at a nominal price for implementation of project actions.
- **Farmers:** Beneficiary groups that accrue benefits from the intervention.

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List of outputs/outcome and indicators:

S.No.	Output	Indicators	Outcome
1	Climate resilient technologies in terms of climate smart crop varieties, livestock breeds and management practices to bring climate resilience in agriculture	Indicator1: Assessment of Impact of climate change on crops, livestock and fisheries Indicator 2: Vulnerable crops/natural resources/ zones prioritized and mapped Indicator 3: Evaluation testing of promising material in irrigated, rainfed and horticulture crops. Potentially useful genes for thermo tolerance identified. Indicator 4: Identification of useful traits in indigenous breeds of cattle, buffalo, pig and poultry in relation to climate change and characterized Changes in incidence pattern of livestock diseases Indicator 5: Erosivity, water harvesting potential and ground water recharge under high intense rains quantified Indicator 6: Potential fishing zones in seas identified and breeding strategy for inland fishes in the context of climate change Indicator 7: shelters for reducing heat stress in livestock Indicator 8: Fish tank/pond management in water excess/scarcity Indicator 9: introduction of agricultural insurance Indicator 10:	overall expected outcome is enhanced resilience of agricultural production to climate variability in vulnerable regions These demonstrations aim at enhancing the adaptive capacity of the farmers and also to cope with climate variability in vulnerable districts which is essential to achieve the climate resilience in agriculture

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		Knowledge Portal on Climate Change and Agriculture	
2	Improved preparedness for minimizing the impact of climate variability on Indian agricultural through site specific technology demonstration	Indicator 1: Combining weather based agro-advisories with contingency plans and best bet practices field tested Indicator 2: Implementation of real time contingency practices Indicator 3: soil and water efficient structures/practices Indicator 4: Introduction of fodder banks for fodder production and supply, seed banks, nutrient banks (vermicomposting units etc) for production and supply of organic fertilizers Indicator 5: water harvesting and recycling for supplemental irrigation in renovating the old check dams, constructions of new farm ponds and village water ponds Indicator 6: introduction of water saving technologies such as sprinkler, micro and drip-irrigation systems Indicator 7: Implementation of conservation agriculture practices Indicator 8: Introduction in farm of new improved climate resilient varieties (such as low duration, salinity tolerant, heat stress, flood/drought) for major crop and associated yield increase Indicator 9: integrated crop/pest/disease management	

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		Indicator 10: No of Custom Hiring Centre (CHC) established	
3	Policy framework for promoting climate resilient agriculture, particularly among small and marginal farmers	Indicator 1: Up-scaling of interventions in non-NICRA districts Indicator 2: Funding for Strategic Research & Technology Demonstration in agriculture getting tapped from international agencies Indicator 3: Achievements of NICRA getting highlighted in NDCs, NATCOM, BUR	
4	Infrastructure at key research institutes for climatic change research	Indicator 1: network of automatic weather stations Indicator 2: Infrastructure to help accelerate the development of new and improved crops	
5	Adequately trained scientific man power to take up climate change research in the country	Indicator 1: Documentation of research and technical findings in the form of publications Indicator 2: need based training to research workers, scientists and other stakeholders	
6	Empower farmers to cope with climate variability	Indicator 1: No of farmers receiving soil health cards Indicator 2: Constitution of Village Level Institutions (VLIs) in a participatory mode such as Village Climate Risk Management Committee (VCRMC) Indicator 3: climate literacy to farmers and various training on crop, pest, weed, farm management and livestock and fishery management	

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Monitoring and Evaluation framework of for the program

In order to monitor and evaluate the impact of the interventions, household surveys are conducted in both NICRA and non-NICRA villages in order to establish baselines. Monitoring is done using a set of indicators that capture the social, economic, environmental and bio-physical impacts of the interventions. Each indicator is given a score ranging from 0 to100 and averaged to arrive the category index value and all categories averaged to arrive at 'resilience score/ index'. Further, a third party evaluation is conducted once every 4 years to track the progress towards the project objective.

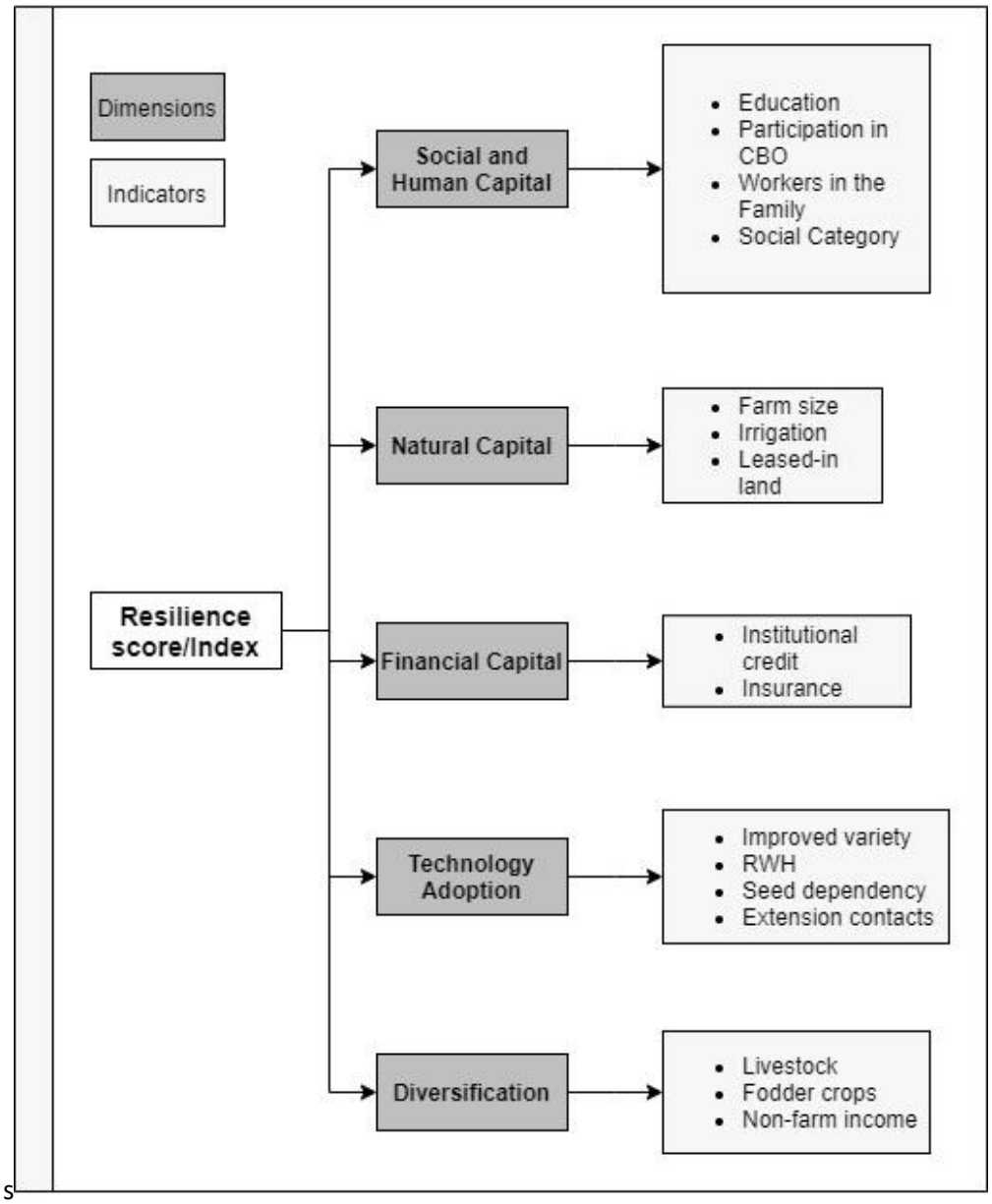

Figure 5 Monitoring and Evaluation framework of NICRA

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Conclusion

For the cases taken into consideration in the scope of this study, only RAH and NICRA has an indicator framework in place with the extensiveness of the framework varying for both of them depending on the measurable nature of impacts. It should be ensured that the indicators developed are not just measurable but also comprehensive enough to capture impacts over a longer period of time.

There is a need to have monitoring and evaluation frameworks for each intervention so that the progress of climate risk reduction can be gauged over a period of time. While attribution of targeted impacts to the project activities itself still remain a challenge, for monitoring and evaluation, project developers must establish a baseline (before implementation of project) against which the progress can be measured.

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