Annexure I: Methodology

Research objectives for the proposed study in Bihar

1. To assess the institutional capacity of the state of Bihar to deliver on CRA.
2. To identify and co-create interventions for government and non-government stakeholders to fill those capacity gaps.
3. To identify an institutional mechanism that can anchor Bihar's CRA adoption strategy, planning and implementation moving forward.

Research theory

1. Defining institutional capacity: For this research, we define institutional capacity as “the ability of the institution to deliver on the set goals through the adoption of efficient policies and implementing them with due diligence (FAO, 2013b)”.

2. Measurement of institutional capacity: Literature on institutional capacity posits multiple frameworks to assess capacity dimensions. The UNDP's framework using the 'institutional capacities and qualities' is utilised in its governance report (UNDP 2011). Such frameworks were synthesised and contextualised for Bihar to create a Capacity Assessment Framework (CAF). CEEW's CAF measures institutional capacity using eight indicators with 22 sub-indicators, each probed using a qualitative inductive method. These include perception and knowledge assessment, mandate and priorities, planning and implementation capacity, monitoring and evaluation, collaboration and coordination, information dissemination, financing, and human resource capacity.

Research method design

We explored various qualitative research types to design a research method. However, multiple research methods are needed to fit or satisfy the objectives mentioned above. Hence, the research methods we chose are a mixture of qualitative methods involving (Kilonzo and Ojebode 2022):

1. Action research: To use a problem-solution focus in the various tools being used for qualitative analysis (Ritchie and Spencer 2002).
2. Case study method: To create a bottom-up and detailed analysis of the relationships between the contextual factors and a visible occurrence of the phenomenology of CRA (Kilonzo and Ojebode 2022).

Considering the objectives of the research, which remain 'exploratory' (Santo et al. 2002) and not 'experimental' (Bozeman 1992)—meaning that the project aims to assess the capacities of operationalising CRA—we chose a qualitative research methodology. A qualitative methodology would give the research the necessary flexibility and adaptability to the information on CRA that exists with the government and non-government stakeholders. It also allows multiple tools of research to be used to arrive at the aimed objectives.

Qualitative tools used

We employed multiple qualitative research tools based on the research design and exploratory goals.

1. We conducted an initial baseline survey for the research using the survey method. We administered a qualitative survey as a self-assessment tool, with questions on institutional capacity.
2. In the second research stage, we conducted in-depth interviews and focus-group discussions using a semi-structured questionnaire with flexibility and space for phenomenological ideation from the key informants.
3. We prepared a questionnaire using the self-assessment results with the CAF created by CEEW.

To assess the institutional capacity to advance CRA in the state, we conducted an analysis of capacities at the state and local level. These capacities were defined using the CAF developed by CEEW's '*Re-calibrating Institutions for Climate Action*' report (Abraham et al 2024). Added to these is the capacity indicator for 'research and development' as part of the enabling individual capacities as given by FAO's CRA capacity development framework (ibid). This framework involves eight capacity indicators separated along the capacity to set mandates, technical and functional capacities, and enabling environment as given in below -

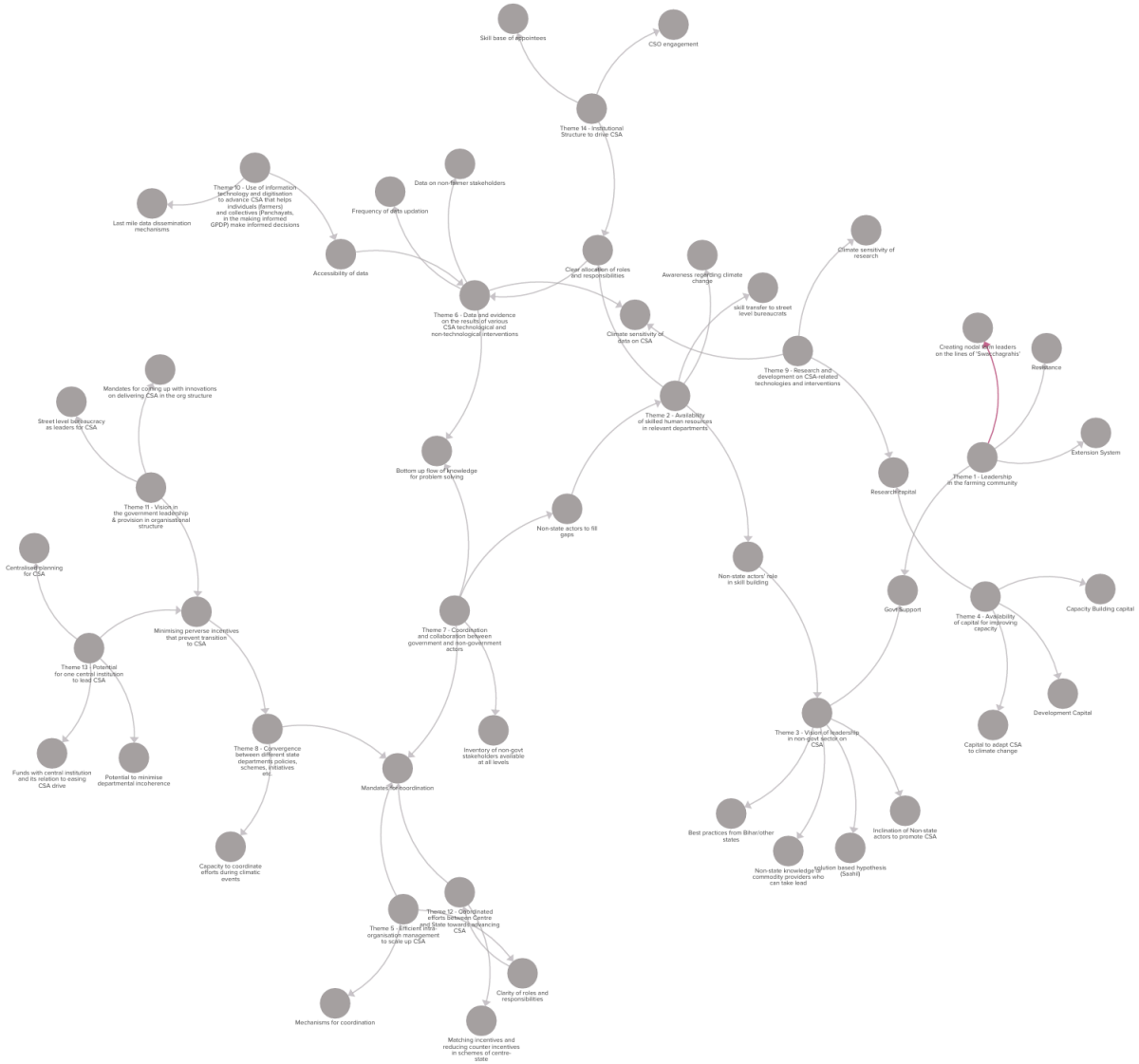
CAF indicator	Brief explanation of meaning
Vision mandate and priorities	The organisation's existing vision (long-term strategies), mandates (documented areas of work interest), and priorities.
Planning and implementation	The organisation's capacity to plan interventions like policy instruments, which includes angles on how participatory it is, risk mitigation, and innovative governance.
Collaboration and coordination	The organisation's capacity to develop coherent policies—achieve inter-departmental collaboration, intra-departmental coordination, and align with Centre's priorities.
Monitoring and evaluation	The organisation's capacity to set up multinational enterprise processes, collect SMART data, do course correction, and be transparent.
Information dissemination	Focuses on information flow to beneficiaries and then to the general public, and information flow between departments.
Financing	Finance availability, usability, and evaluation.
Human resource capacity	Quality and quantity of human resources across value chains.
Research and development	The institution's capacity to develop data and evidence on CRA practices, develop innovations in technology and machines, etc.

A caveat with respect to the definitions of capacity indicators is that even though capacity is assumed to be institutional alone, the nature of the assessment and research objectives necessitate the assessment of capacities available from outside the institutional structure as well. Enabling indicators like human resource Capacity, financing, etc. require external non-state actors to fill the capacity gaps where the state is unable to do so. Literature also reflects a need for co-designing climate-resilient institutional capacities in order to achieve scale up and advancement, especially at the local level (Andrieu et al. 2019). Hence, this assessment goes beyond the institutional structure to assess capacity gaps and challenges, and also formulates recommendations using the same.

Using this framework, we used qualitative research tools like qualitative questionnaire-based surveys, in-depth interviews, and focus-group discussions (Mack et al. 2005) (refer to Annexure III for survey questionnaires). We used both online and offline modes of data collection.

The questions were derived from the CAF, and contextualised to the states' bureaucratic setup in the Indian context. This resulted in the formation of a 'hub and spoke' model of areas of data collection from the information received on institutional capacity to advance CRA. The consultation framework is given below -

Figure A1: 14 major institutional capacity-based thematic areas ('hubs') and 38 interconnected 'spokes' of related capacities


Skill base of appointees
CSO engagement
Theme 14 - Institutional Structure to drive CSA
Theme 10 - Use of information technology and digitisation to advance CSA that helps individuals (farmers) and collectives (Panchayats, in the making informed GPDP) make informed decisions
Last mile data dissemination mechanisms
Data on non-farmer stakeholders
Frequency of data updation
Accessibility of data
Clear allocation of roles and responsibilities
Theme 6 - Data and evidence on the results of various CSA technological and non-technological interventions
Awareness regarding climate change
skill transfer to street level bureaucrats
Climate sensitivity of research
Climate sensitivity of data on CSA
Theme 9 - Research and development on CSA-related technologies and interventions
Creating nodes of in leaders on the lines of 'Swatchagrahis'
Resistance
Extension System
Theme 1 - Leadership in the farming community
Research capital
Theme 2 - Availability of skilled human resources in relevant departments
Mandates for coming up with innovations on delivering CSA in the org structure
Street level bureaucracy as leaders for CSA
Theme 11 - Vision in the government leadership & provision in organisational structure
Bottom up flow of knowledge for problem solving
Non-state actors to fill gaps
Centralised planning for CSA
Minimising perverse incentives that prevent transition to CSA
Theme 13 | Potential for one central institution to lead CSA
Funds with central institution and its relation to easing CSA drive
Potential to minimise departmental incoherence
Theme 7 - Coordination and collaboration between government and non-government actors
Non-state actors' role in skill building
Govt support
Theme 4 - Availability of capital for improving capacity
Capacity Building capital
Development Capital
Capital to adapt CSA to climate change
Theme 3 - Vision of leadership in non-govt sector on CSA
Theme 8 - Convergence between different state departments policies, schemes, initiatives etc
Inventory of non-govt stakeholders available at all levels
Mandates for coordination
Capacity to coordinate efforts during climatic events
Best practices from Bihar/other states
Non-state knowledge of commodity providers who can take lead
Solution based hypothesis (Saahil)
Inclination of Non state actors to promote CSA
Theme 5 - Efficient govt organisation management to scale up CSA
Theme 12 - Coordinated efforts between Centre and State towards advancing CSA
Mechanisms for coordination
Clarity of roles and responsibilities
Matching incentives and reducing counter incentives in schemes of centre-state

Based on the above consultation framework, we planned field visits to different ecological and topographic zones in each state to gain varied insights on the CRA practices and challenges particular to them. The selection criteria for these areas in each state are given in Annexure III.

Annexure II List of Consultations

Bihar Consultations -

Name	**Designation**	**Organisation**
Shri Sanjay Kumar	Research Scientist	BAU
Shri Pavan Shrivastav	Research Scientist	RPCAU
Shri Falguni Ganguli	Senior Program Manager	DigitalGreen
Shri Akash Asthana	State Head - Bihar	DigitalGreen
Shri Bipul Biplav	Assistant Director	ATMA Banka
Dr SK Gangwar	Head of KVK	KVK Madhubani
Dr Saurabh Chaudhary	Senior Research Fellow	KVK Madhubani
Dr Pankaj Kumar	Scientist, Agriculture Extension	KVK, Sabour
Er Jogendra Soren	Research Fellow	KVK Madhubani
Dr Dibyanshu Kumar	Head of KVK	KVK Darbhanga
Shri Abhanshu C. Jain	Director	BAMETI
Dr Sanjay Kumar	Nodal officer, CRA-cum-Associate Professor (Agronomy)	BAU, Sabour
Shri Vivek Anand	Assistant General Manager	NABARD
Dr RK Jha	Project Director, CRA	DRPCAU

Dr Rajesh Kumar	Deputy Director (Agro.), Information	DoA
Mr Anand Kumar	Scientist-C	IMD
Shri Atul Kumar Pandey	State Program Officers	RDD
Dr Pallavi Sinha	Nodal Officer	AFD
Smt. Ruby	Assistant Director	DoH
Smt. Rajni Sinha	Assistant Director (Agro.), Education	DoA
Shri Alok Kr. Singh	Dy. Director	DoSC
Dr Tuntun Singh	Lecturer, Fisheries Training & Extension Centre, Mithapur	AFD
Rajesh Chandra	State Mission Manager	JJHM
Smt Arti Sinha	Sr. Engineer, Irrigation Monitoring	WRD
Shri Wakil Singh	Dy. Gen. Manager	COMFED
Shri Ashish Kumar	Scientist-C	IMD
Smt Swati Sagar	Assistant Director (Agro.)	DoA
Dr RD Reddy	Scientist	BISA
Shri Rakesh Ranjan	Joint Director	SID
Smt Doma Sharma	Executive Engineer	WRD
Shri Narendra Mohan	NA	CRA Cell

Odisha Consultations -

Name	Designation	Organisation
Shri Arabinda Kumar Padhee	IAS, Principal Secretary, Agriculture and Farmers' Empowerment	DA&FE
Shri Prem Chandra Chaudhary	IAS, Director, Agriculture and Nodal Officer, OIIPCRA	DA&FE
Dr Sangram Keshari Pattnaik	Coordinator, Climate Resilience Cell (CRC)	DA&FE
Dr Tushar Ranjan Mohanty	Nodal Officer, CRC	OUAT
Dr Nagendra K Mallick	Nodal Officer, CRC	DA&FE
Shri SK Khatua	Additional Director, Horticulture	Directorate of Horticulture
Dr PJ Mishra	Dean Extension	OUAT
Dr Dilip Panda	Scientist and PI, NICRA	IIWM
Dr KK Bandopadhyaya	Chief Scientist	IIWM
Dr Srinivasan	Scientist	NRSC
Shri Sailendra Narayan Naik	Joint Director	Directorate of Soil Conservation
Dr Indramani Tripathy	Director	Department of SC/ST Development
Dr AK Nayak	Director	NRRI
Shri Deepak Kumar Das	BAO- Nodal Officer Agri	OIIPCRA
Dr Arun Padiyar	Fisheries and Aquaculture Specialist	World Fish India
Shrimati Kalpana Pradhan	Deputy Director	OMM

Dr Mridula Devi	Head	ICAR-CIWA
Dr Sujit Kumar Nath	Head	KVK Ganjam II
Dr Sandeep Mohanty	Plant Protection Scientist	KVK Ganjam II
Dr Sidhartha Sankar Das	Fisheries Scientist	KVK Ganjam II
Shri Pradeep Sahoo	DPM	Fisheries Department, OIIPCRA - Ganjam
Dr Satyamaya Satapathy	KVK head	KVK Bolangir
Shrimati Sunanda Sarangi	ADAO	ATMA Bolangir
Shri Dumbaru Meher	DAO Bolangir	ATMA Bolangir
Dr Nigamananda Behera	Agronomy Scientist	KVK Keonjhar
Dr Deepak Kumar Hembram	Extension scientist	KVK Keonjhar
Shri Mihir Kumar Sahoo	CDAO	ATMA Keonjhar
Dr Jyotiprakash Sahoo	KVK Bolangir Senior Research Fellow	KVK Bolangir
Dr Vijaylaxmi Mahanta	KVK Scientist in Agri Engg	KVK Bolangir
Shri Nirmalendu Jyotishi	Senior Program Officer	FES
Ms Azeb Fissha Mekonnen	Operations Officer	World Bank
Ms Anju Gaur	Senior Water Resource Management Specialist	World Bank

Annexure III Field Selection and Details:

Bihar has been agroclimatically categorised into three major Zones based on the agroclimatic parameters (BAMETI 2021). Zones 1 and 2 have similar agroclimatic patterns, being in the northern and flood-prone parts of the state, while Zone 3 lies in the southern alluvial plains, with drought-prone conditions dominating the districts in it (ibid).
The selection of Darbhanga and Madhubani from Zone 1 and Bhagalpur from Zone 3 meant that we covered significant agro-climatic variations of the state in our sample of observations. It also meant that we covered varied climatic challenges faced by the farmers in these zones.

Details of fields visited in Bihar -
Number of experts consulted -

- Bhagalpur - 2
- Madhubani - 3
- Darbhanga - 2
- Banka - 1 (Interview without field visit)

Focus Group Discussions (FGD) were held with multiple groups of farmers across the three districts chosen for field visits. The details of the field are as follows -
Number of Krishi Vigyan Kendras visited - 3
Number of farmers participating in FGDs -

- Bhagalpur - 26
- Madhubani - 17 (We also conducted an interview with the head of a Farmer Producer Organization in Sukhet)
- Darbhanga - 20

Details of the fields visited in Odisha -
In Odisha, at the field level, we performed the institutional assessment based on qualitative research methods of in-depth interviews and focus group discussions (ibid) with farmers in the selected districts. The details of the consultations are as follows -

1) Exploratory Consultation with the CRC team -
    a) Data collected on the institutional design of CRA and the history of Odisha's CRA initiatives

b) No of Officials - 3

2) Key Informant Interviews at the state level
   a) Assessment of state-level capacities and gaps in advancing CRA
   b) No of Government Stakeholders - 10
   c) No of Non-government stakeholders - 2
3) Field Visit 1 - Ganjam
   a) Local level capacity assessment for CRA
   b) Flood-prone mixed coast and upland district with inland aquaculture
   c) Six farmers in Ganjam
   d) Local officials interviewed - 2
4) Field Visit 2 - Bolangir
   a) Local-level capacity assessment
   b) Drought-prone upland region with mushroom and paira crop cultivation
   c) 25 farmers in Bolangir
   d) Local officials interviewed - 5
5) Field Visit 3 - Keonjhar
   a) Local-level capacity assessment
   b) Drought-prone upland region with millet production
   c) Local officials interviewed - 3

Annexure IV Questionnaires for surveys and in-depth interviews

1) Questionnaire for joint consultation on 12 May 2023 in Bihar -

Questionnaire to (1) understand the **roles and responsibilities of departments** towards advancing Climate Resilient Agriculture (CRA) in Bihar and (2) identify **capacity-building opportunities** for advancing Climate Resilient Agriculture (CRA) in Bihar

Date and Time: 12 May 2023, 12:30 p.m. to 15:30 p.m.
Venue: BAMETI campus, Patna, Bihar

Name	
Designation	
Department	
Phone	

Section 1: Identification of roles and responsibilities of departments towards advancing CRA

Q.1 What is the **level of awareness** in your department regarding CRA?

0	Critically insufficient	
1	Insufficient	
2	Sufficient	
3	Not applicable	

Q.2 What is the department's capacity to **translate the knowledge of CRA into effective CRA interventions**?

The capacity to translate the knowledge into effective CRA interventions includes:

- leveraging the existing research and evidence into developing targeted intervention
- ensuring the objectives of CRA (resilient livelihoods, sustainable natural resource management reducing greenhouse gas emissions) are considered in department's planning and implementation

0	Critically insufficient	
1	Insufficient	
2	Sufficient	
3	Not applicable	

Q.3 Does your department **set and/or align its roles and responsibilities** with state-level plans on CRA? If yes, what is the current capacity for the same? If no, then please select 3 - Not applicable. If you are not aware of the state-level plans on CRA, then please select 3 - Not applicable.

0	Critically insufficient	
1	Insufficient	
2	Sufficient	
3	Not applicable	

Q.4 Please identify the departments (in order of importance) working towards **effective planning of CRA** activities in the state.

The capacity for **effective planning** includes the capacity to

- develop plans for schemes, programmes and projects for advancing CRA
- budget for CRA interventions efficiently through available policies and funds
- develop research priorities for creating evidence-backed CRA interventions
- develop climate risk mitigation strategies

Please note that this is an indicative list.

Most important departments:	
Somewhat important departments:	
Please add any other comments here:	

Q.4 Please identify the departments (in order of importance) working towards **effective implementation of CRA** activities in the state.

The capacity for **effective implementation** includes the capacity to

- involve the government's ground staff and other non-government actors who implement

CRA activities and the beneficiaries (farmers etc.) in the planning stage
- develop innovative measures in governance to improve implementation
- provide sufficient support and handholding to the farmers during the transition period

Please note that this list is an indicative list.

Most important departments:	
Somewhat important departments:	
Please add any other comments here:	

Q.5 Please identify the relevant departments that must **collaborate** to improve CRA efforts of the state.

Collaboration is the depth, frequency and quality of engagements between various government departments in the state as well as between government and non-government actors in the ecosystem of CRA.

Most important departments:	
Somewhat important departments:	
Please add any other comments	

here:	

Q.6 Please identify the relevant departments that must **coordinate and converge** to improve CRA efforts of the state.

The capacity for **effective coordination** is the capacity to

- develop frameworks/provisions to encourage innovation and bottom-up CRA strategies
- develop policy coherence with other departments on CRA priorities of the state
- develop data synergy with state and non-state actors on CRA issues

Please note that this is an indicative list.

Most important departments:	
Somewhat important departments:	
Please add any other comments here:	

Q.7 Please identify the departments (in order of importance) working towards **effective monitoring and evaluation** of CRA activities in the state.

Effective monitoring and evaluation includes setting SMART (**S**pecific, **M**easurable, **A**chievable, **R**ealistic, and **T**imely) targets, tracking progress, analysing data, charting course corrections, etc.

Most important departments:	
Somewhat important departments:	
Please add any other comments	

here:	

Q.8 Please identify the departments (in order of importance) working towards **immediate and responsive CRA-related information dissemination** in the state.

The capacity for **immediate and responsive information dissemination** can include the capacity to

- develop efficient early warning models for hazard monitoring, forecasting and prediction, disaster risk assessment, etc.
- share the threat of a climate hazard, like floods, cyclones or any pest attacks that could affect the crop in a timely manner to reduce crop damage

Please note that this is an indicative list.

Most important departments:	
Somewhat important departments:	
Please add any other comments here:	

Q.9 Please identify the departments (in order of importance) working towards **CRA-related knowledge dissemination** in the state.

The capacity for **knowledge dissemination or transfer** can include:

- capacity training for the state officials, farmers, input dealers, etc.
- technology transfer and input support
- developing context-specific solutions
- keeping farmers at the centre of innovation

Please note that this is an indicative list.

Most important departments:	
Somewhat important departments:	
Please add any other comments here:	

Section 2: Importance and availability of enablers to advance CRA

Through literature review and consultations, we have identified the following **enablers** that are instrumental in advancing CRA.
Please identify (1) the relative importance of these enablers and (2) their sufficiency or insufficiency to ensure concerted, timely and informed action towards advancing CRA in Bihar.

Enablers for advancing CRA	An important enabler and…			Not an important enabler
	Critically insufficient	Insufficient	Sufficient	
Availability of **capital** for improving capacity for advancing CRA				
Research and development on CRA-related technologies and interventions (seed varieties, equipment, warning systems, traditional resilience-building agricultural methods, DSR, IWRM, etc.)				
Data and evidence (through impact assessments, on-farm experiments, etc.) on the results of various CRA technological and non-technological interventions				
Use of **information technology and digitisation** to advance CRA (data dashboards, mobile and web applications, farmer-facing portals, etc.) that helps individuals (farmers) and collectives (Panchayats, in making informed GPDP) make informed decisions				
Coordinated efforts between **Centre and State** towards advancing CRA (leveraging central initiatives, policies and				

programmes by the state, optimising central funding appropriately, etc.)				
Convergence between different **state departments** policies, schemes, initiatives etc.				
Coordination and collaboration between **government and non-government actors** (CSOs, private sector, IFIs[2], etc.)				
Availability of **skilled human resources** in relevant departments for advancing CRA (skills for knowledge dissemination, designing and executing training programmes, etc.)				
Vision in the **government leadership and provision in organisational structure** (special officials or department to focus on CRA, ability for the department to undertake cross-cutting work across departments, etc.) to deliver on CRA				
Vision of **leadership in the non-government sector** (CSOs, private sector, IFIs[2], etc.) to advance CRA				
Presence of **leadership in the farming community** to lead and champion CRA interventions (CRPs[3], champion farmers, SHG leaders, etc.)				

2) Survey Questionnaire for local government officials in Bihar and Odisha

Sr No	Question
1	Who do you interact with during the entire crop cycle - from input provision to farmers selling their produce? Including for research activities
2	What are the major challenges in helping out the farmers across the crop cycle?
3	When crises like floods/droughts/any other climatic events hit, what are your strategies to help farmers then?
4	How quickly do you adapt to incoming news about a climate risk or a farmer's distress call? What causes delays in responses here?
5	How does the farming community respond to training and capacity-building efforts? What factors motivate or hinder the development of leadership and adoption of CRA among the farming community?
6	Is there scope in your org to involve women/landless farmers/labourers/other groups in the CRA process or to help solve their problems specifically? If not, what can help you build that capacity?
7	Do KVKs and ATMA institutions interact with each other on field or are there overlaps that you have noticed? If so, what do you think can be done to resolve or use them better?
8	Is the research in the KVKs reactive to the demands or concerns of the farmers? How can it be scaled up to reach more farmers and areas?
9	Will the presence of an FPO or SHG help solve farmers' problems quicker, or is it better to let them be handled individually?
10	What are the data variables collected to measure the success of CRA interventions? Do climatic extremes like floods or droughts change the type of data collected?
11	How is technology used to collect data or provide information to farmers on CRA? Which department is involved in data collection and data dissemination on the field?

12	Can the creation of a dashboard for govt participants help in decision making and providing info on CRA across the state?
13	Will the presence of an informal/formal farmers' collective help solve farmers' problems quicker or better to let them be handled individually?
14	How are non-government bodies involved in scaling up CRA practices? If not, what can be done to increase their role and coordination with the government on CRA?

3) Questionnaire for farmer FGDs in Bihar and Odisha

Sr No	**Question**
1	Describe stakeholders who interact with you from beginning to end of a crop cycle - from purchasing input to training to selling at the market or claiming insurance
2a,2b,2c	Where in this cycle do you think farmers need support? Where do they get that support, and who provides it? Where do they lack support, and who do you think can provide it?
3	How quickly after you raise a concern is your problem solved? What channels do you use to solve your problems?
4	What are your interactions with KVKs and ATMAs, if any?
5	Is there space to involve women, landless farmers, or labourers in DSR or other such CRA practices? If so, does any institution look out for it? Govt or non-govt?
6	When a crisis like drought, flood, or any other climatic event hits, what support do you get to solve the problems? From whom? What are the challenges, then? If not, then who do you think should interact with you?
7	Why and how are farmers collectivising themselves? What are the goals of such collectivisation?

8	How does the farming leadership group (FPO/SHG/WUAs/any informal group) interact with different stakeholders to solve the challenges of farmers?
9	How does the farming community come up with a plan to avail govt program support for CRA?
10	What are the problems faced in particular CRA practices? (Nudge - climate change-related disasters and perceived risk)
11	How have CRA practices helped in adapting to climate challenges, and which specific practices have been better for your field?
12	How do you think these challenges can be solved?
13	How and which government bodies are involved in scaling up CRA?
14	How and which are non-government bodies involved in scaling up CRA practices?

Annexure V: Field visits

1. Area visited: Longain village in Sabour, Bhagalpur, Bihar

Number of farmers: 26 (14 OBC, 8 SC, 1 ST; all male)

Type of CRA practice: Flood and drought-resilient rice varieties (Sabour Sampann and Sabour Harshit)

Key insights from farmer interaction:

- Agricultural inputs and market access: Local suppliers are the primary source of seeds, weedicide, and fertilisers, but challenges such as delayed payments and higher prices persist. Market access remains a challenge, with limited accessibility to Progressive Agriculture Cooperative Society (PACS) and difficulties in bargaining. There are ongoing challenges with drought, emphasising the need for pumps and improved electricity supply. However, requests for solutions have not received adequate attention. Local suppliers often charge inflated prices for fertilisers, and government regulation is lacking.
- Government support and payments: Farmer distress is exacerbated by delayed payments under various government schemes like *PMFBY* and

PM-KISAN. There is a perceived lack of support and timely information from block agricultural officers and other officials.

- Climate change adaptation and practices: Climate change effects, including changes in water levels and altered rainfall patterns, pose challenges. The adoption of CRA practices such as direct-seeded rice has resulted in reduced water usage and increased yields.
- Need for improved access and training: Timely information and training are lacking, leading to challenges in decision-making regarding appropriate agricultural practices. Issues with information gaps and the absence of leadership training among farmers are also highlighted.
- Role of agricultural institutions and groups: Key institutions such as KVK, District Agricultural Office, PACS, ATMA, and FPO play a critical role in providing information, support, and access to resources.

Photo credit: Sijo Abraham

2. **Area visited:** Sukhet and Jhanjharpur, Madhubani

Number of farmers: Seven females and ten males

Type of crop production: Subsistence farming of rice, vegetables, and pulses

Type of CRA practice: Adoption of DSR method and zero-tillage fields.

Key insights from farmer interaction :

- The community primarily comprises subsistence farmers facing challenges related to savings, particularly due to disappointing yields from DSR. Challenges such as seed-quality issues, machine problems during DSR, and the presence of unwanted seeds necessitate physical removal to prevent crop damage.
- Private input providers are relied upon for fertilisers, and the KVK serves as the source for pesticides and vermicompost, albeit the latter is restricted to potato farmers. The difficulty in obtaining high-quality seeds, vermicompost, and fertilisers for both fruits and vegetables and DSR was highlighted, given the limited assistance from the KVK. Challenges related to the control of livestock diseases, accessibility to training, and availability of irrigation pumps were also noted. The absence of financial institutions in the area further hampers their access to crucial support.
- Complaints were raised about poor-quality fertiliser jamming machinery, jeopardising financial stability. Operational problems, such as mismanagement and the non-operational status of the PACS impact market access, and result in payment delays.
- Positive outcomes are noted with the implementation of the DSR method, showcasing reduced input usage, enhanced irrigation efficiency, and improved yields, particularly with advanced seeding technology. The community engages in fruit and vegetable cultivation on elevated terrain, selling locally. However, cultivation in lower-lying areas yields lower profits. Collective groups have not formed, but weather forecasts inform farming decisions. The construction of recharge structures has begun, but maintenance proves difficult, and the community copes with flooding independently.
- Despite awareness of waterlogging issues, inadequate infrastructure persists, basic machinery is still in use, and limited access to information and resources prevails. Concerns regarding the potential formation of an FPO highlight issues related to equitable representation and benefit distribution, underscoring the need for transparent and inclusive organisational structures. The absence of NGOs in the agricultural landscape limits resource accessibility, emphasising the necessity for diverse external interventions and collaborations to promote sustainable agricultural practices and holistic development within the farming community.
- We identified gender-specific barriers. For example, women’s livestock-related obligations preventing them from accessing the Bureau of Agriculture Office. Institutional support primarily comes from the KVK, raising concerns about equitable access to resources and information due to political influence in membership structures. The farming community exhibits adaptive behaviour, relying on weather forecasts and collective knowledge during crises. However, persistent challenges like waterlogging impact the optimal functioning of solar trees, emphasising the need for enhanced resilience strategies.

Photo credit: Sijo Abraham

3. **Area visited** : Jalay and Sanahpur village; Shinwara block, Jalay block; Ratanpur village (Darbhanga)

Number of farmers: 18 male, two female farmers

Type of crop production: Main crops include rice, wheat, pulses, and vegetables. Limited access to resources and delayed support are impacting productivity.

Type of CRA practice: DSR, and ZT for wheat cultivation.

Key insights from farmer interaction:

- Private players and PACS coordination: Private players serve as the primary suppliers for agricultural inputs, encompassing seeds, fertilisers, and pesticides. Challenges, such as delayed payments and higher prices, prevail in this sector. The PACS encounters coordination issues, with elected officials favouring their own associates. Despite complaints to the District Agricultural Office, issues persist, indicating a lack of effective solutions.
- KVK and ATMA support: The KVK emerges as a crucial support entity, providing immediate advice and information to farmers. It plays a pivotal role in providing seeds for various crops, along with timely pesticides. However, KVK support is limited to those who purchase seeds directly from it, and

delays in KVK support lead to private purchases by farmers. Additionally, limited interaction with the ATMA is noted, with only one visit reported in the past year. An ATMA-related group of farmers with a focus on seed experiments showed minimal activity, and small and marginal farmers express a sense of exclusion from various agricultural groups.

- Crop cultivation and challenges: Various crops, including DSR, moong dal, potato, and maize, are cultivated here. Challenges include crop damage by wild animals, absence of insurance, and livestock diseases addressed by private doctors. Conflicts over machine use and a lack of awareness about disaster management procedures are prevalent issues.
- Agricultural practices and challenges: Farmers' concerns regarding agricultural practices include initial productivity challenges with ZT wheat, and inadequate pesticide training. Knowledge provision at the Custom Hiring Centre (CHC) is suggested, rather than just focusing on agricultural implement provision which is the CHC's only function. Farmers also highlight challenges in milk selling and productivity issues, attributed to water scarcity and infrastructure shortcoming.
- Community irrigation and challenges: While community irrigation systems are in place, there are challenges such as insufficient infrastructure and restrictions on water access by private-made ponds. The recharge systems under command area development are used primarily with electric pumps.
- *Jeevika* and financial aspects: *Jeevika*, an initiative covering female farmers in almost all villages, demonstrates success in providing loans at a nominal fee. However, farmers raise concerns about high-interest rates and a lack of transparency regarding *Jeevika* profits. The initiative's potential for training in intra-banking software to expand agri-business operations is acknowledged.
- Agricultural productivity and practices: We observed a reduction in input costs and increased production, with rice cultivation yielding mixed results. The challenges discussed related to irrigation infrastructure, including the necessity for three to four cycles and the absence of soil moisture measurement.

Photo credit: Sijo Abraham

4. Area visited: Odiapalli, Bolangir, Odisha

Number of farmers: 13 females and 12 males

Type of crop production: Jhai moog (green gram)

Type of CRA practice: Shift to short-duration rice varieties, diversification with moong cultivation, initiatives towards organic farming, including vermicomposting and implementation of Integrated Farming Systems (IFS) model for fisheries by KVK.

Key insights from farmer interaction:

- Farmers have been adjusting to changing climate patterns by adopting shorter-duration rice varieties—a shift necessitated by less predictable rainfall. Despite these challenges, the introduction of hybrid rice varieties has seen an uptick in revenue, a silver lining amidst the adversity. Additionally, the cultivation of green gram among these farmers highlights a broader trend of crop diversification as a strategy to mitigate risk and adapt to changing environmental conditions.
- The discussion revealed that while there are avenues for support, such as subsidies for drilling equipment, and the provision of green gram seeds by the FPO, challenges persist. For access to fertilisers and insecticides, farmers are heavily reliant on local dealers. Training opportunities, provided by

departments such as horticulture, are invaluable yet sporadic. Financial support, particularly loans from the PACS, is marred by delays and piecemeal disbursement, complicating farmers' operational planning.

- Price discovery remains a significant hurdle for these farmers, with notable discrepancies between the prices offered by PACS, local markets, and buyers from regions like Chhattisgarh. This inconsistency underscores the broader issue of market access and the need for more robust mechanisms for price stabilisation. Furthermore, the limited knowledge and availability of machinery operation and maintenance represent additional layers of complexity in their agricultural practices.
- The session underscored the importance of insurance, specifically through the *PMFBY*, offering a degree of financial security against crop failure. However, the impact of these measures is somewhat diluted by a lack of comprehensive training in both equipment operation and livestock maintenance, pointing to gaps in the existing support framework for farmers.
- Farmers expressed a clear need for improved irrigation solutions, including the adoption of solar-powered pumps, to address water scarcity issues. The discussion also highlighted the potential for infrastructural support tailored to women farmers, such as community centres for mushroom cultivation, which could foster greater inclusivity and knowledge sharing within the agricultural community.

Photo credit: Sijo Abraham

5. **Area visited:** Chikarada, Ganjam, Odisha

Number of farmers: Four males, two females

Type of crop production: Rice, vegetables

Type of CRA practice: Solar-powered irrigation systems

Key insights from farmer interaction:

- Climate change impacts: Farmers are facing significant water scarcity, leading to a decline in rice yield and an uptick in pest infestations. Wild boar encroachments have become a notable issue, prompting the use of electric fences for protection.
- Adaptive measures: To combat these challenges, there has been a shift to different rice varieties, increased vigilance against wild boar attacks, and higher pesticide usage to manage pests more effectively.
- Support and assistance: Support spans from input assistance for seeds of new rice varieties and pest management to the provision of a singular electric fence for wild boar protection in one cluster. There's a recognised need for better irrigation facilities, with only one solar pump currently available under the project. Market access varies, with vegetables sold locally and paddy marketed at the mandi or to Agricultural Procurement (AP), though challenges include storage at mandis and potential price reductions through intermediaries.
- Financial services and schemes: Access to credit is restricted, particularly for leased land, due to documentation issues. Government schemes like *Krushak Assistance for Livelihood and Income Augmentation (KALIA)* and *PM-KISAN* have been beneficial. Awareness and application for the *PMFBY* are high among farmers.
- Livestock and infrastructure needs: There's a call for better support and infrastructure for livestock rearing and market access. Challenges include a lack of subsidies for disease remedies and lengthy processes for insurance reimbursement for deceased livestock.
- Awareness and cooperative efforts: A lack of awareness regarding infrastructural support available through MGNREGS has been noted. The operational FPO, Agrotech, supports 300 members with seeds, medicine, and market access, but faces challenges due to water scarcity.
- Cultivation and sustainability: Waterlogging during the Kharif season and wild boar disruptions during the Rabi season present significant cultivation barriers. The necessity for subsidies, particularly for DSR on leased land, and the importance of training for machinery operation and maintenance are highlighted. Sustainable practices like vermicomposting and the use of biopesticides are discussed, albeit with a need for further support and training.
- Future direction: Addressing the entry barriers to subsidy access, exploring microfinance options, and considering value-added processes are seen as potential pathways forward to enhance sustainability and profitability in agriculture.


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Photo credit: Sijo Abraham

Annexure VI: CRA policy ecosystem in Bihar

Table A1: Alignment of departmental schemes with objectives: A comprehensive overview for structured CRA delivery in Bihar

Scheme	Nodal department	Key objectives	Alignment with CRA outcomes	Link to guidelines

Jal Jeevan Hariyali Mission	Rural development	Climate sustenance; conservation and rejuvenation of water bodies and to keep water pollution free; maintaining the level of groundwater; ensuring adequate water availability; climate resilient agriculture; energy conservation; and promoting climate awareness among the masses.	Climate-resilient agriculture and allied sectors; sustainable natural resources; improved lives and livelihoods	https://www.jaljeevanhariyali.bih.nic.in/JalJeevanHaryali/Public/JJH_%20ComponentsDept.pdf
Bihar Agricultural Produce Value-Added Division (BAVAS)	Agriculture	Developing agri market system; dissemination of marketing info to stakeholders; removing bottlenecks to marketing; benchmarking price premiums on agri-produce.	Improved lives and livelihoods	https://horticulture.bihar.gov.in/HORTMIS/baipp/Downloads/BAIPP_PolicyDocuments_2020.pdf
Bihar Shatabdi Niji Nalkup Yojana	Water resources	A grant-based private tube well scheme has been implemented for agricultural development and an increase in agricultural production in the state.	Sustainable natural resources; improved lives and livelihoods	https://minorirrigation.bihar.gov.in/bsnny/Download/bihar%20shtabdi.pdf
Seed Village Scheme	Agriculture	Promote adoption of new and better yielding varieties of seeds across crop groups by farmers.	CRA and allied sectors; sufficient and nutritious food for all; improved lives and livelihoods	https://seednet.gov.in/PDFFILES/Guidelines%20for%20seed%20village%20sceme.pdf
Bihar Rajya Fasal Sahayta Yojana	Agriculture	Crop insurance against climatic extremes	Improved lives and livelihoods	https://oneyojana.com/bihar-rajya-fasal-sahayata-yojana/#:~:text=Under%20the%20Bihar%20rajya%20fasal,be%20%E2%82%B910000%20per%20hectare
Organic farming	Agriculture	The Government of Bihar has taken up several programmes to encourage organic farming, with the objectives of promoting sustainable production,	CRA and allied sectors; sufficient and nutritious food for all; sustainable natural resources	https://state.bihar.gov.in/krishi/cache/29/20-Feb-24/SHOW_DOCS/Organic

promotion plan		improving soil organic carbon for sustenance of soil quality, and promoting export of quality organic produce.		%20farming%20promotion%20plan%20.pdf
Diyara development scheme	Agriculture	Promotion of farming in 'diyara' geographies, which are lands with large sandy depositions from floods.	CRA and allied sectors; sustainable natural resources; improved lives and livelihoods	https://state.bihar.gov.in/krishi/cache/29/20-Feb-24/SHOW_DOCS/diyaara%20development%20scheme.pdf
Paddy community nursery development	Agriculture	Promotion of community paddy nurseries of short-, medium- and long-duration rice varieties (hybrids), to have contingency for delayed rains and proper harvest timing.	CRA and allied sectors; improved lives and livelihoods	https://state.bihar.gov.in/krishi/cache/29/22-Feb-24/SHOW_DOCS/Paddy%20community%20nursery%20development.pdf
Taal Vikas Yojana	Water resources	Management of taal (flood backwater) areas through construction and rejuvenation of ahar-pyne; flood control sluices; check dams and piers.	CRA and allied sectors; sustainable natural resources	https://state.bihar.gov.in/krishi/cache/29/22-Feb-24/SHOW_DOCS/Toll%20development%20scheme%20.pdf
Dhatu Kothila Vitran Yojana **(Metal Shed provision scheme)**	Agriculture	Provision of food storage containers to avoid spoiling of grains and food security.	Sufficient and nutritious food for all	https://dbtagriculture.bihar.gov.in/krishimis/master/UploadFiles/2016_01_13_11_59_23_AM_6525.pdf
Flood Management Improveme	Water resources	Component C, i.e. the Bihar Kosi Flood Recovery Project (BKFRP), is relevant to CRA with its aim to strengthen the overall flood forecasting and flood and sediment management capacity in Bihar by	Improved lives and livelihoods	https://www.fmiscwrdbihar.gov.in/Load_FMIS_Site/aboutus.html

nt Support (FMIS)		enhancing knowledge, understanding, and capacity of flood and sediment management.		
Bihar Mukhyamantri Harit Krishi Sanyantra Yojana	Cooperation	The GoB is establishing 'Krishi Sanyatrata Banks' in various PACS with an expenditure of INR 2 million (20 lakh). These will help in farming machinery hiring by farmers through PACS.	Improved lives and livelihoods	https://epacs.bih.nic.in/MIS/MHKSY/Report/EquipmentGeoTagReport.aspx
Fodder Resources Development Plan for Bihar	Animal husbandry	The plan has been undertaken to enhance fodder production, conservation, and utilisation on a more sustainable basis in different fodder deficit districts of the state.	CRA and allied sectors; sustainable natural resources; improved lives and livelihoods	https://igfri.icar.gov.in/wp-content/uploads/2022/08/Bihar_Plan.pdf

Source: Authors' compilation

Annexure VII: Package of practices for the CRA programme

ZT farming: Through zero-tillage technology, crops like wheat, lentil, chickpeas and mustard are sown without any tillage practice after the rice harvest, to increase yields and profits while lowering cultivation costs. Using machinery to drill the seed in uncultivated land is critical to the success of ZT. During the Kharif season, ZT works best for DSR, maize, soybean, cotton, pigeon pea, mungbean, cluster bean, pearl millet, and wheat; during the Rabi season, it works best for barley, chickpea, mustard, and lentil.

DSR: Direct seeding is a method under which pre-germinated seeds are directly drilled into the field by a tractor-drawn machine or a manually operated drum-seeder. There is no nursery preparation or transplantation involved in this method. Labour, fuel, time, and water-saving technology give a similar yield to transplanted rice. The DSR technique improves soil health and fertiliser, and water use efficiency saves irrigation water.

Raised-bed cultivation: In bed planting systems, wheat, maize, mustard, soybean, pigeon pea and other crops are planted on raised beds in the ridge-furrow system. In the CRA programme, crops' raised bed planting system is particularly advantageous in areas where groundwater levels are falling and herbicide-resistant weeds are becoming a problem. Irrigation done with the furrow irrigation system helps in saving water. Half furrows reduce the timing of irrigation, and act as drainage channels in case of heavy rains. Hence, they save crops from excess moisture if they stay for a longer period. The presence of previous crops' residue in the furrowed soil becomes soft, light, and friable; consequently, the population of earthworms increases very fast, and crops become healthier.

Laser land levelling (LLL): Laser levelling is a process of smoothing the land surface (± 2 cm) from its average elevation, using laser-equipped drag buckets. This practice uses large horsepower tractors and soil movers equipped with laser-guided instrumentation, so that the soil can be moved by cutting or filling to create the desired slope/level. This technique is well known for achieving higher levels of accuracy in land levelling, and offers great potential for water savings and higher grain yields. Laser land levelling increases water application efficiency by about half compared to levelling by a scraper, improving weed control, and nutrient use efficiency.

Alternate wetting and drying (AWD): This irrigation system is an innovative one in which a PVC pipe is established on a farmer's rice field, which allows the lowland rice growers to save water by intermittent irrigation—alternately flooding and drying the field at certain days' interval, which may vary from one to ten or more days, depending on the soil type. The AWD irrigation system requires less water than continuous flood irrigation, thereby improving water use efficiency; it reduces anthropogenic greenhouse gas emissions without any adverse effects on grain yield. This system has been shown to improve grain quality by reducing total arsenic, and has been effective in decreasing insect pests and disease infestation.

Bunding: To stop/minimise water loss through seepage, bunds are prepared with well-compacted and properly sealed walls, with no cracks, holes, etc. The collection of water for irrigation in the corner of the field through a small pond has been prepared, which has been taken up under the CRA programme. This technique saves money by reducing the number of irrigation cycles required, irrigation water, and fuel burning required for irrigation.

Crop diversification: This can be practiced in two ways—temporal/horizontal/crop rotational diversification, and spatial/vertical diversification. The intercropping of potato and maize is introduced through this project, and farmers benefit from both crops with the same inputs like field preparation expenditures, irrigation water, and fertiliser application. The growth in crop productivity of component crops is either stagnating (wheat) or declining (rice), despite the use of higher-yielding cultivars. Thus, substituting rice, which requires more water, with maize or cash crops like sugarcane and cotton will reduce water requirements and enhance the system's productivity.

Mulching and residue management: The CRA programme is taking up the growth of crop varieties tolerant to biotic and abiotic stresses, mulching with crop residue for soil moisture conservation, etc., to achieve the best cropping system and productivity.

Nutrient support tools: Different nutrient management tools are used to prevent the excess application of fertiliser by farmers under the CRA programme. These tools are Leaf Colour Chart, Nutrient Expert, Green Seeker and Integrated Nutrient Management. They help reduce and streamline input provision to the crop.

Soil fertility maps: This is a data-driven farming tool created by collecting, analysing and correlating information about the soil nutrient status, soil nutrient supplying capacity, fertiliser rate and potential yield in the respective location. It leads to the judicious use of fertilisers on soil test-based recommendations. Farmers may start using the site-specific nutrient recommendations in CRA villages. The soil fertility map display may be helpful in diverting the fertiliser demand based on its regional referencing, and help in choosing suitable cropping patterns and agronomic procedures.

Annexure VIII: Evidence from other states

Table A2: Comparative overview of institutional structures for CRA in various states: Organisational and external engagement summary

(Legend for the embeddedness of the programme: Parallel – newly formed external body; Moderately embedded – new officials and experts brought into existing structures; Highly embedded – new responsibilities within the old structure.

Legend for engagement level with non-state actors: Low – no direct engagement; Medium – non-state actors as external partners; High – non-state actors as part of organisational structure)

State	Institution/scheme	Nodal department	Chair	Participating depts	Embeddedness of programme	Engagement level with non-state actors
Maharashtra	Maharashtra Project on Climate Resilient Agriculture (PoCRA)	Agriculture	Chief secy	Water conservation; planning; finance; animal husbandry; marketing	Moderately embedded	High
Andhra Pradesh	Rythu Sadhikara Samstha (RySS)	Agriculture	_	Private organisation	Parallel	Medium

Himachal Pradesh	Prakritik Kheti Khushhal Kisan Yojana (PK3Y)	Agriculture	CM (apex), Chief secy (task force)	Horticulture; animal husbandry	Moderately embedded	Low (via consultants under project directorate)
Gujarat	Gujarat Green Revolution Company (GGRC)	Agriculture (special purpose vehicle)	MD of Gujarat State Fertilisers & Chemicals, who is also additional chief secy	Private organisation, set up by agriculture and horticulture departments	Parallel	High
Manipur	Manipur Organic Mission Agency (MOMA)	Horticulture and soil conservation	Chief secy	Agriculture; panchayati raj and rural development; fisheries; animal husbandry; MSME	Highly embedded	Low
Mizoram	Society for Climate Resilient Agriculture in Mizoram (SoCRAM)	Agriculture	Chief secy	Agriculture; animal husbandry; horticulture; soil and water conservation; land and revenue; planning; finance; forest; rural development	Highly embedded	Low
Odisha	Odisha Integrated Irrigation Project on Climate Resilient Agriculture (OIIPCRA)	Water resources	Chief secy	OCTDMS steering committee involves water, agriculture, fisheries and animal resource development, finance, and panchayati raj departments	Moderately embedded	Medium (as part of capacity building and implementation)
Kerala	Haritha Keralam Mission	Cross-departmental: agriculture; water; local self govt	CM and local self govt minister	Agriculture, planning, health, water resources, local self govt, education, and tourism at state level; SC/ST development, fisheries, and rural development at district level	Highly embedded	Medium (A scientist to be part of state level Committee)
Odisha	Odisha Millet Mission	Agriculture	Development commissioner cum additional chief secy	Education; finance; food supplies; women and child development; forest and environment; SC/ST development;	Moderately embedded	High

				cooperation; housing; and urban development		

Source: Authors' compilation

Annexure IX: Recommendations to advance CRA: Bihar

Table A3: Gaps and recommendations identified for state and non-state actors in CAF indicator areas

CAF indicator	Gap observed	Recommendations	
		Solution via state actors	Solution via non-state actors

CAF indicator	Gap observed	Recommendations	
Vision mandate and priorities	Government departmental programmes operate independently and need more coordination in mandates and technology development. There are also challenges in management of PACS and mills, which lead to financial challenges impacting farmers with delayed payments and lower selling rates.	The institutionalised steering committee should develop a holistic vision for CRA adoption in the state, and set SMART targets and goals. This high-level vision can then be used as a guiding document to foster coordinated action. Inefficiencies in the PACS procurement and payment system go beyond the scope of the CRA programme, but deeply impact its scale-up. Farmers adopting CRA practices should be able to search and discover prices for their produce at alternative locations and institutions. There is a need for studies from the state and external organisations to understand the challenges within the PACS system, and recommend solutions for the state. The involvement of BAVAS in coordinating with CRA-implementing organisations is a key enabler to be explored here.	Private sustainable agriculture start-ups dealing with procuring and selling climate-resilient produce can be roped in to provide better price discovery alternatives to farmers. A provision for collaboration with FPO procurement alternatives requires leadership from the government institutional structure set up for CRA. Formation of an FPO network for procurement of CRA-based produce can be pursued by partnering with farmer collectives for the same.

CAF indicator	Gap observed	Recommendations	
Vision mandate and priorities – gap in supporting women's role in making CRA practices viable with allied activities	The CRA programme lacks formalising women's role in advancing its adoption, unlike *Jeevika*. Women engage in allied activities for the household, like animal husbandry, which acts as buffer income, but they lack support from the CRA programme. This buffer income can increase farmers' risk appetite and can help them transition to CRA. The KVK only provides knowledge transfer to women farmers with material transfer through district or block agriculture offices.	The state needs to focus on farming households rather than farmers. A larger definition of 'CRA-adopting family' rather than 'CRA-adopting farmer' is necessary to target family income generation, and allow retention of CRA practices via risk hedging in the family. Merging *Jeevika* and CRA activities in the same household can enable agricultural incomes from CRA to be buffered with income from livestock-related activities from the *Jeevika* programme. Women's role as income supporters needs to enter the CRA programme guidelines and mandates in a formalised manner.	Self-help groups supported by non-government stakeholders can be tasked with absorbing women belonging to CRA-adopting families and support income enhancing interventions.

CAF indicator	Gap observed	Recommendations	
Collaboration and coordination – presence of leadership in the farming community to champion CRA interventions	The lack of knowledge and leadership in the farming community is linked to limited adoption of CRA.	Creation of 'model farm champions' on the lines of Swachhagrahis involved as agents of change. These farmers may be responsible for co-conducting capacity building and training sessions for fellow farmers. Champion farmers can be selected through a 'value chain' approach by selecting one in each block as a champion of thematic areas: Production Input awareness Market access Business development Farmers successful in the above CRA practices will be part of the structure and would be incentivised to take up training of adjacent farmers; their KPIs could be related to improved CRA outcomes for other farmers.	Non-state actors like CSOs, NGOs, and private bodies can provide capacity for identifying and training farm champions. The finance for such interventions can come from the philanthropy sector. This can happen via MoUs signed at the local or state level with the universities in-charge of implementation of CRA programme.
Collaboration and coordination – vision of leadership in the non-government sector	There is a lack of non-government organisations in the CRA ecosystem. Farmers adopting CRA across the districts did not report a footprint of non-government stakeholders in the local area. The state consultations spoke of the potential	Formalisation of representatives from non-state actors into the institutional structure of CRA can be a way forward, as suggested by multiple non-government stakeholders.	An informal NGO consortium does exist at the state level, but it needs to be formalised to support CRA activities. An attachment with the three university institutions to zonally and thematically divide the NGO consortiums may be a way forward. Each zone could have four thematic NGO groupings with overlapping membership

CAF indicator	Gap observed	Recommendations	
	for collaboration, but not of non-government-led initiatives.		across the four main themes requiring their support: Extension technical training along with MRO training for machinery Climatic and emission data measurement Data dissemination and decision support at local level Business development and market access
Collaboration and coordination – efficient intra-organisation management to scale up CRA	State bodies pursue agricultural solutions separately, causing disjointed efforts. Programmes like *JJHM* and CRA, run by KVKs, overlap, but target different sectors. The conflicting and overburdening roles of ad hoc officials like ATM and BTM hinder CRA promotion.	Creation of an overarching institutional structure driven by bottom up feedback and collaboration on-ground is the way forward. The institutional structure must bring together various departments working on schemes and programmes that impact the CRA value chain, and must be led by the university structure implementing the CRA programme on the ground to allow better scaling potential, due to their continuous engagement with the adopting farmers (refer to the institutional structure section for details on this recommendation).	N.A.

CAF indicator	Gap observed	Recommendations	
Collaboration and coordination – convergence between different state departments' policies, schemes, initiatives etc.	Convergence between policies doesn't translate to on-ground implementation. The absence of convergence with other economic safety net policies like *PM-KISAN* and *PMFBY* remain a significant hindrance due to delayed payments and lack of coverage.	Policy convergence training is required for the three major institutions looking at the implementation of the CRA programme to increase awareness on seeking collaborative implementation on the ground, a gap we identified during field visits. Documentation and mapping of potential convergences must be a part of the mandates under the program guidelines for the new institutional structure under CRA programme.	Convergence with non-government initiatives can also be explored. The government's agro-DSS platform can be supplemented by non-state databases as well. For example, Microsave Consulting has been working on developing a One-Stop Centre, a platform dedicated to bringing all the government schemes and policies relevant for farmers, to increase awareness and ease of application.
Collaboration and coordination – coordinated efforts between Centre and state towards advancing CRA	A few central programmes were not running in the state. For example, Bihar has opted out of *PMFBY* due to the high premiums quoted by private bidders in the state, leading to a lack of crop insurance infrastructure in the state. Such missed collaboration opportunities are reducing enablers across the agricultural value chain for CRA farmers.	Convergence with central schemes requires an active role of the planning and revenue departments in the CRA institutional structure (refer to the institutional structure section for details on this recommendation).	Non-state actors may be brought in to perform assessments of convergence of policies, and provide recommendations for the long run, keeping CRA convergence at the centre of their assessment.

CAF indicator	Gap observed	Recommendations	
Collaboration and coordination – animal attacks on crops	Responsibility for addressing animal attacks falls on the disaster management or environment departments, with limited inter-departmental interaction. The time lag from reporting to action causes significant crop losses, particularly near forest areas. Farmers lack knowledge and capacity to report to the proper authority, leading to shifts away from crops vulnerable to animal attacks, like pulses.	The state needs to develop SOPs for human-wildlife conflict, especially in forest-adjacent districts. These SOPs should formalise a timely and responsive action plan for animal attacks, to reduce the threat of crop loss. Additionally, farmers need to be empowered to take timely action. Human resources from the forest and disaster management departments at the local level must be mandated to collaborate with the extension system and champion farmers to reduce action times.	Insurance coverage and research on the prevention of animal attacks can be a gap filled by non-state actors with expertise, like animal welfare organisations.
Collaboration and coordination – overlap of multiple institutions in the same area for the same programme	Stakeholders acknowledge an overlap of capacity, especially in some geographies and thematic areas. This lack of coordination results in farmers covered by one scheme not receiving support from another, despite potential symbiosis. Farmers and officials are often unaware of relevant contacts for support under the CRA programme.	This capacity gap can be directly addressed by a state-level HR map, as attempted by this report for the local levels. There is a need for transparency and accessibility of that database to the farmers and collectives to bridge the information asymmetry that gives rise to amensal overlaps.	Non-state actors can collaborate to create a farmer-facing dashboard and training programme—carrying information on the problem, and details of responsible authorities farmers can approach at the panchayat level.

CAF indicator	Gap observed	Recommendations	
Collaboration and coordination	There is a lack of formalised coordination among government and non-government stakeholders, which hinders targeted, context-specific and convergent interventions. Currently there are informal channels of collaboration—for example KVKs collaborate with NGOs for environmental impact assessment. But these efforts are unable to scale up.	Making non-state actors a part of the institutional structure to promote CRA must be a priority. This can enable targeted and convergent scale-up of CRA with minimum duplication (refer to the institutional structure section for details on this recommendation).	Non-government consortiums can be an effective way to develop coherence and convergence among organisations. The consortium should also focus on state-level engagement at all levels. This consortium can also support the state HR to reduce overlap and boost synergies.
Information dissemination – data and evidence on the results of various CRA technological and non-technological interventions	Lack of evidence on the effectiveness of CRA practices disallows informed decision-making and may lead to unintended consequences (context specificity). The most important gaps we identified include equipment and lean methodologies to measure accurate data like on-farm emissions. There are no channels for collecting and reporting last-mile feedback on mechanisms for enabling bottom-up feedback from the ground to reach state-level policymakers.	The mandate of the CRA programme should include evidence collection on the climatic adaptive effects of CRA interventions. The appointment of a human resource as a climate data analyst in the institutional structure helps localise this solution.	Non-state actors can support the data and evidence generation on CRA interventions on the ground, as they have the capacity and expertise to deliver on this.
	Translation of collected data into effective decision support tools for farmers.	Funds for satellite-based data monitoring and reporting must be part of the programme documentation, which is currently lacking in the fourth Agricultural Roadmap for Bihar.	To use an example, the Skymet project partnered with CropIN and DigitalGreen to develop a three-day lead-based forecasting decision support PoP for generating weekly

CAF indicator	Gap observed	Recommendations	
			advisories to farmers at the panchayat level. Such initiatives can collaborate with the state machinery to scale up across the state. Mapping and formalising these initiatives can bridge this capacity gap without increasing the state's financial burden. Another example is EDF's N-Balance tool, which helps farmers optimise fertiliser use.
Information dissemination – use of information technology and digitisation to advance CRA that helps individuals (farmers) and collectives (panchayats, in making informed decisions on Gram Panchayat	Farmers experience delays in information transfer regarding climate risks and hazards and accessing subsidies and market support due to difficult document verification systems.	Creation of an agro-decision support system (agro-DSS) is already being explored by the state institutions. Its scale-up and accessibility across the state can reduce the delays in information transfer. Agro-DSS can also use an 'Agri Value Chain' approach to provide advisories on post-harvest management of produce, and create a panchayat-level feedback mechanism based on soil condition reports. Accessibility to social support can be a part of the agro-DSS interface to make documentary training a part of the advisory.	ICT and related sectors have a high presence of non-state actors, and can support this capacity. The state has been engaging with these actors for the agro-DSS. However, their role needs to be increased in the design and formulation stages, rather than the current involvement in implementation alone.

CAF indicator	Gap observed	Recommendations	
Development Plans)	Low digital literacy among farmers and collectives hampers accessibility of scheme-related information. Low digital literacy also hampers their ability to provide sufficient documents required to access scheme benefits, and thus leads to problems of scheme access even after awareness is created for many farmers.	KVKs and ATMAs can be mandated to run digital literacy campaigns regarding access to various schemes of the government that can benefit farmers, and the documents required to access these benefits. Building a One-Stop Centre for accessing information for all schemes and document generation and verification across departments can be a solution in the long term.	

CAF indicator	Gap observed	Recommendations	
Human resource	Lack of skilled human resources limit the on-ground promotion and adoption of CRA. There need to be more resources skilled in climate and emission data measurement, marketing and business training, and MRO for machinery maintenance at a local level.	Appointing one dedicated human resource across the four themes suggested below is required at the block level to scale up the CRA programme at pace: Technical assistant skilled in extension training (which needs to be an agricultural graduate): The main responsibility would be to act as a multiplier for the KVK extension staff, to increase coverage at speed at a local level. Climatic and field data analyst: This can be a position at block level if satellite data surveillance can be made possible for data collection (also needs emission measurement equipment and skill). This person will be responsible for data collection on micro-climate, field-level emission measurement, and coordination with the DAMU for advisory generation for the DSS. Business development officer attached to KVK: This individual will be responsible for conducting trainings on business development for FPOs and SHGs focused on CRA in the area. MRO staff with training on CRA-related machine operation and maintenance: This person will be mandated to provide MRO services and training on MRO to champion farmers within the area.	Non-government organisations skilled in climatic data measurement can create an emissions target for the agricultural sector, to generate momentum for the mitigation narrative. Collaborations with non-state actors can be leveraged for training and capacity building of the field staff in climatic data analysis, agri-business management, training business development officers, and MRO for CRA-related machinery.

CAF indicator	Gap observed	Recommendations	
Human resource	FPOs and CBBOs face low participation among CRA-adopting farmers. Farmer collectives remain non-functional or struggle due to a lack of expertise and skills in agribusiness management. Challenges include insufficient business knowledge for accessing government benefits, difficulties appointing key positions like CEOs, and limited interactions with local CBBOs.	Coordination between CRA-focused farmer-led FPOs and CBBOs must be a programme mandate. The new human resource on business development must be given mandates for this too. Champion farmers within the institutional structure can be provided with business development training and business development experts must have this as a KPI.	Collaboration with state-adjacent actors like NABARD with a high footprint in the state must be leveraged for scaling up CRA-related agribusiness development. Post-harvest value addition for CRA produce in collaboration with local non-state stakeholders can be explored to promote value addition and better price discovery outside the PACS system for the farmers.
Human resource	There is a human resource gap on the ground; KVK officials manage diverse tasks and are stretched thin for the CRA programme. The ATMA ATM/BTM, though temporary, is burdened with multiple tasks, hindering CRA activities.	One recommendation to address the gap is to create a cadre of 'CRA technical assistants' with a training module curated for the local area in every panchayat. For this, a large-scale training and hiring process will have to be put in place, which may significantly increase the costs of the CRA programme. Retrofitting the current Kisan Salahkar cadre with better CRA training or bringing them under the supervision of the KVKs with the support of the DAO may help CRA-related skills in a larger coverage area.	The creation of such a vast technical assistant cadre, or even the training of Kisan Salahkars, will require bringing in non-state actors to collaborate with agriculture universities and identify trainees, develop modules of training, and conduct skill workshops. To fill the requirement of HR in the short-to-medium term, local non-state actors and entrepreneurs can be seen as a potential source. To achieve this, linking a short-course or licencing system for formalising private HR will have to be built via the institutional structure in the state.

CAF indicator	Gap observed	Recommendations	
Research and development	Governmental focus on 'resilience' in Bihar's CRA programme leaves other outcomes overlooked. This manifests as a focus on stress-tolerant varieties, and research thus moves in this direction. Official responses stress the need for 'livelihood/income' prioritisation in research, aiming for better income alongside resilience. The lack of a bottom-up feedback mechanism from KVK's research is a noted gap.	Mandate of research should be shifted to cover all aspects of CRA across the agricultural value chain, to target retention of farmers with CRA. Involvement of agronomic research alongside crop scientists in the CRA programme mandates and institutional structure can fill this gap. Contextualisation of research recommendations via feedback from local KVKs is necessary to make the research viable in local conditions.	Non-state actors can contribute significantly to market-based research on CRA products, and create models for successful price discovery which may be difficult for an overburdened government cadre.
Research and development – lacking soil pre-condition analysis	Research fellows note that district-level assessment for soil analysis presents inaccuracies due to varied conditions within districts. There is a lack of micro-level data collection infrastructure, forcing the state to use older historical data to recommend practices. The CRA programme doesn't document issues like off-variety seeds and weeds, leading to failures in certain practices like LLL paired with DSR.	Soil condition maps for panchayats must be prepared and updated with information on varieties being grown, and incidences of off-variety germination, salinisation, etc. They must be regularly documented and used in creating crop advisories for farmers. Research fellows at the KVK level and ATM at the ATMA level must be leveraged to collect this data.	Non-state actors like Digital Green can play a critical role in mapping the current state of soil and assessing the risk at speed and scale. The state should identify the right actors at local level for this exercise. State-level stakeholder documentation must be taken up to identify potential partners for the government in each locality.

CAF indicator	Gap observed	Recommendations	
Financing	Capital shortage was acknowledged as a challenge for programme advancement. Key areas needing investment include scaling, skilled staff, machinery, data equipment, and local agro-advisories. Insufficient CRA programme grant (INR 3,500) for input support is a key reason for farmers dropping out of the programme.	Promoting awareness and increasing the coverage of the KCC to provide accessible and affordable credit to farmers is a necessary enabler to fill this gap. Convergence among KVK, *Jeevika* and ATMA activities and funds across CRA domains may bring in additional capital for the CRA programme from outside its own granted fund, under the fourth Agriculture Roadmap.	Innovative financing models to run PPP projects led by non-state actors in some high priority areas may be a solution.
Financing – crop insurance gap	The state's insurance support is run on a temporary and sporadic basis. Farmers expressed a need for more information about insurance availability, and acknowledged that a lack of access to insurance was a significant hindrance to the adoption and continuation of CRA practices.	Bringing a state-run satellite-based insurance assessment and payout scheme is important to cover this gap. Using farmer collectives as a unit for collecting premiums may be an option. A portion of membership fees to the local PACS may be used as a premium for a state-run crop insurance scheme, on the lines of Karnataka's *Yeshasvini* scheme, which allied with the PACS systems to promote insurance among farmers.	In the short term, the private sector can be brought in to run pilot insurance schemes for CRA-adopting families through FPO-based insurance payouts and assessment. Alternatively, *Yeshasvini*-like models may also be run by private insurance providers, but that would require reducing PACS membership fees to allow private players to enter the insurance empanelment.
Financing	State officials expressed a gap in training, education, and research investment for effective CRA initiatives. Lack of finance hampers increasing the farm coverage under the CRA programme. Delayed disbursement from ATMAs was seen as a gap in promoting training and CRA adoption.	Additional funding may be sought through collaboration of operations with other policies in the state which link with the CRA programme—*JJHM*, *Jeevika*, and *MGNREGS* could be some of them.	PPP models can be explored to bring in non-state actors to fill the capital availability gap—with conditionalities of filling gaps of human resource or machinery seen as investment in the programme deliverables for the non-state partner.

CAF indicator	Gap observed	Recommendations	
			International donors and funds like the World Bank can also bridge this finance gap by funding the state's CRA interventions.
Financing	The lack of markets is one of the most important problems that significantly affects farmers' incomes, and was highlighted by most participants in the state-level consultations. Farmers reported the inefficiencies in discovering the correct prices for their produce from the PACS mandis, which delayed payments, asked for commissions, and offered prices lower than the MSP on even rice and wheat.	Farmer collectivisation and upskilling of existing collectives to access financing remains an important capacitation, especially for sharecropper and small and marginal farmers. Increasing the penetration of the KCC is another suggestion here. As the CRA programme maintains a minimum one acre condition for selecting farmers, this mandate is ignored in the programme. However, most adoptee CRA farmers were sharecroppers with over one acre land under them. This stresses the importance of inclusion of collective financing training as a mandate under the CRA programme for any new institutional structure.	Major microfinancing initiatives by NGOs and non-state private actors miss a 'CRA' lens. Incentivising agricultural financing to CRA-adopting farmers can become a mandate for the programme to crowd in private financing to fill this gap.

Source: Authors' analysis

Annexure X CRA critical score in Odisha

CRA critical score for district prioritisation - Odisha

Name	Farmers Covered Under OMM	Area Covered under OIIPCRA	CRIDA Vulnerability Score (Very High - 2; High - 1; Medium - 0)	Farmers Covered under OMM (Normalised)	Area Covered under OIIPCRA (Normalised)	CRIDA Vulnerability Score (Normalised)	CRA Critical Score	CRA Cr Score R
Ganjam	15552	18149	1	0.9009756383	1	0.5	0.8003252128	1
Keonjhar	12427	12015	2	0.7184085996	0.6604107845	1	0.7929397947	2
Mayurbhanj	13727	11266	1	0.7943564877	0.6189448043	0.5	0.6377670973	3
Bolangir	15000	4809	1	0.8687269966	0.2614737308	0.5	0.5434002425	4
Nabarangpur	17247	125	1	1	0.002159109782	0.5	0.5007197033	5
Kalahandi	12367	3555	1	0.7149033125	0.1920500471	0.5	0.4689844532	6
Bargarh	12050	2226	1	0.6963837121	0.1184742291	0.5	0.4382859804	7
Nuapada	12403	86	1	0.7170064848	0	0.5	0.4056688283	8
Gajapati	9565	351	1	0.551206403	0.01467087416	0.5	0.3552924257	9
Jajpur	504	598	2	0.02184962318	0.02834523612	1	0.3500649531	10
Balasore	520	456	2	0.02278436642	0.02048386204	1	0.3477560762	11
Bhadrak	130	1356	1	0	0.0703094724	0.5	0.1901031575	12
Kandhamal	9006	452	0	0.5185488111	0.02026241488	0	0.179603742	13

Boudh	1200	755	0	0.06251095402	0.03703703704	0	0.03318266369	14
Subarnapur	598	94	0	0.02734123 97	0.00044289 43143	0	0.00926137 8006	15

Annexure XI: Potential impacts of the seven thematic areas of intervention in Odisha on the other three CRA outcomes

Thematic areas of activity on CRA in Odisha	**Potential impact on Outcome 2: Improved lives and livelihoods**	**Potential impact on Outcome 3: Sustainable natural resources**	**Potential impact on Outcome 4: Safe and nutritious food for all**

Rice (DSR-related benefits)	- Increased system productivity by 7–9% - Enhanced profitability by 19–26% - Reduced global warming potential by 40% (Kakraliya et al. 2018) - Adopting salt-tolerant crop varieties and crop rotation techniques to mitigate soil salinity issues. This helps farmer to adapt to saline soils (Senapati and Goyari 2020)	- Increased emphasis on water management practices, including the creation and repair of farm ponds, to improve crop productivity in rainfed areas (Senapati and Goyari 2020) - Enhanced resilience to water scarcity and drought (Behera 2019) - Improved irrigation and total water productivity by 29–54% (Kakraliya et al. 2018)	- Improved rice yield and quality through drought-tolerant varieties safeguarding production - Increased cropping intensity and integrated farming practices leading to nutritional security (Behera 2019)
Fisheries	- Solar-powered devices with Internet of Things integration for fish farming aid in the efficient distribution of fish feed - Ensures uniform oxygen levels throughout the water tanks and significantly enhances fish and prawn productivity - This leads to increased household income for farmers who adopt this innovative system (Tripathy 2022)	- Practices like regulated fishing seasons, use of permissible fishing nets/gears, etc., help conserve fish stocks and biodiversity in water bodies, ensuring long-term sustenance of fisheries' resources - Scientific management of wastewater from industries/agriculture boosts the quality of aquatic ecosystems (Adhikari et al. 2018)	
Water conservation	- Rainwater harvesting and soil/water conservation activities improve local water resources (Behera 2019)	- Improved water management practices like micro-irrigation, land-levelling, DSR, etc., can help boost water use efficiency and reduce water consumption in agriculture. This helps conserve water resources and ensure the long-term sustainability of groundwater and	

		surface water sources (Sikka, Alam and Mandave 2022) - Rainwater harvesting and farm pond construction help boost groundwater recharge and surface storage. This helps improve water availability for both irrigation and other uses. It supports sustainable and efficient utilisation of water resources even during dry periods or droughts (ibid) - Introduction of less water-intensive crops and crop rotations suitable for local agro-climatic conditions can reduce pressure on water sources. This ensures water resources and their dependent ecosystems are protected for future use. (ibid)	
Soil conservation	- Conservation agriculture systems increased maize yields by 60–70% over traditional farming methods - Evaluations showed how farm communities practising conservation agriculture could enhance smallholder farmers' livelihoods (Chan et al. 2017)	- Rainwater harvesting and soil/water conservation activities, including land development and gully control, enhance local water resource recharge and improve soil health - Organic farming practices, such as composting and using local manure, boost soil fertility and structure, support sustainable agriculture, and reduce soil erosion - Afforestation and forest conservation protect soil water recharge areas, preserving ecosystem services and biodiversity for the future. ('Fair Climate and Sustainable Livelihood Initiatives in	- Conservation agriculture practices, such as reduced tillage and intercropping, have significantly improved maize yields (Chan et al. 2017)

		Odisha' 2017)	
Crop diversification	- Crop diversification enables farmers to adapt to climate change and mitigate risks from weather-related shocks, ensuring livelihood stability by not relying solely on one crop (Makate et al. 2016) - By growing a variety of crops, especially those more resilient to climate variability, farmers can maintain or even increase their incomes despite the adverse effects of climate change on certain crops (Dunnett et al. 2018)	- Promoting soil health improvement through diversified cropping systems, leading to enhanced soil structure and fertility (Vernooy 2022) - Enhancing water use efficiency and conservation, reducing dependency on irrigation through better moisture retention - Supporting biodiversity enhancement, contributing to balanced ecosystems and improved pest control dynamics (Degani et al. 2019)	- Enhancing drought resilience, ensuring stable food production amidst climate change - Increasing dietary diversity, providing essential nutrients from underutilised crops - Improving nutritional security, offering affordable sources of protein, minerals, and vitamins (Jamalluddin et al. 2021)
Millets	- Improved drought resilience and water-use efficiency in agriculture - Diversified farming systems, reducing reliance on water-intensive crops and supporting sustainable agriculture (Babele et al. 2022) - A study observed a 215% increase in the gross value of millet produced per farmer household (Tripathy 2022)	- Enhancing water efficiency, as millets require less water than other cereals, promoting drought resistance, which is crucial for adaptation in semi-arid regions - Reducing dependency on chemical inputs, contributing to soil health (Fischer, Reddy, and Rao 2016)	- Promoting the cultivation of climate-resilient millet varieties, which ensures higher productivity and climate resilience, thus contributing to the food and nutrition security of tribal communities (Mishra, Taraputia and Suchen, 2014) - Millets, being nutrient-rich and capable of growing in marginal conditions, enhance nutritional security and address issues of malnutrition and food scarcity in vulnerable regions (Upadhyaya and Vetriventhan 2018; Tiwari et al. 2022)

Horticulture	- Sweet potato cultivation has shown increasing incomes by 40% and productivity by 17% (CIP 2018)	- Biodiversity conservation: Promoting diverse cropping systems enhances agro-ecosystem resilience and supports a wider range of plant and animal species (FAO 2024)	- CRA can enhance food security and provide better nutrition for communities, addressing both availability and access to a variety of foods (Dhankher and Foyer 2018)

Annexure XII: CRA policy ecosystem in Odisha

Table A4: Alignment of departmental schemes with objectives: A comprehensive overview for structured CRA delivery in Odisha

Scheme	Nodal department	Key objectives	Alignment with CRA outcomes	Reference link
Capital investment on farm mechanisation	DAFE	Promoting scientific agricultural operations; improving post-harvest management tech; capital investment in creating mechanisation infrastructure.	Improved lives and livelihoods	https://agri.odisha.gov.in/sites/default/files/2021-08/Capital_Investment.pdf ; https://finance.odisha.gov.in/sites/default/files/2020-05/AgFE_Outcome_Budget-2019-20.pdf

Sustainable harnessing of groundwater in water-deficit areas	Water resources; Odisha Agro Industries Corp	To create shallow sources of irrigation in rainfed-agri areas that face drought threats; use of solar photovoltaic shallow borewell sets.	CRA and allied sectors; sustainable natural resources	https://www.orissapost.com/odisha-cabinet-approves-rs-364-40-crore-for-harnessing-of-groundwater/ ; https://agri.odisha.gov.in/sites/default/files/2021-08/Outcome%20Budget%202019-20-%20A%26FE%20Dept..pdf
Refresher's training for extension functionaries	DAFE	Upgrading the knowledge and skill of the agriculture extension functionaries working at various levels, actively engaged in the transfer of technology from lab to land.	Improved lives and livelihoods	https://agri.odisha.gov.in/sites/default/files/2021-08/Outcome%20Budget%202019-20-%20A%26FE%20Dept..pdf
Odisha Millet Mission	DAFE	Enhancing millet production in the state, thereby increasing household consumption of millets by about 25 per cent.	All four outcomes	https://agri.odisha.gov.in/sites/default/files/2021-08/Outcome%20Budget%202019-20-%20A%26FE%20Dept..pdf
Special promotion of integrated farming in tribal areas	DAFE; ATMA at local level	Optimum utilisation of available natural resources with 'Reduce, Recycle, Reuse, and Recovery' principles; promotion of site-specific and landscape-based farming systems through diversification, intensification, and integration in a cluster approach; to improve the livelihoods and income of farmers through enterprises, marketing, and value chain interventions by women's self-help groups/FPOs.	CRA and allied sectors; improved lives and livelihoods; sustainable natural resources	https://integratedfarming.in/uploads/files/Approved%20Guidelines%20of%20SPPIF.pdf

Need-based plant protection scheme	DAFE	To advocate for integrated pest and disease management, subsidy assistance would be extended to farmers to take up such emergent steps as would be necessary from time to time, as per recommendations of plant protection experts.	CRA and allied sectors; sustainable natural resources	https://agri.odisha.gov.in/sites/default/files/2021-08/Outcome%20Budget%202019-20-%20A%26FE%20Dept..pdf
Bhoochetna – Soil Health Scheme	DAFE with ICRISAT	The outline of the scheme is to improve the cultivators, local seed banks, land and water management practices, and capacity building for farmers.	Sustainable natural resources	https://www.icrisat.org/soil-health-scheme-for-farmers-in-odisha/
Promotion of improved agronomic package and practices	DAFE	Line sowing and line transplanting, seed treatment and green manuring with *Dhaincha* (Prickly Sesban) would be promoted	Sustainable natural resources	https://agri.odisha.gov.in/sites/default/files/2021-08/Outcome%20Budget%202019-20-%20A%26FE%20Dept..pdf
Input subsidy in seeds, fertiliser, bio-fertiliser	DAFE	To ameliorate the sufferings of farmers in case of severe natural calamities or pests and disease incidence, it is proposed to provide subsidised inputs to farmers like seeds, bio-fertilisers, pesticides and plant protection equipment, etc., and mostly to meet the seed subsidy.	CRA and allied sectors; sustainable natural resources	https://agri.odisha.gov.in/sites/default/files/2021-08/Outcome%20Budget%202019-20-%20A%26FE%20Dept..pdf
Organic farming (horticulture)	Directorate of Horticulture	Organic farming component is being promoted under Paramparagat Krushi Vikash Yojana (PKVY). Adoption of organic farming is to be taken up in a cluster mode of 50 Acre patch	CRA and allied sectors; sustainable natural resources	https://agri.odisha.gov.in/sites/default/files/2021-08/Outcome%20Budget%202019-20-%20A%26FE%20Dept..pdf

Farm Pond+	DAFE	To provide protective/life-saving irrigation during critical stages of growth of plants in the event of long dry spells and also during moisture stress conditions of plants; adoption of different components of integrated farming system for income augmentation and step towards multiplying farmers' income; judicious use of irrigation water through adoption of on-farm water management practices.	CRA and allied sectors; sustainable natural resources	https://odishaagrilicense.nic.in/actsRules/FP1.pdf
OIIPCRA	Water resources	Improve crop productivity for food security and income growth; farmer training for adoption of resilient agricultural practices and technologies (both adaptation and mitigation); diversification, especially during the Rabi (winter) season and for some areas under upland rice in Kharif (monsoon), for income growth, improved nutrition, and adaptation to climate change; a more efficient water-use and better quality and reliability of irrigation service delivery.	CRA and allied sectors; improved lives and livelihoods; sustainable and nutritious food for all	https://documents1.worldbank.org/curated/en/202281558084012152/pdf/Project-Information-Document-Integrated-Safeguards-Data-Sheet-Odisha-Integrated-Irrigation-Project-for-Climate-Resilient-Agriculture-P163533.pdf, https://octdms.in/oiipcra/index.html
Climate-resilient rice-based systems for prosperity and resilience in Odisha (ClimatePRO)	IRRI, DAFE, Water resources	The project will work with smallholder women and men farmers in three districts in Odisha to promote the diversification of rice-based systems as a way of enhancing climate and livelihoods resilience. Climate-resilient and high-yielding rice varieties followed by pulses, oilseeds, and other high-value crops in conjunction with CRA practices will be promoted to improve incomes and contribute to the sustainable intensification of farming systems in	All four outcomes of CRA	https://www.irri.org/news-and-events/news/climate-resilient-rice-based-systems-play-crucial-role-enhancing-climate-resilient

		the state. Formal and informal seed systems will be strengthened to enable crop diversification.		
CHHATA – Community-based harnessing and harvesting rooftop rainwater for augmenting groundwater	Water resources	Augmentation of groundwater recharge to improve water table and water quality conditions of the water scarcity area through the adoption of recharge systems; sustainability of groundwater-based (domestic/irrigation) schemes at gram panchayat level through recharge of defunct public/private wells used as drinking water sources. Rainwater harvesting and groundwater recharge to counter the impact of climate change on water sectors. Adopting the integrated water resources management (IWRM) concept. Ensuring water security for the future.	CRA and allied sectors; sustainable natural resources	https://dowr.odisha.gov.in/sites/default/files/2022-09/1.%20CHHATA%20scheme%202022.pdf
Mukhyamanti Adibandha Tiari Yojana (MATY)	Water resources (minor irrigation)	Check dams are being constructed in small streams and nallahs for conservation of water to meet the domestic needs of people of nearby villages, recharging ground water, and for providing incidental irrigation to the crops in the nearby areas	CRA and allied sectors; sustainable natural resources	https://dowr.odisha.gov.in/sites/default/files/2022-03/Major%20%26%20Medium%20Schemes.pdf
Fodder development programme	Directorate of Animal Husbandry and Vet Sciences	Minikit distribution in Kharif and Rabi season for the cultivation of maize, millets, berseem; azolla cultivation with MGNREGS funds; hand-driven chaff cutters	Improved lives and livelihoods	https://dahvs.odisha.gov.in/dahvsodisha/wp-content/uploads/2022/02/Fodder-Development_09_43_45pm999f2909e14e4935ac47ccee9692c605.pdf

Regional Plant Resource Centre	Department of Environment	Sale of vermicompost; education and training programme on plant propagation and nursery practices for SHGs, farmers and entrepreneurs.	CRA and allied sectors; sustainable natural resources	https://rprcbbsr.in/View/special_projects.aspx
REWARD – Rejuvenating Watershed for Agricultural Resilience through Innovative Development	Department of Rural Development	Participating states would be committed to establishing an agreed number of model watersheds. Each site will be approximately 5,000 ha. An average target of 10–15 model watersheds per state would be taken up.	CRA and allied sectors; sustainable natural resources	https://dolr.gov.in/sites/default/files/Financial%20Management%20Expert-merged_0.pdf

Source: Authors' compilation

Annexure XIII: Odisha capacity gap analysis and recommendations

State-level consultation identifies gaps in agricultural practices, recommending enhanced training, collaboration, digitisation, and targeted financing to improve sustainability, efficiency, and farmer livelihoods through strategic interventions. Below are tables outlining gaps and recommendations across seven thematic areas prioritised by Odisha in its CRA efforts, followed by a table highlighting cross-sectional gaps.

State-level consultation (S); Local official (L); Farmer (F)	**Crop diversification**		
Capacity Assessment Framework themes	**Gaps**	**Why the gap exists**	**Recommendations**

Collaboration and coordination	Some departments remain away from BTT meetings, which causes an issue with scaling up crop diversification	Depts tend to prioritise meetings with their own schemes as agenda and ignore others.	Inviting forest, cooperation and SC/ST departments to BTT meetings and OIIPCRA planning at state level to scale up interventions on crop diversification in these areas through cooperatives. This can unlock problem-solving for animal attacks, non-timber forest products and horticulture value chain development, which can help farmers discover better prices.
Information dissemination	Traditional practice of paira crop (relay cropping) cultivation of pulses after rice has been lost due to lack of awareness among farmers on traditional practices.	The lack of information dissemination on traditional cropping practices has led to loss of such knowledge among farmers	Better planning of Kharif crop in drier monsoons is required with advisory on paira crops.
Financing	Lack of post-harvest processing and marketing infrastructure for non-paddy crops at local level.	Lack of targeted financing for post-harvest processing of pulses or horticulture crops in uplands. Lack of collaboration with non-state actors for filling finance gap for post-harvest value chain.	Targeting post-harvest financing through state and non-state actors for non-paddy crops in local contexts. Financing from MKUY scheme can be targeted at non-paddy crops in certain districts.

Financing	Farmers do not grow certification seeds in scientific manner, especially with non-paddy seeds, and end up buying expensive hybrid seeds from private dealer.	Farmers need to leave isolation gap between traditional variety crop and new certification variety but don't do so, due to fear of loss of income.	Govt can provide compensation for loss of crop in isolation distance to encourage farmers to maintain scientific breeding practice. The government can also bear certification cost to reduce farmers' expenditure. Awareness generation on the benefits of certification must also be taken up. An increase in compensation percentage needs an assessment at the local level for different contexts. Enhancing MnE capacity for crop distance enforcement for certification is an important step to curb .

State-level consultation (S); Local official (L); Farmer (F)	**Soil conservation**		
Capacity Assessment Framework themes	**Gaps**	**Why the gap exists**	**Recommendations**
Collaboration and coordination	Land assessment and crop duration planning exercises are undertaken in silos, leading to suggestion of cultivating long-duration varieties on off-lands.	Prioritisation of areas for short- or long-duration variety based on land assessment is not a part of departmental mandates—it also needs coordination between soil conservation and agriculture directorate.	An assessment exercise is recommended to observe such identification. Assessments should also be done with departmental collaboration to enable synergies in cultivation patterns.

Financing	Funding for the creation of soil conservation infrastructure is irregular, especially from MGNREGS		Looking at non-state actors to fill the financial gap; an integrated data portal for looking at requisite funding. Infrastructure like contour bunds, windbreaks, etc can be created with non-state partnerships, like the RESILIENCE project in the state.

State-level consultation (S); Local official (L); Farmer (F)	**Horticulture**		
Capacity Assessment Framework themes	**Gaps**	**Why the gap exists**	**Recommendations**
Collaboration and coordination	Cooperation with Odisha Rural Development and Marketing Society (ORMAS) is missing at the local level for the OIIPCRA mission, which reduces its scale-up potential in tribal areas and establishing vegetable value chains.		Linkage of ORMAS with the horticulture sector is currently limited and does not cover vegetable value chains. Increasing this footprint via expansion of partnerships under projects like OIIPCRA can be an important area of collaboration.

State-level consultation (S); Local official (L); Farmer (F)	Millets		
Capacity Assessment Framework themes	**Gaps**	**Why the gap exists**	**Recommendations**
Vision mandate and priorities	Millet growth targets not being met for most species other than ragi. This has led to a focus on only one millet type while neglecting diversified cultivation.	OMM targets only ragi procurement, and most budgetary allocation goes to ragi-specific value chains alone.	Diversification of mandate and priorities to focus on non-ragi millets; setting targets for specific contexts which can promote other millets; partnering with non-state actors to set up non-ragi-based supply chains by promoting and partnering with start-ups.
Vision mandate and priorities	Foxtail and little millet being processed in Maharashtra and entering Odisha again.	Absence of a planned value chain for foxtail or little millet leads to raw millets going out of Odisha and processed millets entering Odisha for consumption.	Creation of foxtail and little millet processing value chain via state and non-state actors in Odisha as a part of district plans under OMM. Developing machinery for little millet, which can be made part of the financial allocation and local plans under OMM. The CRC can collaborate with OMM cell and non-state actors, and look at little millet value chain as part of millet crop diversification mandate.

Collaboration and coordination	Separate targeting of fodder production by the Directorate of Animal Husbandry and Vet Sciences (DAHVS) in OMM areas—this is done despite OMM supplying sorghum seeds in the area, which is a great fodder and feed crop.	Separate targets for the two departments at the ground level.	Merger of targets for the two departments at the state and local level to allow sorghum and other millets, which can be a good fodder crop, to be targeted by the DAHVS as well.
Information dissemination	Farmers selling millets at INR 9/kg in the market and unaware of the market rate outside their local area.	Poor information flow to farmers on millet marketing in non-OMM blocks, and a lack of alternative marketing mechanisms close to the farmer in such blocks.	Expanding information dissemination under OMM to cover farmers at a larger scale. Using AmaKrushi portal and other lean communication mechanisms to scale up information dissemination.

State-level consultation (S); Local official (L); Farmer (F)	**Fisheries**		
Capacity Assessment Framework themes	**Gaps**	**Why the gap exists**	**Recommendations**

Vision mandate and priorities	Skill development on latest CRA interventions and fisheries technology is not built into the current academic system of the OUAT for graduates of fisheries sciences.	WorldFish found a lack of skill development for new fisheries graduates and staff in the OUAT system.	Creating a regularly updated fisheries research and exposure visit module, with support from government and non-state experts.
Vision mandate and priorities	Fisheries department is not able to own implementation strategies for activities which come from a line of budgetary provision outside their department.		Creation of joint implementation strategies with better agency to the department, to intervene regarding design of programmes for their vertical.
Planning and implementation	Under current fisheries activities, the government mostly promotes a single species, which does not give a continued income to farmers to remain committed to fisheries.	Monoculture fisheries would make just one income through a year, which reduces the fish farmer's motivation to take it up in a scientific manner, with no interim income to make any other investment in the year.	Including polyculture promotion in the planning and implementation for all fisheries policies.

Planning and implementation	Currently, farmers are trained in practices like Integrated Farming Systems (IFS) and horticulture on bunds without considering the typology of land they own. This means they are not provided with alternative practice options suited to their specific land conditions		Develop context-specific support strategies for various typologies of farmers under current schemes like OIIPCRA.
Monitoring and evaluation	Private players have been hesitant to provide insurance for fisheries as there are no standards for monitoring and evaluation of fisheries production processes.	Experts list experiences of farmers facing losses of fish ponds due to disease, poisoning etc. The risk involved makes farmers hesitant to take up fish farming. Farmers do not continue after failure of a crop as fisheries are not covered under insurance schemes.	Enable private sector participation to research and set up MnE standards and services for fisheries sector; covering fisheries under insurance schemes will help farmers recoup losses and continue with the intervention.
Monitoring and evaluation	Private players provide extension for export-oriented products like shrimp, and are run by feed companies. However, there is no regulation to ensure whether these extension practices are climate-resilient or not.	WorldFish, in their work, saw a clear lack of regulation in the private extension system run by feed companies, in the case of shrimp where the system is working well at communicating with farmers.	Bringing in regulation to monitor practices used in the private extension system with the aim of prioritising CRA-oriented fisheries practices; licences can be made contingent on training and/or following CRA practices.
Human resource capacity	Single extension official to cover 11 blocks. New fisheries graduates either lack the requisite skills or do not prefer joining the government extension system.	Consistent gap pointed out by various stakeholders.	The state can work on identifying new models of extension to fill this gap with non-state actors.

State-level consultation (S); Local official (L); Farmer (F)	Rice		
Capacity Assessment Framework themes	**Gaps**	**Why the gap exists**	**Recommendations**
Planning and implementation	DSR facing the problem of weed growth in rainfed smallholder farms; SMFs are not taking up DSR as weeds take over the fields.	Seed treatment with nitrogen and zinc is required in early growth phase of DSR to give the plant early vigour to compete with weeds.	Subsidisation of nitrogen and zinc-rich fertilisers targeting DSR-adopting farmers must be planned at the local level, which reduces weedicide requirements. Clear recommendations from the National Rice Research Institute for the department on this can lead to elimination of the gap.
Information dissemination	Lessee farmers are not taking up DSR as it has been difficult to access subsidies on various inputs.	Documentation has been a challenge with lessee farmers, who are keeping their fields fallow in Kharif due to waterlogging, rather than going for DSR.	Documentation training and access to finance must be made part of the training module for farmers at ground level.

Human resource capacity	Absent MRO linkage in machinery maintenance and repair HR—local human resource lack requisite skills to repair power tillers or seeders for rice and DSR.	Blacksmiths in older times were skilled at repairing mechanical tools used in agriculture. But their skills were never updated, and have now become defunct as an HR for the new machinery maintenance requirements. PPP can be signed with non-state actors on the model of OAIC for the OIIPCRA scheme.	Upskilling programmes for traditionally skilled blacksmiths to maintain and repair electronic equipment. Scheme for upskilling youth can target CRA-related MRO within the skill matrix.
Research and development	Research on new varieties has quality but lacks quantity of machinery to scale up, like root scanners and high throughput analysers.	Good quality machines at a large scale must be available to push on field trials across topographies, and launch a variety sooner.	PPP with non-state actors to provide requisite machinery to research organisations in the state.

State-level consultation (S); Local official (L); Farmer (F)	**Water conservation**		
Capacity Assessment Framework themes	**Gaps**	**Why the gap exists**	**Recommendations**

Information dissemination	A general gap was observed among small and marginal farmers in accessing government support, due to lack of information. Solar pumps, for example, remain out of reach of small and marginal farmers.	Documentation and information on accessing solar pumps remains unavailable to farmers.	An information dissemination campaign and documentation support module can be taken up to make government support like solar pumps accessible to SMFs. This can be linked to the initiative of bringing in *KALIA* beneficiaries to Bhubaneswar every week for training and awareness programmes.
Financing	After withdrawal of the Infrastructure for Climate Resilient Growth (ICRG) initiative of UNDP, water conservation efforts stopped receiving collaborative focus from other depts . ICRG focused on MGNREGS funds to create climate-resilient infrastructure.	Most staff appointed under ICRG was contractual and the monthly meeting with ZP CEO on collaboration under ICRG stopped after the withdrawal of the programme.	In order to address the withdrawal of the human resource created under ICRG, there is a need for bringing Paani panchayat/Water user association members into FPOs and marketing organisations, to establish financial incentives post plan withdrawal. The next step is to formalise this cadre to avoid shortage or withdrawal of HR when a programme ends.

State-level consultation (S); Local official (L); Farmer (F)	**Cross-sectoral**

Capacity Assessment Framework themes	Gap	Why the gap exists	Recommendation
Vision mandate and priorities	Departments and schemes outside agricultural activities like MSME, energy, SC/ST development etc. do not maintain a 'climate-resilient' lens or coordinate with sectoral experts on schematic areas.	Schemes like OPELIP, dedicated agri and fisheries feeder scheme, etc. do not integrate inputs of CRC or DAFE in their mandates.	The CRC, in coordination with Climate Cell under DoEFCC, should re-examine all departmental programmes and ally with non-state and expert partners to introduce climate-resilient lens to agriculture-oriented components and schemes in all departments.
Vision mandate and priorities	Non-uniform success rates of BTTs; they lack outcome-based thinking.	Some BTTs only conduct meetings and collaborations on paper and achieve KPIs, but the block does not witness progress on outcome parameters for the departments.	Creating outcome-based KPIs for BTTs.

Planning and implementation	Seed availability at official suppliers and of approved varieties does not align with sowing, discouraging seed quality testing, and encouraging use of unauthorised or low-quality seeds. Farmers are buying and growing unlicenced seeds.	Experts have identified patterns of lack of availability of proper varieties of seeds, leading to unlicenced sale, lack of quality testing, and lack of uptake of higher-quality varieties. State lacks assessment of its seed requirement (agri and fisheries) and consumption, which must be matched to diversify in a targeted manner. There is no assessment of seeds consumed and demanded in the agri statistics report. Enforcement team under assistant agriculture officer (AAO) conducts flying visits, but has no punitive or alleviation power.	Creation of seed demand and consumption assessment alongside distribution assessment in the agriculture statistics report. Crop diversification plans must be made according to seed availability and demand in the local context. The CRC should consult experts to design a 'seed quality control' project for the state.
Planning and implementation	Training and capacity building workshops target farmers unselectively and without context.	This is done to fill up targets for training conducted or farmers/crop area covered under a programme.	Localised farmer interest groups can ask for training based on their context and interest. Training KPIs can be changed from quantity of coverage to more qualitative indicators, looking at number of farmers taking up a particular crop/practice after training.

Planning and Implementation	Seed varieties take 13–15 years to reach the market and more time to become ubiquitous.	Most of the seed provision system is formal and controlled by the state. Informal seed provision mechanisms like local seed banks remain underutilised or absent.	Promotion of 'seed villages' or community nurseries in every block for rapid seed growth and distribution. Creating targets for FPOs to distribute certain varieties in local contexts as a mode of increasing seed disbursal at scale. There can be a role for local non-state actors to take up context-specific seed scale-up.
Planning and implementation	Farmer-to-farmer learning is not prioritised, and trained farmers mention not teaching others.	Farmer-to-farmer training is not a part of the plans for the extension or advancement of CRA under any programmes.	Farmer-to-farmer knowledge transfer must be made part of the KPIs for the Farmer Field School (FFS) programme and trained farmers themselves, to avail of subsidies.
Planning and implementation	Farmers do not report machine or infrastructure damage after receiving them.	Follow-ups after infrastructure provision and machine installation are not a part of the plan under schematic documents. No targets measure follow-ups as per scheme KPIs.	Maintenance follow-ups be made part of planning and MnE of infrastructure schemes. Machine life-cycle maintenance system must be set up as part of the information dissemination mechanism at local level, to receive info on farmers' challenges, and provide solutions to them.
Collaboration and coordination	Departments remain focused only on their own departmental schematic targets and not on collaboration on the ground.	As pointed out by multiple stakeholders, even the different directorates of the agriculture department often fail to align on targets and activities, to say nothing of the different departments.	Creating targets with collaboration and outside department achievements as part of officials' KPIs.

Information dissemination	Grassroot level workers like VAWs/Krishi Mitras lack knowledge on latest CRA interventions, and policy interventions promoting them.	Policies lack information-dissemination channels on a targeted format, regarding specific CRA interventions for grassroot workers, as training remains generic or superficial.	The CRC should create a CRA knowledge dissemination portal, along with industry non-state experts, targeted at VAWs.
Information dissemination	Farmers and extension officials receive information only on the input side of the supply chain, through the lean communication mechanisms.	Kisan Mobile Advisory Services (KMAS) cover a large number of farmers, but messages remain themed on plant protection, cropping, and fisheries.	Additional messaging on post-harvest management and marketing should be added to KMAS groups. There should be tie-ups with non-state actors to create contextual advisories on the agricultural value chain.
Information dissemination	Farmer information groups on social media send untargeted agri advisories, which can counter sustainable practice knowledge.	Advisories and messages on WhatsApp groups etc. have no SOPs or targets.	Creation of a CRA-focused WhatsApp messages and crop advisory SOP in the local language.
Information dissemination	Lack of local language-based technology and information communication.	Current Information, Education and Communication (IEC) design does not include fund provision for devising scripts and information packages in local languages like Gondi or Sambalpuri.	Include support for script creation in local languages at ground level in information and machine provision schemes.
Financing	Direct Benefit Transfer timelines: Payments in most cases occur only post-implementation, creating lack of initial resources, and financial risk.	The farmers at FGD in Ganjam raised this point in relation to most of the different initiatives that we asked about, as well as in the case of initiatives they would like to take up.	Implement staggered financing models to improve cash flow to the farmers.

Financing	PACS loans are disbursed in an irregular and instalment-based manner which delays farmers' financial activities.		There's a need to assess PACS loan disbursal by the CRC, in collaboration with the cooperation department, and bring in a streamlined process after identification of key reasons for the inefficiency.
Financing	Small and medium farmers do not take up mechanisation, as they can't pay for fuel to operate the machine.	Fuel price is not a part of subsidisation of farm machinery.	Adding fuel cost under subsidy bundle at Custom Hiring Centres (CHCs) or under schemes.
Human resource capacity	MRO capacity is deficient at the local level.	Service centres in many blocks have become dysfunctional. Companies providing machinery have not taken up responsibility for repair or maintenance.	Companies with whom PPP agreement is signed for machine supply can be mandated to provide MRO facility or training to ground extension staff. Attaching MRO training module to sustainable agriculture extension certification as part of Recognition of Prior Learning (RPL) as shown here.
Human resource capacity	People receiving electrical maintenance training often migrate to other jobs rather than staying in agriculture to help fellow farmers.	Women are generally not a target of STEM-based training like electrical maintenance, which would have ensured lesser migration to outside jobs.	Targeting females for HR capacity development on MRO for machinery.
Human resource capacity	KVKs face challenges in covering their areas as they have four to six scientists per district, and can't perform training of all ground staff at speed and scale as well.	Human resource at the district level is imagined with a single scientist for each area of crop science, with local level staff receiving training to cover local gaps.	Expansion of KVK human resource capacity—CRA technical assistant cadre at local level can be brought in with non-state stakeholder partnership.

Research and development	There's an absence of low-cost contextual equipment for SMFs. Extension workers identified a demand from SMFs and female farmers for quality and quantity of mechanisation equipment like solar pumps, micro tractors, etc., relevant to their geography.	The state lacks a dedicated research and development line for relevant low-cost equipment.	Focusing PPPs on Odisha-specific farm mechanisation development; scaling up of Mukhyamantri Abhinav Krishi Yantrapati Samman Yojana across all blocks. A research project on Nature-Based Solutions (NBS) for Odisha's local context must be taken up by the CRC. The CRC and DAFE can collaborate on projects like Mahindra's 'Prerna' for women farmers.
Use of IT and digitisation	Manual data collection reduces the scalability.		Looking at leaner or less labour-intensive modes of data collection. Apps like Mo Sarkar or ADAPT portal (Analytics for Decision making and Agricultural Policy Transformation) can be used for self data collection and recording from the ground.
Use of IT and digitisation	Farm machinery and infrastructure related complaints are solved with a long delay, as per officials on the ground.	Grievance redressal mechanisms at the local level are not digitised.	Digitisation of grievance redressal dashboard to include complains regarding machinery on Kisan Sarathi portal.

Annexure XIV: Additional insights from the field

Box A1: Interview with the head of an FPO in Sukhet, Madhubani, Bihar

Farmer Producer Organisations (FPOs) are bodies where the members are farmers themselves. ● The Government of India has approved and launched the central sector scheme of 'Formation and Promotion of 10,000 FPOs' till 2027–28, with a total budgetary outlay of INR 6,865 crore. ● An FPO provides end-to-end support and services to small farmers, and covers technical services, marketing, processing, and other aspects of cultivation inputs.		
Details	● Location: Sukhet, Madhubani ● Membership: 350 farmers ● Most farmers were undertaking CRA practices ● Time since establishment: Nearly 15 months	
Major challenges observed	Licence availability	● The FPO could not avail a licence to sell seeds despite applying six months earlier. ● Availability of seeds was the most significant issue highlighted by members.
	Business development	● The FPO head mentioned that no training for business development had been conducted. ● The CBBO had not interacted with the FPO, nor had any other official from NABARD.
	Human resource availability	● The FPO head and chairperson lacked formal business training, and could not take advantage of any agribusiness opportunities. ● The FPO lacked a CEO, who needed to come from a technical business

		background to fill that capacity gap.
Solutions suggested	BAVAS as a route to avail licences	• Setting up an easier licence availability mechanism, especially for seed selling, through BAVAS. • Promoting CRA seeds and practices alongside such licences.
	Capacity building through CBBOs	• Setting up a formal mechanism of monitoring and evaluation of FPO training as a mandate for the institutional structure under the CRA programme. • District development manager of NABARD to be made responsible for feedback on the training of all new FPOs within a year.
	Creating a skilled human resource base for FPO CEO	• One of the mandates of a new institutional structure to promote CRA must be to provide all FPOs with a cadre of CEO candidates. • Setting up business training modules within agri-tech schools may also help fill this gap—non-state stakeholders can be approached for collaboration to provide this.

Box A2: Block Technology Teams (BTTs) in Odisha (SAMETI, n.d.)

Definition	Block Technology Teams (BTTs) are interdepartmental teams of agriculture and other line

	departments operating at the block level. They are created under the National Mission for Agriculture Extension and Technology (NMAET) in many states and function under the SAMETIs and the ATMA Management Committees.
Membership	BTT consists of chairman, Block Panchayat Samiti; block level officers of agriculture, horticulture, animal husbandry, fisheries, plant protection, veterinary science, soil conservation, extension, sericulture, cooperative, marketing and other departments. The Block Technology Manager is the member secretary. A designated scientist from the KVK also attends meetings of the BTT, provides requisite technical guidance and takes feedback from colleagues in the KVK concerning their respective areas of expertise.
Functions	• Prepare a Block Action Plan detailing extension activities to be undertaken. • Coordinate the implementation of extension programmes as identified in the Block Action Plan. • Facilitate the formation of farmer interest group/women's food security groups/FPOs at the block level and below. • Support the ATMA Management Committee in discharging its function by providing inputs related to the block. • Facilitate planning and implementation of farm schools in all major sectors in the block. • The BTT shall meet every month to review the progress and report the same to the ATMA Management Committee.
Importance as an institutional arrangement for CRA	• Being an important institutional agency for agricultural extension at the block level, BTTs are key to CRA advancement. • BTTs can act as agents for collaboration on the ground, as they have membership from across line departments. • They can also act as first points of contact for information dissemination in both directions.
Challenges observed in Odisha	• Experts at the state level highlighted the disproportionate success of BTTs in this state. They also commented that a few BTTs maintain only on-paper records of meetings conducted, funds spent, farmer groups visited, etc., to fulfil their mandate. This also reflected the 'output-based' thinking of the BTTs.

	• Some departments like forest and SC/ST development are not part of BTT membership, which leads to missed opportunities to converge on critical issues, like addressing animal attacks on crops, prioritisation of tribal practices in a local area, and creating insurance access for animal attack-related crop losses.