UPSCALE-India Project

Comprehensive Baseline Indicator Report

Deliverable 1.1

Norwegian Embassy
New Delhi

This project has received funding from the Ministry of Foreign Affairs, Norway/ the Norwegian Embassy, New Delhi, under Grant Agreement No. IND-3025, IND -23/0009

DOCUMENT SUMMARY		
Project Information		
Project Title:	A Transformative Climate Action through Upscaling Climate Resilient Rice and other Agricultural Technologies supported by Evidence-Based Knowledge and Policy in India	
Project Acronym:	UPSCALE-India	
Grant agreement no.:	IND-3025, IND -23/0009	
Project duration	Starting date: 01.10.2024	End date: 30.09.2028
Web--Site address:	www.resilienceindia.org	
Project coordinator:	Norwegian Institute of Bioeconomy Research	
Project coordinator contacts:	Dr. Nagothu Udaya Sekhar- (nagothu.udayasekhar@nibio.no) +47 990 15 621	
Report Information		
Deliverable name:	Comprehensive baseline indicator report	
Author (s):	Tesfai, M., Milon J. K., Suchismita, J., Rahul Tripathi, Rajkumar, R. et al.,	
Principle Author e-mail:	mehreteab.tesfai@nibio.no	
Deliverable Number:	D1.1	
Work Package:	WP1	
WP Leader:	National Rice Research Institute (NRRI)	
Task Number:	1.1	
Task Leader:	Norwegian Institute of Bioeconomy Research	
Dissemination Level:	Public	
Deliverable Nature:	Report	
Delivery Date	31-07-2025	

Acronyms/Abbreviations	
AAU	Assam Agricultural University
AE	Agroecology
AEZs	Agroecological zones
AWD	Alternate wetting and drying
BD	Bulk Density
CLCC	Customized Leaf Color Chart
CRRA	Climate Resilient Rice and other Agricultural technologies
DSR	Direct seeded rice
FGDs	Focus Group Discussions
FNS	Food and nutrition security
GHGs	Green House Gases
GHGI	Green House Gases Intensity
HH	Household
HYVs	High Yielding Varieties
ICT	Information and communication technology
IFSs	Integrated Farming Systems
IPM	Integrated Pest Management,
MoV	Means of verification
MSSRF	M. S. Swaminathan Research Foundation
NIBIO	Norwegian Institute of Bioeconomy Research
NRRI	National Rice Research Institute
NUE	Nitrogen Use Efficiency
OC	Organic Carbon
SOC	Soil Organic Carbon
OUAT	Odisha University and Agricultural Technology
SAC	stake holder advisory committee
SMART	Simple, measurable, achievable, relevant, timely
SRI	System of rice intensification
SSNM	Site Specific Nutrient Management
SRP	Sustainable Rice platform
VC	Value chain
VKCs	Village knowledge centres
WP	Work package

Table of contents

1 Introduction

The goal of **UPSCALE** project is to increase sustainably agricultural productivity, farm income, food and nutritional security in the highly vulnerable states of Assam and Odisha, India to climate change. This will be achieved through upscaling innovative evidence-based sustainable and Climate Resilient Rice and relevant Agricultural (CRRA) technologies that strengthen smallholders to adapt to climate change thereby enable to transformative change to sustainable agriculture systems. It is a 4-year project that have started in October 2024. This project selected technologies with promising results from RESILIENCE and other ongoing projects in India, in consultation with farmers and stakeholders. These CRRA technologies include:

- Direct Seeded Rice (DSR),
- Precision Soil and Nutrient management (that promotes use of digital tools for improving inputs use efficiency: e.g. fertilizers, water, etc.),
- Alternate Wetting and Drying (AWD) system of irrigation,
- Farmer-led smart seed production systems,
- Integrated farming systems (IFS)/diversified crop-livestock systems.

In addition, the project will demonstrate the *use of alternatives energy sources* to fossil fuels and electricity such as solar power and undertake a pilot assessment of *biodegradable plastics for mulching*. The CRRA interventions encompasses technological, institutional and extension aspects of the agricultural systems. The technological interventions include a range of practices on soil, water, crops, energy, environments and markets. These interventions are underpinned by social /institutional structures (for e.g. farmer to farmer exchange of knowledge and Information and communication technologies: ICT-based village knowledge centres), enabling institutions & policies to foster the transition to transformative change (Figure 1.1).

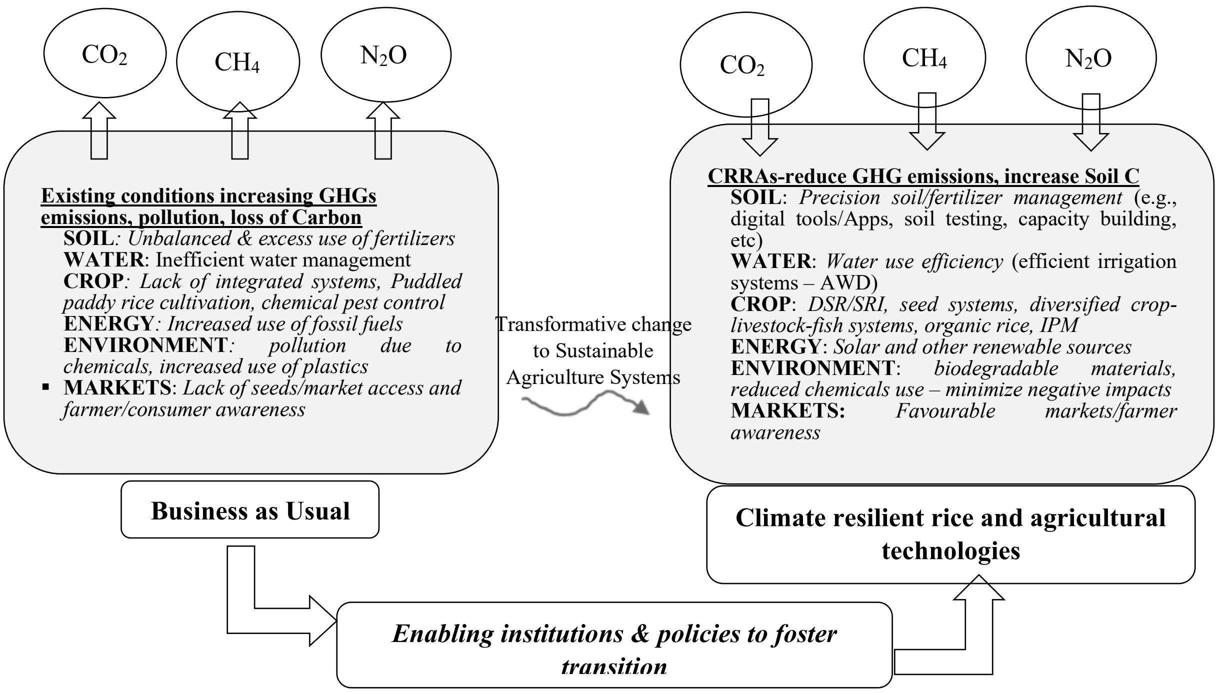

Figure 1.1: Conceptual diagram showing pathways leading towards sustainable agriculture systems.

As planned in the project, the selected CRRA interventions are being upscaled in 9 districts of Assam and 4 districts of Odisha that represent different agro-ecological zones (AEZs) and socioeconomic conditions of the project areas.

UPSCALE interventions are expected to have impact not only in the project sites but also beyond. Upscaling CRRA systems not only will provide increased yields and income for smallholders (small and marginal farmers)[1], but also improved ecosystem services that enhance sustainability and nutrient circularity, while reducing biodiversity loss. Thus, sustainable management of the agricultural system will be an important cross-cutting issue in the project.

According to the logical framework of UPSCALE-India project (Annex B), the two main (expected) impacts are smallholder farmers in Odisha and Assam have improved i) income and climate resilience; and ii) food and nutritional security. However, it is often a challenge to include all elements of impact changes in the problem analysis of a project life. Therefore, it is not possible to predict all-possible impacts of a project. In the process, not only intended, but also unintended changes could occur. There are a range of indicators that can be used to monitor and assess agriculture project impacts (e.g. SRP, 2015; World Bank group, 2016). However, a standard and harmonized methodology to monitor a set of indicators (agronomic, socio-economic, and environmental) that can reflect the climate adaptation/resilience, mitigation and productivity by CRRA technologies interventions over time and space is lacking.

Thus, the specific objective of this Deliverable (1.1) report is to develop a set of key indicators that can serve as baseline for monitoring and assessing project impact in terms of environmental, agronomic and socio-economic aspects on smallholder farmers in Assam and Odisha project areas. More comprehensive information is given on the methods and data collection procedures in the next section.

2 Methods and procedures

The project partners (OUAT, AAU, NRRI, MSSRF) utilized some of the relevant baseline data from the previous RESILIENCE project for the new UPSCALE project areas. In addition, a targeted base line survey and FGDs was conducted by AAU in Assam, OUAT and NRRI in Odisha to collect data as needed in the upscaling districts by:

- -developing a questionnaire and interviewing representatives' farmers from beneficiary groups (those who will be participating in the project activities) and control groups (those who will not be participating in the project activities) to collect baseline information on the indicators (Table 2.1);
- developing selection criteria for target farmers to be identified in each of the project district. The sampling schemes (list of target farmers including women, with necessary details) was prepared as a part of project data base. The demo farmers and other farmers adopting CRRA technologies were mapped (geo-positions of the farms, technologies adopted, etc.).
- carrying out 12 Focus Group Discussions (i.e. 6 FGDs each in Assam and Odisha), 2 meetings with line department officials along with other stakeholders to determine a set of baseline indicators that could assess the agronomic, socio-economic, environmental performance of the project.

[1] Those cultivating 1-2 hectares of farm land are referred as small farmers and those with less than 1 hectare are marginal farmers, 2-4 ha are semi medium and 4-10 ha are medium farmers in India (https://pib.gov.in/newsite/PrintRelease.aspx?relid=188051)

Table 2.1: Number of interviewed farmers in Assam and Odisha project districts for baseline survey

State (Partner)	District	Cluster (villages)	Beneficiary		Control		Total	
			Male	Female	Male	Female	Male	Female
Assam (AAU)	*Golaghat*	1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Sivsagar	1	n.a	n.a.	n.a.	n.a.	n.a.	n.a.
	Jorhat	1 (5)	62	35	4	2	66	37
	Lakhimpur	1 (2)	16	7	6	1	22	8
	Tinsukia	1 (2)	13	1	8	2	21	3
	Darrang	2 (4)	50	4	6	4	56	8
	Karbi anglong	2 (2)	17	7	6	2	23	9
	Kokrajihar	2 (2)	13	2	9	1	22	3
	Nalbari	2 (2)	10	4	7	3	17	7
	Nagaon	2 (5)	59	23	13	2	72	25
	Sri Bhumi	2 (1)	12	1	6	4	18	5
	Total	**-**	**252**	**84**	**65**	**21**	**317**	**105**
Odisha (NRRI)	*Cuttack*		n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	Jagatsinghpur		42	8	14	6	56	14
	Kendrapara		45	5	16	4	61	9
	Total	**-**	**87**	**13**	**30**	**10**	**117**	**23**
Odisha (OUAT)	*Dhenkanal*		30	40	3	7	33	47
	Ganjam		6	4	3	2	9	6
	Nayagarh		15	5	5	5	20	10
	Puri		49	21	6	4	55	25
	Total	**-**	**100**	**70**	**17**	**18**	**117**	**88**

n.a.: not applicable in old districts.

3 Indicators selection

The main steps that were undertaken in the development of key indicators and impact assessment are presented in Figure 3.1.

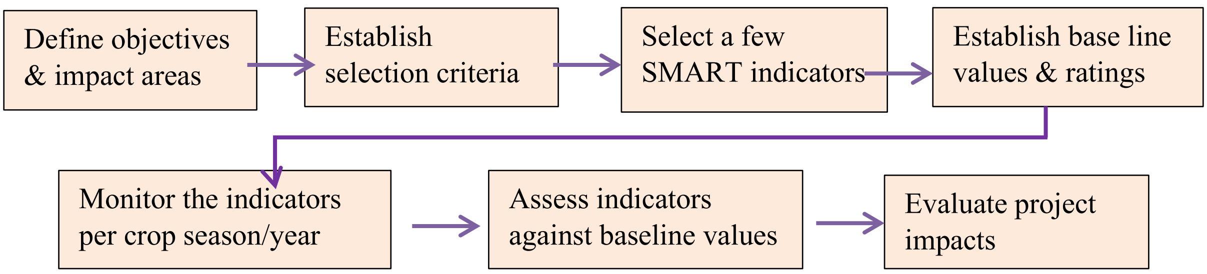

Figure 3.1: Steps to take in the development of key indicators and impact assessment.

In the process of indicator selection, indicators were chosen to ensure that indicators are Specific, Measurable, Achievable, Relevant and Targeted (SMART). These attributes are defined as follows:

i. **Specific**: Indicators should reflect simple information that is communicable and easily understood

ii. **Measurable**: Information can be readily obtained. Are changes objectively verifiable?

iii. **Achievable**: Indicators and their measurement units must be achievable and sensitive to change during the life of the project.

iv. **Relevant:** Indicators should reflect information that is important and likely to be used for management or immediate analytical purposes.

v. **Targeted:** Progress can be tracked at a desired frequency for a set period.

Based on the data collected in Task 1.1 (inputs from questionnaire surveys and focus group discussions), 12 indicators were developed. Table 3.1 provides a list of key indicators, measurement units, and source of information to monitor and assess the success of a CRRA interventions by the project. These indicators are categorized into three impact areas: *productivity, food and nutrition, and adaptation/resilience (including value chain enhancement).*

Table 3.1: List of key indicators chosen to monitor and assess the impacts of UPSCALE project.

S.No.	Name of indicator and contributing task	Units/ equation	Source
CRRA technologies: Productivity, Food and Nutrition Security			
1	**Crop yield** (rice, legume, vegetables, etc.) (Tasks 1.1, 1.4, 1.5)	Kg /ha (acre)	Farm record, Baseline survey *(C/1 – C/8*
2	**Household income** (Tasks 1.1 - 1.6)	Rupee/ha/year	Baseline survey *(D/1 – D/4)*
3	**Soil Organic Carbon** (Task 1.3)	% OC (OM)	Soil analysis *(F/1 - F/4)*
4	**GHG** (CH_4) **emission** (Task 1.3)	Kg CH_4/ha	Gas analysis *(F/1 - F/4*
5	**Energy efficiency** (Task 1.6)	% of reduction in fossil fuel	Farm record, Baseline survey *(G/1 – G/3)*
6	**Integrated pest/disease management** & other measures (Task 1.2)	% of farmers adopting IPM	Baseline survey *(E/1 - E/4)*
CRRA Adaptation /Resilience/Value chain improvement			
7	**Farmers and lead agencies trained** for scaling up CRRA technologies (Tasks 2.1, 2.2)	Number of trainees	Training records, Baseline survey *(H/1 - H4)*
8	**Farmers adopting sustainable CRRA** technologies (Tasks 2.1, 2.2)	% of farm HH	Record at VKCs, Baseline survey *(H/1 - H4)*
9	**Area coverage under sustainable CRRA** technologies (Tasks 2.1, 2.2)	Acre / ha	Farm records, Baseline survey *(H/1 – H/4)*
10	**Farmers using solar devices** (Task 1.6)	% of farmers	Farm records, Baseline survey *(G/1 - G/4)*
11	**Women participation** in household decision making (Task 2.3, 2.4)	% of HH	Farm records, Baseline survey *(I/1 - I/10)*
12	**Farmers participation** in value addition and local institutional arrangements for upscaling (Tasks 1.4, 2.3, 2.4)	% of farm HH	Farm records, Baseline survey *(J/1 - J/5)*

HH: Household, Q: Question, VKC: Village Knowledge Centre.

To track the project progress and develop reliable conclusions, the indicators must be monitored over a minimum of two cropping seasons. To demonstrate the progress of the project in achieving its targets in the impact areas, it is recommended that at least two indicators in each area should be used, which are ideally different in meaning and not subcategories of one indicator. Besides data monitored by farmers, project partners or local extension workers may need to collect basic data.

It is important to document the impact of the project interventions at mid-term and towards the end of the project with the help of well-defined set of indicators (Table 3.1). These are impact related baseline indicators that will be influenced by the project interventions. The indicators are closely related to the CRRA interventions chosen and the intended impact. They are the baseline measurement of the project and designed to assess productivity and FNS improvements of the smallholders in the case study districts of Assam and Odisha because of the interventions by UPSCALE project (Treatment effect). The project impact will be assessed using the following equation (1):

$$Treatment\ effect = (T_A - T_B) - (C_A - C_B) \quad [1]$$

Where,
T_A Treatment effect After (indicator measurement at the end-line) for beneficiary farmers
T_B: Treatment effect Before (Indicator measurement at baseline) for beneficiary farmers
C_A : Control effect After (indicator measurement at the end-line) for control famers
C_B : Control effect Before (indicator measurement at the end-line) for control farmers

The treatment refers to the CRRA technologies upscaled by the project in the different districts of the beneficiary farmers.

4 Sampling approach and data collection

Developing baseline indicators at the start of the project serves as a benchmark for project impacts (Task 1.1). NIBIO, the task leader, will handle data collection with all partners. Data collection methods can vary. When using farmer records, ensure farmers and extension workers can measure accurately. Regular site visits and discussions with farmers are essential. Set baseline values for the 12 indicators at the project's beginning to track improvements (Tables 4.1 - 4.4). Setting baselines depends on historical farm records and household survey data (Task 1.1). AAU/OUAT partners will select representative farmers from the household survey for monitoring. If targeting both genders, stratify by gender to obtain gender-disaggregated data.

The AAU/OUAT partners are advised to gather additional data from a control group of farmers for the project. This will establish a baseline to assess the plausible impact of project interventions on improvements among target farmers. Control farmers may reside in the same village as those involved in the project or in neighbouring villages, or other locations, provided they are matched with project farmers who have similar farming systems and socioeconomic characteristics (such as farm size, irrigation system, and labourers). It is essential to avoid selecting control farmers who might be influenced by project interventions (e.g., through peer-to-peer interactions) or who could benefit from other ongoing initiatives.

The next section explains the 12 key indicators, including their purpose, measurement unit, rationale/ assumptions, data collection methods, limitations, and references.

Table 4.1: Baseline (average) values for each indicator in 11 project districts (**9 new and 2 old districts)** of **Assam**.

Baseline Indicators			Unit	Project districts in Assam: 9 new and 2 old districts baseline values are from the Resilience project (2023/2024).											
				Golaghat	*Sivsagar*	*Jorhat*	*Lakhimpur*	*Tinsikuia*	*Darrang*	*E-Karbi anglong*	*Kokrajihar*	*Nalbari*	*Nagaon*	*Sri Bhumi*	*Project level*
1	Crop yield	*C/1: Stress tolerant HYV for stagnant flooding*	tons /ha	4,66	3,55	2,1	2,0	n.a	1,9	n.a.	n.a.	2,2	1,8	n.a.	
		C/2: Drought tolerant rice varieties		n.a.	n.a	2,0	n.a.	n.a	1,6	n.a	n.a	n.a.	1,7	n.a	
		C/3: RCT- Mechanical line transplanting		n.a	n.a.	2,3	2,2	n.a.	2,1	n.a.	n.a.	2,2	2	n.a.	
		C/4: RCT- wet direct seeding by drum seeder/seed drill		n.a	n.a	2,0	2,2	n.a	2,2	n.a	n.a	n.a.	1,8	n.a	
		C/5: Nutrient management using rice crop manager/ riceNxpert		n.a.	n.a.	2,3	2,0	n.a.	2,2	1,9	n.a.	n.a.	2,4	n.a.	
		C/6: Nutrient management using CLCC, N app		n.a	n.a.	n.a.	n.a	n.a.	n.a.	NA	n.a.	n.a.	n.a	n.a.	
		C/7: Water Management using digital tools		n.a.	n.a.	0,8	0,6	0,5	0,8	0,5	0,55	0,6	0,85	0,4	
		C/8: Farmer practice (Control)		3,01	3,01	1,6	1,4	1,5	1,3	1,3	1,8	2,1	1,7	1,4	
2	Farm Household income		Rupee/ha/yr	44897	36990	52440	46000	80000	64400	44200	45000	42400	68400	32600	
3	Soil Organic Carbon		% Org. C	?	?	0,65	0,62	0,61	0,63	0,92	0,80	0,67	0,62	0,81	
4	GHG (CH_4) emission		Kg CH_4/ha	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
5	Energy efficiency		Fossil fuel reduction (%)	0	0	0	0	0	0	0	0	0	0	0	
6	Integrated pest/disease management and other measures		% of farmers adopting IPM	68,4	50,1	12-13	7-10	2-5	14-14.5	5-8	4-6	2-5	13-15	2-5	
7	Farmers & lead agencies trained for scaling up CRRA technologies		Number of trainees	0	0	10	8	4	10	5	4	4	11	4	
8	Farmers adopting sustainable CRRA technologies		% of farm HH	0	0	15	10	10	10	20	10	10	18	7	
9	Area coverage under sustainable CRRA technologies		Acre / ha under CRRA	0	0	0	0	0	0	0	0	0	0	0	
10	Farmers using solar devices in project villages		% of farmers	0	0	10	9	2	11	4	3	5	12	2	
11	Women participation in household decision making		% of HH	59,6	48,8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
12	Farmers participation in local institutional arrangements		% of farm HH	81,1	75,7	30	20	10	25	15	13	15	35	10	

n.a.: not available/applicable. 1 US dollar is equivalent to 87,5 Rupee at the time of writing this report. Golaghat and Sivsagar are old project districts.

Table 4.2: Baseline (average) values for each indicator in 4 project districts of Odisha under OUAT ***(new and old)***

Baseline Indicators			Unit	Project districts in Odisha				
				Dhenkanal	*Ganjam**	*Nayagarh*	*Puri*	*Project level*
1	Crop yield	*C/1: Stress tolerant HYV for stagnant flooding*	tons /ha	0	0	3,0	0	
		C/2: Drought tolerant rice varieties		0	0	0	0	
		C/3: RCT- Mechanical line transplanting		0	0	0	0	
		C/4: RCT- wet direct seeding by drum seeder/seed drill		0	0	0	0	
		C/5: Nutrient management using rice crop manager/ riceNxpert		0	0	0	0	
		C/6: Nutrient management using CLCC, N app		0	0	0	0	
		C/7: Water Management using digital tools		0	0	0	0	
		C/8: Farmer practice (Control)		3,06	3,5	2,4	3,14	
2	Farm Household income		Rupee/ha/yr	46000	57500	33185	13000	
3	Soil Organic Carbon		% Org. Carbon	0,41	0,46	?	0,41	
4	GHG (CH_4) emission		Kg CH_4/ha	0	0	?	84	
5	Energy efficiency		Fossil fuel reduction (%)	0	0	0	0	
6	Integrated pest/disease management and other measures		% of farmers adopting IPM	0	28	62,5	0	
7	Farmers & lead agencies trained for scaling up CRRA technologies		Number of trainees	0	0	0	0	
8	Farmers adopting sustainable CRRA technologies		% of farm HH	0	0	0	10	
9	Area coverage under sustainable CRRA technologies		Acre / ha under CRRA	0	0	0	4	
10	Farmers using solar devices in the project villages		% of farmers	0	0	0	0	
11	Women participation in household decision making		% of HH	10	25	86,0	2	
12	Farmers participation in local institutional arrangements		% of farm HH	7	25	71,6	20	

**Old district with new villages Baghalati (HUB), Chandapur. and Sana Kusumi selected in UPSCALE project.*

Table 4.3. Baseline (average) values for each indicator in 3 project districts of Odisha under NRRI **(new and old)**

Baseline Indicators			Unit	Project districts in Odisha			
				Cuttack*	***Jagatsinghpur***	***Kendrapara***	***Project level***
1	Crop yield	*C/1: Stress tolerant HYV for stagnant flooding*	tons /ha	5,1	3,0	3,5	
		C/2: Drought tolerant rice varieties		4,9	0	0	
		C/3: RCT- Mechanical line transplanting		5,29	0	0	
		C/4: RCT- wet direct seeding by drum seeder/seed drill		5,35	0	0	
		C/5: Nutrient management using rice crop manager/ riceNxpert		5,31	0	0	
		C/6: Nutrient management using CLCC, N app		5,28	0	0	
		C/7: Water Management using digital tools		0	0	0	
		C/8: Farmer practice (Control)		3,4	2,4	2,9	
2	Farm Household income		Rupee/ha/yr	23000	13000	16000	
3	Soil Organic Carbon		% Org. Carbon	0,41	0,41	0,45	
4	GHG (CH_4) emission		Kg CH_4/ha	94	84	87	
5	Energy efficiency		Fossil fuel reduction (%)	0	0	0	
6	Integrated pest/disease management and other measures		% of farmers adopting IPM	48,0	0	0	
7	Farmers & lead agencies trained for scaling up CRRA technologies		Number of trainees	0	0	0	
8	Farmers adopting sustainable CRRA technologies **		% of farm HH	0	10	12	
9	Area coverage under sustainable CRRA technologies***		Acre / ha under CRRA	0	4	5	
10	Farmers using solar devices in the project villages		% of farmers	0	0	0	
11	Women participation in household decision making		% of HH	27,0	2	1	
12	Farmers participation in local institutional arrangements		% of farm HH	43,0	20	16	

** Old district : baseline values are from the Resilience project (2023/2024).*
*** Percentage of farmers adopting stress-tolerant high-yielding varieties (HYVs) for stagnant flooding conditions under CRRA technologies.*
**** Area under cultivation with stress-tolerant HYVs for stagnant flooding.*

5 Key indicators descriptions

Indicator #1: Crop yield (linked to Tasks 1.1, 1.4, 1.5)

Purpose: This indicator measures productivity, defined as the grain yield per hectare. Cropping intensity and/or crop diversity index could be used as proxy indicators.

Unit of measurement: kg paddy/ha and/ or kg legume/ha or kg vegetables /ha. An increase crop yield over time would be considered desirable.

Rationale and assumption: The rationale for this indicator is based on the UPSCALE project log framework expected impacts of increased farmer income and FNS. The assumption is that increased crop yield leads to increased household FNS and an increase in marketable surplus if market facilities / infrastructure is in place.

Measurement details and data collection: Baseline yield for relevant crops will be collected from HH baseline survey. To compare the grain yield, a follow-up survey will be conducted with farmers in the intervention area. Another option would be to directly implement crop-cutting measurements in intervention plots and compare with the baseline values. If the farmer records separate yield measurements for different fields within a farm, these should be averaged across the whole farm (total amount of grain harvested/total land area of the farm) and reported as one value per household.

Detailed data on yields are recorded in a farmer field book during the crop season by a sample of farmers. Data are collected per farmer, at least at the end of every crop cycle. An extension worker or research partner can also collect and cross-check the data through survey or yield sampling via crop cutting. Alternative data collection methods, such as the use of mobile devices by extension workers, are also encouraged.

Limitations: uncertainty of crop yield data.

References

SRP (2015) Performance indicators for sustainable rice cultivation, Sustainable Rice platform, Bangkok: available online, at http://www.sustainablerice.org/Resources/#performance-indicators

SRP (2019) The SRP Performance Indicators for Sustainable Rice Cultivation (Version 2.0), Sustainable Rice Platform. Bangkok: 2019. Available at http://www.sustainablerice.org

SRP (2020) Sustainable Rice Platform Performance Indicators for Sustainable Rice Cultivation (Version 2.1) Sustainable Rice Platform. Bangkok: 2019. Available at: https://sustainablerice.org/wp-content/uploads/2022/12/203-SRP-Performance-Indicators-Version-2.1.pdf

Tesfai, M., Kumar, R., Sanjay K.C., Nayak, A.K. and Mitra, A. **(2019)** Baseline indicators and methodology, Deliverable 1.3 RESILIENCE project www.resilienceindia.org,

Indicator #2: Household income (link to Tasks 1.1 to 1.6)

Purpose: This indicator measures profitability, defined as a farmer's net income from farm (including rice and other major crops under cultivation) per crop cycle and/or per year.

Unit of measurement: Rupee/year. An increase farmer income over time would be considered positive.

Rationale and assumption: The rationale for this indicator is based on the UPSCALE project results framework principle of improved livelihoods. The assumption is that increased net income leads to increased household capacity to pay for basic needs and services such as food, health, education, clothing and shelter. Increased farmer net income increases the attractiveness towards agriculture and provides increased ability to invest in the farm.

***Measurement details and data collection**:* The indicator is calculated as the gross income received from the sale of the crop minus the total fixed and variable costs incurred to grow the specified crop/s. The calculation should include both crops marketed and used for subsistence as well as the opportunity cost of family labour. The value of subsistence consumption is based on market prices (the average price of 1 kg of grain sold that season). The opportunity costs of labour are determined by the fees for one day of rural labour in the project area during the applicable period.

Baseline values on HH income will be collected from HH baseline survey. With project interventions, detailed data on costs and income are recorded in a farmer field book during the season by a sample of farmers. Data are collected per farmer, at least at the end of every crop cycle. An extension worker or research partner can also collect and check the data for e.g. household survey. More frequent data collection over the crop season is encouraged to ensure the quality of farmer records. Alternative data collection methods, such as the use of digital tools like mobile devices by extension workers, are also encouraged.

Limitations: include data uncertainty on net household come.

References

SRP (2015) Performance indicators for sustainable rice cultivation, Sustainable Rice platform, Bangok: available online, at http://www.sustainablerice.org/Resources/#performance-indicators

SRP (2019) The SRP Performance Indicators for Sustainable Rice Cultivation (Version 2.0), Sustainable Rice Platform. Bangkok: 2019. Available at http://www.sustainablerice.org

SRP (2020) Sustainable Rice Platform Performance Indicators for Sustainable Rice Cultivation (Version 2.1) Sustainable Rice Platform. Bangkok: 2019. Available at: https://sustainablerice.org/wp-content/uploads/2022/12/203-SRP-Performance-Indicators-Version-2.1.pdf

Tesfai, M., Kumar, R., Sanjay K.C., Nayak, A.K. and Mitra, A. **(2019)** Baseline indicators and methodology, Deliverable 1.3 RESILIENCE project www.resilienceindia.org,

Indicator #3: Soil Organic Carbon (link to Task 1.3)

Purpose: This indicator measures the amount of organic carbon contents in the specific soil depth or total amount of carbon stocks in the soil over time.

Unit of measurement: % organic carbon (OC) content in the soil. An increase of OC in the soil over time would be considered positive.

Rationale and assumption: The rationale for this indicator is based on the UPSCALE project results framework of improved agricultural productivity. The assumption is that boosting organic carbon levels in soil will improve soil health and carbon stocks, thereby enhancing soil fertility through application of site-specific nutrient management tools/apps. This approach seeks to increase crop yields while reducing GHG emissions from agricultural fields.

Measurement details and data collection: Representative soil samples collected from the demo plots will be analysed for total soil organic carbon content using the Walkley and Black method in the laboratory (FAO, 2019). The soil organic matter will be derived from total organic carbon using the following formula:

$$\%\ Soil\ organic\ matter\ (SOM) = OC\ x\ 1.72 \qquad [2]$$

The total soil organic carbon (SOC) stock in the topsoil /subsoil per ha can be estimated and computed as follows:

$$Total\ SOC\ (Mg/ha) = SOC\ (g/kg) \times Bulk\ density\ of\ soil\ (Mg/m^3) \times soil\ depth\ (m) \times 10 \qquad [3]$$

The soil bulk density (BD) is measured using the Core Method by taking undisturbed representative sample with known volume. BD measures the mass of oven dry soil per unit volume.

Limitations: include change in soil organic carbon content takes considerable time.

References

FAO (2019) Standard operating procedure for soil organic carbon using Walkley-Black Method:-Titration and Colorimetric Method, Rome, Ava. online at: https://openknowledge.fao.org/server/api/core/bitstreams/e498d73e-1711-4d18-9183-aa8476387e2c/content

FAO (2023) Standard operating procedure for soil bulk density, cylinder method, Rome, Ava. online at: https://doi.org/10.4060/cc7568en

World Bank group (2016) climate-smart agriculture indicators, report number 105162-GLB available at http://documents.worldbank.org/curated/en/187151469504088937/pdf/105162-WP-P132359-PUBLIC-CRRAIndicatorsReportweb.pdf

Indicator #4: Green House Gas emission (link to Task 1.3)

Purpose: This indicator assesses the amount of methane and nitrous oxide emitted per unit of land area.

Unit of measurement: This indicator is expressed in units of CO_{2-e}, utilizing the 100-year global warming potential weighting for various gases. Reducing agricultural GHG emission is beneficial.

Rationale and Assumption: Sustainable agriculture must balance productivity, environment, and economy. It is assumed that reducing GHG emissions (CH_4, N_2O) from rice fields by implementing CRRA technologies (e.g. AWD irrigation, SSNM, DSR practices, etc.) during crop growth can lessen the climate impact of rice farming.

Measurement details and data collection: Closed chambers will be installed in farmer-led demonstrations of rice fields to collect gas samples (CH_4, N2O) during the cropping season. GHG flux from soil is monitored by periodically sampling gasses from the chambers and measuring the change in gas concentration over the linear concentration change period. Subsequently, the analysis is performed using a gas chromatography system installed with a flame ionization detector (FID) as well as a methanizer for CO_2, FID for CH_4, and an electron capture detector (ECD) for N_2O (Nayak et al. 2016). Equations for the calculation of GHG fluxes is as follows:

$$CO_2 - C\,flux = \frac{\Delta x \times EBV_{(SPT)} \times 12 \times 10^3 \times 60}{10^6 \times 22400 \times T \times A} \quad [4]$$

$$CH_4 - C\,flux = \frac{\Delta x \times EBV_{(SPT)} \times 12 \times 10^3 \times 60}{10^6 \times 22400 \times T \times A} \quad [5]$$

$$N_2O - N\,flux = \frac{\Delta x \times EBV_{(SPT)} \times 28 \times 10^3 \times 60}{10^6 \times 22400 \times T \times A} \quad [6]$$

Where,
ΔX = Gas concentration difference between 0, 15 and 30 min.
$EBV_{(SPT)}$ = Effective chamber box volume at standard pressure and temperature
T = Flux measurement time in min (15, 30 min)
A = Chamber box base area in m^{-2} (L × B)

The EBV(SPT) is calculated using the following equation, $\frac{P_1 \times V_1}{T_1} = \frac{P_2 \times V_2}{T_2}$ [7]

Where,
P1 = Barometric pressure at the time of sampling in mm Hg
V_1 = EBV (Effective box volume)
T_1 = 273°K + temperature inside the box at the time of sampling in ^{0}C
P_2 = Standard barometric pressure (760) in mm Hg
V_2 = EBV (STP)
T_2 = 273°K

The EBV is measured using the following equation: EBV= Box [(H-h) × L × B] -V [8]
where,
B = Box breadth (cm)

L = Box length (cm)
h = Height of the field water level (cm)
H = Box height (cm)
V = Crop (e.g., rice) biomass volume (mL) inside the box (above ground biomass only).

GWP (Kg CO_2/ha) = (25 × cumulative CH_4) + (298 × cumulative N_2O) [9]

GWPI (kg CO_2e/ton of rice grain produced) = Total CO_2e × GWP ÷ Rice gain yield (tons) [10]

Limitations/risks: Potential risks include the leakage of gas during the transportation of gas samples to the nearby laboratory for gas analysis.

References

Gupta K., Kumar, R., Baruah, K.K., Hazarika, S., Karmakar, S. and Bordoloi, N. (2021) Greenhouse gas emission from rice fields: a review from Indian context, Environmental Science and Pollution Research 28:30551–30572, Ava. online at: https://doi.org/10.1007/s11356-021-13935-1

Nayak AK, Bhattacharya P, Shahid M, Tripathi R, Lal B, Gautam P, Mohanty S, Kumar A, Chatterjee D. (2016) Modern Techniques in Soil and Plant Analysis. ISBN: 93-272-7059-4, Kalyani Publisher. P.272.

World Bank group (2016) climate-smart agriculture indicators, report number 105162-GLB available at http://documents.worldbank.org/curated/en/187151469504088937/pdf/105162-WP-P132359-PUBLIC-CRRAIndicatorsReportweb.pdf

Indicator #5: Energy efficiency (link to Task 1.6)

Purpose: The energy efficiency indicator measures the energy utilized for irrigation, for pest control and/or other farming activities using renewable energy sources such as solar energy. It indicates the percentage of reduction in fossil fuel usage.

Unit of measurement: A reduction (%) in fossil fuel use (diesel), indicates positive environmental impact due to increased reliance on renewable solar energy.

Rationale and assumption: Solar technology reduces the agriculture energy use of fossil fuels by replacing some of the farm operations (e.g. irrigations, pest control, etc) to be powered by solar energy. This will contribute to mitigate GHG emissions from agricultural fields, support national climate goals (such as National Determined Contributions to climate actions) and sustainable energy.

Measurement details and data collection: The main components of on-farm energy balance calculation are energy input, energy output expressed in energy efficiency (EE). These parameters evaluate agricultural systems' sustainability. Almost all indicator-based sustainability in agriculture includes energy indicators, such as the input of fossil energy or energy efficiency.

$$EE\ (\%) = (Solar\ energy\ used \div Total\ diesel\ energy\ used) \times 100 \quad [11]$$

The following data will be collected from the farmers (refer Annex A for data collection):
- Power of the tractor (horsepower, hp)
- Converting the power of the farm machinery into kW (1 hp = 0.7457 kW)
- Fuel Consumption (liter)
- Time of operation of the farm machinery e.g. tractor, power tiller (hrs)
- Power of the panel (s) used in the solar pump for irrigation, sprayers (kW)
- Diesel/ Petrol required for the whole operation (litres).

The energy used for different farm activities with machinery can be compared with the solar power used in kW. Through fuel consumption by machines/engines, we can calculate the energy used.

Limitations: limited access for smallholders, solar panel sustainability concerns, need for regular maintenance, shortage of skilled technicians.

References

World Bank group (2016) climate-smart agriculture indicators, report number 105162-GLB available at http://documents.worldbank.org/curated/en/187151469504088937/pdf/105162-WP-P132359-PUBLIC-CRRAIndicatorsReportweb.pdf

Indicator #6: Farmers adopting integrated pest management and other pest control measures (linked mainly to Tasks 1.2)

Purpose: To determine the percentage of farmers applying integrated pest management (IPM) practices and/or other bio-pest control measures in their farmland.

Unit of measurement: Percent of farmers who adopted integrated pest management practices and/or other pest control measures promoted by the UPSCALE project

Rationale and assumption: The rationale for this indicator is based on one of the CRRA guiding principle i.e. resource-use efficiency. The assumption is that increased in adoption of IPM and/or other pest control measures by farmers leads to increased farm profitability through increasing yield and/or decreasing input costs, decreased environmental contamination by pesticides. In naturally established agricultural systems, understanding the local agro-ecological balance between "pest" species with other species (including their own natural enemies' parasites and predators) is the core of CRRA practices.

Measurement details and data collection
Attempts will be made to demonstrate the use of eco-friendly pest management technologies by carrying out the following activities:

i) Conducting farmer led-field demonstrations on IPM
- Using solar powered insect traps using yellow or blue strips
- Mass rearing and deployment of natural enemies and/or pathogens; and
- Explore the potential for development of cost-efficient plant-based biopesticides

ii) Develop specific IPM modules
- Develop location specific IPM training modules for rice crop pests under changing climate scenario.

Data collection: Detailed data on pest control measures including IPM are recorded in a farmer field book by a sample of farmers. Baseline values will be collected from the HH survey. After intervention of IPM module, data on identification, scouting, monitoring etc, is recorded during the crop season. Data will be collected from the farmers where IPM module has been advocated and the percentage of IPM adoption will be computed. However, more frequent data collection over the cropping season is encouraged to ensure the quality of farmer records. Alternative data collection methods, such as the use of mobile devices are also encouraged.

Limitations: uncertainty of farm record on IPM adoptions.

References

World Bank group (2016) climate-smart agriculture indicators, report number 105162-GLB available at http://documents.worldbank.org/curated/en/187151469504088937/pdf/105162-WP-P132359-PUBLIC-CRRAIndicatorsReportweb.pdf

Tesfai, M., Kumar, R., Sanjay K.C., Nayak, A.K. and Mitra, A. **(2019)** Baseline indicators and methodology, Deliverable 1.3 RESILIENCE project www.resilienceindia.org,

Indicator #7: Farmers and lead agencies trained for scaling up CRRA technologies,
Indicator #8: Farmers adopting sustainable CRRA technologies, and
Indicator #9: Area coverage under sustainable CRRA technologies (Tasks 2.1, 2.2)
Indicator #10: Farmers using solar devices (link to Task 1.6)

Purpose: To record percentage of farmers and others trained, and/or adopting CRRA technologies, area coverage under sustainable CRRA technologies and farmers using solar devices.

Unit of measurement: No. of farmers and other stakeholders trained and/or adopting CRRA technologies and area coverage (ha/acre) under CRRA technologies.

Rationale and assumption: CRRA practices enable farmers to address climate change threats by increasing income, productivity, and resilience. Effective adoption of these practices also reduces GHG emissions. To achieve this, increasing farmers' knowledge and capacity through training is essential. Online Village Knowledge Centres (VKCs) will be established within the project areas to provide training for farmers and other relevant stakeholders.

Measurement details and data collection: In this project, the already selected technology interventions from the completed project RESILIENCE and other ongoing projects in India, are further upscaled in Assam and Odisha project areas. These technologies include:
- Direct Seeded Rice (DSR),
- Precision Soil and Nutrient management using digital tools
- Precision Water Management using digital tools
- Climate Smart Seed Systems and
- Integrated Farming/Crop-livestock diversification systems

In addition to the above mentioned CRRA technologies, the project will demonstrate use of alternatives innovative solar energy sources to fossil fuels and electricity and undertake a pilot assessment of *biodegradable plastics for mulching*. Apart from practical demos, knowledge management, capacity building and dissemination will be promoted through digital based extension tools (e.g., VKC).

Trainings: Customized trainings will be given to farmers and other relevant stakeholders on the most promising CRRA technologies. The trainings modules are based on the needs assessment carried out by WP2. The trainings could be given online and/or offline knowledge management tools (WP2 and WP3) supported by practical field demos and/or educational materials in local languages. Attendance sheet will be distributed to record the number of people (farmers, others) trained on the different CRRA technologies disaggregated in gender. During closing session of the trainings, evaluation of the courses will be carried out by the trainees to get feedback and improve the quality of trainings.

Awareness: We will assess farmers' awareness of selected CRRA technologies by determining if they have heard of the technology, know how it functions or never heard before. The primary factors preventing farmers from adopting a specific CRRA technology, despite their awareness, will be identified, along with recommendations to enhance adoption rates.

Practitioners: Farmers currently using a CRRA technology will be identified as practitioners of those specific practices. We will report the proportion practicing each technology individually and the overall percentage of farmers adopting any CRRA technology by counting anyone using at least one as a practitioner.

Limitations: Farmers may require varied CRRA technology combinations to address climate change efficiently.

References

World Bank group (2016) climate-smart agriculture indicators, report number 105162-GLB available at http://documents.worldbank.org/curated/en/187151469504088937/pdf/105162-WP-P132359-PUBLIC-CRRAIndicatorsReportweb.pdf

Indicator #11: Women participating in household decision making (linked to Tasks 2.3)

Purpose: This indicator measures women's power to make decisions relevant to their well-being.

Unit of measurement: The measurement unit is a 0 - 100 score based on answers to multiple-choice questions that describe a combination of practices and outcomes related to women's empowerment. An increase score over time would be considered positive.

Rationale and assumptions: The indicator is based on the UPSCALE logical framework of social development. The assumption is that empowerment of women leads to improved maternal health and improved family health and well-being. In situations in which women are directly involved in agricultural production (i.e. any farm production including rice), women's empowerment (e.g., by increasing women's access to knowledge) is also expected to lead to higher productivity and profitability.

Measurement details: Measurement is based on a scorecard covering the following 10 topics:

- Women's control over decisions regarding household agricultural production;
- Women's control over decisions regarding their own labour input;
- Women's satisfaction regarding their labour input;
- Women's access to information and capacity building;
- Women's access to seasonal resources for farm activities;
- Women's control over long-term resources for farm activities;
- Women's control over decisions regarding household income;
- Women's control over their personal income;
- Women's participation in collective decision-making; and
- Gender-based violence

In this indicator, we refer to the main decision-making female(s) in the household (generally spouses). The scorecard includes basic requirement for women's empowerment over the above mentioned 10 indicators and three level (s) of performances that are scored out of 10 and the total score will range between 0 to 100. The scorecard can be found in Annex A of this report or in SRP (2015). The baseline values will be collected from the household survey. A follow-up survey will be conducted to monitor and assess the project interventions impact. The scorecard will then be measured by a household survey at least at the end of each rice crop cycle with a sample of farmers.

Limitations: Subjective information in which quality and accuracy depends on the interviewer and the respondent. However, the scores can be compared with observations and records, such as gender gap reports.

References

SRP (2019) The SRP Performance Indicators for Sustainable Rice Cultivation (Version 2.0), Sustainable Rice Platform. Bangkok: 2019. Available at http://www.sustainablerice.org

SRP (2020) Sustainable Rice Platform Performance Indicators for Sustainable Rice Cultivation (Version 2.1) Sustainable Rice Platform. Bangkok: 2019. Available at: https://sustainablerice.org/wp-content/uploads/2022/12/203-SRP-Performance-Indicators-Version-2.1.pdf

Tesfai, M., Kumar, R., Sanjay K.C., Nayak, A.K. and Mitra, A. **(2019)** Baseline indicators and methodology, Deliverable 1.3 RESILIENCE project www.resilienceindia.org,

Indicator #12: Farmers participating in institutional arrangements (e.g. product value added markets, credit access, etc.) (linked to Tasks 1.4)

Purpose: To record proportions of farmers participating in institutional activities (e.g. product value added markets, credit access, etc.).

Unit of measurement: Proportions of farmers participating in value added markets and proportion of farmers with access to institutional credit.

Rationale and assumptions: This indicator is based on the UPSCALE logical framework of social development. To realize the full potential of new technologies in agriculture, it is extremely important that farmers get crucial institutional support for e.g. access to value added markets, credit access, etc. It is hypothesized that with increasing participation in institutional activities; farmers will be able to adapt the CRRA technologies efficiently and increase their farm productivity and income.

Measurement details and data collection: The baseline values will be based on percentage of farm households that participate in value added markets by grading/processing any of their agricultural products to increase market value. Similarly, the baseline values will be based on the percentage of farming households that have access to institutional credit. These two parameters will have separate values and will be interpreted independently. The baseline values for the indicator will be collected from the baseline survey (Task 1.1).

To determine the proportion of farmers participating in the various institutional activities, farm survey will be conducted in the project villages after and before crop harvest. The institutional activities could include upgrading agricultural produce along the value chain to increase market value or taking credits to implement specific farm activities. The survey team will also interview farmers who are not engaged in value addition or other institutional activities to find out the constraints and suggest solutions accordingly.

Limitations: Subjective information in which quality and accuracy depends on the interviewer and the respondent.

References:

SRP (2015) Performance indicators for sustainable rice cultivation, Sustainable Rice platform, Bangok: available online, at http://www.sustainablerice.org/Resources/#performance-indicators

SRP (2019) The SRP Performance Indicators for Sustainable Rice Cultivation (Version 2.0), Sustainable Rice Platform. Bangkok: 2019. Available at http://www.sustainablerice.org

SRP (2020) Sustainable Rice Platform Performance Indicators for Sustainable Rice Cultivation (Version 2.1) Sustainable Rice Platform. Bangkok: 2019. Available at: https://sustainablerice.org/wp-content/uploads/2022/12/203-SRP-Performance-Indicators-Version-2.1.pdf

Tesfai, M., Kumar, R., Sanjay K.C., Nayak, A.K. and Mitra, A. **(2019)** Baseline indicators and methodology, Deliverable 1.3 RESILIENCE project www.resilienceindia.org,

6 Summary and Conclusion

Developing and monitoring baseline indicators at the early stage of the UPSCALE project and assessing their impacts towards the completion of the project, is an iterative process. The indicators listed in Table 3.1 are further refinements of the indicators in Figure 1.1. A given impact indicator (in Figure 1.1) can be assessed by one or more baseline indicator (for e.g. soil organic carbon, GHG emission, etc.)

Several baseline indicators, such as crop yield, are utilised across the various CRRA interventions implemented by the UPSCALE project in the 15 case study districts of Assam and Odisha. However, most indicators are specific to individual interventions. In total, 12 base line indicators have been identified, and their monitoring methods and data collection procedures have been described. Out of the 12 indicators, six are grouped under Productivity and FNS impact areas and the remaining six relate to Adaptation/Resilience to climate change and Value chain improvement. Local indicators and/or proxy indicators (relevant to the impact areas of the UPSCALE project and logical frame of the project) will be used, when relevant. Along the way, some of these indicators and their monitoring methods may be subjected to readjustment and fine-tuning as the project progresses. Therefore, this report will serve as a dynamic document that will be enhanced and expanded through continuous updates and contributions from our project partners and stakeholders .

UPSCALE

Annexes

A: Data collection for energy consumption in various farming activities

Control farmer or Beneficiary farmer

State: ________________	Farmer ID*: ______________
District: ______________	Farm size: __ ha or acre
Village: _______________	Crop/s cultivated: ___________
Cluster no. __	Season: kharif or rabi

Agricultural field activities	Tractor power used (hp)	Fuel consumed (litres)	Solar power consumed (watt)	Total hours spent using diesel (hrs)	Total hours spent using solar (hrs)
• Land preparation*					
• Sowing/transplanting					
• Fertiliser applications					
• Irrigation (pumping)					
• Pest/weed control					
• Crop harvest					
• Solar dryers					
• Post-harvest processing**					
• Other (specify?)					
Total					

** includes ploughing, harrowing, land levelling, etc.*
*** includes threshing, drying, cleaning, milling, and storage.*
Others include like electrical fencing using solar power.

B: Women's empowerment scorecards

No	Indicator	Corresponding requirement	Level(s) of performance	Score
1.	Women's control over decisions regarding household agricultural production	Women should have decision-making power over the choice of the products and markets of the household's agricultural production	a) Women have at least equivalent decision-making power	10
			b) Women have some but less than equivalent decision-making power	2
			c) Women have none or marginal decision-making power	0
2.	Women's control over decisions regarding their own labor input	Women should have decision-making power over how much labor they contribute to agriculture, the timing of their labor input and the type of activities they do	a) Women have at least equivalent decision-making power	10
			b) Women have some but less than equivalent decision-making power	2
			c) Women have none or marginal decision-making power	0
3.	Women's satisfaction regarding their labor input	Women's labor input in agricultural production should be in balance with their productive and domestic tasks, leisure and possible other income generating activities	a) Women are satisfied	10
			b) Women are partly satisfied (e.g. no balance during peak labor-requiring periods)	2
			c) Women are structurally unsatisfied	0
4.	Women's access to information and capacity building	Women should have access to information, training and extension services related to women activities	a) Women have equal access	10
			b) Women have less access	2
			c) Women have good access	0
5.	Women's access to seasonal resources for farm activities	Women should have decision-making power and equal access to seasonal resources for farm activities including hired labor, seeds, fertilizers, pest control products & credit	a) Women have at least equivalent decision-making power and equal access	10
			b) Womenhavesomebutlessthanequivalentdecision-makingpowerandlessthanequalaccess	2
			c) Women have none or marginal decision-making power and no access	0
6.	Women's control over long-term resources for farm activities	Women should have decision-making power and share ownership of long-term resources (decisions that are made once a year, which affect whole farm, including: land, forests, gardens, livestock, agricultural equipment, irrigation, credit, buildings)	a) Women have at least equivalent decision-making power and ownership	10
			b) Women have some but less than equivalent decision-making power or ownership	2
			c) Women none or marginal decision-making power or ownership	0
7.	Women's control over decision-making regarding household income	Women and men should have decision-making power for total household income	a) Women have at least equivalent decision-making power	10
			b) Women have some but less than equivalent decision-making power	2
			c) Women have none or marginal decision-making power	0
8.	Women's control over their personal income	Women should have equivalent or greater control of income they generate themselves	a) Women have equivalent or greater control	10
			b) Women have some but less than equivalent control	2
			c) Women have no or very limited control	0
9.	Women's participation in collective decision making	Women should be able to participate in group decision-making processes regarding rice production and marketing (e.g. irrigation scheduling, leadership committees of cooperatives, credit groups)	a) Women participate in group leadership, are active in group decisions and their voices are valued	10
			b) Women are present during group decisions, but their contributions are not given full weight	2
			c) Women are excluded from group decision making	0
10.	Violence against women (UN resolution 48/104 of 20 December 1993)	There must not be any violence that results or is likely to result in physical, sexual or mental harm or suffering to women, including threats of such acts, coercion or arbitrary deprivation of liberty, whether occurring in public or private life	a) There are no cases of violence	10
			b) There is at least one case of violence	0
			Total score (0-100)	

UPSCALE

C: Logical framework of UPSCALE project

Log-frame table: Impacts, outcomes and outputs, corresponding measurable indicators, **Means of verification** and assumptions.

Log Frame	Measurable indicators	Means of verification (MoV)	Important assumptions
Impact 1: Smallholder farmers have improved income and climate resilience in Odisha and Assam	*An increase of 30-35% farmer income over the baseline in the new project areas*	Interviews, baseline indicators, (*targeted base line survey will be conducted in the new project areas during the first year*) farmer surveys	• Field verification • Estimating the efficiency • Active cooperation of stakeholders, especially state agencies and farmer communities. • Government prioritizes upscaling, climate adaptation initiatives. • Government programs/ policies actively take up project results/upscaling frameworks • Cooperation from local government agencies and farmers • Access to databases and study sites • Collaboration of farmers in field demonstrations and upscaling
Outcome 1.1: Sustainable crop productivity of smallholders and value chain in Odisha and Assam increased.	*An increase of 30% in crop yields over the baseline in the new project areas, 20-25% increase in soil organic carbon, GHG (methane) emissions reduced by 25-30%*	Crop yields, measurement in field and evaluation.	
Output 1.1.1: Upscaling frameworks developed.	*Upscaling frameworks made accessible for use by stakeholders in Odisha and Assam.*	Reports/manuals published	
Output 1.1.2: A toolbox of sustainable and climate resilient rice technologies developed (including crop, nutrient, soil, water management, and seed systems)	*Toolbox of CRRA technologies evaluated and made available to the beneficiaries (farmers, district agriculture officials, etc) .*	Manuals published, *number of training programmes that have used the toolbox.*	
Output 1.1.3: Integrated Pest management	***30-35 percent of farmers** practicing IPM measures as compared to the baseline in the project areas*	Field evaluations and interviews with farmers	
Output 1.1.4: Efficient value chains developed with project inputs (rice, legumes, vegetables)	***4-5 crop value chain maps** developed*		
Outcome 1.2: Amount of fossil fuels used on farm reduced	*At least **25% decrease** in use of fossil fuels (diesel) as compared to the baseline*	Measurement in field and evaluation.	
Output 1.2.1: Solar devices use on farms demonstrated.	*Percentage of farmers using solar devices in the project villages against the baseline*	Survey data and field verifications	
Outcome 1.3: Extent of area and farmers practising sustainable, and climate resilient rice/agriculture technologies expanded	*At least 40% of farmers adopting and 30% area coverage under sustainable and CRRA technologies increased*	Interviews and field evaluation	▪ Collaboration of state government officials, farmers & extension agents.
Output 1.3.1: 18 village knowledge centres (digital VKCs) established	*18 virtual VKCs (digital) operational and farmer linked*	Functional village knowledge centres and farmer connectivity rates	▪ Knowledge gained effectively used by farmers in upscaling

Output 1.3.2: Farmer capacity building workshops on sustainable farming systems organized	*Numbers of farmers (men and women) trained*	List of (attendance) of trainees/farmer feedback	
Output 1.3.3: Policy frameworks for up-scaling selected CRRA technologies developed.	*2 Policy manuals/ or briefs*	Policy inputs provided to state and national climate policy and actions	▪ State climate action pan put into action
Impact 2: Improved food and nutritional security of smallholders in Odisha and Assam	*Area and % of farmers within and outside project areas practicing sustainable and climate resilient technologies.*	Base line indicators	• Enabling policy environment • Conducive environment for cooperation • Market access /FPOs engagement • Cooperation between the stakeholders to achieve desired outcome and impact
Outcome 2.1: Increased women and youth participation in upscaling	*35-40 % of women participating in household decision making*	Base line indicators	
Outcome 2.2: Improved farmers participation in local institutional arrangements for upscaling	*Number of farmers participating in decision making*	Interviews; base line indicators	
Output 2.2.1 Farmers and local lead agencies for scaling up trained	*Number of farmers and lead agencies trained for scaling up CRRA technologies*	Interviews and base line indicators	
Outcome 2.3: State governments integrate project results into state level climate action plan	*Number of participatory consultations and joint strategy preparation initiatives*	Interviews with farmers	
Output 2.3.1: Multi-actor/Stakeholder interaction workshops organized.	*8 stakeholder workshops organised.*	State level climate action plan	
Output 2.3.2: Science-policy linkages improved	*2 policy dialogue forums organised.* *2 Policy briefs published*	Minutes of the workshops	