

**E-Learning Module
for Decentralized Renewable Energy Applications
Agriculture, Dairy And Fishery**

CAPACITY GAP ASSESSMENT

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Bonn and Eschborn, Germany

Address

First Floor, B5/2 Safdarjung Enclave
New Delhi-110029, India

T: +91 4949 5353

F: +91 4949 5391

E: info@giz.de

I: www.giz.de

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Responsible

Nilanjan Ghose, Project Manager

E: nilanjan.ghose@giz.de

Author

PricewaterhouseCoopers Private Limited

Content Review

Prasun Kumar Das, Energy Advisor, IGEN-PWSP, GIZ-India

On behalf of

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List of Abbreviations

Abbreviation	Full Form
AAGC	Anil Agarwal Green College
AC	Alternating Current
AICTE	All India Council of Technical Education
APRACA	Asia-Pacific Rural and Agricultural Credit Association.
BABTPL	BAIF Agro and Biotechnology Pvt Ltd.
BCS	Battery-charging station
BOP	Bottom of the Pyramid
CAFT	Centre for Advanced Faculty Training
CEC	Consortium for Educational Communication
CEE	Clean Energy Entrepreneurs
CEEW	Council on Energy, Environment and Water
CIEMAT	Centre for Research in Energy, Environment and Technology
CIFRI	Central Inland Fisheries Research Institute
CIFT	Central Institute of Fishery Technology
CLEAN	Clean Energy Access Network
CPI	Climate Policy Initiative
CSE	Centre for Science and Environment
CSIR	Council of Scientific and Industrial Research
CSO	Civil society organization
DC	Direct Current
DISCOM	Distribution company
DRE	Distributed / decentralized renewable energy
DST	Department of Science & Technology
EPC	Engineering, Procurement & Construction
ESMAP	Energy Sector Management Assistance Program
FPC	Farmer Producer Company
FPO	Farmer Producer Organisation
GSES	Global Sustainable Energy Solutions
HACCP	Hazard analysis and critical control points
HKH	Hindu Kush Himalaya
HRD	Human Resource Development
ICAR	Indian Council of Agricultural Research
IGEN-PSWP	Indo-German Energy Programme, Promotion of Solar Water Pumps
IGNOU	Indira Gandhi National Open University
IIFPT	Indian Institute of Food Processing Technology
IIMB	Indian Institute of Management, Bangalore
IRENA	International Renewable Energy Agency
ISO	International Organization for Standardization
ITEC	Indian Technical and Economic Cooperation
ITI	Industrial Training Institute
IWMI	International Water Management Institute
JRF	Junior Research Fellow
KVK	Krishi Vigyan Kendra Knowledge
MANAGE	National Institute of Agricultural Extension Management

MFI	Microfinance institutions
MNRE	Ministry of New and Renewable Energy
MoFPI	Ministry of Food Processing Industries
MPPT	Maximum Power Point Tracking
MSME	Ministry of Micro, Small and Medium Enterprises
NABARD	National Bank for Agriculture and Rural Development
NARES	National Agricultural Research and Education System
NBFI	Non-bank financial institution
NCERT	National Council of Educational Research and Training
NERC	North-East Regional Centre
NERC	North-East Regional Centre Guwahati
NFDB	National Fisheries Development Board
NFFBB	National Fresh Water Fish Brood Bank Bhubaneshwar
NGO	Non-Government Organisation
NIMSME	National Institute for Micro, Small and Medium Enterprises
NIOS	National Institute of Open Schooling
NIRDPR	National Institute of Rural Development and Panchayati Raj
NISE	National Institute of Solar Energy
NITTR	National Institute of Technical Teachers Training and Research
NMAET	National Mission on Agricultural Extension & Technology
NOS	National Occupational Standards
NPTEL	National Programme on Technology Enhanced Learning
NPTI	National Power Training Institute
NRESF	National Renewable Energy Science Fellow
NRREP	National Rural and Renewable Energy Programme
NSDC	National Skill Development Corporation
O&M	Operations & Maintenance
PAYG	Pay As You Go
PM KUSUM	Pradhan Mantri Kisan Urja Suraksha Evam Utthaan Mahaabhiyan
PRI	Panchayati Raj Institutions
PV	Photovoltaic
QP	Qualification Packs
R&D	Research & Development
RA / PDF	Research Associates and Post-Doctoral Fellows
RAF	Rural and Agricultural Finance
RE	Renewable Energy
RECIPMT	REC Institute of Power Management & Training
REEECH	Renewable Energy & Energy Efficiency Capability for the Hindukush Himalaya
RET	Renewable Energy Technologies
RFP	Request for Proposal
RSETI	Rural Self Employment Training Institutes
RUDSETI	National Academy of Rural Development & Self Employment Training Institute
SAME	Sub-Mission on Agricultural Extension
SCAAP	Supervisory Capital Assessment Program & Capital Assistance Program
SCFGJ	Skill Council for Green Jobs
SDC	Swiss Agency for Development and Cooperation
SDG	Sustainable Development Goal

SEC	Solar Energy Centre
SEED	Society for Energy, Environment and Development
SETNET	Solar Energy Training Network
SIP	Solar irrigation pumps
SME	Small & Medium Enterprises
SNA	State Nodal Agency
SPI	Smart Power India
SPV	Solar Photovoltaic
SRF	Senior Research Fellow
SRLM	State Rural Livelihood Mission
STRY	Skill Training of Rural Youth
SURE	Sakhi Unique Rural Enterprise

1. Executive Summary

The primary objective of this study is to develop self-paced e-learning modules to promote the utilization of Distributed Renewable Energy (DRE) for productive use across different stages of agricultural, dairy, and fishery value chains. In the context of the agricultural value chain, these encompass stages such as irrigation and pre-harvesting, post-harvesting, as well as food preservation for storage and transportation. The dairy value chain entails milk production and preservation, milk processing and storage, marketing, distribution, while the fishery value chain includes primary production, post-production, processing, distribution, and consumption. This study is in line with the priorities set by the Ministry of New and Renewable Energy (MNRE) in its draft policy framework for DRE livelihood applications. Capacity development in the DRE segment within the agriculture, dairy, and fishery sectors aims to empower local institutions enhance their decision-making capabilities in the field of DRE. This assignment serves as evidence of the need for assessing capacity gaps, developing curricula and training materials, and supporting training partners in conducting independent training courses.

The curriculum that has been developed is designed to address the requirements of the DRE sector in the three relevant value chains, with a particular emphasis on market viability of such technologies in the short, medium, and long terms. This approach aligns with the identified needs highlighted by GIZ, which emphasizes capacity building as a crucial element for the effective implementation of DRE in these three value chains.

Our strategy for executing this project involves a combination of **desk research and primary consultations**. The team has started with reviewing the existing national and international resources / study material available with public and private organizations, training institutes, not for profit organizations, multilateral development organizations in India and outside for decentralized renewable energy across three value chains. The review aimed to gather insights into the existing knowledge landscape and identify relevant materials that can contribute to the development of DRE technologies in these sectors. The focus, thus far, has also been on identifying the market trajectory for DRE appliances / products / systems most actively been used across the three value chains. The outcomes of this analysis influenced the process of identifying the knowledge and the skills required by the market for successful deployment of DRE in the three focus sectors.

To further assess the gaps in training needs, the team has also conducted 325 stakeholder consultations, utilizing both primary consultations and questionnaire-based responses. The primary objective of these consultations was to collect feedback from industry and market stakeholders regarding the existing training materials and identify the shortcomings within the DRE training programs in the agriculture, dairy, and fishery sectors.

At present, training sessions are being conducted through various approaches, including:

- *Face-to-face delivery*: This involves classroom training, seminars, roundtables, group exercises, workshops, assessments, field trips, and on-the-job learning.
- *Online delivery*: This method utilizes e-learning platforms, virtual meetings, webinars, and mobile applications to provide training remotely.
- *Blended learning*: This approach combines elements of face-to-face and online delivery to create a comprehensive learning experience.

The majority of the training programs examined primarily rely on face-to-face training sessions. These sessions are predominantly conducted by KVKs, SAMETIs, and training institutions. However, certain professional development training providers adopt a combination of face-to-face and online training methods.

It is evident that training gaps on technical know-how are adequately addressed among all stakeholder groups, while business guidance, policy, and financial topics are covered in select professional development programs and through KVKs, SAMETIs, and training institutes. However, the development

of entrepreneurship skills and the establishment of local professional networks through the training of master trainers have not yet reached a significant scale.

As a next step, a training need assessment analysis has been undertaken. The trainings needs have been identified for each stakeholder category including farmers, service providers, product developers, rural entrepreneurs, SRLMs, SNAs and State Government Departments. These trainings needs have been divided into five key buckets for each of the three value chains, namely, awareness enhancement, technical know-how, business model guidance, entrepreneurial skill development and training of trainers.

For farmer groups, the main training gaps exist around **awareness enhancement, technical know-how, guidance on expanding business opportunities in the focused sectors, policy and financial aspects.**

Specifically, in the agriculture, dairy and fishery sectors, farmers possess a solid understanding of the benefits of solar water pumps on their farmland. However, **their knowledge regarding other applications of solar energy, such as solar cold storages, solar dryers, micro-grids, and mini-grids to power various farm equipment like rice hullers, threshers, milling machines, and aerators, is limited.** The link between the adoption of solar-based farm equipment and its potential impact on productivity, livelihoods, and food security requires further exploration within the farming community. For instance, in the dairy sector, it is crucial to clarify to large farmers that DRE-based cold storage products are cost-effective and offer a lucrative return on investment, motivating them to reconsider their current dairy product storage methods.

Moreover, **farmers still lack knowledge regarding the ways in which harnessing solar energy can positively impact their farming practices, particularly in terms of increasing irrigation intensity and substantially boosting their income levels.** Closing this knowledge gap is of utmost importance to help farmers realize the potential benefits of integrating solar-based technologies into their agricultural activities. Similarly, in the dairy sector, farmers have limited understanding of the technical aspects associated with cold storage systems and solar milk chillers. This includes monitoring temperature in control panels, utilizing remote monitoring systems, conducting inspections of solar panels, determining optimal locations for PV panel installation, carrying out basic operations and maintenance tasks, as well as cleaning the chillers and cold storage units.

Additionally, through stakeholder consultations, it is understood that the **farmers occasionally lack a comprehensive understanding of the complexities involved in system installation, resulting in potential investment losses or additional costs due to poor decision-making.** Therefore, it is crucial to enhance their capacity in key areas related to equipment installation and maintenance practices across all three sectors.

Furthermore, **farmers often harbor concerns about potential soil contamination when installing solar systems on their farmland.** They worry about the possibility of rendering the land unusable after the operational life of the solar system comes to an end. Addressing these concerns requires providing farmers with the necessary capacity building to alleviate their worries and educate them about the minimal risk of soil contamination during the decommissioning and removal of the DRE system from their farmland.

In terms of policy training gaps, within the farming community, there exists limited knowledge about the policies and schemes in the DRE sector which could potential increase their affordability of the DRE products. In certain cases, farmers have encountered information about these schemes and policies in passing, yet they lack a clear understanding of how to engage with such policies and reap the corresponding advantages. This challenge has been consistent across all matured DRE technologies within the agriculture, dairy and fishery sector.

As far as the financial aspects are concerned, farmers often encounter difficulties due to their inability to be able to make the initial investment required for acquiring DRE solutions. When farmers cannot

afford these DRE solutions, their motivation to participate in such programs diminishes. Despite the presence of bank loans and other financial assistance options in the market, they tend to hesitate when it comes to seeking financial support from commercial institutions. Insights gathered from interactions with farmers reveal that they lack the technical expertise needed to prepare detailed project reports and financial models to present to banks or FIs for undergoing the due diligence process and securing loans. This reflects a significant gap in training within the farming community.

For service providers, product manufacturers and rural entrepreneurs, training gaps exist around awareness enhancement, technical know-how, guidance on upscaling business opportunities, policy, financial and most importantly, entrepreneurial skill development.

Similar to farmer groups, **there is a need to build the capacity of service providers, product manufacturers, and rural entrepreneurs regarding the diverse productive uses of DRE solutions.** Identified capacity gaps exist among these stakeholders in terms of understanding the range of productive loads that their businesses can support through their product offerings. Addressing these gaps is crucial to enable the effective utilization of DRE solutions for various productive purposes.

Furthermore, the role of product manufacturers, service providers, and rural entrepreneurs in meeting the specific demands of local customers and designing optimal DRE systems is significant. However, **these stakeholders often struggle to grasp the precise technology requirements of DRE at the farm level. It is imperative to design innovative DRE technologies that consider resource constraints, logistical challenges, and usability in rural contexts.** Addressing this challenge requires capacity building for product manufacturers, service providers, and rural entrepreneurs. They need to acquire the knowledge and understanding necessary for designing DRE solutions that effectively cater to the needs and constraints of rural farming communities in the agriculture, dairy, and fishery value chains.

Additionally, **service providers and rural entrepreneurs frequently lack the skills to identify sustainable, robust, and cost-effective supply chain processes** while focusing on expanding their businesses and enhancing energy security for their customers. At this stage, there is a need to enhance the capacity of service providers and rural entrepreneurs in fundamental aspects of supply chain management that are highly relevant to their businesses.

Moreover, **rural entrepreneurs frequently venture into the realm of experimenting with new customer value propositions.** As a result, their decision-making processes need to be flexible and centered around continuous learning. These enterprises may explore various system or product variations before identifying a compelling value proposition and target customer segments. The aim of such decision-making is to minimize uncertainty regarding the product or service and the market in which the enterprise operates. However, **rural entrepreneurs often lack the necessary skill set to effectively engage in this type of decision-making.** It is essential to address this gap through training and capacity building initiatives. By equipping rural entrepreneurs with the knowledge and skills required for adaptive decision-making and continuous learning, they can effectively navigate the challenges of experimentation, reduce uncertainties, and enhance their prospects of success in rural markets.

The training gaps in policy and financial domains corresponds to the ones that exist for the farmer groups. At times, product manufacturers, service providers, and rural entrepreneurs have limited awareness concerning the existing schemes and policies for DRE solutions within the market. Furthermore, they lack a comprehensive understanding of the procedures necessary to access the advantages offered through these schemes. In terms of financial aspects, product developers, service providers and rural entrepreneurs have a training need to understand the cost-benefit of investing a DRE business. This involves obtaining a thorough understanding of how their investments and endeavors result in financial gains throughout the year. By recognizing the direct link between business actions and income, they can formulate informed decisions and strategies to optimize their profits. Equally crucial is their awareness of the particular documentation requirements needed to secure loans from banks and other financial institutions.

For State Government Departments, SRLMs and SNAs, training gaps fall in the buckets of **awareness enhancement and training of trainers**.

SRLMs, SNAs, and State Government Departments require capacity building to raise awareness about the favorable ecosystem they have established. This ecosystem encompasses various elements such as skill development, policy frameworks, fiscal and financial incentives, technology support, and more. **It is crucial to effectively communicate and disseminate information about these provisions to ensure that potential beneficiaries and stakeholders are well-informed about the available support.**

Additionally, capacity building is needed for Government Departments, SRLMs, and SNAs **to conduct demand assessments of DRE livelihood applications in the agriculture, dairy, and fishery sectors, with the aim of prioritizing market expansion.** State Governments can provide support mechanisms to assist in identifying and mapping beneficiaries, particularly for rural enterprises that may lack the capacity to carry out market and need assessments. These measures can significantly contribute to scaling up the adoption of DRE solutions for productive purposes within the farming community.

Another important training requirement for SRLMs and SNAs is the **training of trainers to facilitate capacity building among different stakeholder groups. This involves the development of two essential types of skills: domain skills and soft skills.** Domain skills encompass sector-specific expertise, technical knowledge, and proficiency in DRE technologies, their applications, and operations. On the other hand, soft skills involve effective presentation techniques used by trainers to deliver key messages. Currently, master trainers at SRLMs and SNAs lack these skills, highlighting the need for their development to enhance their effectiveness as trainers.

2. Value Chain Analysis

2.1. Agriculture Value Chain

Ideally, an agricultural value chain would incorporate developing seeds, sowing, pest control, agricultural production, harvesting and handling, transportation, storage, processing, packaging, finance, marketing and market feedback. These activities can be clubbed into different stages as mentioned below:



Figure 1: Stages in agriculture value chain

Across the major stages of the agriculture value chain, various equipment is used to carry out the harvesting activities which can be based on renewable energy. Some of these include:

Table 1: Possible DRE equipment in agriculture value chain

Stage		Possible DRE Equipment ¹
Pre-farm		<ul style="list-style-type: none"> • Soil testing kit • Seed treatment unit • Bio fermenter
On-farm		<ul style="list-style-type: none"> • Transplanter • Seeder • Sprayer • Weeder • Thresher with winnowers • Water pump
Post-Harvest Management	Produce	<p>Paddy Processing</p> <ul style="list-style-type: none"> • Parboiler • Pre-cleaner • Destoner • Huller with polisher • Dehuller • Separator • Polisher • Grader <p>Millet Processing</p> <ul style="list-style-type: none"> • Pre-cleaner • Dehuller • Grader and destoner <p>Sorter with Grader</p> <ul style="list-style-type: none"> • Roller grader • Vibro mat grader • Round table grader • Solar cabinet dryer • Solar bubble dryer • Biomass dryer
Storage		<ul style="list-style-type: none"> • Cold storages <p>Passive storages:</p> <ul style="list-style-type: none"> • Pits • Heaps • Ventilation
Horticulture		<ul style="list-style-type: none"> • Potato Washer and peeler • Pulp making • Fruits and Vegetable slicer • Apple peeler and slicer • Tomato blancher • Banana Mill
Mills		<ul style="list-style-type: none"> • Flour mill • Dal mill • Oil mill • Chilli Pounding

¹ List obtained from SELCO Foundation

Food processing	Roti rolling: <ul style="list-style-type: none"> • Dough kneading • Roller type machine • Conveyor belt type machine • Built environment 	Snack making: <ul style="list-style-type: none"> • Papad making • Chakli making • Sev Bhujija making • Pani puri making
	Puffed rice: <ul style="list-style-type: none"> • Built environment • Stirrer: single spindle • Stirrer : four spindle • Roaster 	Chips making: <ul style="list-style-type: none"> • Built environment • Oil dryer • Chips maker • Vermicelli maker • Pickle maker • Packaging machine • Millet café
Pest Management	<ul style="list-style-type: none"> • Snake repellent • Monkey repellent • Solar fencing • Elephant repellent 	

2.2. Dairy Value Chain

The dairy value chain in India involves three major stages:



Figure 2: Stages in dairy value chain

Across the value chain of dairy, several DRE appliances / products can be integrated. A list of the same has been presented below:

Table 2: Possible DRE equipment in dairy value chain

Stage	Possible DRE Equipment ²
Input	<ul style="list-style-type: none"> • Hydroponics • Chaff cutter • Vaccine cold storage • Vaccine carriers
On-farm	<ul style="list-style-type: none"> • Dairy shed • Pressure washer • Water heater • Foggers • Biodigester • Milking machine
Collection	<ul style="list-style-type: none"> • Can chiller • Instant milk chiller • Bulk milk chiller • Weighing + Milk testing

² List obtained from SELCO Foundation

Processing & value addition

- Butter churning
- Khowa Machine
- Khowa built environment

2.3. Fishery Value Chain

A multitude of value chain actor combinations, harvesting techniques, fish products, and geographical contexts create a wide range of possibilities for fish to be supplied to consumers. The fishery value chain in India involves several stages as mentioned below:

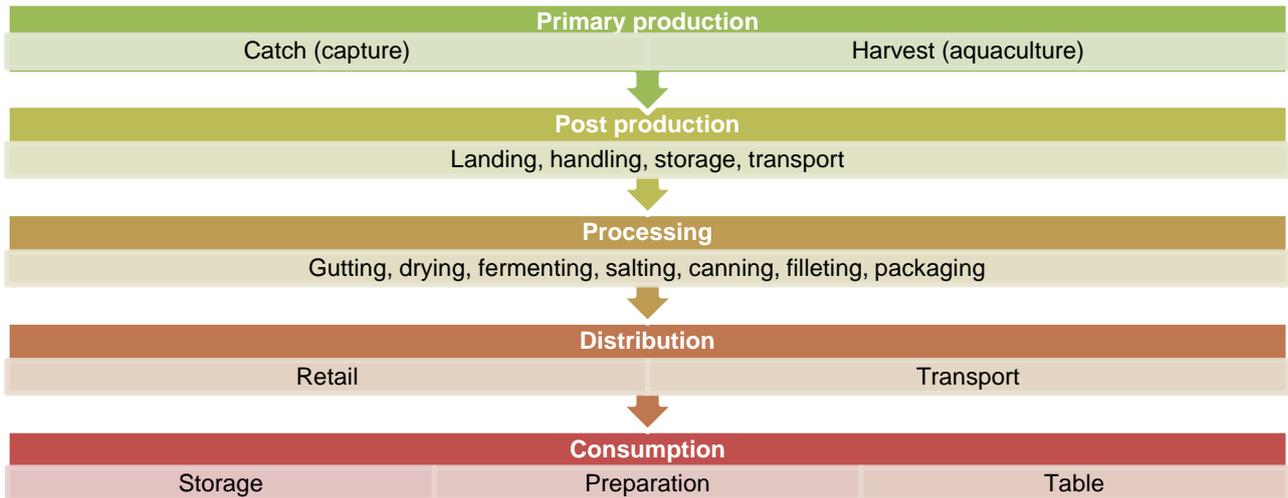


Figure 3: Stages in fishery value chain

Across the steps of this value chain, DRE technologies can be integrated. Some of the key DRE technology options have been summarized in the table below:

Table 3: Possible DRE equipment in fishery value chain

Stage	Possible DRE Equipment ³
Catch	<ul style="list-style-type: none"> • Solar operated fishing boats
Harvest	<ul style="list-style-type: none"> • Solar pumps • Solar aerators • Cage fishing
Post-production	<ul style="list-style-type: none"> • Solar cold storage • Solar deep freezers
Processing	<ul style="list-style-type: none"> • Solar dryers • Solar dehydration units

3. Capacity Gap Assessment of Different DRE Sector Stakeholders Within Value Chains

3.1. Methodology

The review aimed to gather insights into the existing knowledge landscape and identify relevant materials that can contribute to the development of DRE technologies in these sectors. As a part of this assignment, the existing national and international resources / study material has been reviewed which

³ List obtained from SELCO Foundation

are available within the public and private organizations, training institutes, not for profit organizations, multilateral development organizations in India and outside for decentralized renewable energy across three value chains.

Furthermore, an assessment has been carried out concerning the market trajectory of DRE appliances, products, and systems that are actively being utilized in the agriculture, dairy, and fishery value chains. By understanding the current market trends and preferences, the intention was to acquire valuable insights that could guide the identification of necessary knowledge and skills required for the successful deployment of DRE in these sectors. The combined findings from the review and market analysis played a crucial role in shaping the approach for identifying the specific knowledge and skills needed by the market to effectively implement DRE solutions in the agriculture, dairy, and fishery sectors.

As a next step, to delve deeper into the realm of existing training need gaps, **325 stakeholder consultations has been conducted** (through primary consultations and questionnaire-based responses). The objective of the primary consultations has been to gather industry and market feedback around the available training material and the gap that exists within these DRE trainings in agriculture, dairy and fisheries sectors.

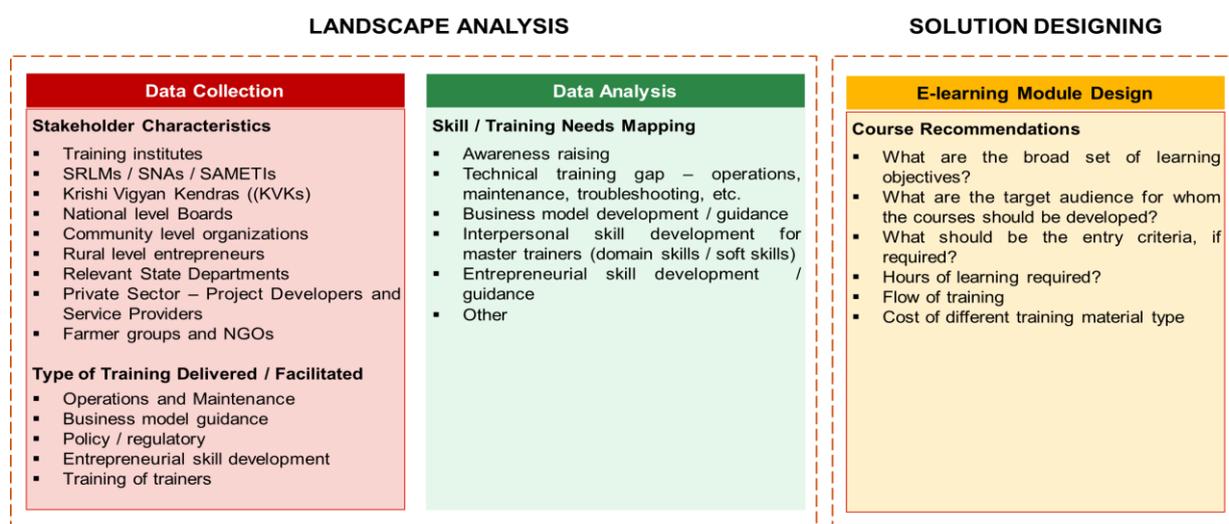


Figure 4: Process followed for development of self-paced e-learning training modules

The feedback gathered from primary consultations will also form the basis on developing the e-learning material. The chart below showcases stakeholder category-wise consultations undertaken:



Figure 5: Number of stakeholder consulted

Farmer groups cover farmer cooperatives and associations. Capacity gaps have been identified for both farmers belonging to the farm groups and the staff of these farmer groups.

NGOs cover non-governmental organisations promoting sustainable livelihoods by building the capacities of farmers on improved agricultural development practices and the latest technologies that increase crop yields, conserve water, and improve soil fertility.

Project developers and service providers cover companies either engaged in production and manufacturing of DRE products in the agriculture, dairy and fishery value chains or companies engaged in distribution of these DRE products to the farmers and rural population.

Rural entrepreneurs cover farmers and rural population carrying out the business in rural areas with the utilization of local resources. Examples of rural entrepreneurship include small businesses, family farms, and agribusinesses.

Community level organisations cover organisations working at the local level to improve the growth of agriculture, dairy and fishery sectors and the rural economy through community based and self-help mechanisms. Examples include farmer cooperative society, self-help group and farmers club or farmers service society.

National level Boards cover National Dairy Development Board, National Fisheries Development Board, etc. which are working to strengthen farmer owned institutions and support national policies that are favorable to the growth of such institutions.

Krishi Vigyan Kendras (KVKs) cover are the agricultural science centres established as innovative institutions for imparting vocational training to the practising farmers, school dropouts and field level extension functionaries.

State Rural Livelihood Missions (SRLMs) cover agencies aimed at organizing the poor into SHG (Self Help Groups) groups to start some entrepreneurial activities and make them capable for self-employment. This forms a part of the poverty alleviation project implemented by Ministry of Rural Development, Government of India.

State Nodal Agencies cover agencies in the states, designated by the State Government to act as the agency to deal with issues related to coordinated development of renewable energy; subsidy approval and disbursement to persons developing distributed energy projects, etc.

State Agricultural Management And Extension Training Institutes (SAMETIs) cover state level Institutional mechanism for extension provided under Extension Reforms Scheme for catering the training and Human Resource Development needs of Extension functionaries

Training institutes cover institutions actively providing training courses and programmes in distributed renewable energy space in the agriculture, dairy and fishery sectors.

The list of stakeholders consulted has been provided in Annexure 1. For each sector, separate questionnaires were prepared for each stakeholder group. Responses were gathered on the basis of these questionnaires. Detailed questionnaires used to garner stakeholder responses have been provided in Annexure 2.

3.2. Training Modes Used by Stakeholders

Currently, trainings are being delivered using the following approaches:

- **Face-to-face delivery** – classroom training, seminars, roundtables, group exercises, workshops, assessments, field trips or on-the-job;
- **Online delivery** – e-learning, virtual meetings, webinars, or even mobile applications;
- **Blended learning** – usually a mix of face-to-face and online delivery

Most of the training programmes reviewed use the face-to-face approach. These sessions are mostly delivered by KVKs, SAMETIs and training institutions. Some professional development training providers use a blend of face-to-face and online training. Blended delivery allows for more flexibility in terms of when, where and how different types of training is done. For example, theoretical training can be done remotely or online, while practical work is done in the classroom or the field. It is understood that the blended approach helps the training providers to keep their costs down and widen the audience of potential students. For online delivery, it has been mentioned that the success of any programme involving online content depends on the training providers and students having access to power, computers / smartphones and the internet.

3.3. Training Content Offered

The figure below summarizes the type of content covered by the different categories of stakeholders. It shows that content on technical know-how is well covered across all stakeholder groups while business guidance / policy / financial topics are covered in some professional development programmes and through KVKs, SAMETIs and training institutes. Entrepreneurship skill development and local professional network creation through development of master trainers has still not achieved scale. The numbers provided below are based on training programmes / modules reviewed.

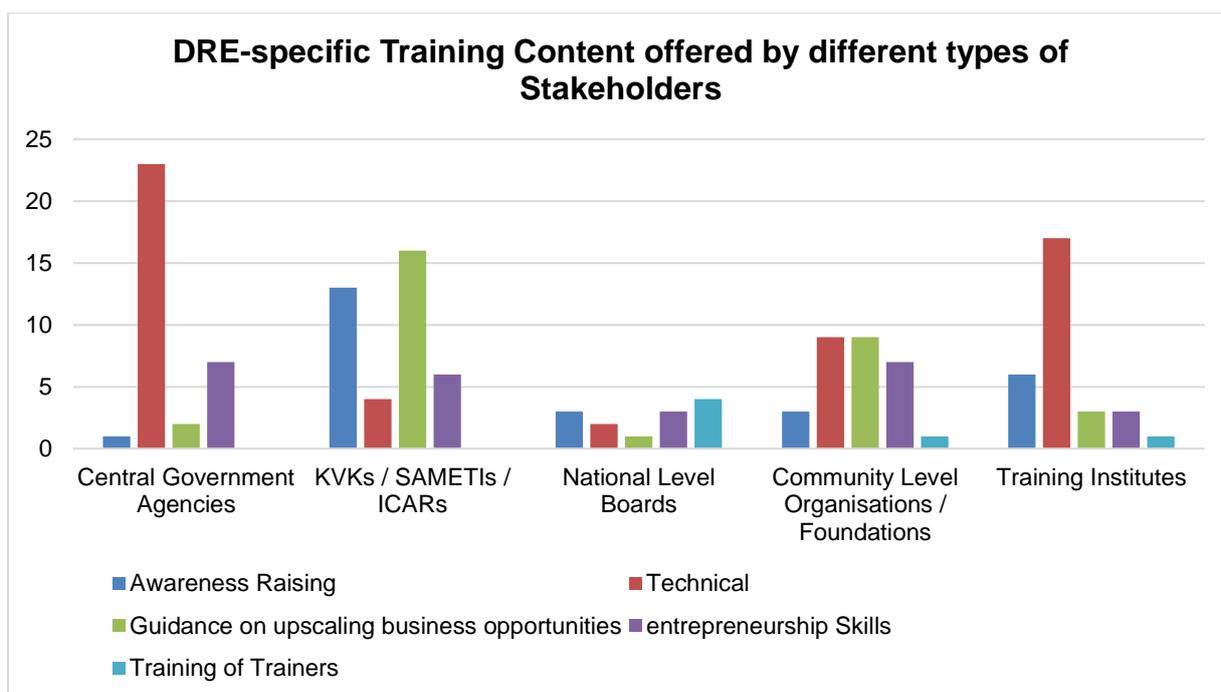


Figure 6: DRE-specific Training Content offered by different types of Stakeholders

Training gaps on policy and financial aspects have also been briefly covered in the report. From the current analysis, it is understood that **at the national level, MNRE has been spearheading skill development and training in the clean energy sector (including DRE) in India** since over two decades. Apart from its in-house resources, the Ministry extensively interacts with industry experts, veterans, and professionals to identify the manpower competencies and skill gaps and chart the future course of skills for the industry. **The focus of these trainings and course is largely on expanding technical competencies through creating a qualified and trained workforce.** NISE, NPTI and SCFGJ also have a similar focus. These organizations target employability / professional skill development-oriented training. On the other hand, organizations like **SWAYAM Central, MANAGE, ICAR and its affiliated institutes** conduct dedicated capacity building sessions, workshops and trainings in DRE sector for farmers and agriculture extension workers. These trainings are mostly conducted offline and are **focused on awareness creation about the DRE technology, technical and operational guidelines, their innovative applications, business models, etc.** These trainings come under different cost brackets.

National Fisheries Development Board, National Institute for Micro, Small and Medium Enterprises, National Skill Development Corporation and National Academy of RUDSETI have also been offering trainings in the DRE segment in agriculture, dairy and fishery sectors. Their focused audience includes across farmers, budding entrepreneurs, college graduates, working professionals, SHGs, FPOs and unemployed youth. The larger focus the trainings provided by these organizations is **facilitating entrepreneurship, capacity building for business expansion and sustainability, creation, development and dissemination of enterprise knowledge and empowering the underprivileged through entrepreneurship.** Furthermore, National Skill Development Corporation also has an e-learning portal known as KaushalMart and e-Skill India which is a resource hub for trainees and a platform that combines skilled resources and closes the supply-demand gap. In the DRE sector, so far, it has published a ‘Facilitator guide to trainees and trainers on Solar Pump technical’ which serves as an approach map for interacting with trainees.

At the state level, most of the organizations such as **SRLMs, community level organizations, SNAs,** etc. are providing training in overall livelihood development of the agriculture, fishery and dairy sectors rather than focusing particularly on productive use of DRE technologies in these sectors. Where such training is being provided, the **focus has largely been on awareness creation, system / product**

installation and operations. On the contrary, **KVKs** offer multiple trainings in the DRE segment in agriculture, dairy and fishery sectors for farmers, FPOs, unemployed youth and other stakeholders with topics spanning across **awareness creation, technical knowhow, financial capacity building, productive use of DRE products,** etc. All of the trainings offered by KVKs are free of cost and usually take place offline (at a physical location). Depending on the topic of discussion, these trainings pan across 1-5 days.

Other than this, training institutes, foundations and NGOs / NPOs are involved in the DRE segment livelihood development. These organizations have dedicated research, demonstration and training centres providing relevant training to different stakeholders across the concerned value chains. Some of the key ones active in the DRE sector include **Global Sustainable Energy Solutions, SELCO Foundation, SwitchON, BAIF Foundation, SEED, CLEAN and UDEMY.** Most of these institutions have dedicated research, demonstration and training centres and have **created an inventory of training material for farmers, technicians, youth, bankers and government officials focused on product awareness creation, installation & maintenance, business model guidance.** The trainings the training institutes offer are not free in most cases. The cost differs from institute to institute and the mode of these trainings is mostly offline.

4. Training Need Assessment

The training need assessment has been carried out with a certain demand group of stakeholders in each of the three value chains. The demand group of stakeholders in the agriculture value chain are **farmers, rural entrepreneurs, product developers and service providers, FPOs / NGOs, SRLMs/SNAs**. Similarly, in the dairy the stakeholders are **farmers, rural aggregators, rural entrepreneurs, product developers and service providers, FPOs / NGOs, SRLMs/SNAs**. In the fishery value chain, the involved stakeholders are **farmers, training institutes, rural entrepreneurs, women self-help groups, FPOs/NGOs, product developers and service providers**.

4.1. Common Training Gaps Across Sectors

Based on the stakeholder consultations and desk based research, a series of training gaps across stakeholders have been identified in the agriculture, dairy and fishery sectors. Some of these training gaps are overlapping across the three focused sectors. The same has been presented in the table below. The sector specific training gaps are documented in the subsequent sections.

Table 4: Common DRE-specific training gaps identified in the agriculture, dairy and fishery sectors

Training Topic	Gaps in training content	Demand Group of Stakeholders
Awareness Enhancement	Less understanding around the use of DRE solutions <ul style="list-style-type: none"> Protecting DRE systems from theft / stealing / robbery 	<ul style="list-style-type: none"> Farmers Rural Entrepreneurs
Technical aspects	Need for understanding of installation best practices <ul style="list-style-type: none"> Installing DRE equipment in flood plains and its impact on cost of DRE system Conversion of land back to agricultural uses at the end of the operational life for DRE system installation on farmland 	<ul style="list-style-type: none"> Farmers FPOs Rural Entrepreneurs
	<ul style="list-style-type: none"> How to select the most suited vendor for installation of DRE systems? 	<ul style="list-style-type: none"> Farmers FPOs
	Less understanding of operation and maintenance <ul style="list-style-type: none"> Cleaning and first level O&M of the system 	<ul style="list-style-type: none"> Farmers FPOs

Guidance on upscaling business opportunities	How to secure supply chain? <ul style="list-style-type: none"> Identifying major players such as raw material providers, assemblers, distributors, retailers, etc while developing a DRE system Raw material requirement and sourcing Determining supplier evaluation criteria Understanding of AMC offered by the vendor 	<ul style="list-style-type: none"> Product developers and Service Providers
	Product branding and marketing <ul style="list-style-type: none"> Use of proper marketing tools After sales customer service 	<ul style="list-style-type: none"> Product developers and Service Providers
	Limited business model assessment <ul style="list-style-type: none"> Identifying bankable business models Investment analysis under CAPEX and OPEX-based business models 	<ul style="list-style-type: none"> Product developers and Service Providers
Entrepreneurial skill development	Need for developing project management techniques / skills <ul style="list-style-type: none"> Optimising the DRE system production process taking into account the existing technical equipment or to start a new investment Targeting the right market for the DRE product 	<ul style="list-style-type: none"> Product developers and Service Providers
	<ul style="list-style-type: none"> Talent management to scale-up the business Opportunities for women to invest in DRE systems at the village level Potential role of local women as technicians / electricians in routine operation and maintenance of DRE systems 	<ul style="list-style-type: none"> Rural Entrepreneurs FPOs / NGOs
Training of trainers	Need for developing domain skills <ul style="list-style-type: none"> DRE Equipment and specifications of machineries for productive uses Preventive and breakdown maintenance of DRE equipment for productive use Capacitating local trainers to be able to install, assemble, and test solar PV systems 	<ul style="list-style-type: none"> SRLMs / SNAs FPO staff / NGO staff
	Need for developing soft skills <ul style="list-style-type: none"> Importance of soft skills and communication Training delivery skills 	<ul style="list-style-type: none"> SRLMs / SNAs FPO staff / NGO staff

Financial aspects	<ul style="list-style-type: none"> • Sources of funding available • Documentation required to avail loans from banks and other financial institutions 	<ul style="list-style-type: none"> • Farmers • FPOs / NGOs • Product developers and Service Providers
Policy	<ul style="list-style-type: none"> • Government schemes, incentives and subsidies available for DRE solutions • Lack of understanding around availing benefits under the schemes, incentives and subsidies available for DRE solutions • Lack of information around the implementing agency to approach for information about the scheme / policy • Documentation required to be submitted to avail scheme / policy benefits 	<ul style="list-style-type: none"> • Farmers • FPOs / NGOs • Product developers and Service Providers

4.2. Training Gaps Specific to Agriculture Sector

Based on the existing trainings available in the country, DRE-specific training needs and skill gaps have been identified within the agriculture sector. This exercise has been carried out only for matured DRE technologies and solutions. These include **solar water pumps, solar cold storages, solar dryers and RE-based mini-grids serving productive loads (such as rice hullers, millers, threshers, etc.)**

Table 5: DRE-specific training gaps identified in the agriculture sector

Training Topic	Applicable DRE solution	Gaps in training content	Applicable Value chain step	Demand Group of Stakeholders
Awareness Enhancement	Solar dryer	Need for understanding environmental and social benefits <ul style="list-style-type: none"> • Quality and hygiene as opposed to open drying for the case of solar dryers. • Improved nutritional conditions and hence, better economic value of produce in the market 	Harvest processing	Farmers
Guidance on upscaling business opportunities	Solar pumps	Less understanding technical specification <ul style="list-style-type: none"> • Which factors decide suitable size of solar agriculture pump? • Demand stimulation, especially with productive users 	Irrigation & pre-harvesting	<ul style="list-style-type: none"> • Farmers • Product developers and Service Providers

	Solar dryers	<ul style="list-style-type: none"> Understanding of multi-seasonal uses of DRE systems to reduce payback period 	Harvest processing	Farmers
	Solar water pumps, RE-based mini-grids	<p>Lack of understanding of impact on crop productivity</p> <ul style="list-style-type: none"> Does solar panels impact the health of the soil underneath or around them? Will solar panels on farmland change the microclimate underneath the panels and impact crops? Is it safe to spray agrochemicals near solar panels? 	Irrigation & pre-harvesting	Farmers

4.3. Training Gaps Specific to Dairy Sector

Based on the existing trainings available in the country, DRE-specific training needs and skill gaps have been identified within the dairy sector. This exercise has been carried out only for measured DRE technologies and solutions. These include **solar milk chillers, solar milking machines and solar refrigerators**.

Table 6: DRE-specific training gaps identified in the dairy sector

Training Topic	Applicable DRE Solution	Gaps in training content	Applicable Value Chain Step	Demand Group of Stakeholders
Awareness enhancement	Solar milk Chillers	<p>Need for understanding economic benefits</p> <ul style="list-style-type: none"> Reduced milk spoilage especially in rural areas where there is no electricity (due to the option of chilling milk) 	Milk production and preserving	<ul style="list-style-type: none"> Farmers Rural aggregators⁴
	Solar refrigerators	<ul style="list-style-type: none"> Economic benefit in terms of increased milk preservation and potentially, higher revenue / earnings Possibility of wide varieties of product storage like curd, paneer, butter, etc. 	Milk Processing and Storage, marketing, and distribution	<ul style="list-style-type: none"> Farmers Rural aggregators

⁴ Rural aggregators- Rural aggregators are intermediaries or entities operating within rural areas who collect, aggregate, and manage the supply of dairy products from local farmers and then distribute these products to various markets or processing facilities. Their role involves coordinating and streamlining the collection and distribution process to enhance efficiency and market access for dairy products produced by local farmers.

	Solar milking machine	<ul style="list-style-type: none"> • Possibility of high yield of milk • Time-saving benefit associated with the milking process 		<ul style="list-style-type: none"> • Farmers • FPOs
Technical aspects	Solar refrigerators, Solar Milk Chillers	<p>Less understanding of operation and maintenance</p> <ul style="list-style-type: none"> • Monitoring system temperature and setting of control panel in a solar refrigerator • Identifying compressor capacity in solar refrigerators and milk chillers • Chilling time duration to be set in the solar milk chillers • Understanding of tank capacity of solar milk chillers and solar refrigerators as per the milk storage requirement 	Milk production, and preserving, marketing and distribution	<ul style="list-style-type: none"> • Farmers • FPOs • Rural Entrepreneurs
Guidance on upscaling business opportunities	Solar Refrigerators, Solar Milk Chillers, Solar Milking machine	<p>Less understanding of technical specifications</p> <ul style="list-style-type: none"> • Selection of suitable size and overall design of the DRE technology based on the business model • Ability to scaling up the business based on market demand 	Milk processing and Storage, milk production, and preserving, marketing and distribution	<ul style="list-style-type: none"> • Product developers and Service Providers
	Solar Refrigerators	<ul style="list-style-type: none"> • Understanding of payback period and its relation to cooling rate/size of solar refrigerators and milk quality 	Milk processing and storage	<ul style="list-style-type: none"> • Product developers and Service Providers

4.4. Training Gaps Specific to Fishery Sector

Based on the existing trainings available in the country, DRE-specific training needs and skill gaps have been identified within the fisheries sector. This exercise has been carried out only for measured DRE technologies and solutions. These include **solar water pumps, solar cold storages, solar dryers and solar aerators.**

Table 7: DRE-specific training gaps identified in the fishery sector

Training Topic	Applicable DRE solution	Gaps in training content	Applicable Value Chain Step	Demand Group of Stakeholders
Awareness enhancement	Solar aerators	<p>Less Understanding of environmental and social benefits of solar aerators</p> <ul style="list-style-type: none"> • Maintaining and improving the water quality, preventing the water from stagnating, leading to fewer algae, nuisance bacteria, and mosquitoes • Improved oxygen level and hence keeping the fish healthy for better economic value 	Primary production	<ul style="list-style-type: none"> • Farmers • FPOs
	Solar dryers	<p>Less Understanding of environmental and social benefits of solar dryers</p> <ul style="list-style-type: none"> • Quality and hygiene as opposed to open drying • Improved nutritional conditions and hence, better economic value of produce in the market 	Post-production, processing	<ul style="list-style-type: none"> • Farmers • FPOs
	Solar cold storage	<p>Less Understanding of environmental and social of solar cold storages</p> <ul style="list-style-type: none"> • Enhanced food security during periods of low catch or market fluctuations • Reduced post-harvest losses in terms of better product quality 	Post-production, distribution, consumption	<ul style="list-style-type: none"> • Farmers • FPOs • Rural entrepreneurs
Guidance on upscaling business opportunities	Solar aerators	<p>Less understanding of technical specifications</p> <ul style="list-style-type: none"> • Sizing of aerators for specific sizes of inland fish farm • Understanding the different types of aerators and their implications on energy consumption 	Primary production	<ul style="list-style-type: none"> • Product developers and service providers
Entrepreneurial skill development	Solar dryers, solar pumps and solar cold storage	<ul style="list-style-type: none"> • Limited understanding of multi-seasonal uses of DRE technologies in fisheries to reduce the payback period • Return on investment, net savings of end users with respect to DRE solutions 	Primary production, post-production, processing, distribution, consumption	<ul style="list-style-type: none"> • Farmers • FPOs

4.5. Identified Training Needs for Different Stakeholders

Various stakeholders are involved or need to be taken on board to ensure the success of DRE projects in agriculture, dairy and fishery sectors. Knowledge required depends on the specific roles of the key stakeholders have or may assume in the course of planning, implementation, operations and productive uses. Specific needs for different stakeholders identified through the consultations are mentioned below:

Agriculture Sector

Farmers and FPOs / FPCs

Awareness Enhancement

India holds a prominent position in the field of agriculture, with a large section of its population relying on this sector for their livelihoods. Nevertheless, due to a lack of awareness, farming in India continues to rely on conventional techniques.

For example, solar water pump and its role on the farmland is well understood by the farmers; however, the association of solar on farmland is restricted to the use of solar water pumps. There is a lacuna that solar panels / micro-grids / mini-grids can power their other farm equipment as well such as rice hullers, threshers, milling machines. The link between the introduction of solar-based agricultural equipment and agricultural productivity, livelihoods and food security still needs to be better understood by the farmer community. They still lack the knowledge about how this can enable them to increase their irrigation intensity, adopt multi-cropping and substantially drive their income levels.

Further, for the farmers, theft of solar modules, inverters, cables and other valuable equipment from a solar PV installation on a farmland is still a common occurrence. This creates a risk perception in the mind of a farmer. An investment in DRE system, thus, is often regarded as a risky proposition. Overall, for a farmer, the potential losses and risks triggered by the theft of solar modules as well as other equipment from an installation are manifold and include:

- **capital losses** (loss of equipment)
- **loss of revenue** due to (partial) shutdowns
- **repurchase costs**, also including installation cost
- **operational safety** due to damages (vandalism) caused by theft
- **loss of confidence** in DRE investments

As such, building the capacity of the farmer to avoid such thefts / robberies is pertinent at this point in time to instill confidence in them for investing in DRE systems. While there are insurance solutions in the market that address theft; however, being ex-post solutions, their coverage often comes with limits that may hardly address the full scope of consequences resulting from equipment theft and also vandalism. As such, as a proactive approach, creating awareness among the farmer groups around theft-control choices they can make is imperative and can be targeted as one of their training needs.

In case of specific DRE products, such as solar dryers, the farmers sometimes do not understand the environmental and social benefits associated with them. These include quality and hygiene benefits as opposed to open drying and improved nutritional conditions and hence, better economic value of produce in the market. From stakeholder consultations and market research, it is understood that

farmers are aware about the uses of solar dryers for drying fruits and vegetables but their decisions are also influenced by the return on their investment as opposed to open drying. What is not understood at their end is the cost associated with crop wastage due to widespread fungal infection resulting from unexpected rains or fog vs destruction of unprotected / open drying of crops. It is also important to build their capacity around quality induced market pricing of the produce which can result from following better crop drying practices.

Technical Know-how

There are several obstacles limiting the adoption and increase of solar irrigation systems on farmlands. One of such challenges is lack of technical expertise among the farming community. Many farmers lack the necessary technical expertise to install and upkeep a solar irrigation system and require support in this regard.

Different parcels of agriculture land have different characteristics. For installing DRE systems on flat terrains, capacity building of farmers is being undertaken in India; however, when it comes to flood plains, not many trainings are being imparted to farmers on how effectively install DRE systems in a floodplain area. While DRE systems can be installed in flood plains, few key points have to be kept in mind such as all electrical equipment will have to be installed above the projected level of flooding. Raising equipment could increase the cost of installation and may negatively impact the project economics. Also, the cost of insurance could be higher for PV systems in a flooding area. Farmers sometimes do not understand these nuances of the system at hand and subsequently, have to incur investment losses / additional cost due to wrong installation choices. As such, it is pertinent to build their capacity around key equipment installation practices such as:

- Anchoring solar panels to prevent collapse or movement during a flooding event
- Flood resistant materials to be used for all DRE system components
- Installing solar panels at or above the flood protection grade

Furthermore, one of the biggest fears farmers have before installing solar systems on their farmlands is that whether the panels will contaminate the ground beneath them since contamination can render the land useless after end of the operational life for solar system installation on farmland. At this stage, they require capacity building around the negligible risk to soil after decommissioning and removing the DRE system from the farmland. Currently, they also fail to understand the requirement of resting the land after system decommissioning which allows the soil to replenish its nutrients. Building their capacity on these aspects is also important to instill confidence in them around secured avenues of income generation from crop production on the land as was being done before the DRE system installation on the farmland.

Guidance on upscaling business opportunities

Farmer would optimize the utilization of available resources to enhance profits by carefully selecting the most favorable alternatives for themselves. A pre-requisite for this is handholding them to be able to diagnose, plan and implement their strategy / business model on ground. However, in the present context, this skill is required to be built in many farmers when it comes to extracting value out their DRE systems. The capacity needs in this regards have been highlighted below.

Selection of optimally sized solar pumping systems is a challenging task, not least because farmers' demand for energy for irrigation is a complex, derived demand. Several technical, biophysical and social factors govern the pump set size, which needs to be properly accounted while designing a matching solar pumping system. Most often than not, farmers fail to account for such factors when deciding the

optimal pumping system size. Negligent ‘under-sizing’ or unnecessary ‘over-sizing’ of solar water pumping system might lead to poor farmer experience and this can, in the long run, limit the overall size of the solar water system economy. Farmers are needed to be capacitated around the derived demand for pumping capacity, depending on a large number of variables such as estimating the irrigation demand, calculating the peak discharge and head requirements to arrive at optimal size of solar water pumping system.

Moreover, with respect to solar dryers, farmers’ understanding of multi-seasonal uses of solar dryers to reduce payback period is also missing to a large extent. The technical, financial and operational barriers with respect to selection of solar dryers limit smallholder ownership of commercially viable dryers by farmers. Building their capacity to address this lacuna is the need of the hour. Together with service-based operation to support smallholder access, payback time reduction possible with multi-season dryer use vs single-season usage is also not clearly understood by farmers. These factors, if understood well, can drive multi-season utility solar dryer adoption by farmers.

Further, farmers often fail to identify a suitable vendor for installing the DRE system on their farmland. Some of the key points to keep in mind while selecting a vendor, to de-risk a system installation, include:

- Vendor shall have a work performance experience that demonstrates its ability to install safe and reliable solar PV systems on farmland
- Vendor should be able to understand structural requirements (e.g. weight, wind, solar radiation, etc.)
- Ideally a vendor should have a quality management plan in place which shall include system equipment testing, inspection protocol, design best practices, safety policies, etc. Existence of quality assurance plan demonstrates a strong commitment by the vendor to building quality PV systems.

Farmers often overlook these technical aspects before making a vendor selection for DRE system installation on their farmlands. Building their capacity around these aspects could guide their investment in DRE systems.

Another issue that needs better understanding of farmers, at this point, is how crop productivity is not impacted by installation of solar systems on their farmlands. To address this problem, firstly farmers need to understand the relationship between soil health and solar panels. Studies have shown that soil health is not significantly impacted by trace levels of chemicals used in photovoltaic panels. On the contrary, growing crops underneath the panels generate a cooling effect that makes panels work more effectively. Further, crop yields can be increased while reducing water use and increasing energy independence due to the impact of solar panels on soil moisture. Creating capacity of the farmers with respect to these aspects is paramount. It has been regarded as the key bottleneck in farmer decision making to invest in solar systems.

Financial Aspects

Many times, farmers face challenges owing to their inability to pay for the upfront contribution for purchasing DRE solutions for their farmland. Farmer motivation to participate in the scheme is dwarfed when they are unable to afford the DRE solutions. Though bank loans and other funding support is available to them in the market, they tend to shy away from approaching such commercial institutes for funds. Interactions with farmers revealed that they lack the technical know-how to prepare detailed project reports (DPRs) and financial models to provide to the bank / FI for carrying out their due diligence process for obtaining loans / funding support from FIs. This corresponds to a huge training gap among the farming community.

Policy

The Government of India has been at the forefront of introducing policies in the DRE space in the agriculture sector. In the recent past, policies supporting productive use of DRE technologies in the agriculture sector have also been put in place, with the prime objective of farmer welfare and betterment at heart. One major observation of this study is that despite the policies supporting farmer adoption of DRE technologies and encouraging livelihood enhancement are in place, there is limited awareness among the farmer community about such schemes. In some instances, the farmers have heard about the schemes and policies cursorily but do not understand how to participate in such policies and avail the associated benefits. This has been an issue across all the matured DRE technologies in the agriculture sector.

There has also been an awareness gap around the implementing agency in the state for the relevant policies and schemes. At present, the farmer community doesn't understand who to approach if case they would like to participate in the sector scheme. It is paramount to disseminate relevant policy and scheme related information to the farmers including information on implementing models, means of accessing finance to cover their capital expenditure (as permitted in the scheme guidelines), etc. Appropriate capacity building of farmers will support in rapid rolling out and scaling up policy / scheme adoption for their benefit.

Service Providers, Product Manufacturers and Rural Entrepreneurs

Awareness Enhancement

Like farmer groups, service providers, product manufacturers and rural entrepreneurs are also required to be capacitated around the different productive uses of DRE solutions. This information is essential for business scale up and growth. When providing DRE solutions on farmland, the focus should not only be on ensuring that energy is accessible but also to provide the services people need to become productive through an integrated approach.

Capacity gaps have been identified among service providers, product manufacturers and rural entrepreneurs with respect to what productive loads businesses could serve through their product offerings. It is pertinent to understand that productive loads can be categorized across three different heads namely agricultural, light industries and lastly the commercial and retail uses. The range of services that fall under agricultural use could be irrigation, fertigation, cold storage, rice hullers, , threshers, milling machines, other value addition, etc.

Service providers also need an understanding of avoiding theft / robbery of solar modules, inverters, cables and other valuable equipment from a solar PV installation on a farmland so that they can impart this knowledge to the farmers and other end-users. Building the capacity of the farmers to avoid such thefts / robberies is pertinent at this point in time to instill confidence in them for investing in DRE systems. This is going to have a ripple effect on service providers with improved sales and eventually business scale up opportunity.

Technical know-how

Just as the characteristics of people in every region are different, the energy needs of every region also vary. The product manufacturers / service providers / rural entrepreneurs, who essentially respond to these local demands, need to understand the requirements of these customers and design the DRE system optimally.

Product manufacturers / service providers often fail to understand the appropriate DRE technology needs at the farm level. Innovations in DRE technologies need to be designed keeping in mind the resource constraints, logistical challenges and usability in rural contexts. Efficiency of equipment become especially important, and can drastically reduce the cost of powering agriculture services through DRE. This is a pain point that product manufacturers / service providers / rural entrepreneurs need to be capacitated about.

Furthermore, in remote contexts, failures in either the equipment or the energy systems can result in significant downtimes which would have adverse effects on crop productivity / value addition. As such, training and engaging local energy enterprises in the installation, maintenance and troubleshooting of these systems, as understood from consultations, can ensure periodic servicing for the energy systems, increasing their reliability and durability. Further, at the local technician level, being aware about the basic maintenance procedures can help troubleshoot and resolve common problems such as burning out of fuse, refilling distilled water in batteries, etc.

Guidance on upscaling business opportunities

To capitalize on the business opportunities available in the DRE-focused agriculture sector in India, product manufacturers / service providers need to understand the opportunity they have at hand and how can that opportunity be optimized. However, service providers / rural entrepreneurs often lack the skills to identify sustainable, robust and cost effective supply chain processes, while focusing on business expansion for themselves and energy security enhancement for customers.

At this stage, service providers / rural entrepreneurs are required to be capacitated around fundamental aspects of supply chain management with high relevance to their businesses. These include raw material requirement and sourcing, logistics chain, supply chain analysis and strategy, supplier evaluation and selection. Effectively preparing and leading negotiations, inventory planning and management are some of the other focus areas requiring skilling of service providers / rural entrepreneurs in DRE-based agriculture sector value chain.

While securing the supply side, it is also paramount for service providers / product manufacturers / rural entrepreneurs to focus on demand stimulation. Through consultations, it is understood that without proper demand creation, low energy consumption for agricultural activities coupled with low affordability can render DRE businesses financially unviable. Therefore, it is felt that the private sector needs to be capacitated about the ecosystem approach for a successful establishment of productive use in agricultural activities at a community level.

At the same time, reaching out to the local communities to stimulate demand also requires proper branding and marketing of the products to establish a market presence. Through discussions, it is understood that service providers / product manufacturers / rural entrepreneurs lack the right branding and marketing skills. If clean energy products and service companies desire to be market-oriented, they are required to develop the in-house capability to manage all facets of channel functioning until the product is available to the end customer at desirable and actionable terms. As such, businesses in the domain are often required to develop strategic local partnerships. Such partnerships could ensure last-mile connectivity and enhance market outreach for some companies. Capacitating these companies on how to do so is imperative and can be addressed by building their skills around these parameters.

Entrepreneurial Skill Development

Agri-entrepreneurship holds the potential for both social and economic development, including employment generation, poverty reduction, enhancements in nutrition, health, and overall food security

in the national economy, particularly in rural regions. In current scenario, these entrepreneurship skills are lacking in some rural level entrepreneurs and service providers. Rural entrepreneurs often experiment with new customer value propositions. As such, their decision-making processes are required to be adaptive and focused on learning.

Enterprises might experiment with numerous system / product variations before identifying a compelling value proposition and customer segments. The goal of this type of decision-making is to reduce uncertainty about the product or service and the market the enterprise is operating within. This skill set is often missing in the rural entrepreneurs and is needed to be addressed through training and capacity building.

Additionally, raw material markets and markets for mass products are characterized by growing quality demands and falling prices. What is really necessary for an efficient manager is to produce according to these conditions. That means rationalization, that is, optimizing the production process, taking into account the existing technical equipment and if that is no longer possible, to start the next investment. This always results in rising fixed costs, larger production quantities and falling variable costs. Reduction of variable costs always includes cutting staff expenses: employees can be dismissed or one employee can manage larger quantities (e.g. when changing from stables where the cows are tied up to boxes which are technically well-equipped). These project management skills are still lacking in most of the product manufacturers, service providers and rural entrepreneurs.

Further, for those enterprises which are embarking on their journey of business scale-up, the development of processes and systems that support their client acquisition and sales processes, management of partnerships, management of inventory, and resources for project implementation, etc. is paramount. This is considered as a huge skilling gap as rural enterprises are not often equipped to make these kind of decisions. Their capacity building can help them to recognize these transition points as early as possible and develop or recruit the necessary talent, because they can easily disrupt the culture of the organization. These transitions can also require large investments, and they may pay dividends only when a certain level of scale has been reached. Managing these transitions is also crucial for market readiness for these enterprises as they move through different stages of growth of the organization and respond to shifts in the market.

Another training gap that has been identified at the ground level is the lack of confidence in women to set up rural DRE-specific enterprises in agriculture sector. For many rural women, entrepreneurship is part of a broader livelihood strategy, often undertaken on a part-time basis, and where it is difficult to separate production and reproduction tasks, as well as market and non-market work. At present, lack of training and business education & experience is limiting the capacity of rural women entrepreneurs to consolidate sustainable enterprises. Building their capacity around how to run a DRE-based rural enterprise, how to create a market presence and generate customer leads, how to carry out routine operation and maintenance of DRE systems is the need of the hour.

Financial aspects

Service providers, product manufacturers, and rural entrepreneurs are required to undergo training to familiarize themselves with the diverse funding avenues available for launching their ventures in the DRE sector. Equally crucial is their understanding of the specific documentation prerequisites necessary to secure loans from banks and other financial institutions. By grasping the direct correlation between their business actions and income, they can make well-informed decisions and devise strategies to optimize their profits.

Furthermore, these stakeholders must also acquire proficiency in assessing the payback period subsequent to making an investment. Gaining knowledge about the time-frame required for their initial investment to yield returns is indispensable for effective financial planning. This knowledge empowers them to align their business strategies with practical financial expectations, facilitating a seamless transition from investment to revenue generation.

Therefore, their training requirements encompass understanding funding sources, compiling documentation for loan applications, projecting income based on business activities, and evaluating investment payback period. These aspects are pivotal in enabling service providers, product manufacturers, and rural entrepreneurs to establish prosperous and sustainable businesses within the DRE space in agriculture sector.

Policy

Product manufacturers, service providers, and rural entrepreneurs sometimes possess limited knowledge about the available schemes and policies for DRE solutions in the market. Moreover, they lack a clear understanding of the processes required to avail the benefits facilitated by these schemes.

For rural entrepreneurs, it is essential that they gain an understanding of policies and schemes designed to facilitate obtaining end-user financing for solar-powered livelihood projects. These mechanisms hold a critical role in fostering the widespread adoption of DRE livelihood solutions in rural settings. Moreover, there is a significant gap in terms of knowledge regarding the optimal implementing agency to engage with for thorough information regarding particular schemes or policies. Additionally, a lack of comprehension exists concerning the necessary documentation that needs to be provided to access the advantages inherent in these schemes or policies.

SRLMs / SNAs / State Government Departments

Awareness Enhancement

SRLMs / SNAs / State Government Departments generally have the overall responsibility of promoting the uptake and use of DRE applications on the farmland, as per the central government and their own mandates. Despite government stakeholders' / SRLMs' / SNAs' understanding of the need to develop rural livelihood based on sustainable clean energy solutions, they sometimes lack the avenues to scale up the uptake of these solutions at the ground level.

It is understood from stakeholder consultations that they are unable to establish partnerships with the industry stakeholders such as NGOs, service providers, etc. for wide scale implementation of DRE solutions on farmlands. One of the key bottlenecks that the Government Departments need to address is the facilitation of R&D opportunities to the private sector to be able to pilot innovative DRE solutions in the agriculture sector which could potentially address the issue of energy access and promote livelihood development and income enhancement for farmers. Alongside, the Government Departments also need to encourage service providers to promote inclusive business models to better serve smallholder farmers' needs.

SRLMs, SNAs and State Government Departments also need to spread awareness around the conducive ecosystem that they are providing in terms of skill development, policy framework, fiscal & financial incentives, technology support, etc. For example, multiple State Governments provide various advantages to registered MSMEs, including the provision of collateral-free bank loans, subsidies for patent registration, and reduced rates on working capital loans. Similarly, the government has implemented comparable initiatives to assist recognized startups, such as tax exemptions, support for

patent-related matters, enabling expansion through government-supported procurement opportunities, and offering incubation opportunities to foster growth. Sometimes, despite of these benefits being available to product developers, service providers and farmers, they are not marketed to the level where widespread knowledge about these aspects is available to the stakeholders working at the ground level.

Furthermore, stakeholder consultations have brought forward the need for developing a local ecosystem for manufacturing, installation, and servicing for end consumers. This shall enable a reduction in transportation costs and thereby, bringing down overall cost of the DRE solutions for production & service and end-use at the farmer's end.

Another area identified where capacity building of Government Department, SRLMs and SNAs is required deals with carrying out demand assessment of DRE livelihood applications in the agriculture sector to prioritize the market scale up. Support mechanisms provided by the State Government for identification and mapping of beneficiaries especially for rural enterprises which do not have the capacity to conduct market and need assessment could aid in scaling up the adoption of DRE solutions for productive uses by the farmer community.

Training of Trainers

Training is a process of acquiring knowledge, skills, and attitude that are needed to fill the gap between their current abilities and their desired objectives. Providing training to trainers is crucial since it enables them to deliver their respective sessions with greater efficiency and effectiveness. This process offers an opportunity for trainers to enhance their skills and core competencies, leading to the creation of more exciting, innovative, and unique training experiences, ultimately benefiting the end users.

In this context, SRLMs and SNAs have expressed a need for training of trainers to undertake capacity building of different stakeholder groups at the ground level. For this, two types of skills hold utmost importance for SRLMs and SNAs. These include domain skills and soft skills. Domain skills here refer to the sector-specific skills, technical knowledge and know-how of DRE technologies, their uses and their operations. Soft skills refer to presentation behaviors that a trainer uses to transmit content effectively. At this juncture, these skills are largely absent in the master trainers at SRLMs and SNAs and are required to be developed to make them effective trainers.

Some of the domain skills identified to be developed for the master trainer at these organizations include To impart knowledge on identification of business opportunities and preparation of business plan, profile of products under the group, procurement and quality standards complementary products, by-products and their use, profile of processing technology, overview of machinery, their costing any sourcing, product quality and safety requirement as per the national and international standards, etc. In the context of soft skills, capacity gaps exist around development of the trainers' interpersonal skills, confidence building and training delivery skills to leave a lasting impact on the trainees.

Dairy Sector

Farmers and FPOs / FPCs

Awareness Enhancement

In India, the majority of milk production is carried out by smallholder farmers and the excess milk is sold in local markets. However, milk at ambient temperature creates an ideal environment for bacterial growth, making it a potential carrier of infectious diseases and unsafe for human consumption. To address this issue, cooling the milk slows down bacterial growth, reducing spoilage, increasing farmers'

income, and ensuring a safer product for consumers. Implementing clean energy cooling technology in the milk value chain holds the promise of enhancing both the quality and quantity of milk available in the formal market. This advancement can result in improved food safety for consumers, higher incomes for farmers, and the generation of job opportunities within clean energy solution enterprises. This is very capacitating the farmers becomes paramount.

There are limited measured DRE technology in the dairy value chain where the farmers lack an understanding of productive use of DRE technology. Smallholder farmers typically think of DRE in the form of solar home lighting, so they have limited awareness of DRE-powered dairy equipment. Additionally, even though there is a high demand for cold storage it is seen as a luxury good and willingness to pay is low because many smallholder farmers have adapted to a lack of access to the technology. It is not clear to smallholder farmers that DRE based cold storage products are cheap enough or have a sufficiently quick return on investment to warrant a change in how they store dairy products.

Further for farmers, awareness on net savings with respect to DRE systems such as A 100 L DC refrigerator driven by solar energy only uses 0.329 kWh (units) in a 24-hour period, whereas its AC electricity-powered competitors need 1.3 units/24-hour. Awareness of farmers around socio-economic benefits of milk chillers will allow farmers to combine their morning and evening milk and subsequently selling them to milk collection centers which only buys milk in the morning which ultimately increases their profit.

Technical Know-how

The adoption and expansion of DRE solutions, especially for storing milk, by dairy farms is faced with various hurdles, and one significant challenge is the lack of technical expertise among the dairy farmers. Many farmers lack the necessary knowledge and skills to install and maintain a solar irrigation system, making them dependent on external support and assistance in this regard. A considerable number of farmers do not possess the adequate technical knowledge and skills required for the installation and maintenance of small-scale solar PV systems that can be used for chilling milk and milk products.

As the technological ecosystem is limited for the small holder farmers, these farmers need to be capacitated around technical aspects such as first level O&M of solar refrigeration units/ deep freezers, building an understanding towards operational parameters like energy requirements, storage capacity, temperature range for storing a variety of dairy products, compressor capacity, chilling rate and how it affects their investment made into dairy business.

They should have a clear understanding of technical knowhows like handling batteries and safety aspects while operating DRE systems amongst farmers, since they are the end users of it. In such scenarios awareness of safety features such as antifreeze doors, locking mechanism, warning signs is of utmost importance.

Dairy products like cottage cheese, cheese is susceptible to chilling burns if stored below their freezing point, building consciousness around these concepts will help farmers to extend the shelf life of the dairy products. Farmers lack an understanding of technical aspects such as monitoring temperature in control panel, remote monitoring systems, inspection of PV panels, knowing where to install PV panels, first level O&M and cleaning of the chillers. Farmers should have an idea of how to install solar panels that can maximize solar energy to harvest. The direction that the roof faces is one of the primary factors that determine how much sunshine your solar panels will see over the day.

In addition, it is understood from stakeholder consultations and market research that farmers sometimes struggle with identifying the faults in these systems and dealing with compressors, maintain

an optimum moisture level. When moisture levels are too high, electronics fitted inside these units may experience problems, and products kept inside may experience bacterial contamination that may pose health risks to workers and consumers. Electronic fittings when exposed to humidity and condensation, electronics encounter problems that affect workers, such as a lack of productive goods and device malfunctioning.

Guidance on upscaling business opportunities

Farmers can maximize their profits by skillfully selecting the most advantageous options and optimizing the use of available resources. To achieve this, it is essential to provide them with guidance and support, enabling them to effectively diagnose, plan, implement and monitor their strategies and business models on the ground. Numerous farmers aspire to venture into either small-scale or large-scale dairy farming businesses based on clean; however, they often lack the knowledge and expertise necessary to establish and manage such enterprises.

Understanding 'chilling time' is an utmost important factor which directly affects CAPEX cost. Dairy farmers need to have an awareness of the industry, since the scope is beyond selecting optimal sized and capacity of solar cold storage. Negligent 'under-sizing' or unnecessary 'over-sizing' of solar cold storages might lead to poor farmer experience, and this can, in the long run, limit the overall size of the solar cold storage system economy.

Further, farmers often fail to identify a suitable vendor for installing the DRE system in their vicinity. Some of the key points to keep in mind while selecting a vendor, to de-risk a system installation, include:

- Vendor shall have a work performance experience that demonstrates its ability to install safe and reliable solar PV systems on farmland.
- Vendor shall have a preventive maintenance checklist for the requested DRE system.
- Vendor shall provide do's and don'ts checklist of DRE system.
- Vendor should be able to understand of structural requirements (e.g. weight, tilt, solar radiation, moisture etc.)
- Ideally a vendor should have a quality management plan in place which shall include system equipment testing, inspection protocol, design best practices, safety policies, etc. Existence of quality assurance plan demonstrates a strong commitment by the vendor to building quality PV systems.

Farmers often overlook these technical aspects before making a vendor selection for DRE system installation on their farmlands. Building their capacity around these aspects could guide their investment in DRE systems.

Financial aspects

Access to financial and credit services stands out as the primary obstacle faced by dairy farmers when it comes to adopting solar-powered milk chillers, refrigerators, or milking machines. Their lack of understanding regarding potential sources of appropriate financial assistance for acquiring DRE technologies is a major concern. Additionally, they are unfamiliar with the documentation required to access loans.

There is also uncertainty surrounding the possibility of securing loans at lower interest rates, along with doubts about the availability of flexible repayment options and the tenure of the repayment period. At times, they also encounter difficulties in weighing the product's cost against the value of the loan, further

complicating their decision-making process⁵. Moreover, they require a deeper understanding of the initial higher costs, which can ultimately yield substantial returns on investment.

Policy

Implementing DRE solutions in dairy farms offers a plethora of advantages, including extended shelf life for dairy products, reduced reliance on the power grid, long-term financial savings and reduced environmental impact. However, farmers encounter notable hurdles in the adoption of such solutions on their farms. These challenges predominantly stem from the substantial initial investment required, prompting them to seek governmental subsidies and incentives to alleviate this financial burden.

The Government of India has been establishing a favorable landscape for DRE technology penetration in the dairy sector in the country both at a centralized and decentralized levels. While great initiatives are being taken by the central government, there is limited awareness among the farmer community about such schemes. In some instances, the farmers have heard about the schemes and policies cursorily but do not understand how to participate in such policies and avail the associated benefits. This has been an issue across all the matured DRE technologies in the dairy sector. Dairy farmers often lack an understanding of capital subsidies on DRE products, performance-based incentives, interest subvention and longer tenure loans on DRE products.

Furthermore, farmers sometimes fail to understand the procedures to avail benefits provided through these schemes, incentives, and subsidies that cater to DRE solutions including information on implementing models, means of accessing finance to cover their capital expenditure (as permitted in the scheme guidelines), etc. Appropriate capacity building of farmers will support in rapid rolling out and scaling up policy / scheme adoption for their benefit. Additionally, there is a lack of information regarding the appropriate implementing agency to approach for details about specific schemes or policies, as well as the necessary documentation that needs to be submitted to avail the benefits of these schemes or policies.

Service Providers, Product Manufacturers and Rural Entrepreneurs

Awareness Enhancement

Service providers, product manufacturers, and rural entrepreneurs also need to be equipped with knowledge and skills concerning the various productive uses of DRE solutions. This information is crucial for scaling up and expanding their businesses. When offering DRE solutions for dairy farmers, the emphasis should not solely be on making energy accessible but also on providing the necessary services that enable people to enhance their productivity through a comprehensive and integrated approach.

In the dairy business, service providers, product manufacturers and rural entrepreneurs are required to be capacitated around environmental and social benefits of using solar-based cold storages and solar deep freezers. These benefits include keeping a greater stock of milk, and other dairy products because the risk of spoilage has reduced. By building the capacity and confidence of retailers around these benefits such as increased shelf life of milk with reduced spoilage can help the retailers to add more products like paneer, buttermilk, mawa in their portfolio.

⁵ https://www.ceew.in/sites/default/files/CEEW-Financing-Solar-powered-Livelihoods-in-India-24Sep19_compressed_0.pdf Accessed on August 21, 2023

Technical Know-how

Product manufacturers, service providers, and rural entrepreneurs, who cater to these local demands, need to comprehend the specific needs of their customers and design DRE systems accordingly. It is crucial for technology providers to have a grasp of technical parameters related to DRE solutions in dairy sector that can be tailored to the requirements of their target audiences.

Furthermore, stakeholder consultations have revealed that the main challenge faced by product manufacturers is acquiring the essential components required for product development. Building the capacity of vendors in procuring these key components can contribute to the development of the dairy ecosystem. Additionally, providing training and involving service providers, entrepreneurs, and vendors in maintenance tasks such as routine inspections for preventive maintenance, conducting tests like earth continuity tests, insulation tests, and fault detection, as identified through consultations, can ensure regular servicing of energy systems, ultimately enhancing their reliability and longevity.

Guidance on upscaling business opportunities

Rural entrepreneurship exhibits distinct characteristics and necessitates analysis from a resource-based perspective, as it operates within resource-constrained rural communities. Adopting a sustainable livelihood perspective becomes a pertinent framework in rural entrepreneurship, as it considers the resources and capacities required to address limited resources available with dairy farmers in rural areas. Service providers / product manufacturers and rural entrepreneurs need to develop different value-creating strategies to engage in on-farm diversification ventures related to DRE solutions in the dairy sector.

As such, the capacities for product manufacturers, service providers and rural entrepreneurs needs to be developed around branding and marketing of the products to establish a market presence. They need guidance on identifying smallholder farmers that respond to their value propositions. A significant fraction of a smallholder farmers' milk yield is lost to spoilage before it even reaches milk collection centre. This loss represents an attractive business opportunity for cold storage technology providers. However, smallholder farmers are frequently skeptical about the necessity of cold storage and the viability of using renewable energy to drive dairy equipment.

Technology providers lack an understanding to the payback period of their product. In some cases, scaling down product size or cooling capacity may reduce a product's payback period.

These service providers need an understating of business models like 'chilling as a service' which allows customers to pay per-usage of the chilling equipment. Technology providers should have a thorough understanding of the dairy value chain into which they plan to introduce cold storage. Technology providers should evaluate the processes and people involved in producing the dairy product for whom they are designing their cold storage equipment to store.

Entrepreneurial Skill Development

Rural entrepreneurship holds the potential for rural entrepreneurs / service providers and enterprises to generate value for their communities and foster more resilient localities. Through entrepreneurship, individuals can pursue self-employment opportunities, enriching and enhancing the lifestyle of communities while working towards achieving sustainable livelihoods.

At present, the village level co-operative societies for milk collections are provided by bulk milk coolers operating on conventional grid supply of electricity and in case of unavailability of electric supply diesel generator sets are provided for cooling the milk. To overcome the problem of continuous grid supply of

electricity and diesel generator sets, solar based refrigeration system for milk cooling at society level is quiet feasible. Product manufacturers have a vital role in the development of solar based milk chillers plant and solar refrigeration system at the community level at the villages.

Understanding of milk products, supply chain, market value, marketing of the product are the key requirement for entering in the sector. Furthermore, understanding of initial investment requirement under different business models available in the market to setup the DRE solution in the region is mandatory process. Technical understanding such as suitable size of the solar cold storage, internal storage volume, temperature range, cooling backup capacity, solar photovoltaic panels, multiple chamber options, Integration with existing cold storages etc. are the parameters for which trainings are required by the sectorial specific trainer.

Furthermore, women partnership in the dairy sector is much required as they have key role in the milk extraction and milk collection. Capacity building program at the village level to understand DRE solutions in the sector shall be paced by the Women SHGs. Also, training of local women for need based Operation & Maintenance of the DRE equipment cold be the forwarding step in the women entrepreneurship in the sector.

Financial aspects

Service providers, product manufacturers, and rural entrepreneurs need to be capacitated around various funding options accessible for initiating their business within the dairy sector. Equally important is their familiarity with the specific documentation prerequisites necessary to secure loans from banks and other financial establishments.

Primarily, these stakeholders need to gain insights into how their ongoing business operations will influence their annual earnings. This entails a comprehensive grasp of how their investments and efforts translate into financial gains over the course of a year. By understanding the direct relationship between business activities and income, they can make informed decisions and strategies to maximize their profits.

Additionally, these individuals must also gain proficiency in evaluating the payback period after making an investment. Acquiring knowledge about the timeframe required for their initial investment to generate returns is essential for effective financial planning. This knowledge empowers them to align their business strategies with realistic financial expectations, ensuring a smoother transition from investment to revenue generation.

Hence, their training needs encompass source of funding, documentation for loans, income projection based on business operations, and investment payback duration which is pivotal for enabling service providers, product manufacturers, and rural entrepreneurs to establish successful and sustainable businesses within the dairy sector.⁶

Policy

Product manufacturers, service providers, and rural entrepreneurs possess limited awareness of the diverse array of schemes, incentives, and subsidies accessible in the market for obtaining DRE

⁶https://www.ceew.in/sites/default/files/CEEW-Financing-Solar-powered-Livelihoods-in-India-24Sep19_compressed_0.pdf Accessed on August 21, 2023

solutions. Moreover, they lack a clear understanding of the processes required to avail the benefits facilitated by these schemes.

In the context of rural entrepreneurs, it is imperative that they acquire knowledge about schemes that could be harnessed to secure end-user financing for solar-powered livelihood initiatives. Noteworthy examples include schemes such as Pradhan Mantri MUDRA Yojana (PMMY) and the Credit Guarantee Fund Trust for Micro and Small Enterprises (CGFTMSE). These mechanisms can play a pivotal role in enabling the proliferation of DRE livelihood solutions within rural contexts.

Furthermore, a notable deficiency exists in terms of information regarding the most suitable implementing agency to approach for comprehensive insights about specific schemes or policies. Additionally, there is a lack of understanding about the requisite documentation that must be submitted in order to unlock the benefits inherent in these schemes or policies.

SRLMs / SNAs / State Government Departments

Awareness Enhancement

SRLMs / SNAs / State Government Departments are typically tasked with the primary responsibility of encouraging the adoption and utilization of DRE applications by dairy farmers and entrepreneurs, aligning with both central government directives and their own mandates. While government stakeholders, SRLMs, and SNAs recognize the importance of fostering rural livelihoods through sustainable clean energy solutions which can be used for productive uses, they encounter challenges in scaling up the implementation of these solutions at the grassroots level.

One of the key bottlenecks that the Government Departments need to address is the facilitation of R&D opportunities to the private sector to be able to pilot innovative DRE solutions in the dairy sector which could potentially address the issue of energy access, promote livelihood development, income enhancement and proliferation of dairy farms. Alongside, the Government Departments also need to encourage service providers to promote inclusive business models to better serve smallholder farmers' needs. Additionally, state government departments could possibly help businesses in carrying out balance in economic, environmental, and social imperatives through implementation of various management systems which include ISO 9001, ISO 22000, ISO 14001, ISO 50001, OHSAS 18001.

SRLMs, SNAs and State Government Departments also need to spread awareness around the conducive ecosystem that they are providing in terms of skill development, policy framework, fiscal & financial incentives, technology support, etc. For example, multiple State Governments provide various advantages to registered MSMEs, including the provision of collateral-free bank loans, subsidies for patent registration, and reduced rates on working capital loans. Similarly, the government has implemented comparable initiatives to assist recognized startups, such as tax exemptions, support for patent-related matters, enabling expansion through government-supported procurement opportunities, and offering incubation opportunities to foster growth. Sometimes, despite of these benefits being available to product developers, service providers and farmers, they are not marketed to the level where widespread knowledge about these aspects is available to the stakeholders working at the ground level.

Furthermore, stakeholder consultations have brought forward the need for developing a local ecosystem for manufacturing, installation, and servicing for end consumers. This shall enable a reduction in transportation costs and thereby, bringing down overall cost of the DRE solutions for production & service and end-use at the farmer's end.

Another area identified where capacity building of Government Department, SRLMs and SNAs is required deals with carrying out demand assessment of DRE livelihood applications in the dairy sector

to prioritize the market scale up. The Government departments can scout for DRE technologies and commercially viable solutions to address the problems faced by the animal husbandry and dairy sector and bring startups, small business on board to introduce these technologies to the dairy farmers. They need their knowledgebase around dissemination tools to effectively communicate these technologies and benefits to the mass.

Training of Trainers

Increasing the trainer's knowledge in the use of clean energy solutions in the dairy sector is paramount so that they can improve the skills of stakeholders dairy industry, resulting in higher quality dairy products. The significance of providing training to trainers lies in their ability to conduct sessions with increased efficiency and effectiveness. This training opportunity allows trainers to elevate their skills and core competencies, resulting in the development of more captivating, innovative, and one-of-a-kind training experiences, ultimately benefiting the end users.

SRLMs and SNAs require training of trainers to undertake capacity building of different stakeholder groups in the dairy sector. These trainers comprise of milk producers, milk traders, sweet makers, and cottage processors. For this, two types of skills hold utmost importance for SRLMs and SNAs. These include domain skills and soft skills. Domain skills here refer to the sector-specific skills, technical knowledge and know-how of measured DRE technologies like solar milk chillers and refrigerators, their uses, and their operations. Soft skills refer to presentation behaviors that a trainer uses to transmit content effectively. At this juncture, these skills are largely absent in the master trainers at SRLMs and SNAs and are required to be developed to make them effective trainers.

Some of the domain skills identified to be developed for the master trainer at these organizations include To impart knowledge on identification of business opportunities and preparation of business plan, profile of products under the group, procurement and quality standards complementary products, by-products and their use, linkage of DRE technology in milk processing and storage, profile of processing technology, overview of machinery, their costing any sourcing, product quality and safety requirement as per the national and international standards, etc. In the context of soft skills, capacity gaps exist around development of the trainers' interpersonal skills, confidence building and training delivery skills to leave a lasting impact on the trainees. Furthermore, state government departments can aid in constituting a dairy committee among the trained trainers to monitor the adoption of improved practices taught during the training.

Fishery Sector

Farmers and FPOs / FPCs

Awareness Enhancement

The widespread lack of awareness among fish farmers regarding available renewable-based solutions and their long-term advantages has hindered the adoption of such solutions in the sector. To overcome the initial hesitancy associated with new technologies, it is essential to conduct targeted information campaigns that highlight the benefits offered by various DRE solutions in the fishery sector.

Various consultations conducted with farmers carrying out inland fish farming revealed that they have very little awareness about the DRE technologies available that can be used in the fishery sectors to improve productivity and reduce dependency on various fossil fuels based technology. Although the farmers are aware about the solar energy and its benefits but none of them who were consulted have been using any kind of DRE technology in their farm. These farmers though understand that existing

electrical equipment like water pumps, aerators, deep freezers etc. used in the sector can be powered by solar energy but still lack know-how about these alternatives.

Currently, these farmers do not fully understand the best practices involved for improving quality and hence the produce for better economic value. Various trainings are being conducted for making them aware about such best practices. But there exists no such training where these farmers are being made aware DRE technologies which can further increase the quality and improve productivity.

At present, the farmers are not much aware about the environmental and social benefits of using various DRE technologies in the fish farming practices. For example, taking case of solar aerators which can help in maintaining and improving the water quality and helps prevent the water from stagnating leading to less algae, nuisance bacteria and mosquitoes. Such DRE products can help in improved oxygen level, improved nutritional conditions and hence keeps the fish healthy for better economic value of produce in the market.

Technical Know-how

To empower the fish farmers and encourage the use of clean energy solutions by them, it is important to enhance their technical skills so that they can effectively participate in the value chain. At present, a significant number of farmers lack the necessary technical knowledge and skills to install and maintain DRE systems that can be utilized for fish farming and storage and processing of the catch.

In a gap assessment conducted with various stakeholder, it was identified that there exists a gap regarding the technical aspects of the DRE systems. Skill gap regarding choosing and sizing of aerators and pumps for specific size of inland fish farm exists within the sector. For installing of DRE equipment in inland fish farm and understanding its impact on cost of DRE system. Such gaps were identified as not many trainings are being imparted to farmers with respect to technical aspects related to DRE technologies.

It was also observed that during consultations and secondary research that the large number of training manuals available for various DRE such as solar PV, mini-grids, etc. have limited contents and do not include specific DRE technology that can be applicable to fishery sector. The manuals do not or partially cover sizing, installation and commissioning of the DRE systems.

In addition, it is understood from stakeholder consultations and market research that farmers sometimes struggle with system troubleshooting. From consultations, it was observed that there is a lack of available trained manpower in O&M and aftersales service segments were put forth by most the farmers. There exists a skill gap to conduct safety audits and detect system faults.

Guidance on upscaling business opportunities

A business model that combines DRE and fishery plays a key role to expand distributed renewable energy and improve rural economic development. However, this combination faces huge difficulties since the farmers fail to understand the business model that could be most suited in their context.

Through various consultations and secondary research, it has been understood that the sector also needs training and build the capacity in business model that exists within the DRE sector. In the areas of skill gap, suggestions came from the farmers regarding the immediate need for finance, accounting and marketing skills across the DRE sector. Various gaps that has been identified under business model guidance include selecting the right technical specifications of DRE technology, access to finance, securing supply chains and product marketing.

There is a clear necessity to build the capacity of the farmers and impart training in choosing and selecting the optimally sized solar pumps and solar aerators for the fish farms. This is especially required as it may impact on costing of the DRE systems otherwise which in turn can lead to the development of a risky perception about the DRE sector at large. The farmers need to be trained on the several factors that govern the sizing of such DRE technologies.

Further, farmers often fail to identify a suitable vendor for installing the DRE system on their farmland. Some of the key points to keep in mind while selecting a vendor, to de-risk a system installation, include:

- Vendor shall have a work performance experience that demonstrates its ability to install safe and reliable solar PV systems on farmland
- Vendor should be able to understand of structural requirements (e.g. weight, wind, solar radiation, etc.)
- Ideally a vendor should have a quality management plan in place which shall include system equipment testing, inspection protocol, design best practices, safety policies, etc. Existence of quality assurance plan demonstrates a strong commitment by the vendor to building quality PV systems.

Farmers often overlook these technical aspects before making a vendor selection for DRE system installation on their farmlands. Building their capacity around these aspects could guide their investment in DRE systems.

During the discussions, it was also observed that these farmers also need skill enhancement in easy to access end user finance for adoption of DRE. There is a need in providing support and guidance to understand various govt. schemes which is available at their disposal which can help these farmers adopt the DRE technologies to increase their productivity. The farmers were also interested in understanding the various finance mechanism and instruments available in the market which can help them adopt such technologies in their fish farms.

Financial aspects

The introduction of DRE technologies has brought about several advantages to the sector, such as continuous water oxygenation; however, some farmers are not well-acquainted with the benefits that DRE technologies offer compared to traditional solutions, and they struggle to assess the financial viability of such technologies. In this context, given that these technologies require substantial investment, conducting a financial viability assessment becomes crucial. This assessment is necessary to understand the payback period and annual operating costs and develop a sound case for adoption of DRE solutions in the fishery sector.

Another major challenge faced by fish farmers in India pertains to access to affordable financial and credit facilities. This obstacle hinders the adoption of solar-powered aerators, cold storage, water pumps, and dryers. The lack of information about potential sources of funding for procuring DRE systems poses a significant concern.

Policy

The impact of the fisheries sector extends to several Sustainable Development Goals (SDGs). Considering this, the GoI has placed emphasis on the expansion of fishing and aquaculture, guided by comprehensive and enduring objectives. In 2020, the National Fisheries Policy was introduced, aiming to establish a fisheries sector that is ecologically sound, economically viable, and socially inclusive. This sector is intended to contribute to the nation's economic well-being and the welfare of fishers and fish

farmers, while also ensuring sustainable and responsible means of providing food security and nutrition for the country. Enhancing farmers' income is one of the key priorities of the government. India's policymakers are also focusing on decentralized renewable energy products with an aim to boost the revenue, double profits. In fact, in February 2022, the MNRE released a framework for promoting DRE livelihood applications⁷. However, farmers have a limited understanding of the DRE centric schemes, incentives, and subsidies that are available in the market for accessing DRE solutions. They also don't understand the process to avail themselves of the benefits offered by various programs, incentives, and central and state subsidies that support DRE solutions.

Therefore, they need to be capacitated around the schemes in which they can participate along with the details of the implementing agency with whom they can touch base for participating in the scheme. They also need to be guided with the necessary documentation that needs to be submitted to avail the benefits of these schemes or policies.

Service Providers, Product Manufacturers and Rural Entrepreneurs

Awareness Enhancement

Service providers, product manufacturers, and rural entrepreneurs need to be equipped with knowledge and skills related to the various productive uses of DRE solutions for fishery sector. This information is crucial for the growth and expansion of their businesses. When offering DRE solutions for fishery sector, the emphasis has to go beyond ensuring energy accessibility; it should also encompass providing the necessary services that enable farmers to enhance productivity through an integrated approach.

During the gap assessment survey and consultations, it was identified that the gaps in form of awareness for DRE application exist amongst service providers, product manufacturers and rural entrepreneurs like as it exists for the farmers. The research conducted showed that these groups need to build their capacity about their DRE offerings to right set of audience. Sometimes there is a mismatch between what is being asked by the farmer and what is being delivered by the product manufacturers. Hence such training need is required especially when there exists a mismatch between the expectations and what product is being offered.

It has been identified and understood that these groups need training to develop their skills in targeting specific audience with their right offerings. Service providers also need an understanding of avoiding theft / robbery of solar modules, inverters, cables and other valuable equipment from a solar PV installation on a farmland so that they can impart this knowledge to the farmers and other end-users. Building the capacity of the farmers to avoid such thefts / robberies is pertinent at this point in time to instill confidence in them for investing in DRE systems. This is going to have a ripple effect on service providers with improved sales and eventually business scale up opportunity.

Technical Know-how

Before service providers / product developers can serve the market, they need to understand the products required to serve the needs of the fish farmers. The key requirement here is to simplify and explain the technology to the farmers, making it more accessible and understandable to them.

⁷ https://mnre.gov.in/img/documents/uploads/file_f-1644909209115.pdf , Accessed 21 August, 2023

As seen from the consultations and secondary research, on the technical aspects, there is a need to build the capacity of product manufacturers / service providers / rural entrepreneurs to understand the end user requirement and optimally design the system. The training need for best practices of system installation is also one of the requirements in the sector. It was also observed that there is lack of available trained and skilled manpower in O&M and aftersales service segments.

It is also understood from the consultation that these group of stakeholder also has training need in carrying out troubleshooting of these systems, identify system faults and carry out safety audits which can ensure periodic servicing for the energy systems, increasing their reliability and durability. Further, at the local technician level, being aware about the basic maintenance procedures can help troubleshoot and resolve common problems such as burning out of fuse, refilling distilled water in batteries, etc.

Guidance on upscaling business opportunities

Working with the fishery farmers in the DRE ecosystem possess unique attributes and requires an examination from a resource-based standpoint due to its presence in resource-limited rural communities. However, service providers and rural entrepreneurs in the sector fall short of skills in identifying sustainable, robust, and cost-effective supply chain processes while prioritizing their business expansion and enhancing sustainable energy security for the fish farmers.

There is a need for training of service providers/ rural entrepreneurs which captures all aspect of business planning and implementing DRE systems that they need to be aware about. From the responses received from consultations in the areas of skill gap, most of the respondents mentioned the immediate need for finance, accounting and marketing skills for their business expansion and growth.

It has been understood from the consultations and secondary research that the product manufacturers/ rural entrepreneurs need training to develop pitch documents targeting specific investors in the DRE sector such as banks, private debt providers, grant makers, venture capitalists and CSR donors.

Service providers / rural entrepreneurs often lack the skills to identify right market and doing the detailed market assessment. They need to be trained on such aspects and also dwells into basics of marketing and provides details for developing a marketing plan for the rural enterprise, along with developing market linkages and facilitating access to markets.

Those who participated in the consultations, evaluate their cost and schedule performance based on experience, which is an unstructured approach. As a result, they are unable to map success metrics for their businesses. This also results in challenges in planning and tracking resource allocation. There is a lack of awareness regarding the quality and project management systems. The general notion within the DRE organizations is that the quality management systems are only for manufacturers. However, Quality Management Systems are applicable for service providers as well. Following project management practices allows the enterprises to map the risks in advance and develop mitigation strategies. It was noted that service providers which practice quality management and project management practices can easily communicate to investors, financing entities with their success metrics. Further, it was noted to create trust among investors.

Service providers / rural entrepreneurs are also required to be capacitated around fundamental aspects of supply chain management with high relevance to their businesses. These include raw material requirement and sourcing, logistics chain, supply chain analysis and strategy, supplier evaluation and selection. Effectively preparing and leading negotiations, inventory planning and management are some

of the other focus areas requiring skilling of service providers / rural entrepreneurs in DRE-based agriculture sector value chain.

Financial aspects

Service providers, product manufacturers, and rural entrepreneurs need to be capacitated around various funding options accessible for initiating their business within the fishery sector. Equally important is their familiarity with the specific documentation prerequisites necessary to secure loans from banks and other financial establishments.

Primarily, these stakeholders need to gain insights into the ways in which their ongoing business operations will influence their annual earnings. This entails a comprehensive grasp of how their investments and efforts translate into financial gains over the course of a year. By understanding the direct relationship between business activities and income, they can make informed decisions and strategies to maximize their profits.

Additionally, these stakeholders must also gain proficiency in evaluating the payback period after making an investment. Acquiring knowledge about the timeframe required for their initial investment to generate returns is essential for effective financial planning. This knowledge empowers them to align their business strategies with realistic financial expectations, ensuring a smoother transition from investment to revenue generation.

Hence, their training needs encompass source of funding, documentation for loans, income projection based on business operations, and investment payback duration which is pivotal for enabling service providers, product manufacturers, and rural entrepreneurs to establish successful and sustainable businesses within the fishery sector

Policy

Product manufacturers, service providers, and rural entrepreneurs possess limited awareness of the diverse array of schemes, incentives, and subsidies accessible in the market for obtaining DRE solutions. Moreover, they lack an understanding of the eligibility criteria, procedure and processes to participate in the scheme. In the context of rural entrepreneurs, it is imperative that they acquire knowledge about schemes that could be harnessed to secure end-user financing for solar-powered livelihood initiatives.

Noteworthy examples include initiatives such as Jawaharlal Nehru National Solar Mission (JNSSM)⁸ and Pradhan Mantri Kisan Urja Suraksha Evam Utthan Mahabhiyan (PM-KUSUM)⁹. These mechanisms can play a pivotal role in enabling the proliferation of DRE livelihood solutions within rural contexts.

Furthermore, there exists a deficit in information concerning the implementing agency responsible for providing details about particular schemes or policies, along with the requisite documentation that must be furnished to access the benefits associated with these schemes or policies.

⁸ <https://hareda.gov.in/intoduction-jnssm/> Accessed on August 21, 2023

⁹ <https://pmkusum.mnre.gov.in/> Accessed on August 21, 2023

SRLMs / SNAs / State Government Departments in Agriculture, Dairy and Fishery Sectors

Awareness Enhancement

Government stakeholders' / SRLMS' / SNAs' are often responsible for creating public awareness to promote adoption of DRE livelihood applications in fisheries sector. To create public awareness their own knowledge base needs to be firstly developed around DRE technologies in the fishery value chain. Their capacity needs to be developed around conducting demand assessment to map the needs of fish farmers with an appropriate fit to DRE livelihood applications in fisheries value chain.

In this regard, stakeholder consultations have brought forward the need for mass knowledge dissemination methods amongst state government departments. They need to be well versed with knowledge translation tools such as organizing local livelihood discussions, supporting demonstration of DRE technologies at exhibitions while ensuring the implementation of such technologies amongst fishery farmers.

Another key aspect that the Government Departments need to address is the facilitation of R&D opportunities to the private sector to be able to pilot innovative DRE solutions in the fishery sector which could potentially address the issue of energy access and promote livelihood development and income enhancement for farmers. The idea here is to promote research and studies on fisheries and fishery related areas so that benefit can be disseminated to the grass root level users.

Alongside, state government departments can aid in providing test-bedding sites such as labs and testing centres to safely trial their ideas and innovations by product developers, providing business acceleration support, including strategic advisory and networking sessions for product developers, service providers and farmer and income security & livelihood enhancement for fish farmers.

Though they understand the need to develop rural livelihood based on sustainable clean energy solutions, they sometimes lack the avenues to scale up the uptake of these solutions at the ground level. It is understood from stakeholder consultations that they are unable to establish partnerships with the industry stakeholders such as NGOs, service providers, etc. for wide scale implementation of DRE solutions on farmlands. This is where they can serve as a knowledge portal for DRE resources including policy best practices, data, and analysis tools and share the same with product developers, service providers and rural entrepreneurs in the state

SRLMs, SNAs and State Government Departments also need to spread awareness around the conducive ecosystem that they are providing in terms of skill development, policy framework, fiscal & financial incentives, technology support, etc. For example, multiple State Governments provide various advantages to registered MSMEs, including the provision of collateral-free bank loans, subsidies for patent registration, and reduced rates on working capital loans. Similarly, the government has implemented comparable initiatives to assist recognized startups, such as tax exemptions, support for patent-related matters, enabling expansion through government-supported procurement opportunities, and offering incubation opportunities to foster growth. Sometimes, despite of these benefits being available to product developers, service providers and farmers, they are not marketed to the level where widespread knowledge about these aspects is available to the stakeholders working at the ground level.

Another area identified where capacity building of Government Department, SRLMs and SNAs is required deals with carrying out demand assessment of DRE livelihood applications in the fishery sector to prioritize the market scale up. Support mechanisms provided by the State Government for identification and mapping of beneficiaries especially for rural enterprises which do not have the

capacity to conduct market and need assessment could aid in scaling up the adoption of DRE solutions for productive uses by the farmer community.

Training of Trainers

The crux of conducting any training program lies in identifying and selecting capable trainers / instructors. These trainers or potential instructors must comprehend the flexibility of requirements when designing and implementing training material tailored for the targeted groups, in this case fishery sector stakeholders. Trainers should possess the necessary skills and be capable of developing or customizing a training curriculum and materials suiting the needs of their audience. Additionally, they should be adept at employing a non-formal teaching approach and offering ongoing support to beneficiaries even after the training period, where feasible.

In the fishery sector, SRLMs and SNAs have a training requirement focused on training trainers to conduct capacity building for diverse stakeholder groups. This shall empower trainers to effectively enhance the skills and capabilities of different stakeholders. It is also important to involve seasoned traditional fishermen as trainers so as to leverage their experience and wisdom which can be easily related with other fishers. For this, two types of skills hold utmost importance for SRLMs and SNAs. These include domain skills and soft skills. Domain skills here refer to the sector-specific skills, technical knowledge and know-how of DRE technologies, their uses and their operations. Soft skills refer to presentation behaviors that a trainer uses to transmit content effectively. At this juncture, these skills are largely absent in the master trainers at SRLMs and SNAs and are required to be developed to make them effective trainers.

Some of the domain skills identified to be developed for the master trainer at these organizations include To impart knowledge on identification of business opportunities and preparation of business plan, linkage of DRE technologies in harvest, post-harvest and processing of fisheries, profile of products under the group, procurement and quality standards complementary products, by-products and their use, profile of processing technology, overview of machinery, their costing any sourcing, product quality and safety requirement as per the national and international standards, creating self-employment avenues for prospective entrepreneurs who are trying to tap the increasing demand for processed and in the domestic market. In the context of soft skills, capacity gaps exist around development of the trainers' interpersonal skills, confidence building and training delivery skills to leave a lasting impact on the trainees.

5. Recommendations on capacity strengthening needs

The training needs of stakeholders i.e., farmers and FPOs/FPCs, service providers, product manufacturers, rural entrepreneurs, aggregators and SRLM/SNAs, and state government departments that have been previously identified are classified into 5 major buckets namely, **awareness enhancement, technical know-how, business model guidance, entrepreneurship skill development and training of trainers**. To address the identified training needs of these stakeholders in the agricultural value chain to harness the potential of Decentralized Renewable Energy (DRE) systems effectively, the following recommendations are proposed.

5.1. Agriculture Sector

Awareness Enhancement

Creating capacity around use of DRE Systems on farmland

To address the training gaps and support farmers in grasping the utilization of DRE solutions on their farmland, it is crucial to enhance their understanding of the connection between the introduction of DRE systems and their impact on agricultural productivity, livelihoods, and food security. It is equally vital to highlight the significance of safeguarding these DRE systems from theft, stealing, or robbery. To achieve this, farmers should be trained on **the benefits of adopting multi-cropping patterns**, which optimize land use and **enhance income generation**. Diversifying crops can lead to increased productivity and reduced reliance on single crops, ultimately contributing to improved food security. Secondly, farmers should receive training on effective **security measures to protect their DRE systems**. This entails the use of solar panel locks, fences/barbed wire, and pop rivets/blind rivets to secure the panels and prevent unauthorized access. Additionally, techniques such as gluing, welding, or sealing the panels and linking racks can further enhance security. Alarm systems installation is another aspect to be covered in training, alerting farmers to potential threats to their DRE systems. By empowering farmers with these essential skills and knowledge, they can not only enhance agricultural productivity, livelihoods, and income generation but also ensure the long-term efficiency and sustainability of their DRE systems, bolstering food security on their farmland

Environmental and Social Benefits of DRE systems

Farmers need to understand the **economic benefits** of DRE systems, such as increased income through reduced post-harvest losses and access to premium markets for better-quality products. In addition to economic benefits, they should be capacitated around the **social empowerment aspect** of DRE systems in terms of how it creates additional job opportunities for women and rural communities in the drying and processing value chain. Apart from these benefits, it is crucial for them to be educated about seamless transition from conventional systems to DRE systems in the agricultural value chain.

Technical know-how

DRE systems maintenance and upkeep

Based on stakeholder consultations, it has been identified that there exists a knowledge gap concerning the maintenance, upkeep, and decommissioning of DRE systems, including solar panels, at the end of their life cycle. To address this issue, it is essential to impart education to farmers on the **proper procedures for safe dismantling and removal of the equipment** from their land. They should receive clear step-by-step guidance on how to **clean and inspect** the system, enabling them to identify **potential leakage or damage** issues. Moreover, guidance on **land reclamation techniques** should

be provided to restore the area previously occupied by the DRE system to its original agricultural state. This may involve soil remediation, land preparation, and reintroduction of suitable crops or vegetation. Equipping farmers with this knowledge and training will ensure environmentally responsible decommissioning practices and enable effective reclamation of the land for agricultural purposes.

Installation practices

To bridge this gap, it is essential to provide training to farmers and rural entrepreneurs on **constructing elevated platforms** or foundations for DRE systems in floodplains. This training will help minimize the risk of damage during floods. Additionally, they should be educated on the use of **waterproof and weatherproof materials** for DRE system components to prevent water damage during flood events. Moreover, introducing **methods for installing** solar panels at or above the flood protection grade can prove advantageous for farmers situated in flood-prone regions. Comprehensive training should cover the advantages and considerations of using this technology in floodplains. By providing farmers and entrepreneurs with these skills and knowledge, they can effectively protect their DRE systems during floods and make informed decisions about implementing floating solar technology in their agricultural operations.

Guidance on upscaling business opportunities

Creating capacity around technical specifications

Based on stakeholder consultations, it has been observed that farmers often face challenges in properly sizing their DRE systems, either ending up with oversized or undersized systems. To address this issue, they should be provided with guidance on selecting the appropriate type and size of DRE systems based on their **specific energy needs, battery and PV panel capacity, number of panels and budget constraints**. Creating awareness about sizing and designing tools such as the **SIP sizing tool by MNRE** will be beneficial, as it can help farmers optimize the performance of their systems and achieve the best results for their irrigation needs. By offering this training and support, farmers can make informed decisions and ensure the efficient and effective use of solar pumps in their agricultural operations.

Assessment of parameters for making vendor selection

Farmers and entrepreneurs frequently encounter challenges in accurately identifying their specific requirements and priorities while choosing a vendor. The significance of aligning vendor capabilities with their distinct needs is often overlooked. To address this issue, they should undergo training to recognize vendors based on their **experience and track record** in the agricultural sector. Additionally, farmers and entrepreneurs need to understand the importance of considering factors such as the **vendor's financial capacity and local presence** to ensure consistent service and support. By providing this training, farmers and entrepreneurs can make well-informed decisions when selecting vendors, leading to more successful partnerships and improved outcomes in their agricultural endeavors.

Understanding crop productivity

To raise awareness regarding factors such as the impact of solar panels on the soil underneath or around them, and the implications of spraying agrochemicals near DRE systems, farmers need to be educated on the benefits offered by solar panels. These benefits include the **cooling effect** they can have on crops, which can enhance crop productivity. Additionally, solar panels can **reduce the water or moisture requirements** for crops growing underneath them, leading to more **efficient water usage**. This, in turn, can contribute to **increased crop yield and overall agricultural productivity**. By

capacitating farmers with this knowledge, they can make informed decisions and adopt sustainable practices for better agricultural outcomes.

Creating capacity around avenues of securing Supply Chain

Product manufacturers, service providers, and rural entrepreneurs need guidance to improve their supply chain management capabilities and establish a resilient and efficient supply chain to support business growth. To achieve this, they should undergo training on various aspects, including **business models, demand forecasting and planning, product modalities, establishing strategic partnerships at the local level, and supplier evaluation**. By receiving training in these areas, they can streamline their supply chain processes, meet customer demands effectively, and foster sustainable business growth.

Product branding and marketing

Product manufacturers, service providers, and rural entrepreneurs require assistance in adopting effective branding and marketing strategies. Therefore, it is recommended that product manufacturers focus on targeting specific end-users for their DRE products. Moreover, they should undergo training on **talent management techniques, such as organizational restructuring** tailored to the needs of start-ups and established enterprises. Understanding the appropriate processes and organizational structures and recognizing transition points are essential for their business growth and success.

Entrepreneurial skill development

Capacity development around Women's entrepreneurship possibilities

Women often face a lack of confidence when it comes to establishing rural DRE-specific enterprises in the agriculture sector. Instead, they are often engaged as technicians or electricians, primarily involved in the routine operation and maintenance of DRE systems. To address this, it is crucial to empower women by providing capacitation in various areas. Topics such as **system design, interconnection of battery wires, safety aspects of solar PV systems, operation and maintenance, troubleshooting, and system selection** from available options in the market should be covered. Additionally, training should focus on appropriate **cable sizing and selection, electrical demand load analysis**, and ensuring efficient energy utilization. By building their capacities around these subjects, women can gain the knowledge and skills needed to start and successfully run their enterprises in the DRE sector, fostering their entrepreneurial growth and success.

Project Management Techniques/Skill development

The training gaps identified for rural entrepreneurs, product manufacturers, and service providers in project management skills include optimizing the DRE system production process, considering existing technical equipment or starting new investments, and talent management to scale up their businesses. To address these gaps, they require guidance and capacitation to enhance their project management capabilities. This will result in successful and efficient project execution, improved business outcomes, and increased customer satisfaction. Additionally, they need to be trained in areas such as **improving career development opportunities** for women as rural entrepreneurs, **data collection and management for RE-based mini-grids**, and **conducting routine operations and maintenance of DRE systems**. By receiving training in these areas, they can strengthen their skills and competencies, leading to overall growth and success in their ventures.

Training of Trainers

Domain skill development

SRLMs/SNAs/State Govt departments frequently conduct 'Training of Trainer' (ToT) programs for various stakeholder groups. However, to effectively carry out these programs, they need to strengthen their domain skills, such as understanding DRE equipment and machinery specifications for productive use and performing timely preventive and breakdown maintenance of DRE equipment. To bridge these gaps, it is essential to capacitate them in the following areas:

- Interpreting technical parameters/documentation and disseminating knowledge related to DRE equipment.
- Identifying necessary materials and tools (hand tools, machine tools, and workshop equipment).
- Verifying the circuit, equipment, and panel functionality based on drawings.
- Connecting, testing, and undertaking maintenance and disposal of solar batteries.
- Connecting and testing solar panels, charge controllers, battery banks, and inverters.

By building their capacities in these skills, they can enhance their effectiveness as trainers and better support stakeholders in the DRE sector.

Soft skill development

Presently, the master trainers at SRLMs and SNAs lack these crucial skills, making it necessary to develop and enhance their abilities to be more effective in their training roles. Capacitating them in essential interpersonal skills is essential, including **public speaking, training delivery techniques, networking, confidence-building, providing constructive feedback to participants, and actively seeking feedback** for continuous self-improvement as trainers. By focusing on these areas, the master trainers can become more proficient and impactful in their training endeavors, leading to better outcomes for the stakeholders they engage with.

Financial aspects

Capacity development around sources of financing

The tangible components of DRE in agriculture have been covered at length and breadth encompassing infrastructure, technologies, and products. Yet, these physical elements must be accompanied by the intangible aspects, often referred to as the "software," which involves addressing training and capacity requirements in the financial sector while also broadening the understanding of farmers. E-learning material needs to be developed to educate the farmers on the financial aspects. There is a crucial requirement to provide them with knowledge regarding the diverse funding sources at their disposal, the criteria for eligibility, and the necessary documentation needed to secure loans from banking institutions and other financial institutions. Additionally, they should be equipped with the necessary skills to navigate financing options for both small and large-scale DRE equipment.

Furthermore, there is a notable advantage in enhancing their capability to understand the cost-economics of DRE solutions when compared to conventional alternatives. Imparting them with a comprehensive understanding of the economic implications of selecting DRE solutions constitutes a pivotal aspect of their decision-making process. This involves comprehending the financial advantages, potential cost savings, and overall return on investment associated with the adoption of DRE solutions.

Policy

Capacity development around policy incentives and subsidies

Farmers, FPOs as well as the private sector possess limited awareness about the policies and schemes in the DRE sector that are accessible to them. Consequently, to address these information gaps, it becomes essential to improve their understanding of government policies and programmes, the

advantageous aspects of these policies / schemes, the implementing agencies responsible, and the necessary documentation required for accessing the benefits offered by these policies and programmes. Hence, augmenting the knowledge of farmers and rural entrepreneurs concerning the available schemes, the application process for availing scheme benefits, and the appropriate channels for acquiring information and submitting necessary documents stands as a crucial measure in nurturing the adoption and success of DRE solutions across diverse communities.

5.2. Dairy Sector

Awareness Enhancement

Understanding the dairy value chain

Farmers frequently encounter challenges in comprehending the utilization of Solar Deep freezers/refrigeration units for storing various dairy products, such as milk, curd, cottage cheese, cream, etc. To address this gap, it is crucial to build their capacity in utilizing renewable energy for milk processing and value addition. This includes educating them about **DRE-powered milk pasteurizers, different types of solar milk chillers, and deep freezers**. Furthermore, they should be provided with guidance on how specific **DRE solutions can be integrated into various stages of the dairy value chain**, encompassing on-farm production, processing, and distribution. By capacitating them in these areas, farmers can leverage renewable energy to enhance their dairy operations, leading to improved efficiency and sustainability.

Productive Use of measured DRE technology

Dairy farmers have the opportunity to acquire essential knowledge and skills to make effective use of solar milk chillers and deep freezers, resulting in increased productivity, improved milk quality, reduced post-harvest losses, and overall enhancement of dairy farming practices. To achieve this, it is vital to raise awareness about the **working principles** of measured technologies like solar milk chillers and solar deep freezers, along with their **practical applications in farming operations, including milk cooling, storage, and preservation**. By understanding these technologies better, dairy farmers can utilize them efficiently to optimize their dairy processes. Additionally, farmers should receive guidance **on managing energy requirements during periods of low solar radiation**, such as cloudy days or seasonal variations, to ensure uninterrupted operation and consistent benefits from these solar-powered solutions.

Understanding the Environmental and social benefits of DRE systems in the dairy value chain

Farmers and rural entrepreneurs currently possess limited knowledge about the environmental and social benefits of DRE technologies in the dairy value chain. To address this gap, it is essential to capacitate them with information regarding the **economic advantages** of utilizing DRE systems. This includes understanding how these technologies can lead to **reduced energy costs and increased income through improved milk quality and longer shelf life of dairy products**. Additionally, they should be educated about the **social benefits** of DRE systems, which encompass increased access to clean energy in rural areas, contributing to community development, and **empowering women through income generation opportunities**. By gaining awareness of these benefits, farmers and rural entrepreneurs can make informed decisions and embrace sustainable and empowering practices in their dairy operations.

Technical know-how

Operation and Maintenance of DRE systems

As identified previously, farmers and rural entrepreneurs find difficulty in understanding temperature monitoring aspects and operating process parameters in a control panel. They are not usually aware of cleaning and first-level O&M techniques of the system. Therefore, it is recommended to build their capacity around these areas and develop comprehensive training modules that cover all aspects of **operating and maintaining solar milk chillers and solar freezers, from installation to day-to-day operations**. This would include **safety guidelines for handling solar-powered equipment**, including electrical safety **precautions and proper handling of refrigerants**.

Guidance on upscaling business opportunities

Creating capacity around technical specifications

Farmers and product manufacturers need to enhance their capacities in understanding technical specifications, including differentiating between refrigeration units used for agriculture and dairy applications, comprehending CAPEX and OPEX investments, and checking sizing options with vendors. This can be achieved by familiarizing them with the key distinctions in **temperature and humidity requirements for storing agricultural produce and dairy products**. Additionally, training should emphasize conducting **vendor assessments to evaluate suppliers' credibility, reliability, and track record**.

Creating capacity around avenues of securing the supply chain

Product manufacturers and service providers should grasp the importance timely significance of timely milk dispatch and arrival while employing DRE solutions, which can affect their capex costs along with an idea of major players in the market such as component manufacturers, assemblers, distributors, retailers, etc. for procuring equipment and supplier evaluation criteria. For building their capacities, they need to be equipped with knowledge about various factors, such as the intricacies of the **production process involved in manufacturing solar deep freezers/ milk chillers**, including **raw material sourcing, assembly, quality control, and testing**. Additionally, they should gain insights into **distribution channels and logistics** involved in transporting DRE systems from manufacturers to end-users, along with the ability to **assess the sizing and capacity requirements** of DRE systems based on their production needs and milk dispatch schedules.

Product branding and marketing strategies

In the preceding sections, it was emphasized that product manufacturers and service providers must grasp effective strategies for product branding and marketing. It is crucial for them to identify bankable business models and target smallholder farmers who align with their value propositions. To enhance their capabilities in these domains, it is recommended to train them on developing expertise in business models like "storage as a solution" and "storage and logistics as a solution." Additionally, they should be well-informed about **customer needs and necessary documentation, conduct comprehensive market analysis, identify core competitors, and accentuate the unique selling points and value propositions of solar milk chillers and solar deep freezers**. **Crafting a compelling brand story** is also vital to connect with their audience. By following these recommendations, product manufacturers and service providers in the decentralized renewable energy value chain can bolster their branding and marketing efforts, paving the way for business growth and success.

Entrepreneurship skill development

Project Management Techniques /Skill development

As previously identified, the training needs of product manufacturers and rural entrepreneurs revolve around efficiently managing the business. This entails **understanding the supply chain, acquiring**

technical equipment for the investment, selecting suitable sites, assessing resource availability, and making initial budget estimates for DRE system implementation. Furthermore, they need to comprehend the **tank capacity of solar milk chillers and solar cold storage** based on milk storage requirements. **Resource management**, particularly for short-shelf-life products, is crucial. Understanding **project lifecycles** is also essential for successful project execution. Therefore, raising awareness and providing training on these aspects is crucial to support their ventures in the dairy sector.

Capacity development around Women entrepreneurship possibilities

Women entrepreneurs in the dairy sector often face difficulties in comprehending the supply value chain, technical aspects of DRE equipment, and basic financial profit analysis. To tackle these challenges, there is a need to strengthen their capacities in areas such as **sourcing raw materials, inventory management, transportation logistics, and establishing connections with distributors and retailers**. This involves gaining insights into investment costs, operational expenses, revenue generation, and profit margins. Additionally, building an understanding of the tank capacity of solar milk chillers and solar cold storage following the milk storage requirements will enable them to make informed decisions and effectively manage their dairy businesses in the DRE sector.

Training of trainers

Domain Skill development

To meet the training needs related to desired project layout, smooth operation, and processing and preservation methods for milk and milk products, it is essential to provide comprehensive training to trainers. They should be educated on how to design an efficient project layout for dairy processing, considering the flow of operations and equipment placement. Trainers should be well-versed in various **processing and preservation methods such as pasteurization, homogenization, and chilling techniques utilizing DRE solutions**. Additionally, training should focus on **food safety regulations and standards specific to dairy processing** methods to ensure product quality and consumer safety. Moreover, trainers need a deep understanding of solar milk chillers and deep freezers, including their technical specifications and maintenance requirements. Equipping trainers with these domain skills will empower them to effectively train others in the dairy value chain while incorporating renewable energy solutions for sustainable and eco-friendly practices.

Soft Skill development

The training requirement for SRLMs and SNAs involves preparing trainers to conduct capacity building for diverse stakeholder groups in the dairy sector. As previously identified, trainers need to enhance their soft skills, particularly in implementing effective educational techniques to improve the training's impact. To address this gap, local trainers should be equipped with various methods such as **experiential learning, interactive sessions, gamification, and the use of visual aids and multimedia**. Additionally, incorporating **peer learning exercises** fosters active participation and collaboration among trainees. These capacitation measures will enable trainers to conduct more engaging and productive training sessions, benefitting stakeholders in the dairy sector.

Financial aspects

Capacity development around sources of financing

Farmers, FPOs and NGOs commonly seek guidance on avenues for securing funding and the essential documentation needed. They are also in search of information regarding the minimum initial investment needed to initiate their businesses. To bridge this informational gap, there is a clear need to empower them with **knowledge regarding the various funding sources** accessible to them, **eligibility criteria**, and the **requisite documentation** essential for obtaining loans from banks and financial institutions.

They also need to be capacitated around financing options for both small and large-scale DRE equipment.

Furthermore, there is a distinct advantage in building their capacity concerning the **cost economics** of DRE solutions as compared to conventional alternatives. Empowering them with a deep understanding of the economic implications of opting for DRE solutions stands as a pivotal aspect of their decision-making process. This encompasses grasping the **long-term financial benefits, potential savings, and overall return on investment associated** with adopting DRE solutions.

Moreover, it's essential to provide farmers with training and knowledge regarding alternative methods of purchasing DRE solutions. These methods include options like **group purchases, leasing/rental models, and engaging in public-private partnerships (PPPs)**.

Hence, addressing these knowledge gaps requires a comprehensive approach that equips farmers, FPOs, NGOs and the private sector with the necessary insights regarding funding options, eligibility requirements, documentation prerequisites, and a comprehensive understanding of the cost-efficiency and economic advantages inherent in opting for DRE solutions over traditional alternatives.

Policy

Capacity development around policy incentives and subsidies

Farmers, FPOs, and NGOs along with product manufacturers and service providers, possess limited knowledge about the policies, incentives, and subsidies that are available to them. Consequently, to address these gaps, it is imperative to enhance their understanding of government policies and schemes, the associated **benefits** of these schemes, the details of **implementing agency**, and the **necessary documentation** that must be fulfilled to access the benefits provided by these schemes and policies.

Hence, enhancing the understanding of product manufacturers, service providers, and rural entrepreneurs about available schemes, the application process for scheme benefits, and the appropriate channels for seeking information and submitting documentation, remains a critical step toward fostering the adoption and success of DRE solutions in various communities.

5.3. Fisheries Sector

Awareness enhancement

Understanding of various DRE systems available in the fishery value chain

Fish farmers and entrepreneurs encounter challenges in comprehending the available DRE solutions for fish farming, such as solar pumps, solar dryers, solar chillers, and solar aerators. To bridge this gap, it is crucial to enhance their understanding of the fishery value chain and the application of DRE technologies within it. They should be informed about the **specific benefits of DRE systems** in terms of **reducing spoilage** and **preserving fish quality**. Additionally, capacity-building should focus on familiarizing fish farmers with various solar-powered fish farming equipment, emphasizing the advantages of **cost-effectiveness, reliability, and ease of use associated with such solar-based solutions**. This capacitation effort will empower fish farmers to leverage DRE technologies effectively and optimize their fish farming practices.

Understanding the economic, environmental and social benefits of DRE systems in the fishery value chain

To equip farmers with knowledge about the environmental and social benefits of solar dryers and aerators, it is recommended to raise awareness about the advantages of utilizing solar aeration and solar dryers, the different types available, **their appropriate usage, and capacity requirements**. They should also be informed about how these technologies can positively impact market pricing due to improved product quality. Furthermore, the training should emphasize the **environmental benefits** of solar aerators and dryers, such as **maintaining optimal oxygen levels** for healthier fish and enhancing the overall economic value. Additionally, farmers should be made aware of the **superior quality and hygiene** offered by DRE-based fish processing when compared to traditional fish processing methods. Moreover, farmers should be provided with insights into the **economic benefits** that these systems offer, such as **reduced operational costs** leading to **increased income** for fisherfolk as well as **increased efficiency** of fish processing, storage, and transportation operations.

Technical know how's

Understanding system sizing and installation

Farmers and rural entrepreneurs lack knowledge concerning the sizing and installation guidelines for measured DRE technologies in the fishery value chain. To address this gap, they should receive capacity-building in key areas, such as determining the **appropriate aerator size** for a specific tank or pond, **selecting and sizing solar panels** for powering the aerators, adopting **installation best practices** to ensure optimal system performance, and conducting thorough system testing and commissioning. By enhancing their understanding of these aspects, farmers and entrepreneurs can effectively implement DRE technologies in their fishery operations, promoting efficient and sustainable practices.

Guidance on upscaling business opportunities

Creating capacity around avenues of securing the supply chain

The lack of understanding among product manufacturers, service providers, and entrepreneurs lies in identifying major players like component manufacturers, assemblers, distributors, and retailers for procuring equipment, as well as sourcing raw materials and components required in manufacturing technologies such as solar aerators, solar pumps, and solar dryers. To address this gap, capacitation is needed to help them comprehend the specific components required in solar dryers and aerators, gain better insights into making informed decisions on where to procure these components or finished products, establish a **checklist for supplier evaluation criteria, and access contact details of key players, manufacturers, and distributors supplying equipment** and components for solar pumps, solar dryers, and aerators. By enhancing their understanding in these areas, product manufacturers, service providers, and entrepreneurs can streamline their supply chain, ensure quality and reliability, and facilitate smooth operations in the adoption of renewable energy technologies.

Understanding business models related to DRE systems in the fishery value chain

To empower rural entrepreneurs and product manufacturers with the necessary knowledge about the multi-seasonal uses of DRE systems and their implications on energy consumption, they should undergo capacitation in the following areas: Understanding the **operational model** to facilitate the adoption of DRE systems by smallholder fish farmers, as well as learning about **service-based operational models** that allow fish farmers to benefit from equipment usage without incurring upfront capital costs. Additionally, they should be informed about the **potential revenue streams** that can be generated from fish drying. This capacitation will enable them to make informed decisions, promote the utilization of renewable energy technologies, and offer better services and solutions to fish farmers.

Entrepreneurship skill development

Project Management Techniques/Skill Development

To bridge the training gaps for product manufacturers of solar pumps, solar dryers, and solar aerators in the fishery value chain, two key areas need to be addressed: optimizing the DRE system production process and talent management for business scaling. Firstly, manufacturers should receive comprehensive technical training to **improve production processes**, considering existing technical equipment and exploring opportunities for efficiency enhancements. Keeping them updated on the **latest technological innovations** will encourage technology upgradation, leading to improved product performance and cost-effectiveness. Secondly, capacity-building in **talent management** will help manufacturers build a skilled workforce and create an environment conducive to **business expansion** and growth. By focusing on these recommendations, product manufacturers can streamline their operations, utilize resources efficiently, and elevate their position in the fishery value chain.

Capacity development around Women's entrepreneurship possibilities

To address the training gaps for women entrepreneurship, the following recommendations are proposed. Firstly, empower women as rural entrepreneurs by focusing on enhancing their leadership skills, business acumen, and networking abilities. Providing specialized training in **leadership skills and data collection** and management for renewable energy-based mini-grids will enable women entrepreneurs to gather and analyze relevant data for informed decision-making. Secondly, offer comprehensive training on **routine operation and maintenance of DRE systems**, covering areas such as **motor repair, wire connections, noise and vibration checks, bearing temperatures, and seal integrity inspections for solar water pumps and aerators**. Hands-on practical sessions will reinforce their understanding and confidence in **handling DRE system maintenance**. By implementing these recommendations, women entrepreneurs in the renewable energy sector will be better equipped to drive their businesses forward and make significant contributions to sustainable energy solutions in their communities.

Training of trainers

Domain Skills development

The training needs that SRLMs and SNAs have is to train their trainers to undertake capacity building for various stakeholder groups. Additionally, it is crucial to involve **seasoned traditional fishermen as trainers** to capitalize on their experience, which can be readily related to and appreciated by other fishers. These local trainers need to be capacitated around areas such as **installation, assembling, and testing of solar PV systems** and conduct **safety audits** as a part of O&M of solar water pumping systems and solar aerators.

Soft Skills development

The training needs that SRLMs and SNAs have is to equip their trainers with the necessary skills to conduct capacity building for various stakeholder groups. To address the training gaps related to developing interpersonal skills, particularly in pitching for a product, converting new customers, and building negotiation skills, comprehensive recommendations are proposed. Firstly, trainers should be provided with the capacitation to learn **effective verbal communication, active listening, and the significance of non-verbal cues** in convincingly conveying the value of their products. Simulated **pitching exercises** with **constructive feedback** and coaching can assist individuals in refining their pitches and becoming more persuasive when engaging potential customers. Secondly, there should be a strong focus on understanding customer needs through **empathetic listening**. By gaining insights into customer's pain points and requirements, entrepreneurs can tailor their pitches to address specific concerns, thereby increasing the likelihood of successful conversions. Lastly, it is crucial to provide training on building **self-confidence**, as it plays a pivotal role in delivering pitches confidently and

engaging customers effectively. By implementing these recommendations, entrepreneurs can enhance their interpersonal skills, pitch their products more effectively, and convert potential customers, ultimately leading to greater business success and growth.

Financial aspects

Capacity development around sources of financing

Product manufacturers and service providers face numerous challenges in accessing low-cost capital in the research and demonstration phases, as well as growth capital to streamline manufacturing and accelerated deployment. Similarly, farmers/FPOs have insufficient capital support to adopt DRE-based solutions. They are also in search of information regarding the minimum initial investment needed to initiate their businesses. To bridge this informational gap, there is a clear need to empower them with knowledge regarding the various **funding sources** accessible to them, **eligibility criteria**, and the **requisite documentation** essential for obtaining loans from banks and financial institutions.

Furthermore, there is a distinct advantage in building their capacity concerning the **cost economics** of DRE solutions as compared to conventional alternatives. Empowering them with a deep understanding of the economic implications of opting for DRE solutions stands as a pivotal aspect of their decision-making process. This encompasses grasping the **long-term financial benefits, potential savings, and overall return on investment** associated with adopting DRE solutions.

Hence, addressing these knowledge gaps requires a comprehensive approach that equips farmers, FPOs, NGOs, product manufacturers, and service providers with the necessary insights regarding funding options, eligibility requirements, documentation prerequisites, and a comprehensive understanding of the cost-efficiency and economic advantages inherent in opting for DRE solutions over traditional alternatives.

Policy

Capacity development around policy incentives and subsidies

Farmers, FPOs and NGOs along with product manufacturers and service providers, possess limited knowledge about the policies, incentives, and subsidies that are available to them. Consequently, to address these gaps, it is imperative to enhance their understanding of government policies and schemes, the associated **benefits** of these schemes, the details of **implementing agency**, and the **necessary documentation** that must be fulfilled to access the benefits provided by these schemes and policies.

Hence, enhancing the understanding of product manufacturers, service providers, and rural entrepreneurs about available schemes, the application process for scheme benefits, and the appropriate channels for seeking information and submitting documentation, remains a critical step toward fostering the adoption and success of DRE solutions in various communities.

6. Annexures

6.1. Annexure 1 - List of Stakeholders Consulted

Training Institutes

S.N	Stakeholder	Name of the Organisation	Location	Contact details
1.	Dr. Mahendiran Ramasamy	Tamil Nadu Agricultural University	Coimbatore	maheephd@tnau.ac.in
2.	Sunil Sinha	MIT Mehsana, NDDB	Mehsana	sssinha@nddb.coop
3.	Dr. Saravanan Raj	MANAGE	Hyderabad	saravanan.raj@manage.gov.in
4.	Dr. Srinivasacharyulu Attaluri	MANAGE	Hyderabad	ascharyulu@manage.gov.in
5.	Mr Kolluru Krishnan	Skill Council for Green Jobs	Delhi	krishan@cvc-biorefineries.com
6.	Deepak Rai, Prem	National Skill Qualification framework	Delhi	deepak@sscgi.in
7.	Dr Vikrant Sharma	NISE	Delhi	vikrant.sharma@nise.res.in
8.	Smir R Lende	Centre of Excellence in aquaculture, Kamdhenu University, Ukai	Gujarat	smit@kamdhenu.edu.in
9.	Amit Ranjan	Tamil Nadu Dr. J. Jayalalithaa Fisheries University (TNJFU)	Chennai	amitrnanjan@tnfu.ac.in
10.	Hitendra Rathod	MIT Mehsana, NDDB	Mehsana	
11.	Mr. Naranjan Karade	NDDB	New Delhi	nmkarade@nddb.coop

12.	Saravanan KP	Tamil Nadu Veterinary and Animal Science University	Chennai	k.p.saravananvet@gmail.com
13.	Satendra Arya	Agriculture skill council of India	New Delhi	ceoasci@gmail.com
14.	Partha Pratim Bhattacharya	NIRDPR	Guwahati	Partha550@yahoo.com
15.	MD Khan	NIRDPR	Hyderabad	rtp.nird@gov.in
16.	Dr Tripti Thakur	NPTI	Faridabad	dgnpti@gov.in
17.	Sanjay Sarma	ARIAS	Guwahati	sanjaysarma@arias.in
18.	Bikram Baruah	NPTI	Guwahati	
19.	Dr. Sanjay Kumar Singh	ICAR-IIHR	Bengaluru	director@ihr.res.in
20.	Mr. S. Pugalendhi	Agricultural Engineering College and Research Institute	Coimbatore	bioenergy@tnau.ac.in
21.	Ms. Svati Bhogle	TIDE Women Technology Park	Tumkur	svati.bhogle@gmail.com
22.	Dr Shreekant Sharma	NIMSME	Hyderabad	sharma@nimsme.org
23.	Kathiresan	NIRDPR,	Hyderabad	kathiresan.nird@gov.in
24.	George Ninnan, Dr Nikita Gopal	CIFT	Kochi	director.cift@icar.gov.in
25.	Pravin Borkar	MITCON Consultancy Engineering Services Private Limited	Pune	cs.bhosale@mitconindia.com
26.	S.D. Deshmukh	Maharashtra Centre of Entrepreneurship development	Pune	executivedirectormced1@gmail.com
27.	N kashi vishwanath	TUV Rheinland (India) Private Limited.	Pune	gyan.sharma@ind.tuv.com
28.	Shrikhar Dole	IL&FS Academy of Applied Development	Pune	shrikar.dole@ilfsacademy.org

29.	Adwait P Suratkar	Indian Institute of Technology, Bombay	Mumbai	khakhar@che.iitb.ac.in
30.	Rajneesh Kumar	Smart Brains Engineers & Technologist Private Limited	Pune	ankitgupta@smartbrains.in
31.	Ms Supriya Patil	Royal Institute of Fire Safety	Pune	info@rifsindia.com
32.	Vishal Ghule,	CLR Skill training foundation	Pune	vishal@clrservices.com
33.	T. P. Singh,	National Institute of Electronics and Information Technology	Aurangabad	dir-imphal@nielit.gov.in
34.	Satya Bhushan Rath,	Centurion University of Technology & Management	Bhubaneswar	satyabhushan.rath@cutm.ac.in
35.	Soumendra Choudhury	IL&FS Skills Development Corporation Limited.	Bhubaneswar	soumendra.choudhury@ilfsindia.com
36.	L. Rajasekha	Central Tool Room and Training Centre	Kolkata	cttc@cttc.gov.in
37.	S. Swain	Synergy Institute of Technology	Rajpura	contact@synergyinstitute.ac.in
38.	Shankar Lal	OMS Power Training And Research Institute	Bhubaneswar	info@omstraining.net
39.	Er. Biplab Bhanjan Buduge	Indianeers Media Private Limited.	Bhopal	baripadaocvet@yahoo.com
40.	Gurpreet Singh Saini,	Avteg Private Limited.		psingh@udayskills.org
41.	Neeraj Sangal	All India Society for Advance Education & Research	Alwar	lksharma@dtieducation.com
42.	Anil Mahalwat	Deep Training Institute Pvt. Ltd.	Mumbai	mahalwaranilaiet@rediffmail.com

43.	Lakhan Bai	Agile Skills Development Private Limited.	Mumbai	meenabalveer@yahoo.co.in
44.	Ram Lal Jajra	Shri Damaram Memorial Shikshan Avm Prasikshan Sansthan	Kimsar	vikashjajra4@gmail.com
45.	Suresh,	Shree Karni Shikshan Sansthan	Bhiwandi	shravan2525@gmail.com
46.	Prof. H Vijaymurthy	Shri Dharamsthala Manjunateshwara College of Engineering & Technology	Dharwad	hvijaymurthy@gmail.com
47.	Ratan Lal	B. R. Chaudhary College Management Committee	Hanumangarh	operationbrcsf@gmail.com
48.	Dalgobind Mahto	All India Agrasen Technical Education & Research Foundation	Jaipur	mahto123@rediffmail.com
49.	Parmeshwar	Vivekananda Global University	Jaipur	pkrijpr@gmail.com
50.	Ajay Sharma,	MSME Technology Development Centre		badalnitdgp@gmail.com
51.	Anil Kumar	All India Institute of Local Self-Government		anil.kumar@aillsg.org
52.	Ashok Dhariwal	Shri Lal Bahadur Shastri Research & Training Institute	Jodhpur	slbseducation@gmail.com
53.	Sanjeev Somra	Smart Brains Engineers & Technologist Pvt. Ltd	Noida	satyamdubey@smartbrains.in

54.	Gulam Nabi Quazi	Bagaria ITI	Bagsara	sandeepbagaria2612@gmail.com
55.	P Deiva Sundari	KCG College of Technology	Tamil Nadu	hodeee@kcgcollege.com
56.	Haribobu	G M Shiptech Training Pvt. Ltd.	Chennai	haribobu@gmail.com
57.	Viveak M.P	Florance Institute of Solar Technology	Mumbai	viveak@floranceenergysolutions.com
58.	S Kamraj,	Non-Conventional Energy & Rural Development Society	Tamil Nadu	nerdsocietycoimbatore@hotmail.com
59.	CO Mohan	CIFT	Kochi	comohan@gmail.com
60.	Prakash Singh	NERERL	Assam	psingh@nererl.com
61.	P Anbazhagan,	MAS Solar Systems		ceo@massolarsystems.com
62.	G. Karuppusami,	Sri Eshwar College of Engineering		karuppusami.g@sece.ac.in
63.	Samuel R	Kondaas Learning and Research Centre	Coimbatore	samuelrajendran04@gmail.com
64.	S. Pugalendhi	Agricultural Engineering College and Research Institute	Coimbatore	bioenergy@tnau.ac.in
65.	Shanthi Tangavelu	PPG Institute of Technology	Coimbatore	shanthivelu@gmail.com
66.	A. Sakthivel	Dr. Mahalingam College of Engineering & Technology	Pollanchi	principal@drmcet.ac.in
67.	V. Kirubakaran	The Gandhigram Rural Institute		kirbakaran@yahoo.com
68.	T. Tamizharasan	Green Pearl Electronics Pvt. Ltd.		ceo@greenpearlelectronics.com

69.	Vamsi Krishna .	Institute of Solar Power Technologies and Vocational Training	Hyderabad	cvkr29@yahoo.com
70.	S. Devraj	Sona Yukti Pvt. Ltd	Tamil Nadu	chocko@veetechnologies.com
71.	N. Mohanraj	The Institute of Entrepreneurship Development (IED)		ied_edp@rediffmail.com
72.	Vimal Kumar Eswarla	Mangla Smart Energy Solutions Private Limited.	Tiruppur	vimalswaralal@yahoo.com
73.	V.Ramakrishnan	Skills India Foundation	New Delhi	udumalpet.skillsindia@gmail.com
74.	Suresh Kumar,	Ultimate Energy Resource Private Limited.		shobha@ecocapita.in
75.	Shekhar Maramraju	Surabhi Educational Society		shekmaram@gmail.com
76.	Atuk,	2E Knowledge Ventures Pvt. Ltd.		atul@2eskills.com
77.	Gangi Reddy,	Green Urja Technologies & Systems (GUTS)	Hyderabad	nmdshajahan.g@gmail.com
78.	Adapa Raja Suresh Kumar	SynchroServe Global Solutions Private Limited.		pmkk.rangareddy@synchroserve.com
79.	S.P. Gonchaudhuri	NB Institute for Rural Technology	Kolkata	nbirt2012@gmail.com
80.	Rajan Tiwar	Earth & Moon HR Pvt. Ltd.		rajan@earthnmoon.com
81.	Manmohan Singh Chauhan,	TATA Strive	Mumbai	ssamaddar@tata.com
82.	Anand Samson,	Indian Institute of Higher Education and Research Trust	Pune	anandsamson2@gmail.com

83.	Anubhuti Awasth	Mahendra Skills Training & Development Private Limited.		manager.prt@mahendras.org
84.	Punit Kumar	Megha Vincom Private Limited.	Varanasi	balajiskilldevelopmentcenter@gmail.com
85.	Vivek Kumar	Vidyaam Skills & Technology Services Pvt. Ltd.		vidyaam_001@hotmail.com
86.	Mania Naik	Karnataka Veterinary, Animal and Fisheries Sciences University, College of fisheries, Mangalore	Mangalore	manjanaikbkvafsu@gmail.com
87.	Jaiprakash,	AIM Achievers		aimaskillcentermau@gmail.com
88.	Lalit Khanna,	JK Centre for Technician Training	Kanpur	lalit.khanna@jkcement.com
89.	Akash Sharma	C DOTS Educational Society	Kanpur	info@ceedots.com
90.	Uttam Dutta	Salt Lake Institute of Engineering & Management	West Bengal	debashism@sliemskills.com
91.	Shakti Singh	Anuna Education Network Pvt. Ltd.		shakti.singh@anuna.in
92.	Usha Bajpai	University of Lucknow	Lucknow	bajpai.usha@gmail.com
93.	A.K. Singh,	UPNEDA Research Development & Training Centre	Lucknow	ho.aks@rediffmail.com

94.	Ramesh Gera	Maharishi University of Information Technology	Lucknow	dean.mcre@muit.in
95.	Nitin Kumar	ADS Global Knowledge Academy Private Limited.		director@ads-gka.com
96.	Ramesh Kumar	Centum Worskills India limited.	Lucknow	cdm.infrastructures@gmail.com
97.	MK Jain,	Amity University		mkjain@amity.edu
98.	Avinash Mohan Bhardwaj,	Roorkee Engineering & Management Technology Institute	Roorkee	avinash312@gmail.com
99.	Sagar Anand,	Transforming Skills	Navi Mumbai	ceo.transformingskills@gmail.com
100.	Awadhesh Kumar	State Banking Institution of India		vidyaam26@hotmail.com
101.	R.V.S. Chauhan,	The Institution of Engineers (India)		uttarakhandsc@ieindia.org
102.	Raghubir Singh,	Government Polytechnic Dehradun	Dehradun	principalgppddn@rediffmail.com
103.	Rajendra bariyal,	Northern Institute Of Technical Education		rkbariyal@gmail.com
104.	Apurba Chowdhury,	Mallabhum Institute of Polytechnic	Bishnupur	mipbishnupur2014@gmail.com

105.	Sreyasi Rupa De	Hooghly Engineering & Technology College	Kolkata	sreyaside@gmail.com
106.	Diptaru Bandyopadhyay,	Kingston Polytechnic College	Berunanpukuria	keduins@gmail.com
107.	Nandan Singha,	NIC Institute of Technology	Rajarjat	nandansingha.nicit@gmail.com
108.	Sandip Chakraborti,	Quivan Skill Empowerment Private Limited.	Kolkata	quivan.sandipm@gmail.com
109.	Kiran	ANERT	Kerala	anert033@gmail.com

State Nodal Agencies

S.N.	Stakeholder	Name of the Organisation	Location	Contact details
1.	Hemanga Deka	AEDA	Assam	hemangadeka9678@gmail.com
2.	Kabyashree Dutta	AEDA	Assam	kabyashreedutta89@gmail.com
3.	Jaspal singh, Davinder Singh	PEDA	Punjab	sharad.sharma315@punjab.gov.in ; rajesh.bansal67@punjab.gov.in ; jaspalsingh@peda.gov.in
4.	Money Khanna	PEDA	Punjab	money.khanna127@punjab.gov.in
5.	Abhishek Sengupta	BREDA	Bihar	breda@breda.in
6.	Deepak Dutt Rawal	RRECL	Rajasthan	sunitmathur@rajasthan.gov.in , rrec2016@gmail.com
7.	Ashok Kumar	NREDCAP	AndhraPradesh	dmatp@nredcap.in

State Rural Livelihood Missions

S.N	Stakeholder	Name of the Organisation	Location	Contact details
1.	Mr Himadri	ASRLM	Assam	asrlms.coo@gmail.com
2.	Dhruba Jyoti	ASRLM	Assam	asrlms.coo@gmail.com

	Gogoi			
3.	Pallabh Goswami	ASRLM	Assam	arslms.pallab.pmlm@gmail.com
4.	Indrajeet Das	ASRLM	Assam	spmep.asrlms@gmail.com
5.	Mr Bikash Laha	WBSRLM	West Bengal	wbsrlm@gmail.com
6.	Mr Amit Saha	WBSRLM	West Bengal	cb.wbsrlm@gmail.com
7.	Sri Kaushik Kumar Pal	WBSRLM	West Bengal	jsnres2021@gmail.com
8.	Tarun Singh Chauhan	Rajasthan Gramin ajeevika vikas parishad	Rajasthan	secy.see@rajasthan.gov.in
9.	Jitender Kumar	BRLPS	Bihar	jitendra.live@gmail.com
10.	Amit Singh	BRLPS	Bihar	amitsingh563nb@gmail.com
11.	Jyoti Somjaji	ORLM	Odisha	somjaji04@gmail.com
12.	Bibhu Santosh	ORLM	Odisha	bibhusantosh143@gmail.com
13.	Mission Shakti Department	ORLM	Odisha	smmu.olm@gmail.com
14.	Sudhir Kumar Singh	UPSRLM	U.P	slrmupme@gmail.com
15.	Syed Imran	UPSRLM	U.P	mdsrlmup@gmail.com
16.	Dr. Amarinder Kaur	HSRLM	Haryana	aajeevikaskills.haryana@gmail.com , ceohsrlm-hsrlm@nic.in , ceohsrlm@gmail.com
17.	Mr. Kalpesh Bhatt	GLPC	Gujarat	gmstp@glpc.co.in
18.	Mr. Parasar Raval	GLPC	Gujarat	apmstp@glpc.co.in
19.	Mr. Omdevsinh Chudasama	GLPC	Gujarat	gmfarmagri-glpc@gujarat.gov.in
20.	Mr. Rahul Kumar Jha	GLPC	Gujarat	stpyp.glpc@gmail.com , ypstp.glpc@gmail.com
21.	Dr. Prasada Rao Vaddarapu	TRLM	Tripura	smm.ibcb.trlm@gmail.com
22.	Sri Ripan Chakma	TRLM	Tripura	pm.cbsi.trlm@gmail.com
23.	Smt Kanika Debbarma	TRLM	Tripura	ceotrlm@gmail.com
24.	Shilpa Shrivastava	Bihan	Chattisgarh	mcdgsrlm@gmail.com
25.	Smt Rashmi Khandekar	SRLM	Maharashtra	

26.	Ramdas Dhumale	SRLM	Maharashtra	cb@umed.in
27.	Mr Pravin Jain	SRLM	Maharashtra	pravin.jain@gov.in
28.	Mr Nagaraja Rao	SERP	Telangana	tsserpdairy@gmail.com
29.	Mr Shravan	SERP	Telangana	nonfarm.serpt@gmail.com
30.	Mr Ravindra Rao	SERP	Telangana	ibserpts@gmail.com
31.	Neha Chhabra	HSRLM	Haryana	ceohsrlm@gmail.com spmhsrlm.lh@gmail.com
32.	Dr Shameena	Kudumbashree- Kerala	Kerala	info@kudumbashree.org
33.	MK Ali	KSRLPS	Karnataka	spm.sm.cd@gmail.com
34.	Bobby Singh	Manipur- SRLM	Manipur	khbobs@yahoo.co.in

SAMETIS

S.N	Stakeholder	Name of the Organisation	Location	Contact details
1.	Mr. Sankar Lingam	Tamil Nadu SAMETI	Tamil Nadu	tnsameti@gmail.com
2.	Dr. Rajesh Chand Sood	Himachal Pradesh SAMETI	H.P	himsameti@gmail.com rajeshsood.baijnath@gmail.com
3.	Ravneet Singh	PAMETI	Punjab	
4.	Yezaho Swu	SAMETI	Nagaland	sameti_medz@rediffmail.com
5.	Sri B. Prasad Director	SAMETI	Andhra Pradesh	director.sameti.ap@gmail.com sametidirector@gmail.com
6.	Dr. Dusa Lida Director	SAMETI	Arunachal Pradesh	sametipasighat1@gmail.com
7.	Dr. Chanda Srivastava Joint Director	SAMETI	Andaman and Nicobar Islands	pdatma.andaman@gmail.com diragri@gmail.com
8.	Mr. Rabijit Director	SAMETI	Assam	sameti.assam@gmail.com
9.	Sri Abhanshu C. Jain Director	SAMETI	Bihar	bameti.bihar@gmail.com
10.	Dr. C. N. Singh Director	SAMETI	Chhattisgarh	des.rpr@igkv.ac.in

11.	Shri. Satej KamalDy. Director	SAMETI	Goa	sametigoa@gmail.com
12.	Shri H. K. Vadhvaniya (IAS) Director	SAMETI	Gujarat	sameti.gujarat@gmail.com
13.	Dr. Karam ChandDirector	SAMETI	Haryana	Karamchanddda2011@gmail.com hametijind@gmail.com
14.	Sri Ajay kr. Singh	SAMETI	Jharkhand	sametijharkhand@
15.	Dr. K Narayanagowda	SAMETI	Karnataka	deuasbangalore@gmail.com
16.	Dr. A. S. VASTRAD Director of Extension	SAMETI	Karnataka (North)	de@uasd.in
17.	Sri. George Sebastian Director	SAMETI	Kerala	sametikerala@gmail.com
18.	Dr. K.B. Ahirwal Director	SAMETI	Madhya Pradesh	siaetbhopal@gmail.com
19.	Smt Buveneswari S, IAS	SAMETI	Maharashtra	sameti123@yahoo.co.in
20.	N. Gojendro Director	SAMETI	Manipur	directorsametimipur@gmail.com , hrdeputydirector@gmail.com
21.	Shri Maqbool L.Suiam	SAMETI	Meghalaya	mametimeg@gmail.com
22.	Ms. Lalnunpuii Parte, Director	SAMETI	Mizoram	mametimizoram@gmail.com
23.	Dr. (Ms) Watimongla Jamir Director	SAMETI	Nagaland	sameti_medz@rediffmail.com , sameti.nagaland@gmail.com , imtiamenla01@gmail.com
24.	Sri Sarada Prasad Misra Director	SAMETI	Odisha	imagebbsr@rediffmail.com
25.	Mr. Jakir Hussain Director	SAMETI	Puducherry	dirsameti.pon@nic.in , sametipdy@gmail.com
26.	Dr H S Dhaliwal Director	SAMETI	Punjab	drhsdhaliwal_pau@yahoo.co m
27.	K B Sharma Director	SAMETI	Rajasthan	directorsiamjpr@gmail , shitalsharma40@gmail.com
28.	Dr Madhu Sudan Sharma	SAMETI		-
29.	Mrs. Bina Kumari Rai Director	SAMETI	Sikkim	sameti.sikkim@gmail.com

30.	Smt. G Nareemani Director	SAMETI	Telangana	telanganasameti@gmail.com
31.	Shri Surajit Ray Director	SAMETI	Tripura	tsameti.govt@gmail.com
32.	Dr Pankaj Tripathi Director	SAMETI	Uttar Pradesh	directorsameti@gmail.com , directorsima@gmail.com , sametiup@gmail.com
33.	Dr. Anil kumar Sharma Director	SAMETI	Uttarakhand	sametiuttarakhand@gmail.com , dee_gbpuat@rediffmail.com
34.	Dr. Manas Ghosh Director	SAMETI	West Bengal	sametiwbbrkm@gmail.com

Foundations

S.N.	Stakeholder	Name of the Organisation	Location	Contact details
1.	Tukaram Suryawanshi,	Yuva Vikas Society	Mumbai	kamotheetc@gmail.com
2.	Mr Santhosh	NETFISH MPEDA	Kerala	netfishmpeda@gmail.com
3.	Rachita Mishra	SELCO Foundation	Bangalore	rachita@selcofoundation.org
4.	Mahesh Lade	BAIF	Pune	maheshlade@baif.org.in
5.	Mayur Sarode	BAIF	Pune	mayur.sarode@baif.org.in
6.	Alok Juneja	BAIF	Pune	alokjuneja@baif.org.in
7.	Maya Nair	TISS	Mumbai	maya.nair@tiss.edu
8.	Rashmi Adlekha	Harsha Trust	Bhubaneshwar	harshaho@harshatrust.org
9.	Shelly J Kerketta	Mlinda Charitable Trust	Jharkhand	sjkerketta@mlinda.org
10.	Debjyoti	Mlinda Charitable Trust	Jharkhand	
11.	Saurav Singh	Mlinda Charitable Trust	Jharkhand	
12.	Mr Gajanan	Syngenta Foundation	Pune	gajanan.rajurkar@aegf.in
13.	Rushil Laheri	SEWA	Pune	rushilaheri@sewa.org
14.	Mr. Ranajeet Shanbhag	Vigyan Ashram Technologies Foundation	Pune	vapabal@gmail.com
15.	Ms Shyamala	SEED	Hyderabad	seedngo87@gmail.com

16.	Ananth	Villgro	Karnataka	ananth@villgro.org
17.	Karthik Chandrashekhar	Sangam Ventures	Rajasthan	karthik@sangam.vc

Cooperatives / National Level Boards

S.N.	Stakeholder	Name of the Organisation	Location	Contact details
1.	Dr. D Senthil Kumar	Malabar Regional Milk Producers Union Ltd	Ernakulam	preman@malabarmilma.coop
2.	Premanand	Malabar Regional Milk Producers Union Ltd	Ernakulam	preman@malabarmilma.coop
3.	Mr. Naranjan Karade	NDDDB	New Delhi	nmkarade@nddb.coop
4.	Dr Kamlesh Prasad	Eastern Regional Demonstration & Training Centre National Dairy Development Board	Siliguri	siliguri@nddb.coop
5.	Mr. Shreekant	NIMSME	New Delhi	shreekant21@gmail.com
6.	MD Khan	NIRDPR	New Delhi	rtp.nird@gov.in
7.	Ashim Borah	NFDB	Assam	ashim.borah@nfdb.gov.in
8.	Captain G S Rathee	Advisor to Tripura Tribal Areas Autonomous District Council (TTAADC)	Tripura	advisor.ttaadc@gmail.com

Farmer Producer Organisations

S.N.	Stakeholder	Name of the Organisation	Location	Contact details
1.	Dr Vinod	Shakti Vardhak Milk Producer Company Limited	Haryana	shaktifpo@gmail.com

2.	Ranjit Singha	Lala Farmer Producer Company Limited	Assam	ranjitasingha449@gmail.com
3.	Ms. Nandita Sharma	Manakamana Agro Producer Company Limited	Assam	somakanta@gmail.com
4.	Suneshwar Singh	Dandai Oilseeds Farmer Producer Company Limited	Jharkhand	suneshwarsingh042@gmail.com
5.	Ajeet kumar Mishra	Itarhi Farmer Producer Company Limited	Bihar	8002922400
6.	Mr. Ramesh Kumar	Purnia Producer Company Limited	Bihar	rk4245124@gmail.com
7.	Radha Vaishnav	Sabka Sathi Kisan Producer Company Limited	Rajasthan	8003132179
8.	Gyan Prakash	Patani Jungle Naugarh Agro Producer Company Limited	Uttar Pradesh	9838306353
9.	Ramdeen Yadav	Devipatan Farmer Producer Company Limited	Uttar Pradesh	9919100294
10.	Sanjay Gupta	Uska Bazar Farmer Producer Company Limited	Uttar Pradesh	8808881755
11.	Mr. Prabhakar Adhikar	Pragati Koraput	Odisha	pragatikoraput@gmail.com
12.	Sudip Mazumder	Bagma Agri Producer Company	Tripura	sudipgbfc@gmail.com
13.	Satish R Banait	Josa Shetkari Farmer Producer Company Limited	Maharashtra	9423828154
14.	Ranjit Singha	Lala Farmer Producer Company Limited	Assam	ranjitasingha449@gmail.com
15.	Ms. Nandita Sharma	Manakamana Agro Producer Company Limited	Assam	somakanta@gmail.com , 8811097400
16.	Suneshwar Singh	Dandai Oilseeds Farmer Producer Company Limited	Jharkhand	suneshwarsingh042@gmail.com
17.	Ajeet kumar Mishra	Itarhi Farmer Producer Company Limited	Bihar	8002922400

18.	Mr. Ramesh Kumar	Purnia Producer Company Limited	Bihar	rk4245124@gmail.com , 7250182104
19.	Radha Vaishnav	Sabka Sathi Kisan Producer Company Limited	Rajasthan	8003132179
20.	Gyan Prakash	Patani Jungle Naugarh Agro Producer Company Limited	Uttar Pradesh	9838306353
21.	Ramdeen Yadav	Devipatan Farmer Producer Company Limited	Uttar Pradesh	9919100294
22.	Sanjay Gupta	Uska Bazar Farmer Producer Company Limited	Uttar Pradesh	8808881755
23.	Arpita Baral	Bani Khetra Women Farmers Producer Company Limited	Odisha	8847883266
24.	Rabindranath Routray	Daya Rajua Farmers Producer Company Limited	Odisha	9861835586
25.	Gavneet	AMBALA FARMERS PRODUCER CO LTD	Haryana	9315015540
26.	Rajender Yadav	Nihalgarh Milk & Organic Food Producers Company Ltd	Haryana	9416129081
27.	Surinder Singh	High Hill Jubbal Farmer Producer Company Limited	Himanchal Pradesh	8219547565
28.		Himachal Pradesh Mahila Kalyan Mandal Kullu	Himanchal Pradesh	9418239369
29.		Malappuram Agro Producer Company Limited	Kerala	maappco@gmail.com , 9495241353
30.		Jan Kissan Producer Company Limited	Kerala	psassociatespkd@gmail.com , 4923243189
31.	Nikhilesh Bhatt	Sabarmathy Agri And Livestock Farmers Producer Company Limited	Kerala	ca.bijup@gmail.com , 9447587749
32.	Sachin Yadav	Retam Farmer Producer Company Limited	Madhya Pradesh	7225927202

33.		Shribaraahdev Farmers Producer Company Limited	Madhya Pradesh	9826258344
34.		Maladevi Milk Producer Company Limited	Madhya Pradesh	9425148866
35.	Vikas Baliram Zanak	Tiwali Richland Farmer Producer Company Limited	Maharashtra	9130421018
36.		Himalaya Kalyan Farmers Producer Organization-South	Sikkim	krishakorg@gmail.com 9563785258
37.		Krishak Kalyan Farmer Producer Organization - South	Sikkim	9609862220
38.	Vidhi Sharma	Samrala Farmers Vegetable Producer Company Limited	Punjab	vidhi.sharma@itsltd.in Shri. Subhash Singh Ph.No-9988665196
39.	Srishti Saxena	Jagraon Farmer Vegetable Producer Company Limited	Punjab	srishti.saxena@itsltd.in
40.	Shri. Gurdeep Singh	Progressive Vegetable Grower Farmer Producer Company Limited	Punjab	gs_josan@yahoo.com Ph.No- 9914121605
41.	Mr. Kusangkumchu	Donen Sang Farmers Producer Company Limited	Nagaland	7060941452
42.	Mr. Shanglow Y	Rural Phek Farmers Producer Company Limited	Nagaland	M 9862836405
43.	Mr. Joel Khate	Peren Jalukie Agri Fed Producer Company Ltd	Nagaland	9366227178
44.	Keshav	Chaukhutiya Krishak Vikas Producer Company Limited	Uttarakhand	9149002931
45.	Umesh Chandra	Dwarahat Krishak Vikas Producer Company Limited	Uttarakhand	9410102861
46.	Jagdeep Bhardwaj	Narayanbagar Krishak Vikas Producer Company Limited	Uttarakhand	6396258557
47.	B.Rajendar	Jagadevpur Farmer Producer Company	Telangana	6281202362

		Limited		
48.	B.Siva Kumar	Sri Nandeeshwara Farmers Producer Company Limited	Telangana	6281202449
49.	B.Ashok	Sri Ambhurameshwara Farmers Producer Company Limited	Telangana	6281202421
50.	B.Chandrakant	Kagnajala Farmers Producer Company Limited	Telangana	6281202452

KVKs

S. No	Stakeholder	Name of the Organisation	Location	Contact details
1.	Dr Bhrmaprakash	<u>Indian Institute of Sugarcane Research, Raebareilly Road, P.O. Dilkusha, Lucknow</u>	Lucknow	director@iisrko@gmail.com
2.	Dr. Ranjit Bordoloi	KVK Sonitpur	Assam	branjit86@gmail.com
3.	Dr Aashutosh Sharma	KVK Narisinghpur	Madhya Pradesh	Dr. Aashutosh Sharma
4.	Dr. Shakuntala Gupta	KVK Bijnor	Uttar Pradesh	Dr. Shakuntala Gupta
5.	Dr Nagashree	ICAR-Central Research Institute for Dryland Agriculture (CRIDA) Santoshnagar, Hyderabad - 500	Hyderabad	director.crida@icar.gov.in
6.	MS Behera	ICAR-Central Research Institute for Jute and Allied Fibres Barrackpore, Kolkata	Kolkata	crijaf-wb@nic.in

7.	Dr. Y Ramakrishna	ICAR-Central Island Agricultural Research Institute Post Box No. 181, Port Blair	Port Blair	yeraboina@icar.gov.in
8.	Dr Gurpreet Singh Makkar ,	Krishi Vigyan Kendra, Samrala, Distt. Ludhiana	Ludhiana	kvk.ludhiana@icar.gov.in ; kvk-ludhiana@pau.edu
9.	Dr Pramod Kum ar,	KVK, Jagannathpur, PS - Jagannathpur,	Jagannathpur ,	kvk.wsinghbhum@icar.gov.in ; kvkws1@gmail.com
10.	Dr Muneshwar Prasad	Krishi Vigyan Kendra, Vijay Nagar, Distt. Banka	Banka	kvk.banka@icar.gov.in ; bankakvk@gmail.com
11.	Dr Sanjay Kuma r Mohanty,	Krishi Vigyan Kendra, At: Sakhigopal, Infront of Satyabadi Block, Distt. Puri, Odisha	Odisha	kvk.Puri@icar.gov.in ; purikvk@yahoo.co.in
12.	Dr Ashok Kumar	Krishi Vigyan Kendra, Zonal Agricultural Research Station, Daleep Nagar, Distt. Kanpur	Kanpur	kvk.KanpurDehat@icar.gov.in ; kvkkanpurdehat@gmail.com
13.	Dr C P Meena	Krishi Vigyan Kendra, Jaisalmer-II, NH- 11, Gomat, Pokaran, Jaisalmer, Rajasthan- 345021	Jaisalmer	kvk.Jaisalmer2@icar.gov.in ; kvkpokaran@gmail.com
14.	Dr. Meena Siwach, Head KVK,	KVK- Rohtak, Rohtak Haryana	Rohtak	kvk.rohtak@icar.gov.in ; kvkrohtaksc2@gmail.com
15.	Dr Bharat Bhai Mehta,	Krishi Vigyan Kendra, At. & Po Golagamdi, Ta. Sankheda, Dist. Vadodara- Chhotaudepur	Vadodara- Chhotaude pur	kvk.Vadodara@icar.gov.in ; kvkvd@gmail.com

16.	Dr D. N. Kalita,	Krishi Vigyan Kendra,Kamrup, Kahikuchi, GuwahatiDistt. Kamrup	Kamrup, Kahikuchi,	kvk.kamrup@icar.gov.in ; kvk_kamrup@aaau.ac.in
17.	Dr M.A.Vennila	Krishi Vigyan Kendra,State Seed Farm,Papparapp aty, Pennagaram TkDistt. Dharmapuri	Dharmapuri	kvk.Dharmapuri@icar.gov.in ; kvkdpr@tnau.ac.in
18.	Dr. Aashutosh Sharma	Krishi Vigyan Kendra,Station Gunj,Distt. Narsinghpur	Narsinghpur	kvknarsinghpur@rediffmail.com
19.	Dr Desh Beer Singh	ICAR CITH Srinagar	J&K	dircithsgr@icar.org.in
20.	Dr. R K Singh	ICAR-CIPHET, Ludhiana	Punjab	ciphetyludhiana1989@gmail.com
21.	Dr. A. Pattanayak-	ICAR-VPKAS, Almora	Uttarakhand	director.vpkas@icar.gov.in
22.	Dr. O.P. Yadav	ICAR-Central Arid Zone Research Institute (CAZRI) Jodhpur,	Rajasthan	director.cazri@icar.gov.in
23.	Dr. M.S. Chauhan	ICAR-National Dairy Research Institute, GT Road,Karnal, Haryana -132 001	Haryana	dir.ndri@gmail.com
24.	Dr. M.S. Chauhan	National Dairy Research Institute, Karnal-132 001	Haryana	director@ndri.res.in
25.	Dr. Ajay Kumar Singh	ICAR - Indian Agricultural Research Institute, Pusa, New delhi	New Delhi	director@iari.res.in
26.	Dr. R.K. Singh	Research, P. B. No. 1,Jakhini, Shahanshahpur, Varansi	U.P	directoriivr@gmail.com
27.	Dr. Jagdish Singh	ICAR - Central Institute for Sub tropical Horticulture,Reh mankhara, P.O.	U.P	srajanlko@gmail.com

		Kakori, Lucknow - 226 101		
28.	Dr. BP Bhatt	RCER, ICAR - Research Complex for Eastern Region, ICAR Parisar P.O. Bihar Veterinary College Patna	Bihar	directorrcer2@gmail.com
29.	Dr. K.K. Sharma	IINRG, ICAR- Indian Institute of Natural Resins and Gums Namkum, Ranchi,	Jharkhand	director.iinrg@gmail.com
30.	Dr. Vishal Nath	NRC Litchi, NRCL Mushahari Fram	Bihar	director.nrcl@icar.gov.in , nrclitchi@yahoo.co.in
31.	Dr. P. L. Saroj	ICAR-Central Institute for Arid Horticulture Beechwal, Bikaner-334006,	Rajasthan	ciah@nic.in
32.	Dr. Eaknath Bhanudasrao Chakurkar	ICAR - CCARI, Ela, Old Goa	Goa	director.ccari@icar.gov.in
33.	Dr. P S Tiwari	ICAR-Central Institute of Agricultural Engineering Berasiya Rd, Navi Bagh, Bhopal	Madhya Pradesh	singh_ciae@yahoo.com , kk.singh@icar.gov.in
34.	Dr. G. Ravindra Chary	ICAR-Central Research Institute for Dryland Agriculture (CRIDA) Santoshnagar, Hyderabad - 500	Andhra Pradesh	director.crida@icar.gov.in
35.	Dr. M.R.Dinesh	ICAR-IIHR, P.O. Hessaraghatta Lake , Bengaluru	Karnataka	director.ihr@icar.gov.in

Service Provider/Product Manufacturers

S.N.	Stakeholder	Name of the Organisation	Location	Contact details
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1.	Prof Saroj Kumar Nayak	Karmatech	Bhubaneswar	saroj.nayak7@gmail.com
2.	Ram Bheke	Promethean Power	Mumbai	ram@promethean.power.com
3.	Shashank Shukla	Statcon Energia	Noida	rakesh.mishra@energiaa.in
4.	Aneeksha Anand	Agri Vijay	Pune	partner@agrivijay.com
5.	Lokesh	TERP	Noida	
6.	Sidharth	DD Solar	New Delhi	bizdev@ddsolar.in
7.	Mehul Patel	kWatt Solutions Private Limited	Mumbai	yogesh@kwattsolutions.com
8.	Kamlesh Upadhyay	Mahindra Susten Private Limited.	Thane	ddukk@cuh.ac.in
9.	Pravin Borakar	Mitcon consultancy	Mumbai	pravin.borkar@mitconindia.com
10.	Pranshul	Raheja Solar Food Processing Private Limited	Indore	pranshul2604@gmail.com
11.	P. Chandra Prakash-	Sri Chandra Engineering & Trading Company	Andhra Pradesh	chandraprakashkamana@gmail.com
12.	G Ravi Kumar	Container Corporation of India Ltd (CONCOR)	New Delhi	-
13.	Mahesh Rathi	Mahesh Kumar & Co	Mumbai	rathimahesh1874@gmail.com
14.	Their Rajan	ATR Solar	Tamil Nadu	atrsolar@gmail.com
15.	Dr. Nitin Goel	Inficold	Karnataka	ng@inficold.com
16.	Prabhakar	Phocos	Puducherry	prabhakar@phocos.com
17.	Manish Mishra	SBI Ven Capital Pte. Ltd.	Bihar	mamishra@sbigroup.com.sg
18.	Nikhil Mishra	Varddan Dairy	Mumbai	nikhil.mishra@varddan.com

19.	Dushyant	Cold Chain Solutions	Delhi	Dushyant@coldchainsolution.in
20.	Mr. Levine Lawrence	Ecoideaz Ventures	Karnataka	editor@ecoideaz.com
21.	Gauhar ali	Centair Private Limited		gauharali@thecpl.in
22.	Harsh	Uniref	Ghaziabad	harsh@unirefindia.com
23.	Lavjeet	Keon Reftec Private Limited	Gujarat	sales4keon@gmail.com
24.	Mr. Venkat Kumar Tangirala	Windstream Energy Technologies India Pvt Ltd	Telangana	vk@windstream.tech
25.	Niraj	CoolCrop		niraj@coolcrop.in
26.	Devendra Gupta	Ecozen Solutions	Maharashtra	devendragupta@ecozensolutions.com
27.	Naveen Garg	Husk Power	Bihar	naveen_garg@huskpowersystems.com
28.	Katie	Khethworks	Maharashtra	katie@khethworks.com
29.	S R Sinha	Saija	Delhi	saija.inc@gmail.com
30.	Dr. Ashok Das	SunMoksha	Karnataka	das@sunmoksha.com

6.2. Annexure 2 – Stakeholder-wise Questionnaires Developed

Agriculture Sector

Questionnaire for Farmers / FPOs – Agriculture Sector

General

1. Name of respondent:
2. Mobile Number/ any other contact no:
3. Location:
4. What line of business are you involved in?
5. Apart from you, who else in your family is engaged in this line of business?

Technical and Operational

1. Which part of agriculture value chain are you involved in:
 - a. Nursey
 - b. Production
 - c. Harvesting
 - d. Post-harvesting
 - e. Processing
 - f. Other
2. Which agricultural machinery / equipment is used across the following components of the value chain;
 - a. Nursey
 - b. Production
 - c. Harvesting
 - d. Post-harvesting
 - e. Processing
 - f. Other machinery used
3. Are you aware about DRE-based machinery / equipment available for use in agriculture sector? If yes, have you used any?
4. If yes to #3, which DRE-based machinery / equipment have you used?
 - a. Do you understand the correct usage of the applicable DRE technologies?
 - b. Are there any limitations of the technology being used? If yes, what limitation exist?
 - c. Have you faced any operational challenges in the usage of the DRE technology / product? If yes, what challenges have you faced?
 - d. Would you like to have a training with respect to the correct usage of the DRE technology / machinery in the future?
 - e. Is there a specific aspect of the DRE machinery operations that you would like a training on?
5. Other than operational aspects of the DRE technology, have you ever received any capacity building, with respect to DRE technologies, in any of the following areas:
 - a. Installation and maintenance of DRE technologies
 - b. Safety of the DRE machinery / equipment
 - c. Business model guidance
 - d. Scaling up crop production
 - e. Crop preservation and transport
 - f. Environmental benefits associated with the use of DRE technologies

- g. Other
- 6. Are these trainings also provided to women farmers / entrepreneurs?
 - a. Are any additional trainings provided to women farmers? If yes, what do those trainings entail?
- 7. Who imparts these trainings in your area?
- 8. Has there been noticeable impact of the training on:
 - a. Livelihood
 - b. Income generation opportunities
 - c. Enterprise development / increase in entrepreneurship in the area;
 - d. Increase in commercial activity in the area
 - e. Other
- 9. Is there any cost benefit of using DRE vs conventional technology in the agri value chain? If yes, what cost benefits do you think exist?
 - a. Has any training been imparted to explain such benefits?
- 10. Has the DRE technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
 - a. Is there a requirement for capacity building on community skill development in the context of DRE technologies for the agriculture sector?
- 11. What are the other capacity gaps / training gaps according to you that needs to be addressed? Do you have a preference?
- 12. Do you know of a training institute / organisation which can provide the necessary training?

Financial

- 1. Are you aware of any financing schemes and existing financial institutions?
 - a. How did you get to know about the applicable schemes?
 - b. Have you availed any financing support / subsidy under the scheme?
- 2. Do you plan to avail loan from banks for your line of business in the future? If yes, would you like to obtain any training to guide you with the process?
- 3. Overall, has there been any training provided to you on financing in your value chain?
 - a. If yes, on what topics?
 - b. Do you find any gaps in the trainings or the material that is provided to you?
 - c. What, do you think, are the knowledge areas that should be covered in the existing training material?
- 4. Do you know of a training institute / organisation which can provide the necessary training?

Policy and Regulatory

- 1. Are you aware of any Government schemes/incentives/subsidies available that are applicable in the agriculture sector, especially in the DRE domain?
 - a. Do you know how to avail subsidy under these schemes?
 - b. Was there any knowledge sharing session conducted for providing a briefing about these schemes? If yes, for which one?
 - c. Are there any challenges being faced to undertake those trainings?
 - d. Do you require any capacity building / future trainings in this regard?

Questionnaire for Rural Entrepreneurs and Product Sellers / Manufacturers – Agriculture Sector

General

1. Name of respondent:
2. Mobile Number/ any other contact no:
3. Location:
4. What line of business are you involved in?

Technical and Operational

1. Are you involved in DRE product sales in the agriculture sector? If yes, which products do you manufacture / sell?
2. What is your geographical coverage?
3. According to you, what DRE technologies are applicable at each stage of the agriculture value chain?
4. Do you impart knowledge around the correct usage of the applicable DRE technologies to the buyer / community? If yes, what topics do you cover through such trainings?
5. Do you engage with the buyers / community on the appropriate business models with respect to the use of the DRE technology?
6. What parts of the system require regular maintenance?
 - a. Do you provide SOP to the customer to be followed for maintenance of the DRE product?
7. Do you provide any after-sale services for the DRE product? If yes, what does it entail?
 - a. Do you build the capacity of the customer with respect to the after-sale services available on the product??
8. Has the DRE technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
9. Overall, do you provide any training to the customer on the following:
 - a. Installation best practices of the system / product
 - b. Operation, up-keep and maintenance of the product / system
 - c. Feasible business models for the product / technology /system
 - d. Business expansion opportunities available to the farmer
 - e. Cost benefit of adopting the DRE technology
 - f. Environmental benefits of the DRE technology
 - g. Others
10. If not you, do you know if any training institute imparts such trainings in your area?
 - a. If yes, can you name the respective training institutes?
 - b. What type of trainings do they impart?
 - c. What is the duration of the trainings?
 - d. Are they online or physical?
 - e. Are such training free or paid? If paid, what is the fee?
 - f. What is the frequency of such trainings?
11. Has there been noticeable impact of the training on:
 - a. Livelihood
 - b. Income generation opportunities
 - c. Enterprise development / increase in entrepreneurship in the area;
 - d. Increase in commercial activity in the area

- e. Other
- 12. Has this helped in the expansion of existing businesses?
- 13. What are the capacity gaps / training gaps according to you that needs to be addressed?
- 14. Do you know of a training institute / organisation which can provide the necessary training?

Financial

- 5. Are your customers aware of any financing schemes and existing financial institutions in the agriculture specific DRE sector?
 - a. Are you aware if they have availed any financing support / subsidy under the scheme for DRE product procurement?
 - b. Has there been any trainings provided to them on availing support under the scheme in the agri value chain? If yes, on what topics?
 - c. Do you find any gaps in the trainings or the material that is provided to the end user of the DRE product?
 - d. What, do you think, are the knowledge areas that should be covered in the existing training material?
- 6. Do you plan to avail loan from banks for your line of business in the future? If yes, would you like to obtain any training to guide you with the process?

Policy and Regulatory

- 1. Are you aware of any Government schemes/incentives/subsidies available that are applicable to you in the agriculture sector, especially in the DRE domain?
- 2. Is there any financial support available to you under such schemes? Do you know how to avail subsidy under these schemes?
 - a. Was there any knowledge sharing session conducted for providing a briefing about these schemes? If yes, for which one?
 - b. Are there any challenges being faced to undertake those trainings?
 - c. Do you require any capacity building / future trainings in this regard?

Questionnaire for Training Institutes and SAMETIs

General

- 1. Name of respondent:
- 2. Mobile Number/ any other contact no:
- 3. Location:
- 4. Which training institute are you associated with and in what capacity?

Technical and Operational

- 1. What do you think entails agriculture sector value chain?
- 2. According to you, what DRE technologies are applicable at each stage of the value chain?
 - a. Do you think farmers are aware of the applicable DRE technologies in agri sector?
 - b. Do you think farmers understand the correct usage of these technologies?

- c. Do you provide trainings to the farmer / community on generating awareness about DRE technologies in the agri sector and the apt usage of such DRE products / technologies?
 - d. What topics do you cover?
3. Are there any limitations/ challenges of the DRE technology being used by farmers?
 - a. If yes, what limitation/ challenges exist?
 - b. Do you / have you provided any trainings to address these limitations / challenges?
4. Are you aware if the DRE product/ technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
5. Other than stated above, do you provide trainings in any of the below mentioned areas which area do you provide trainings:
 - a. Design and installation of the system / product
 - b. Operation, up-keep and maintenance of the product / system
 - c. Need and utility of a Business Plan for a rural enterprise
 - d. Components of a Business Plan
 - e. Guidelines for preparing a Business Plan
 - f. Feasible business models for the product / technology /system
 - g. Others
6. Please provide the following details about the trainings being delivered in DRE:
 - a. What is the frequency at which your institution delivers the training?
 - b. Who is your clientele for the trainings?
 - c. Do you have any eligibility criteria for imparting training to your clientele?
 - d. What is the mode of training (offline / online)?
 - e. Is it a free or paid course? If paid, how much is the course / training fee?
 - f. Is the training material available on free / open source platform? Could you share a copy of the course module?
 - g. Who imparts these trainings in your institute (self-learning/ expert delivered)?
7. Do you also conduct training of trainers to create capacity at the ground level?
 - a. If yes, in which areas of agri value chain?
 - b. Who do you trainer under your TOT programme (govt. officials, community members, etc.)?
8. Do you have tie ups / association with state level departments / SNAs / SRLMs for imparting trainings in a state? If yes, in which states?
9. Do you plan to expand such tie ups with additional states? If yes, with which states? Has there been noticeable impact of the training on
 - a. Livelihood
 - b. Income generation opportunities
 - c. Enterprise development / increase in entrepreneurship in the area;
 - d. Increase in commercial activity in the area
 - e. Other
10. Has this helped in the expansion of existing businesses / rural entrepreneurs in the state?
11. What are the capacity gaps / training gaps according to you that needs to be addressed?
 - a. Are you planning to expand your training courses to cover such capacity gaps? If yes, when and for what category of gaps identified so far?
 - b. What should be the frequency of these trainings?
12. Have you received renewed interest among the farming community for trainings you provide?
13. Have you / do you plan to provide refresher courses?

Financial

1. Are the end users/ farmers aware of the financing schemes / initiatives in the agri sector? If yes, which ones?
 - a. Has there been any trainings provided to end users/ farmers on financing in agri value chain?
 - b. Do you think there are any gaps in such trainings being provided to the farmers at present?
 - c. What, do you think, are the knowledge areas that should be covered in the existing training material for end users/ farmers?
 - d. Do the farmers seek any additional help from the SNAs/ SRLMs in order to build their capacities to avail finances/ subsidy for DRE technologies in the sector? If yes, could you elaborate what help is sought in this regard?
 - e. Are you planning to provide trainings to the farmers to provide assistance around this?
- 2.
3. Are you exploring to tie up with any additional state level departments / agencies to impart DRE training related to financing / availing funding in the sector to end users/ farmers
 - a. If yes, with whom, for what technologies and in which step of the agri value chain?

Policy and Regulatory

1. Are there any trainings available with you to impart knowledge about state level schemes/incentives/subsidies in the agriculture sector?
 - a. Was there any knowledge sharing session conducted by you / any training institute for providing a briefing about these schemes? If yes, for which one?
 - b. Are there any challenges being faced by farmers to undertake those trainings? If yes, what improvements are you planning to incorporate in such trainings?
2. Are you aware if any additional capacity building / future trainings in this regard are required by the end users? If yes, in what areas?
 - a. Do you plan to impart trainings in this regard?

Questionnaire for SRLMs / SNAs / State Departments

General

1. Name of respondent:
2. Mobile Number/ any other contact no:
3. Location:
4. Which Department / Agency are you associated with and in what capacity?

Technical and Operational

1. What do you think entails agri sector value chain?
2. According to you, what DRE technologies are applicable at each stage of the value chain?
 - a. Which out of these technologies are being promoted by your department and at what stage of the value chain?
 - b. Are multiple sellers/providers of the technology available in the state? If yes, do you impart knowledge among the farmer community about these technology providers / product sellers in the market?
3. Do you impart knowledge around the correct usage of the applicable DRE technologies to the buyer / community? If yes, what topics do you cover through such trainings?

4. Are there any limitations/ challenges of the technology being used?
 - a. If yes, what limitation/ challenges exist?
 - b. Do you / have you provided or arranged any trainings to address these limitations / challenges?
 - c. Have you identified any other trainings that are needed to be provided in this regard?
 - d. Have you partnered with any training institute which provides such trainings?
 - e. If yes, can you name the respective training institutes?
 - f. What type of trainings do they impart?
 - g. What is the duration of the trainings?
 - h. Are they online or physical?
 - i. Are such training free or paid? If paid, what is the fee?
 - j. What is the frequency of such trainings?
5. Has the DRE-based product/ technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
6. Do you engage with the agri farmers/ community on the appropriate business models with respect to the use of the DRE technology? If yes, what trainings are provided in this regard?
7. Overall, do you provide any training to the agri farmers on the following:
 - a. Installation best practices of the system / product
 - b. Operation, up-keep and maintenance of the product / system
 - c. Feasible business models for the product / technology /system
 - d. Business expansion opportunities available to the farmer
 - e. Cost benefit of adopting the DRE technology
 - f. Environmental benefits of the DRE technology
 - g. Others
8. If not you, has your department / agency associated with any training institutes to impart such trainings? If yes, which ones?
 - a. What topics do they cover?
 - b. What type of trainings do these institutes provide and at what frequency?
 - c. What is the mode (online/ offline) of these trainings?
 - d. How much do these institutes charge for such trainings?
9. Has there been noticeable impact of the training on:
 - a. Livelihood
 - b. Income generation opportunities
 - c. Enterprise development / increase in entrepreneurship in the area;
 - d. Increase in commercial activity in the area
 - e. Other
10. Has this helped in the expansion of existing businesses/ adoption of DRE in agri value chain in the state?
11. What are the capacity gaps / training gaps according to you that needs to be addressed?
 - a. Do you know of a training institute / organisation which can provide the necessary training?
 - b. If yes, could you name the training institute?
 - c. Are you exploring / do you plan to explore tie ups with the trainings institute?

Financial

1. Do you promote any financing schemes / initiatives in the agri sector in the state? If yes, which ones?
2. Are end users/ agri farmers aware of the financing support/ subsidy available for DRE technologies applicable to them?

3. Has there been any trainings provided to end users/ farmers / rural level entrepreneurs on financing in agri value chain?
 - a. Do you think there are any gaps in such trainings being provided to the farmers at present?
 - b. What, do you think, are the knowledge areas that should be covered in the existing training material for end users/ farmers?
 - c. Do the farmers seek any additional help from the SNAs/ SRLMs in order to build their capacities to avail finances/ subsidy for DRE technologies in the sector? If yes, could you elaborate what help is sought in this regard?
 - d. Are you exploring to tie up with any training institutes to impart DRE training to the farmers in the financing / funding space? If yes, at which step of the value chain?

Policy and Regulatory

1. Are there any state level schemes/incentives/subsidies available that are applicable in the agriculture sector?
 - a. Are end users/ farmers aware on how to avail subsidy under these schemes?
 - b. Was there any knowledge sharing session conducted by you / any training institute for providing a briefing about these schemes? If yes, for which one?
 - c. Are there any challenges being faced to undertake those trainings? If yes, what improvements would you suggest?
 - d. Are you aware if any additional capacity building / future trainings in this regard are required / desired by the farmers? If yes, in which areas?

Dairy Sector

Questionnaire for Farmers / FPOs – Dairy Sector

General

1. Name of respondent:
2. Mobile Number/ any other contact no:
3. Location:
4. What line of business are you involved in?
5. Apart from you, who else in your family is engaged in this line of business?

Technical and Operational

1. Which part of the dairy value chain are you involved in:
 - a. Milking
 - b. Collection
 - c. Chilling
 - d. Processing
 - e. Other
2. Which machinery / equipment is used across the following components of the value chain:
 - a. Milching and Milking
 - b. Collection
 - c. Chilling
 - d. Processing
 - e. Other machinery used
3. Are you aware about DRE-based machinery / equipment available for use in dairy sector? If yes, have you used any?
4. If yes to #3, which DRE-based machinery / equipment have you used?
 - a. Do you understand the correct usage of the applicable DRE technologies?
 - b. Are there any limitations of the technology being used? If yes, what limitation exist?
 - c. Have you faced any operational challenges in the usage of the DRE technology / product? If yes, what challenges have you faced?
 - d. Would you like to have a training with respect to the correct usage of the DRE technology / machinery in the future?
 - e. Is there a specific aspect of the DRE machinery operations that you would like a training on?
5. Other than operational aspects of the DRE technology, have you ever received any capacity building, with respect to DRE technologies, in any of the following areas:
 - a. Installation and maintenance of DRE technologies
 - b. Safety of the DRE machinery / equipment
 - c. Business model guidance
 - d. Scaling up milk production
 - e. Milk preservation and transport
 - f. Environmental benefits associated with the use of DRE technologies
 - g. Other
6. Are these trainings also provided to women farmers / entrepreneurs?
 - a. Are any additional trainings provided to women farmers? If yes, what do those trainings entail?

7. Who imparts these trainings in your area?
8. Has there been noticeable impact of the training on:
 - a. Livelihood
 - b. Income generation opportunities
 - c. Enterprise development / increase in entrepreneurship in the area;
 - d. Increase in commercial activity in the area
 - e. Other
9. Is there any cost benefit of using DRE vs conventional technology in the dairy value chain? If yes, what cost benefits do you think exist?
 - a. Has any training been imparted to explain such benefits?
10. Has the DRE technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
 - a. Is there a requirement for capacity building on community skill development in the context of DRE technologies for the dairy sector?
11. What are the other capacity gaps / training gaps according to you that needs to be addressed? Do you have a preference?
12. Do you know of a training institute / organisation which can provide the necessary training?

Financial

1. Are you aware of any financing schemes and existing financial institutions?
 - a. How did you get to know about the applicable schemes?
 - b. Have you availed any financing support / subsidy under the scheme?
2. Do you plan to avail loan from banks for your line of business in the future? If yes, would you like to obtain any training to guide you with the process?
3. Overall, has there been any training provided to you on financing in your value chain?
 - a. Do you find any gaps in the trainings or the material that is provided to you?
 - b. What, do you think, are the knowledge areas that should be covered in the existing training material?
4. Do you know of a training institute / organisation which can provide the necessary training? Can you name the same?

Policy and Regulatory

1. Are you aware of any Government schemes/incentives/subsidies available that are applicable in the dairy sector, especially in the DRE domain?
 - e. Do you know how to avail subsidy under these schemes?
 - f. Was there any knowledge sharing session conducted for providing a briefing about these schemes? If yes, for which one?
 - g. Are there any challenges being faced to undertake those trainings?
 - h. Do you require any capacity building / future trainings in this regard?

Questionnaire for Rural Entrepreneurs and Product Sellers / Manufacturers – Dairy Sector

General

1. Name of respondent:
2. Mobile Number/ any other contact no:
3. Location:
4. What line of business are you involved in?

Technical and Operational

1. Are you involved in DRE product sales in the dairy sector? If yes, which products do you manufacture / sell?
2. What is your geographical coverage?
3. According to you, what DRE technologies are applicable at each stage of the dairy value chain?
 - a.
4. Do you impart knowledge around the correct usage of the applicable DRE technologies to the buyer / community? If yes, what topics do you cover through such trainings?
5. Do you engage with the buyers / community on the appropriate business models with respect to the use of the DRE technology?
6. What parts of the system require regular maintenance?
 - a. Do you provide SOP to the customer to be followed for maintenance of the DRE product?
7. Do you provide any after-sale services for the DRE product? If yes, what does it entail?
 - a. Do you build the capacity of the customer with respect to the after-sale services available on the product??
8. Has the DRE technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
9. Overall, do you provide any training to the customer on the following:
 - a. Installation best practices of the system / product
 - b. Operation, up-keep and maintenance of the product / system
 - c. Feasible business models for the product / technology /system
 - d. Business expansion opportunities available to the dairy farmer
 - e. Cost benefit of adopting the DRE technology
 - f. Environmental benefits of the DRE technology
 - g. Others
10. If not you, do you know if any training institute imparts such trainings in your area?
 - a. If yes, can you name the respective training institutes?
 - b. What type of trainings do they impart?
 - c. What is the duration of the trainings?
 - d. Are they online or physical?
 - e. Are such training free or paid? If paid, what is the fee?
 - f. What is the frequency of such trainings?
11. Has there been noticeable impact of the training on:
 - a. Livelihood
 - b. Income generation opportunities
 - c. Enterprise development / increase in entrepreneurship in the area;
 - d. Increase in commercial activity in the area

- e. Other
- 12. Has this helped in the expansion of existing businesses?
- 13. What are the capacity gaps / training gaps according to you that needs to be addressed?
- 14. Do you know of a training institute / organisation which can provide the necessary training?

Financial

- 1. Are your customers aware of any financing schemes and existing financial institutions in the dairy specific DRE sector?
 - a. Are you aware if they have availed any financing support / subsidy under the scheme for DRE product procurement?
 - b. Has there been any trainings provided to them on availing support under the scheme in the dairy value chain? If yes, on what topics?
 - c. Do you find any gaps in the trainings or the material that is provided to the end user of the DRE product?
 - d. What, do you think, are the knowledge areas that should be covered in the existing training material?
- 2. Do you plan to avail loan from banks for your line of business in the future? If yes, would you like to obtain any training to guide you with the process?

Policy and Regulatory

- 1. Are you aware of any Government schemes/incentives/subsidies available that are applicable to you in the dairy sector, especially in the DRE domain?
- 2. Is there any financial support available to you under such schemes? Do you know how to avail subsidy under these schemes?
 - i. Was there any knowledge sharing session conducted for providing a briefing about these schemes? If yes, for which one?
 - j. Are there any challenges being faced to undertake those trainings?
 - k. Do you require any capacity building / future trainings in this regard?

Questionnaire for SNAs / State Departments

General

- 1. Name of respondent:
- 2. Mobile Number/ any other contact no:
- 3. Location:
- 4. Which Department / Agency are you associated with and in what capacity?

Technical and Operational

- 1. What do you think entails dairy sector value chain?
- 2. According to you, what DRE technologies are applicable at each stage of the value chain?

- a. Which out of these technologies are being promoted by your department and at what stage of the value chain?
- b. Are multiple sellers/providers of the technology available in the state? If yes, do you impart knowledge among the farmer community about these technology providers / product sellers in the market?
3. Do you impart knowledge around the correct usage of the applicable DRE technologies to the buyer / community? If yes, what topics do you cover through such trainings?
4. Are there any limitations/ challenges of the technology being used?
 - a. If yes, what limitation/ challenges exist?
 - b. Do you / have you provided or arranged any trainings to address these limitations / challenges?
 - c. Have you identified any other trainings that are needed to be provided in this regard?
 - d. Have you partnered with any training institute which provides such trainings?
 - e. If yes, can you name the respective training institutes?
 - f. What type of trainings do they impart?
 - g. What is the duration of the trainings?
 - h. Are they online or physical?
 - i. Are such training free or paid? If paid, what is the fee?
 - j. What is the frequency of such trainings?
5. Has the DRE-based product/ technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
6. Do you engage with the dairy farmers/ community on the appropriate business models with respect to the use of the DRE technology? If yes, what trainings are provided in this regard?
7. Overall, do you provide any training to the dairy farmers on the following:
 - a. Installation best practices of the system / product
 - b. Operation, up-keep and maintenance of the product / system
 - c. Feasible business models for the product / technology /system
 - d. Business expansion opportunities available to the farmer
 - e. Cost benefit of adopting the DRE technology
 - f. Environmental benefits of the DRE technology
 - g. Others
8. If not you, has your department / agency associated with any training institutes to impart such trainings? If yes, which ones?
 - a. What topics do they cover?
 - b. What type of trainings do these institutes provide and at what frequency?
 - c. What is the mode (online/ offline) of these trainings?
 - d. How much do these institutes charge for such trainings?
9. Has there been noticeable impact of the training on:
 - a. Livelihood
 - b. Income generation opportunities
 - c. Enterprise development / increase in entrepreneurship in the area;
 - d. Increase in commercial activity in the area
 - e. Other
10. Has this helped in the expansion of existing businesses/ adoption of DRE in dairy value chain in the state?
11. What are the capacity gaps / training gaps according to you that needs to be addressed?
 - a. Do you know of a training institute / organisation which can provide the necessary training?
 - b. If yes, could you name the training institute?

- c. Are you exploring / do you plan to explore tie ups with the trainings institute?

Financial

1. Do you promote any financing schemes / initiatives in the dairy sector in the state? If yes, which ones?
2. Are the dairy farmers aware of the financing support/ subsidy available for DRE technologies applicable to them?
3. Has there been any trainings provided to end users/ rural level entrepreneurs on financing in dairy value chain?
 - a. Do you think there are any gaps in such trainings being provided to the farmers at present?
 - b. What, do you think, are the knowledge areas that should be covered in the existing training material for the farmers?
 - c. Do the farmers seek any additional help from the SNAs/ SRLMs in order to build their capacities to avail finances/ subsidy for DRE technologies in the sector? If yes, could you elaborate what help is sought in this regard?
 - d. Are you exploring to tie up with any training institutes to impart DRE training to the farmers in the financing / funding space? If yes, at which step of the value chain?

Policy and Regulatory

1. Are there any state level schemes/incentives/subsidies available that are applicable in the dairy sector?
 - l. Are farmers aware on how to avail subsidy under these schemes?
 - m. Was there any knowledge sharing session conducted by you / any training institute for providing a briefing about these schemes? If yes, for which one and by whom?
 - n. Are there any challenges being faced to undertake those trainings? If yes, what improvements would you suggest?
 - o. Are you aware if any additional capacity building / future trainings in this regard are required / desired by the farmers? If yes, in which areas?

Questionnaire for Training Institutes

General

1. Name of respondent:
2. Mobile Number/ any other contact no:
3. Location:
4. Which training institute are you associated with and in what capacity?

Technical and Operational

1. What do you think entails dairy sector value chain?
2. According to you, what DRE technologies are applicable at each stage of the value chain?
 - a. Do you think farmers are aware of the applicable DRE technologies in dairy sector?
 - b. Do you think farmers understand the correct usage of these technologies?
 - c. Do you provide trainings to the farmer / community on generating awareness about DRE technologies in the dairy sector and the apt usage of such DRE products / technologies?
 - d. What topics do you cover?
3. Are there any limitations/ challenges of the DRE technology being used by farmers?
 - a. If yes, what limitation/ challenges exist?
 - b. Do you / have you provided any trainings to address these limitations / challenges?
4. Are you aware if the DRE product/ technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
5. Other than stated above, do you provide trainings in any of the below mentioned areas which area do you provide trainings:
 - a. Design and installation of the system / product
 - b. Operation, up-keep and maintenance of the product / system
 - c. Need and utility of a Business Plan for a rural enterprise
 - d. Components of a Business Plan
 - e. Guidelines for preparing a Business Plan
 - f. Feasible business models for the product / technology /system
 - g. Others
6. Please provide the following details about the trainings being delivered in DRE:
 - a. What is the frequency at which your institution delivers the training?
 - b. Who is your clientele for the trainings?
 - c. Do you have any eligibility criteria for imparting training to your clientele?
 - d. What is the mode of training (offline / online)?
 - e. Is it a free or paid course? If paid, how much is the course / training fee?
 - f. Is the training material available on free / open source platform? Could you share a copy of the course module?
 - g. Who imparts these trainings in your institute (self-learning/ expert delivered)?
7. Do you also conduct training of trainers to create capacity at the ground level?
 - a. If yes, in which areas of dairy value chain?
 - b. Who do you trainer under your TOT programme (govt. officials, community members, etc.)?
8. Do you have tie ups / association with state level departments / SNAs / SRLMs for imparting trainings in a state? If yes, in which states?
9. Do you plan to expand such tie ups with additional states? If yes, with which states? Has there been noticeable impact of the training on

- a. Livelihood
 - b. Income generation opportunities
 - c. Enterprise development / increase in entrepreneurship in the area;
 - d. Increase in commercial activity in the area
 - e. Other
14. Has this helped in the expansion of existing businesses / rural entrepreneurs in the state?
15. What are the capacity gaps / training gaps according to you that needs to be addressed?
- a. Are you planning to expand your training courses to cover such capacity gaps? If yes, when and for what category of gaps identified so far?
 - b. What should be the frequency of these trainings?
16. Have you received renewed interest among the farming community for trainings you provide?
17. Have you / do you plan to provide refresher courses?

Financial

1. Are the end users/ farmers aware of the financing schemes / initiatives in the dairy sector? If yes, which ones?
 - a. Has there been any trainings provided to end users/ farmers on financing in dairy value chain?
 - b. Do you think there are any gaps in such trainings being provided to the farmers at present?
 - c. What, do you think, are the knowledge areas that should be covered in the existing training material for end users/ farmers?
 - d. Do the farmers seek any additional help from the SNAs/ SRLMs in order to build their capacities to avail finances/ subsidy for DRE technologies in the sector? If yes, could you elaborate what help is sought in this regard?
 - e. Are you planning to provide trainings to the farmers to provide assistance around this?
2. Are you exploring to tie up with any additional state level departments / agencies to impart DRE training related to financing / availing funding in the sector to end users/ farmers
 - a. If yes, with whom, for what technologies and in which step of the dairy value chain?

Policy and Regulatory

1. Are there any trainings available with you to impart knowledge about state level schemes/incentives/subsidies in the dairy sector?
 - a. Was there any knowledge sharing session conducted by you / any training institute for providing a briefing about these schemes? If yes, for which one?
 - b. Are there any challenges being faced by farmers to undertake those trainings? If yes, what improvements are you planning to incorporate in such trainings?
2. Are you aware if any additional capacity building / future trainings in this regard are required by the end users? If yes, in what areas?
 - a. Do you plan to impart trainings in this regard?

Fisheries Sector

Questionnaire for Farmers / FPOs

General

1. Name of respondent:
2. Mobile Number/ any other contact no:
3. Location:
4. What line of business are you involved in?
5. Apart from you, who else in your family is engaged in this line of business?

Technical and Operational

1. Which part of the fishery value chain are you involved in:
 - a. Hatchery
 - b. Rearing
 - c. Harvesting
 - d. Post harvesting and drying
 - e. Storage and transportation
 - f. Processing
 - g. Other
2. Which machinery / equipment is used across the following components of the value chain:
 - a. Hatchery
 - b. Rearing
 - c. Harvesting
 - d. Post harvesting and drying
 - e. Storage and transportation
 - f. Processing
 - g. Other machinery used
3. Are you aware about DRE-based machinery / equipment available for use in fishery sector? If yes, have you used any?
4. If yes to #3, which DRE-based machinery / equipment have you used?
 - a. Do you understand the correct usage of the applicable DRE technologies?
 - b. Are there any limitations of the technology being used? If yes, what limitation exist?
 - c. Have you faced any operational challenges in the usage of the DRE technology / product? If yes, what challenges have you faced?
 - d. Would you like to have a training with respect to the correct usage of the DRE technology / machinery in the future?
 - e. Is there a specific aspect of the DRE machinery operations that you would like a training on?
5. Other than operational aspects of the DRE technology, have you ever received any capacity building, with respect to DRE technologies, in any of the following areas:
 - a. Installation and maintenance of DRE technologies
 - b. Safety of the DRE machinery / equipment
 - c. Business model guidance
 - d. Scaling up fish production
 - e. Drying, storage and transport
 - f. Environmental benefits associated with the use of DRE technologies

- g. Other
- 6. Are these trainings also provided to women fish farmers / entrepreneurs?
 - a. Are any additional trainings provided to women fish farmers? If yes, what do those trainings entail?
- 7. Who imparts these trainings in your area?
- 8. Has there been noticeable impact of the training on:
 - a. Livelihood
 - b. Income generation opportunities
 - c. Enterprise development / increase in entrepreneurship in the area;
 - d. Increase in commercial activity in the area
 - e. Other
- 9. Is there any cost benefit of using DRE vs conventional technology in the fishery value chain? If yes, what cost benefits do you think exist?
 - a. Has any training been imparted to explain such benefits?
- 10. Has the DRE technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
 - a. Is there a requirement for capacity building on community skill development in the context of DRE technologies for the fishery sector?
- 11. What are the other capacity gaps / training gaps according to you that needs to be addressed? Do you have a preference?
- 12. Do you know of a training institute / organisation which can provide the necessary training?

Financial

- 1. Are you aware of any financing schemes and existing financial institutions?
 - a. How did you get to know about the applicable schemes?
 - b. Have you availed any financing support / subsidy under the scheme?
- 2. Do you plan to avail loan from banks for your line of business in the future? If yes, would you like to obtain any training to guide you with the process?
- 3. Overall, has any training been provided to you on financing in your value chain?
 - a. Do you find any gaps in the trainings or the material that is provided to you?
 - b. What, do you think, are the knowledge areas that should be covered in the existing training material?
- 4. Do you know of a training institute / organisation which can provide the necessary training?

Policy and Regulatory

- 1. Are you aware of any Government schemes/incentives/subsidies available that are applicable in the fishery sector, especially in the DRE domain?
 - a. Do you know how to avail subsidy under these schemes?
 - b. Was there any knowledge sharing session conducted for providing a briefing about these schemes? If yes, for which one?
 - c. Are there any challenges being faced to undertake those trainings?
 - d. Do you require any capacity building / future trainings in this regard?

Questionnaire for Rural Entrepreneurs and Product Sellers / Manufacturers

General

1. Name of respondent:
2. Mobile Number/ any other contact no:
3. Location:
4. What line of business are you involved in?

Technical and Operational

1. Are you involved in DRE product sales in the fishery sector? If yes, which products do you manufacture / sell?
2. What is your geographical coverage?
3. According to you, what DRE technologies are applicable at each stage of the fishery value chain?
4. Do you impart knowledge around the correct usage of the applicable DRE technologies to the buyer / community? If yes, what topics do you cover through such trainings?
5. Do you engage with the buyers / community on the appropriate business models with respect to the use of the DRE technology?
6. What parts of the system require regular maintenance?
 - a. Do you provide SOP to the customer to be followed for maintenance of the DRE product?
7. Do you provide any after-sale services for the DRE product? If yes, what does it entail?
 - a. Do you build the capacity of the customer with respect to the after-sale services available on the product??
8. Has the DRE technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
9. Overall, do you provide any training to the customer on the following:
 - a. Installation best practices of the system / product
 - b. Operation, up-keep and maintenance of the product / system
 - c. Feasible business models for the product / technology /system
 - d. Business expansion opportunities available for fish farming
 - e. Cost benefit of adopting the DRE technology
 - f. Environmental benefits of the DRE technology
 - g. Others
10. If not you, do you know if any training institute imparts such trainings in your area?
 - a. If yes, can you name the respective training institutes?
 - b. What type of trainings do they impart?
 - c. What is the duration of the trainings?
 - d. Are they online or physical?
 - e. Are such training free or paid? If paid, what is the fee?
 - f. What is the frequency of such trainings?
11. Has there been noticeable impact of the training on:
 - a. Livelihood
 - b. Income generation opportunities
 - c. Enterprise development / increase in entrepreneurship in the area
 - d. Increase in commercial activity in the area
 - e. Other
12. Has this helped in the expansion of existing businesses?
13. What are the capacity gaps / training gaps according to you that needs to be addressed?

14. Do you know of a training institute / organisation which can provide the necessary training?

Financial

1. Are your customers aware of any financing schemes and existing financial institutions in the fishery specific DRE sector?
 - a. Are you aware if they have availed any financing support / subsidy under the scheme for DRE product procurement?
 - b. Has there been any trainings provided to them on availing support under the scheme in the fishery value chain? If yes, on what topics?
 - c. Do you find any gaps in the trainings or the material that is provided to the end user of the DRE product?
 - d. What, do you think, are the knowledge areas that should be covered in the existing training material?
2. Do you plan to avail loan from banks for your line of business in the future? If yes, would you like to obtain any training to guide you with the process?

Policy and Regulatory

1. Are you aware of any Government schemes/incentives/subsidies available that are applicable to you in the fishery sector, especially in the DRE domain?
2. Is there any financial support available to you under such schemes? Do you know how to avail subsidy under these schemes?
 - a. Was there any knowledge sharing session conducted for providing a briefing about these schemes? If yes, for which one?
 - b. Are there any challenges being faced to undertake those trainings?
 - c. Do you require any capacity building / future trainings in this regard?

Questionnaire for Training Institutes

General

1. Name of respondent:
2. Mobile Number/ any other contact no:
3. Location:
4. Which training institute are you associated with and in what capacity?

Technical and Operational

1. What do you think entails fishery sector value chain?
2. According to you, what DRE technologies are applicable at each stage of the value chain?
 - a. Do you think farmers are aware of the applicable DRE technologies in fishery sector?
 - b. Do you think farmers understand the correct usage of these technologies?
 - c. Do you provide trainings to the farmer / community on generating awareness about DRE technologies in the fishery sector and the apt usage of such DRE products / technologies?

- d. What topics do you cover?
3. Are there any limitations/ challenges of the DRE technology being used by farmers?
 - a. If yes, what limitation/ challenges exist?
 - b. Do you / have you provided any trainings to address these limitations / challenges?
4. Are you aware if the DRE product/ technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
5. Other than stated above, do you provide trainings in any of the below mentioned areas which area do you provide trainings:
 - a. Design and installation of the system / product
 - b. Operation, up-keep and maintenance of the product / system
 - c. Need and utility of a Business Plan for a rural enterprise
 - d. Components of a Business Plan
 - e. Guidelines for preparing a Business Plan
 - f. Feasible business models for the product / technology /system
 - g. Others
6. Please provide the following details about the trainings being delivered in DRE:
 - a. What is the frequency at which your institution delivers the training?
 - b. Who is your clientele for the trainings?
 - c. Do you have any eligibility criteria for imparting training to your clientele?
 - d. What is the mode of training (offline / online)?
 - e. Is it a free or paid course? If paid, how much is the course / training fee?
 - f. Is the training material available on free / open source platform? Could you share a copy of the course module?
 - g. Who imparts these trainings in your institute (self-learning/ expert delivered)?
7. Do you also conduct training of trainers to create capacity at the ground level?
 - a. If yes, in which areas of fishery value chain?
 - b. Who do you trainer under your TOT programme (govt. officials, community members, etc.)?
8. Do you have tie ups / association with state level departments / SNAs / SRLMs for imparting trainings in a state? If yes, in which states?
9. Do you plan to expand such tie ups with additional states? If yes, with which states? Has there been noticeable impact of the training on
 - a. Livelihood
 - b. Income generation opportunities
 - c. Enterprise development / increase in entrepreneurship in the area;
 - d. Increase in commercial activity in the area
 - e. Other
18. Has this helped in the expansion of existing businesses / rural entrepreneurs in the state?
19. What are the capacity gaps / training gaps according to you that needs to be addressed?
 - a. Are you planning to expand your training courses to cover such capacity gaps? If yes, when and for what category of gaps identified so far?
 - b. What should be the frequency of these trainings?
20. Have you received renewed interest among the farming community for trainings you provide?
21. Have you / do you plan to provide refresher courses?

Financial

1. Are the end users/ farmers aware of the financing schemes / initiatives in the fishery sector? If yes, which ones?
 - a. Has there been any trainings provided to end users/ farmers on financing in fishery value chain?

- b. Do you think there are any gaps in such trainings being provided to the farmers at present?
 - c. What, do you think, are the knowledge areas that should be covered in the existing training material for end users/ farmers?
 - d. Do the farmers seek any additional help from the SNAs/ SRLMs in order to build their capacities to avail finances/ subsidy for DRE technologies in the sector? If yes, could you elaborate what help is sought in this regard?
 - e. Are you planning to provide trainings to the farmers to provide assistance around this?
- 2.
3. Are you exploring to tie up with any additional state level departments / agencies to impart DRE training related to financing / availing funding in the sector to end users/ farmers
 - a. If yes, with whom, for what technologies and in which step of the fishery value chain?

Policy and Regulatory

1. Are there any trainings available with you to impart knowledge about state level schemes/incentives/subsidies in the fisheries sector?
 - a. Was there any knowledge sharing session conducted by you / any training institute for providing a briefing about these schemes? If yes, for which one?
 - b. Are there any challenges being faced by farmers to undertake those trainings? If yes, what improvements are you planning to incorporate in such trainings?
2. Are you aware if any additional capacity building / future trainings in this regard are required by the end users? If yes, in what areas?
 - a. Do you plan to impart trainings in this regard?

Questionnaire for SNAs / State Departments

General

1. Name of respondent:
2. Mobile Number/ any other contact no:
3. Location:
4. Which Department / Agency are you associated with and in what capacity?

Technical and Operational

1. What do you think entails fishery sector value chain?
2. According to you, what DRE technologies are applicable at each stage of the value chain?
 - a. Which out of these technologies are being promoted by your department and at what stage of the value chain?
 - b. Are multiple sellers/providers of the technology available in the state?
 - c. If yes, do you impart knowledge among the farmer community about these technology providers / product sellers in the market?

3. Do you impart knowledge around the correct usage of the applicable DRE technologies to the buyer / community? If yes, what topics do you cover through such trainings?
4. Are there any limitations/ challenges of the technology being used?
 - a. If yes, what limitation/ challenges exist?
 - b. Do you / have you provided or arranged any trainings to address these limitations / challenges?
 - c. Have you identified any other trainings that are needed to be provided in this regard?
 - d. Have you partnered with any training institute which provides such trainings?
 - e. If yes, can you name the respective training institutes?
 - f. What type of trainings do they impart?
 - g. What is the duration of the trainings?
 - h. Are they online or physical?
 - i. Are such training free or paid? If paid, what is the fee?
 - j. What is the frequency of such trainings?
5. Has the DRE-based product/ technology provided any opportunity for community skill development? If yes, what skills have been developed with the aid of the technology?
6. Do you engage with the fish farmers/ community on the appropriate business models with respect to the use of the DRE technology? If yes, what trainings are provided in this regard?
7. Overall, do you provide any training to the fish farmers on the following:
 - a. Installation best practices of the system / product
 - b. Operation, up-keep and maintenance of the product / system
 - c. Feasible business models for the product / technology /system
 - d. Business expansion opportunities available to the farmer
 - e. Cost benefit of adopting the DRE technology
 - f. Environmental benefits of the DRE technology
 - g. Others
8. If not you, has your department / agency associated with any training institutes to impart such trainings? If yes, which ones?
 - a. What topics do they cover?
 - b. What type of trainings do these institutes provide and at what frequency?
 - c. What is the mode (online/ offline) of these trainings?
 - d. How much do these institutes charge for such trainings?
 - e. Has there been noticeable impact of the training on:
 - f. Livelihood
 - g. Income generation opportunities
 - h. Enterprise development / increase in entrepreneurship in the area;
 - i. Increase in commercial activity in the area
 - j. Other
9. Has this helped in the expansion of existing businesses/ adoption of DRE in fishery value chain in the state?
10. What are the capacity gaps / training gaps according to you that needs to be addressed?
 - a. Do you know of a training institute / organisation which can provide the necessary training?
 - b. If yes, could you name the training institute?
 - c. Are you exploring / do you plan to explore tie ups with the trainings institute?

Financial

1. Do you promote any financing schemes / initiatives in the fishery sector in the state? If yes, which ones?

2. Are end users/ fishers / rural level entrepreneurs aware of the financing support/ subsidy available for DRE technologies applicable to them?
3. Has there been any trainings provided to end users/ rural level entrepreneurs on financing in fishery value chain?
 - a. Do you think there are any gaps in such trainings being provided to the farmers at present?
 - b. What, do you think, are the knowledge areas that should be covered in the existing training material for the farmers?
 - c. Do the farmers seek any additional help from the SNAs/ SRLMs in order to build their capacities to avail finances/ subsidy for DRE technologies in the sector? If yes, could you elaborate what help is sought in this regard?
 - d. Are you exploring to tie up with any training institutes to impart DRE training to the farmers in the financing / funding space? If yes, at which step of the value chain?

Policy and Regulatory

1. Are there any state level schemes/incentives/subsidies available that are applicable in the fishery sector?
 - a. Are farmers aware on how to avail subsidy under these schemes?
 - b. Was there any knowledge sharing session conducted by you / any training institute for providing a briefing about these schemes? If yes, for which one and by whom?
 - c. Are there any challenges being faced to undertake those trainings? If yes, what improvements would you suggest?
 - d. Are you aware if any additional capacity building / future trainings in this regard are required by the end users? If yes, in what areas?

Disclaimer

The report has been developed based on research and interactions with the key stakeholders such as farmers, FPOs, product manufacturers/service providers, rural entrepreneurs, state nodal agencies, state rural livelihood missions, training institutes, SAMETIS, foundations, KVKs, cooperatives and national level development boards. The present document is an attempt to assess the capacity gaps of demand group of stakeholders and develop self-paced e-learning modules to promote the utilization of DRE technologies for productive use across different stages of agricultural, dairy, and fishery value chains. Please note that this document is neither exhaustive nor comprehensive, GIZ will not be responsible for any financial decision based on the information provided in the document.

**Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH**

First Floor, B-5/2, Safdarjung Enclave
New Delhi-110029, India
T: +91 4949 5353
F: +91 4949 5391
E: info@giz.de
I: www.giz.de