PoCRA- IITB
MoU IV -Phase 2 review
Post Harvest Component

Section 1
Climate Agnostic
Onion Storage Structure

1 February 2022

Overall objective of the Onion storage part

- To visit and survey FPOs dealing with onion commodity (Phase II)
- To survey various existing onion storage structures in order to critique the feasibility of current solutions in the market and compare it to CA storage developed at IIT Bombay. (Phase II)
- To conduct comparative analysis (Techno-Economic) among all the potential solutions available in Onion storage system (Phase III)
- To select appropriate FPO and install Climate agnostic onion storage facility (Phase IV)

Specific tasks expected to be completed

1. To visit the locations in PoCRA region where *traditional as well as modern storage structures* are installed and operated by FPOs

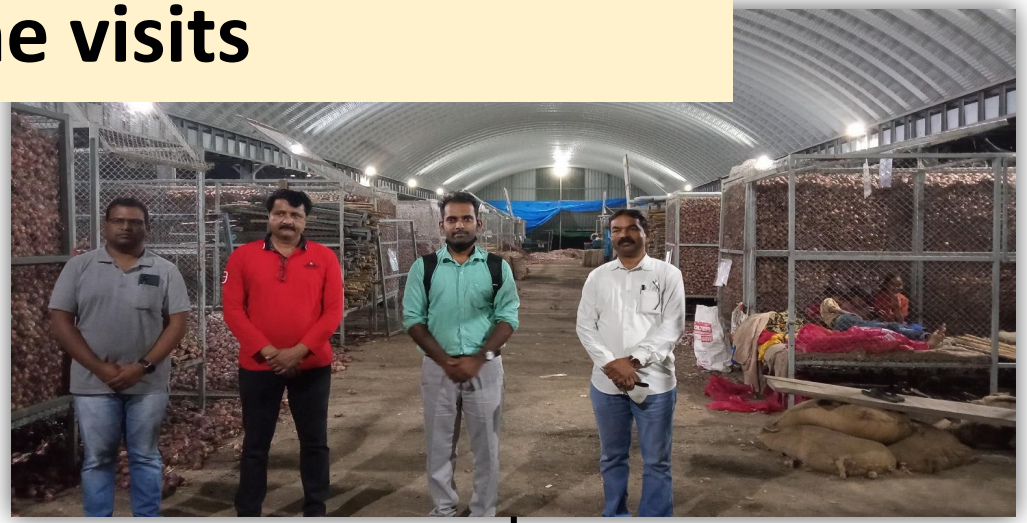
2. To visit other locations where,

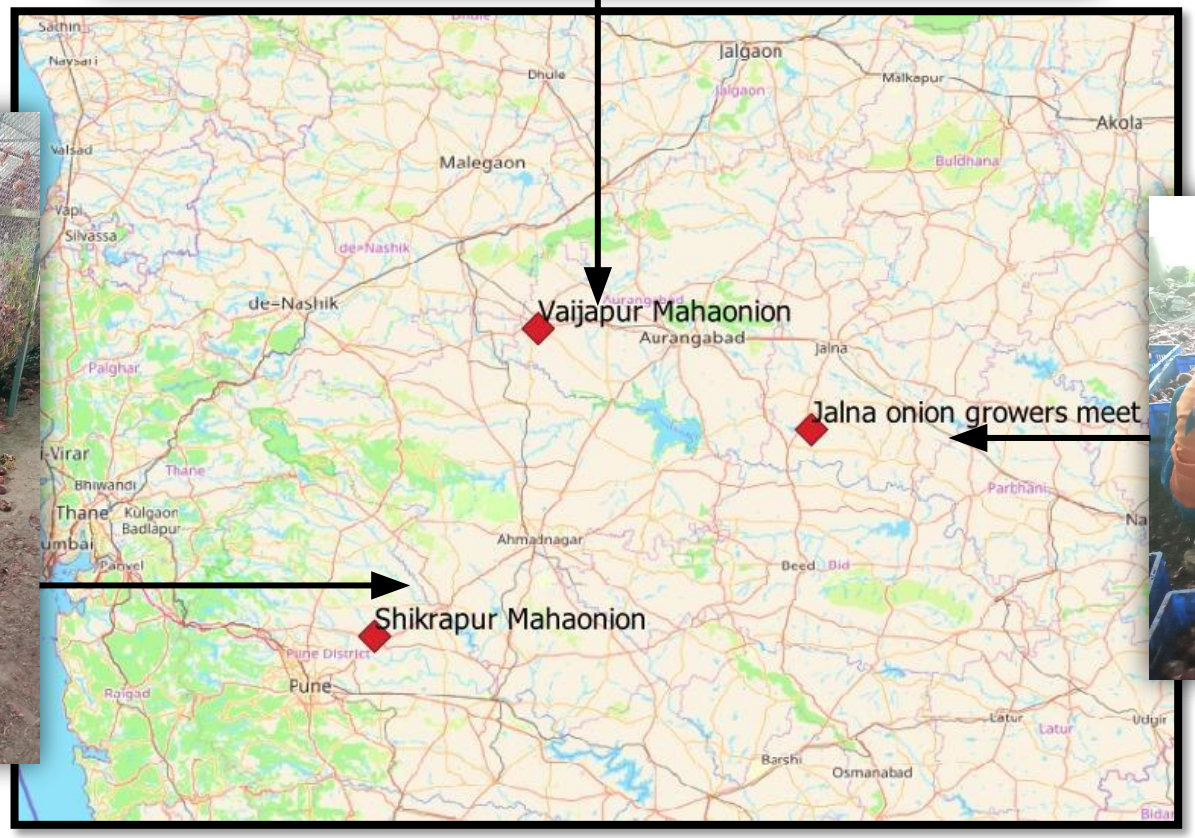
a. Ventilated storage structures are installed and operated by private entities

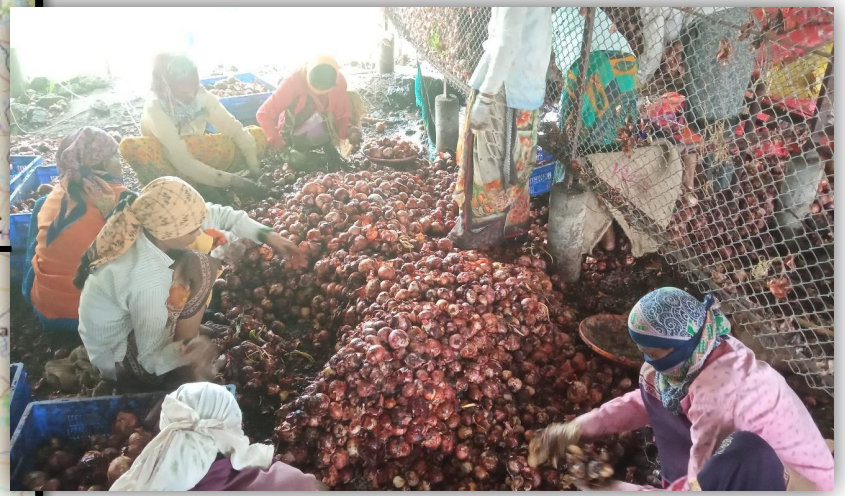
b. Climate agnostic/ Forced ventilation onion storage structures are in operation

c. ICAR-DoGR and visiting structures installed there.

Locations of the visits







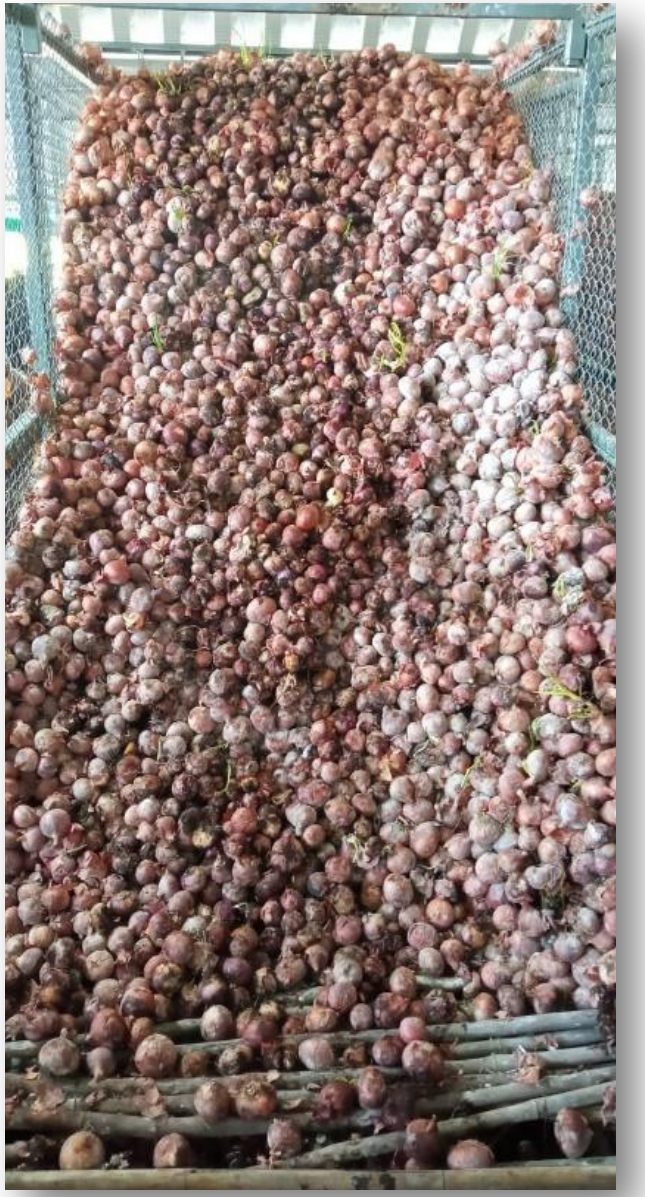
Major factors affecting storability of onion in existing storage ecosystem

1. Poor quality Onion seed

One of the major reasons as told by farmers was the use of bogus (low quality and un certified) seeds which has resulted in onion with less storability properties.

2. Mixing of varieties of onion

Due to **improper sorting** of the onion, there are always chances of mixing of two or more different varieties. Onion with poor storability properties have great chances to spoil over the period of time under uncertain climatic conditions and due to mixing of such onion bulbs with other good quality bulbs make **whole lot to spoil** within couple of days.



3. Heavy & uncertain rain

In the months of July and August, there were high humidity conditions which is not good for the storability of onions. As it is seen in the picture, onions have undergone sprouting and rotting to a significant level.

4. Exposure to direct sunlight

Exposure to direct sunlight results in degradation of outer layer of onion and causes excessive PWL

5. Lack of proper/forced ventilation

It was found that though it was called The open ventilated storage structure, sufficient channels **were not** provided to take out **hot, moist air and gases from inside the storage structure.**

6.Spread of rotting due to heavy staking

- The bottom layer of onion was subjected to almost 25 MT load over it for more than 3 months.
- This highly damages the onion and reduces its life
- growth of microorganisms (black mould, fungus) and bugs which speed up the rotting

7.Accumulation of dew on ceiling

- Due to lack of opening at the roof, this saturated air upon striking the roof, condensed and the resulting water fell down on the onion
- Onion, upon getting wet starts cycle of sprouting and rotting

8.Costly, time consuming Loading/unloading and sorting operations

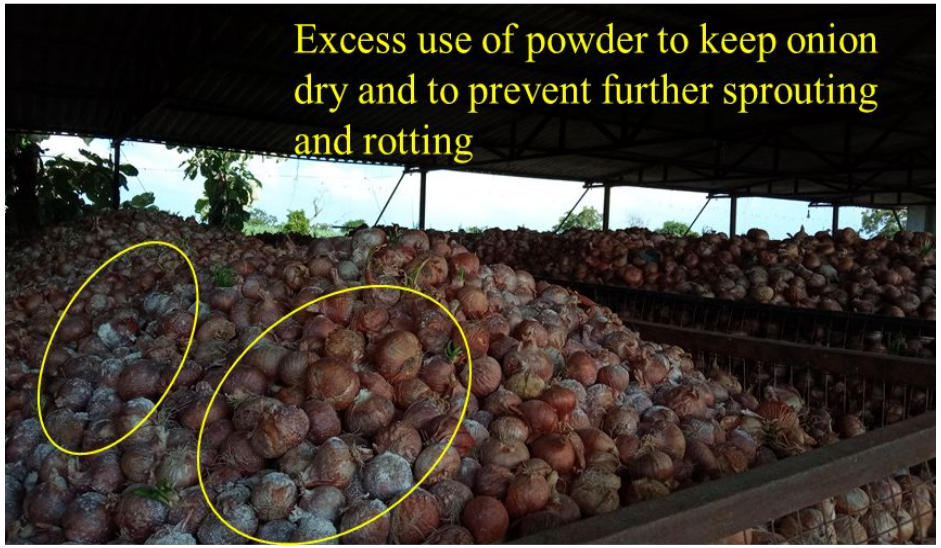
- No provision for reducing the cost and drudgery of loading and unloading of the onion stored in the storage facility
- Operation is fully manual and it amounts to a lot of labour effort
- exposure to odour and gases from rotted onion without proper safety equipment.

9.Defected onion bulbs due to improper curing

- Onions were cut improperly during manual curing operation and hence it obviously affected the post-harvest shelf life of the onion.
- Also uniform curing (pre heating) was not done to onion

10.Uncontrolled use of powder as a shortcut to stop sprouting

- Local quality white powders are spread to cover the onion surface and keep them dry
- for excessive use of such materials and its unintended effects on quality of onion and safety of consumers



Important observations

- Farmers were more focused on saving on *initial costs of the structure than understanding the effect of design parameters on Storage losses as well as operational costs*
- *Budget constraints of FPCs, Cap on subsidies on storage structure, focus on more storage capacity with less investment at cost of quality* were some of the reasons for poor functioning of onion storage structures.

The current NAFED model

- Risks of onion spoilage and subsequent *financial losses to the owner/FPO are highly reduced.*
- *Though this model works well for FPOs or private investors, this completely shifts the focus from reduction in storage losses.*
- *In such cases, the FPO focuses more on increasing the storage capacities in order to earn more rent (profits) and the* noble objective of 'reducing storage losses is ignored.

**MahaOnion (MahaFPC) team recently (3rd December'21) had meeting with the IITB team for improved designs of their storages in order to reduces the losses occurring in existing system.*
**BAIF has collaborated for development of storages of small, medium and large scales to employ all over India.*
** Mr. Sanjay Joshi (CEO of krishakMitra) show readiness to install Onion storage structure at Nasik.*

Primary comparison based on data from field visits

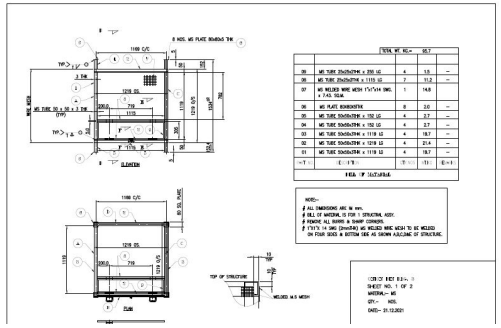
Features	MahaOnion Storage Structure	Tata Steel Onion storage structure	IITB CA Storage structure
			
Floor space needed	Large	Medium	less
Temp. control	No	Partial	Yes
Humidity control	No	No	Yes
Loading/Unloading	Manual	Manual	Automatic
Anti bug UV lights	No	No	Yes
Controlled air flow	No	No	Yes

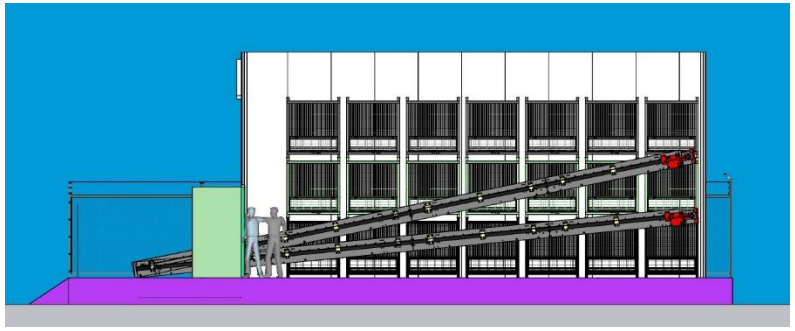
100 MT CA storage structure at VNMKV, Parbhani by IIT Bombay

Major works completed

- Design of the system
- Modeling and Simulation
- Parameters for evaluation of performance
- Selection of appropriate vendors (manufacturers and fabricators)

Installation and commissioning work will be completed by February 2022





Way ahead (Phase-III)

- Visit to Onion storage structures (forced convection based) developed by other agencies (completed)
- Detailed Techno-economic feasibility analysis of potential storage structures in order to go ahead with the most feasible solution (Ongoing)
- Selection and finalization of the FPO for Onion storage structure installation and commissioning

Gantt Chart

Tasks	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Preliminary Report (Overall: Field & Desk)												
1. Matrix Development												
1.1 Mapping of Onion FPC within PoCRA-												
1.2 Total Production/Productivity/Area Sowing & Harvesting Schedule, Variety of onion.												
1.3 Current Practices (Selling in Market/Processing), Mode of Selling, Any Current Value Addition & Storage, Seasonality												
1.4 FPC Portfolio (No of Farmers associates, variety of onion, Revenue, Profit												
1.4.1 Identifying potential buyers based on the current demand of products (Onion). Prepare a list of potential forward linkages.												
1.5 Identification turn- key providers for onion storage intervention (Pre fab structure, cooling system, sensors & controls)												
1.6 Screening of FPCs from PoCRA project list for Technological Intervention based 1.												
1.7 Detail Market Analysis of Onion/Onion based products resulting from technological intervention (seasonality-based Market Demand, Export, Price trends, Profit margins												
2. Match Making with FPCs with Technological Intervention												
3. Financial Viability Model												
4. Installation & Commissioning												
4.1 Selection of vendors from 1.5												
4.2 Installation and post Installation support (As per MoU)												
4.3 Final Impact report preparation												

Tasks completed

Tasks planned

Section 2
Value addition

Overall objective:

To prepare a **detailed project report** for one FPC in regard to value addition of agriculture produce (Phase-III)

- Techno-economic feasibility study
- Matrix for screening crops in PoCRA areas
- Market viability study
- Details of food safety measures and regulatory aspects

Methodology:

Screening of FPC for field work

- Top 3 producing districts for soybean, maize and turmeric
- Age, commodity profile and Rating of FPC

Field Visit to FPC

- Primary data collection
  i) Number of commodities
  ii) Quantum
  iii) Existing processes
  iv) Willingness for value addition

Data Analysis

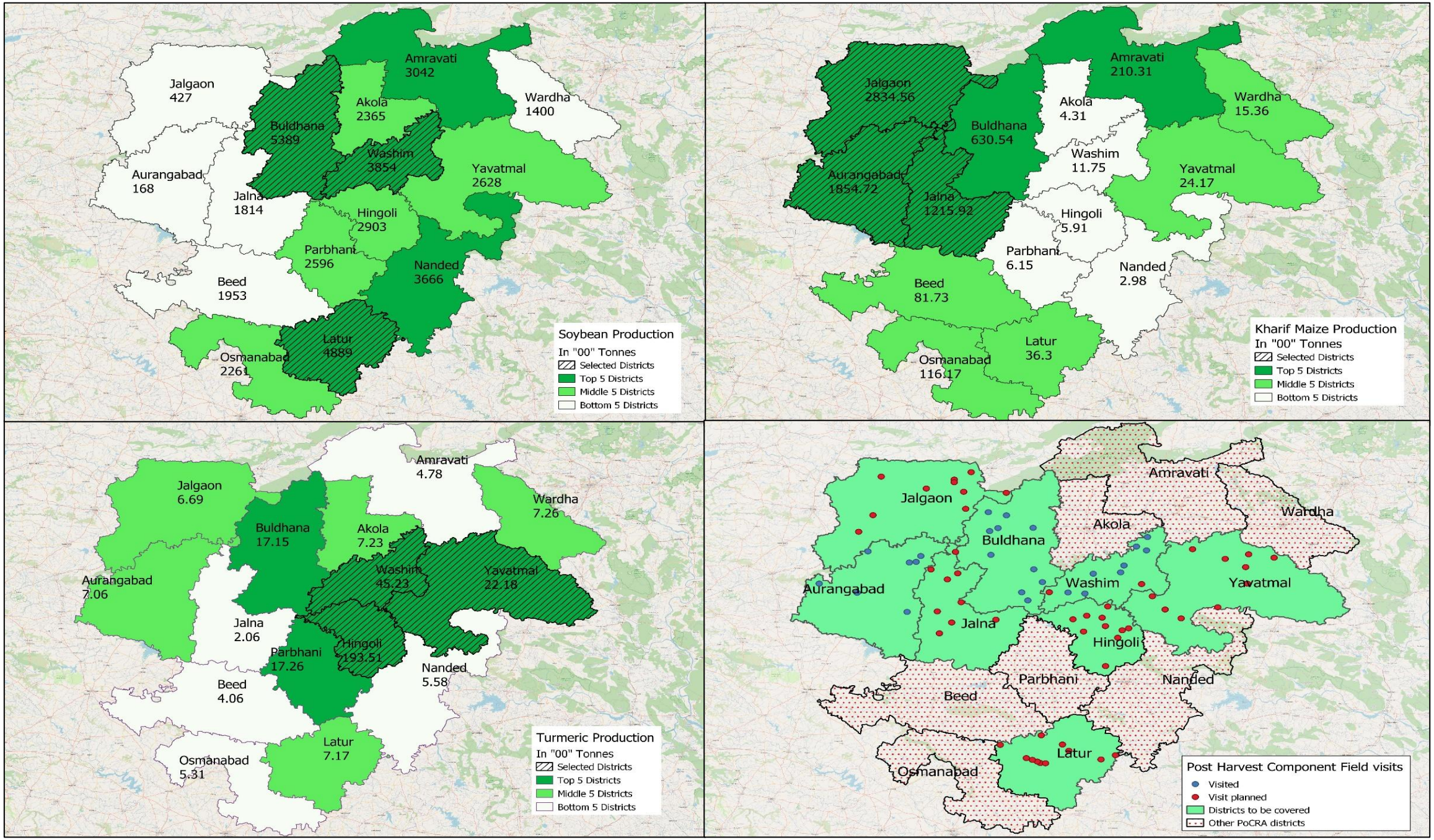
- Segregate FPCs based on commodity profile
- Identify various value added products based on quantum

Techno-economic feasibility study

- Check technical and financial feasibility by estimating economic indicators
- Conduct uncertainty analysis
- Market viability

Detailed Project Report

- Cost estimates of plants for different capacities, value chain proposition, operating plan, forward linkages, food regulation details



Distribution of production in PoCRA districts for Soybean, Maize and Turmeric. Location of screened district and FPCs

Primary data (commodity quantum)

Quantum / Commodity	<10 MT/annum	10 to 100 MT/annum	100 to 500 MT/annum	> 500 MT/annum
Soybean	2 (B-2)	1 (B-1)	3 (B-1, W-2)	3 (B-1 , W-2)
Maize			2 (A-2)	5 (A-4, W-1)
Turmeric			2 (A-1 , W-1)	
Ginger			2 (A-2)	1 (A-1)
Tur	2 (B-1, W-1)	6 (A-3, B-2, W-1)	3 (A-1, B-1, W-1)	
Wheat	1 (B-1)	1 (W-1)	6 (A-1, B-2, W-3)	1 (A-1)
Gram	2 (A-1, W-1)	3 (B-3)	4 (W-4)	3 (A-1, B-2)

A- Aurangabad, B- Buldana, W- Washim

Preliminary Observations

- Cleaning, grading and packaging was the most popular processing activity in case of soybean and maize
- Many FPCs were NAFED agents (1% commission)
- Generally, trading of grain provided a profit of around 2%
- In case of soybean, seed processing was popular and generated a profit around 15%
- However, seed processing of soybean had a rejection rate around 30-40% while were then traded as grain
- FPCs dealing in Turmeric and Ginger were mainly involved in trading. The practices related to processing were not observed during field visit
- In few cases, drying of horticulture produce, cold press oil extraction and essential oil business was observed

<u>Challenges:</u>

- The accuracy of primary data was based on respondent's heuristics
- The respondents expected that we would provide them with immediate solutions or grant approvals
- Contact details were often inaccurate, especially in Washim district
- Hurdles such as ST strike and omicron reduced field mobility

Commodity	Potential value added products	Remarks (wrt to quantum of input/raw material)
Soybean	Soy oil	Viability -Solvent extraction -30000 MT/annum and Mechanical Extraction > 4000 MT/annum
	Soy oil cake	By product of soy oil processing.
	Soybean protein	General viability >500 MT/annum
	Protein isolate	General viability >500 MT/annum
	Soybean atta	Feasible even at small scale (~10 MT/annum)
	Soy milk	Small to medium scale enterprise (>20MT/annum), Highly perishable
	Soy tofu	Small to medium scale enterprise (>20MT/annum), Highly perishable
	Animal feed (Okara)	By-product of milk processing
	Soya snacks (namkeen, sticks, chunks)	General viability >100 MT/annum
Maize	Corn flour	General viability > 400 MT/annum
	Corn flakes	Cereal and namkeen. General viability > 400 MT/annum
	Corn starch	General viability >1000 MT/annum ,Residue could go as poultry feed
	Glucose	Economics of scale is critical
	Protein rich poultry feed	By-product of starch processing
	Pop corn	Based on variety, General variability to be estimated
	Corn snacks	Chips and extruded snacks markets are upcoming. General variability to be estimated
	Silage	General variability to be estimated
Ginger	Dried ginger powder (Sunth)	Feasible even at small scale
	Ginger oil	Feasible even at small scale
	Pickle	Unsure of market
Turmeric	Turmeric powder	Depends on the curcumin content, Feasible even at small scale
	Curcumin extraction	Residue is starch, Feasible even at small scale
	Essential oil extraction	Feasible even at small scale
Gram	Dal mill	Feasible even at small scale
	Dal mixture/snacks	Feasible even at small scale
	Protein (Depending on quality)	General variability to be estimated
	Besan	Feasible even at small scale
Tur	Dal mil	Better value for unpolished dal

Commodity & (No. of FPCs dealing in the commodity)	Potential value added products	Preliminary feasibility of no of FPCs that could deal in respective value added products
Soybean (9)	Soy oil	Solvent Extraction- Nil , Mechanical – 3 (B-1, W-2)
	Soy oil cake	3 (B-1, W-2)
	Soybean protein	3 (B-1, W-2)
	Protein isolate	3 (B-1, W-2)
	Soybean atta	9 (B-5, W-4)
	Soy milk	7 (B-3, W-4)
	Soy tofu	7 (B-3, W-4)
	Animal feed (Okara)	7 (B-3, W-4)
	Soya snacks (namkeen, sticks, chunks)	7 (B-3, W-4)
Maize (7)	Corn flour	7 (A-6, W-1)
	Corn flakes	7 (A-6, W-1)
	Corn starch	4 (A-3, B-1)
	Glucose	2 (A-1, B-1)
	Protein rich poultry feed	4 (A-3, B-1)
	Pop corn	To be estimated
	Corn snacks	To be estimated
	Silage	To be estimated
Ginger (3)	Dried ginger powder (Sunth)	3 (A-3)
	Ginger oil	3 (A-3)
	Pickle	3 (A-3)
Turmeric(2)	Turmeric powder	2 (A-1, W-1)
	Curcumin extraction	2 (A-1, W-1)
	Essential oil extraction	2 (A-1, W-1)
Gram (12)	Dal mill	12 (A-2, B-5, W-5)
	Dal mixture/snacks	12 (A-2, B-5, W-5)
	Protein (Depending on quality)	12 (A-2, B-5, W-5)
	Besan	12 (A-2, B-5, W-5)

Way ahead/On-going work (Phase-III)

- Field visits to remaining FPCs *(Ongoing)*
- Detailed techno-economic feasibility study for various value added products *(Ongoing)*
  - Produce economic indicators such as cost-benefit and break-even at different scales
  - Conduct uncertainty analysis
- Understand market/forward linkages for proposed products
  - Identifying potential buyers and potential forward linkages *(Ongoing)*
  - Market viability
- Selection of a FPC and commodity for preparing DPR
  - Scope/Viability of value addition in commodities
  - Quantum of commodities
  - Willingness for value addition intervention

Cleaning grading sorting unit at Jai Siddheshwar, Aurangabad

Seed processing and Warehouse at Sonpaul, Buldana

Steam distillation unit at Nardus FPC, Washim

Gantt Chart

Tasks completed

Tasks ongoing

Tasks planned

Tasks	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Preliminary Report (Overall: Field & Desk)							
1. Matrix Development							
1.1 Mapping of Crops FPC within PoCRA							
1.2 Total Production/Productivity/Area Sowing & Harvesting Schedule, Variety							
1.3 Current Practices (Selling in Market/Processing), Mode of Selling, Any Current Value Addition							
1.4 FPC Portfolio (No of Farmers associates, variety of crops, Revenue, Profit							
1.5 Screening of FPCs for Technological Intervention based 1.4							
1.6 Ranking/Screening of Crops based on (1.1-1.4) Economic Value, Market Integration/Demand							
1.6.1 Identification of a list of technological interventions which are feasible (based on Shelf life, scale & economics) eg: Soybean to protein, soya oil etc.: Turmeric to curcumin etc.							
1.6.2 Identifying potential buyers based on current demand of products. Prepare list of potential forward linkages.							
1.7 Identification turnkey providers for screened technological interventions							
1.8 Detail Market analysis of product resulting from technological intervention (Market Demand, Export, Domestic Demand, Price trends, Profit margins)							
1.9 Logistics of processed products (Storage + Transport)							
2. Match Making with FPCs with Technological Intervention							
3. Financial Viability Model							
4. Details food safety measures & regulatory aspects.							
5. Preparation DPR and necessary revisions							