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FINAL REPORT

Mapping Study on Agribusiness Industry & Value Chain Players in the State Of Maharashtra

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Submitted to:

ADB ASIAN DEVELOPMENT BANK

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ABBREVIATIONS

ADB	Asian Development Bank
APMC	Agricultural Produce Market Committee
ATMA	Agricultural Technology Management Agency
CA	Controlled Atmosphere
CC	Collection Centre
CoE	Centre of Excellence
F&V	Fruits & Vegetables
FGD	Focus Group Discussion
FPC	Farmer Producer Company
FPO	Farmer Producer Organization
FYM	Farm Yard Manure
GAP	Good Agriculture Practices
GDP	Gross Domestic Product
GI	Geographical Indication
Govt	Government
GSVA	Gross State Value Added
Ha	Hectare
INM	Integrated Nutrient Management
IQF	Individual Quick Freezing
IVC	Integrated Value Chain
JFPR	Japan Fund for Poverty Reduction
KVK	Krishi Vigyan Kendra
MACP	Maharashtra Agricultural Competitiveness Project
MagNet	Maharashtra Agricultural Network
MAP	Modified Atmosphere Packaging
MFI	Micro Finance Institution
MIDC	Maharashtra Industrial Development Corporation
MoFPI	Ministry of Food Processing Industries
MSAMB	Maharashtra State Agricultural Marketing Board
MT	Metric Ton
NABARD	National Bank For Agriculture And Rural Development
NAFED	National Agricultural Cooperative Marketing Federation of India
PPC	Primary Processing Centre
PSU	Public Sector Undertaking
SEZ	Special Economic Zone
SFAC	Small Farmers' Agriculture-Business Consortium
SPV	Special Purpose Vehicle
VC	Value Chain

1 Background

1.1 Introduction

Agriculture is one of the most important sectors for the development of Indian economy. It supports livelihoods of majority of the population in rural areas and contributes significantly to the food security in the country. Although the share of gross domestic product (GDP) generated by the sector has declined over the years (to about 17%), it still generates employment for over 60% of the population.

Globalization and liberalization of trade with rapid urbanization and income growth in low & middle-income countries has accelerated the agricultural sector growth and resulted in increasing dietary transition from cereals to high value processed foods, fruits and vegetables. In addition, there is a shift of focus from food security to nutritional security and food safety. Growing integration of global economies presents an opportunity for increased vertical and horizontal integration of production clusters in developing countries with the global consumption market. India, being world's one of the leading producers of many fruits and vegetables, has immense potential to benefit from such integration, particularly in terms of increased value realization for players along agricultural value chains.

In spite of the opportunities, the benefits of such developments are yet to reach the small and marginal farmers in a sustainable manner. The integration of small farmer groups in global agricultural value chains is constrained by various factors such as - small farm size, low productivity, depleting natural resources base, impact of climate volatility, access to technology and quality inputs, shortage and increasing labour cost, high wastages, lack of post-harvest, storage and marketing infrastructure, low processing levels among other factors.

In the past, the strategy for development of agriculture sector has primarily focused on increasing productivity through use of high yielding varieties, increased use of fertilizer, pesticide inputs and irrigation and related public investments. However, the sector requires a paradigm shift from merely maximizing productivity to achieving profitability and proficiency across the complete value chain of the produce. This may be critical for achieving the Government of India's commitment to double the farmer income in India by 2022.

Farmers need to be integrated into modern value chains so as to raise their incomes and also minimise the risks arising from middlemen and volatile markets. Sustained interventions are required to be undertaken for integration of post-harvest, processing and marketing infrastructures, adding value and quality to the raw produce of farmers. In addition, technologies suited to respective agro-ecologies need to be put in place and demonstrated to growers whose produce can be aggregated & marketed through Farmer Producer Organizations (FPOs). One of the most important interventions that would be required to increase the value realization by the farmers/ FPOs is to facilitate access to markets. This coupled with infrastructure intervention would help the farmers/ FPOs in increase their income and also increase efficiency of the entire value chain.

1.2 Significance of Horticulture Sector in the Maharashtra State

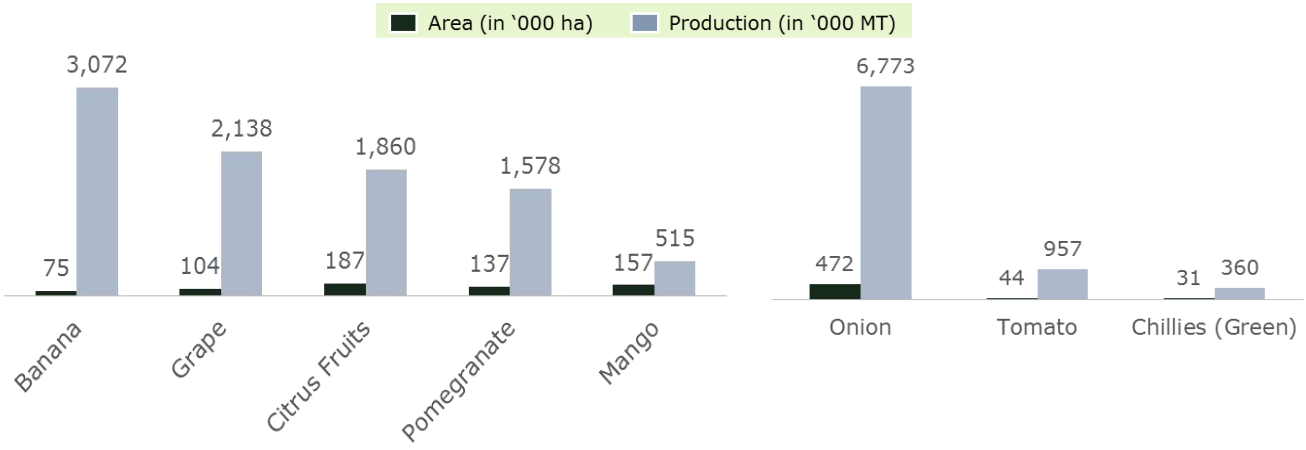
Agriculture & allied activities sector plays an important role in the economic development of the State. The share of agriculture & allied activities sector in the total Gross State Value Added (GSVA) is about 12.2 per cent during 2016-17 in Maharashtra. Horticulture holds a significant share of about 30 per cent in the state's

agricultural GSVA[1]. The State has 9 agro-climatic zones based on rainfall, soil type & vegetation, favouring cultivation of a multitude of fruits and vegetables round the year. The state has a total of about 15 lakh Ha of area under different fruits and vegetable crops.

Maharashtra has emerged as one of the country's largest producers of fruits and vegetable crops. In terms of production, the state accounts for 11% of total fruits & 5% of total vegetables produced in the country[2]. Maharashtra is the largest producer of seedless grapes & pomegranate in India. The State is also the 3rd leading producer of citrus fruits such as mandarin (orange). The state is also a robust producer of other fruits such as banana, custard apple & strawberry. Maharashtra is also the largest producer of onions in the country. Tomato, green chillies, ginger are among other major crops grown in the state. The state is also the leading exporter of fruits and vegetables such as Alphonso mangoes, grapes, pomegranates, oranges, bananas, onion, green chillies etc. from India to the European Union, Thailand, Netherlands, Doha, Bahrain etc. A large number of farmers are engaged in the sector in Maharashtra, most of them small and marginal. Thus, the interventions to develop agribusiness infrastructure and promoting market linkages can make a significant impact in increasing farmer incomes and livelihood generation in the State. The total area & production for horticulture crops in the state is as shown in the below table[3].

Crop	2016-17		2017-18	
	Area (000 Ha)	Production (000 MT)	Area (000 Ha)	Production (000 MT)
Fruits	705.12	10,630.08	695.05	10,879.88
Vegetables	712.68	10520.49	572.13	9043.98

Figure 1. Area & Production of major Fruit & Vegetable Crops in Maharashtra for 2016-17



Source: Horticulture Statistics of Maharashtra, Department of Horticulture, 2016-17

Overall, Maharashtra has been at the forefront in horticulture crops production as highlighted below:

[1] Economic Survey of Maharashtra, 2017-18
[2] Source: Area and Production of Horticulture Crops – Category wise 2017-18 (1st Adv. Est.). National Horticulture Board (http://nhb.gov.in/statistics/State_Level/2017-18(1st%20Adv.%20Est).pdf accessed on 03.09.2018)
[3] Horticulture statistics at a Glance, 2017

- Highest producer of Grapes contributing about 80 % of total production in the country
- Contributes 67 % of the total Pomegranate production in India
- Largest producer of Onions accounting about 28% of total production in the country
- Ranks 3rd in production of Mandarin & Sweet Lime/ Orange and contributing respectively 35 % & 23% of the total area under the crop in India
- Contributes 19.60 percent to the Banana production in the country
- Largest exporter of Thomson Seedless Grapes and Alphonso Mangoes
- Mahabaleshwar Strawberries, Nashik Grapes and Nashik Valley Wine have also been awarded Geographical Indication (GI) which gives them an edge over other varieties in the world.

Rigorous efforts are being made by the Central & State Governments and various development agencies to promote sustained cultivation of high value fruits and other horticulture crops along with improvement and development of associated marketing, cold chain and processing infrastructure along the supply chain for improved market connectivity, which can help enhance farmers' income. The State is also facilitating federation of small and marginal farmers into Farmer Cooperative / Producer Company under various Central/ State schemes for extending technical support, technology dissemination, aggregation and marketing of produce at farmer level.

1.3 Current Study on Mapping Study for Inclusive Agribusiness Value Chain Development in Maharashtra

To support the rigorous efforts being made by the State Government to promote agribusiness value chain development in the state and the limited success of the earlier initiatives, the ADB is preparing a new investment project to develop business linkages of the farmer organizations with the agribusiness value chains. The objective to is enhance commercial opportunities in a way that benefits millions of farmers via generation of market access and value addition as well as the entire value chain players through reducing food losses, transaction costs, and resource use efficiency in the chains.

For this purpose, experts from Deloitte Touche Tohmatsu India LLP have been appointed by ADB to carry out a pre-feasibility study to understand the rapidly growing agri-business industry in the State of Maharashtra, identify opportunities for linking of farmer producer organizations and key agri-business value chain players in the State.

1.3.1 Study Objective

Reference to the terms of reference (ToR) for the Pre-feasibility study, the objectives of the study are as follows:

- To carry out a prefeasibility study to understand the rapidly growing agri-business industry.
- To identify accessible market opportunities for farmer producer organizations and key agri-business value chain players in the state of Maharashtra
- To prepare a long list of potential public-private co-investment partnerships in linking FPOs with new marketing opportunities.

The intent of the study outcomes will be to inform the design of an ensuing investment project by ADB for implementation during 2020-2025 to achieve accelerated growth and to support related infrastructure in rural areas, along the Integrated Value Chains.

1.3.2 Proposed Approach & Methodology

Based on above understanding and the scope of work, the assignment was executed in two-phased manner, which included:

Phase I: Inception phase	**Phase II:** Detailed field survey
○ Project kick-off meeting & Inception workshop ○ Selection on focus crop based on private sector feedback & comparative analysis of major commodities on various parameter ○ Mapping of production cluster for proposed focus crop ○ Identification of focus crop FPO clusters in the State	○ Selection of farmer collectives/ FPOs based on maturity and performance assessment ○ Field visit & interaction with selected FPOs to assess the need gap ○ Value chain analysis to map the commodity flow along traditional channels and identify the barriers to supply chain ○ Evaluation of status of existing infrastructure to identify the investment opportunities and requirements ○ Mapping the potential buyers of FPO produce, understanding their perspective of challenges and potential for co-investment in the value chain infrastructure. ○ Review of performance of past investment projects & benchmarking of best practices

Based on the above activities, recommendations have been made for appropriate interventions to develop linkages between farmer and their collectives and the emerging markets for the focus horticulture crops.

A workshop was held in December, 2018 in Mumbai to discuss the outcome of the above activities and the recommendations made, where a wide range of stakeholders (including farmer collective members, private agribusiness companies, government officials, ADB team members, etc.) were present. The feedback received during the workshop has also been incorporated in this report.

1.3.3 Activities Completed

The following key activities have been completed till date:

- 5 focus crops selected
- Production crop cluster identified
- 49 Farmer Producer Organizations covered (23 selected for detailed discussions)
- 9475 famers covered through detailed discussions with 23 selected FPOs
- 44 key value chain stakeholders interacted during field visits
- Database of 100 private sector agri-business created
- Detailed discussions with over 50 agri-businesses held

Field visits conducted in September to October 2018

Coverage of Principal Stakeholders
- Local Traders Commission Agents
- Transport Providers
- Cold Storages Operators,
- Processors
- Mandis/ APMCs officials
- Officials from relevant Depts


Pictures from Field Visits
Interaction with Sweet Lime FPO


Pictures from Field Visits
Pomegranate Packing at APMC Nashik

1.3.3.1 Selection of Focus Crops & Major Production Clusters

During the Inception Phase, based on secondary analysis and inputs from some of the key private sector agri-businesses, the following **5 focus crops were selected** amongst all the crops grown in the State.


Pomegranate


Sweet Lime


Mandarin


Banana


Custard Apple

The selection of the focus crops was done on the following key criteria:

%age share in All-India Area of the Crop	%age share in state total area of the Crop	State's All India Rank in terms of Crop Production	%age share of volume of exports	Requirement of support infrastructure
Ratio of state avg productivity to national avg	Seasonality advantage	Price volatility	Scope for value addition	

The production clusters of the selected crops in Maharashtra were mapped to understand the production and area distribution of the crops in the state, the districts with the highest production and the productivity of the crops in the major production clusters in the state. The mapping of the production clusters of the selected crops assisted in identification of the focus areas of the study by covering clusters of high production. The details of the major production clusters identified are given in the value chain analysis section of the report.

1.3.3.2 Selection of FPOs

During the Inception Phase, an exhaustive database of FPOs was prepared- based on the information collated from various secondary sources. Amongst this database, 49 FPOs were found to be engaged in the production and marketing of either of the selected focus crops.

The Study team conducted interactions with these 49 FPOs, primarily to assess their maturity and operational performance, and also to ensure screening-out of non-performing and non-functional FPOs.

The key parameters for conducting the FPO assessment and selection have been given below:

1. Number of farmer members associated with FPO
2. Existing production volumes of focus crop
3. Existing area under focus crop production under FPO
4. Current sales/ Annual turnover of FPO
5. Production and marketing related functions performed by FPO
6. Intent & ability to co-invest in market linkage development

As an outcome of this activity, **21 FPOs were shortlisted & selected**, with whom detailed interactions were scheduled during the field visits to production cluster for the purpose of this pre-feasibility study. The summary of these 21 FPOs is enclosed below:

No. of Selected FPOs	Total No. of Member Farmers	Total area under production of focus crops (Acres)	Total Production Capacity p.a. (MT)
21	9475	21,590	2,27,980

 Pomegranate	 Sweet Lime	 Mandarins	 Banana	 Custard Apple
6 FPOs	**3 FPOs**	**7 FPOs**	**6 FPOs**	**1 FPO**
2418 Farmers	**955 Farmers**	**3787 Farmers**	**1715 Farmers**	**600 Farmers**
2010 acres of land under crop	**2950 acres** of land under crop	**11,280 acres** of land under crop	**3600 acres** of land under crop	**150 acres** of land under crop
18,300 MT of crop production	**24,700 MT** of crop production	**58,880 MT** of crop production	**1,16,100 MT** of crop production	**10,000 MT** of crop production
Locations: **Sangamner, Vavi, Satana**	Locations: **Jalna, Pachod**	Locations: **Amravati**	Locations: **Chopada, Muktainagar, Raver**	Locations: **Saswad**

The details of these 21 FPOs has been captured in the subsequent chapter of Value Chain Analysis.

1.3.3.3 Field Visits for Interactions with FPOs and Principle Stakeholders of Value Chain

The objective of the field visits was to develop a clear understanding of the following:

- To identify the various economic activities along focus crop value chain
- To identify the key actors/ agents involved, their size and scale of operations
- Understand linkages/ operations of the key actors i.e. physical functions engaged in
- Study flow of commodity & its distribution pattern through different agents

- Understand the value addition, costs, prices, margins & loss for each economic agent at various stage of the supply chain i.e. the financial functions involved.
- Study the price difference between key markets including exports

The field visits to major production clusters of the respective focus crops were conducted during September to October 2018.

During these visits in-depth field based interviews and Focus Group Discussions (FDGs) were held with the key value chain stakeholders engaged in focus crop. The following key stakeholders were covered during the field visits across the value chain functions:

- 49 Farmer Producer Organizations (23 selected for detailed discussions)
- Local Traders, Commission Agents/ Aggregators
- Transport & Logistics Providers
- Cold Storages & Other Post-Harvest Infrastructure Operators,
- Secondary & Tertiary Processors
- Officials from Mandis/ APMCs etc.
- Officials from Local Municipalities/ Other relevant Departments

The detailed findings and observations captured during the field visits have been compiled and documented in subsequent section of Value Chain Analysis.

1.3.3.4 Agri-business Database Creation and Private Sector Consultations

A parallel assessment has been conducted to understand the requirements of consumption markets for existing as well as potential buyers of the produce along the supply chains for horticultural produce from the state of Maharashtra. The assessment involved high-level scanning of the agribusiness sector through secondary research for creation of a database, followed with detailed interactions with select private sector organizations to understand the key challenges faced by these businesses, their willingness to engage with the FPOs through direct procurement or co-investments, and also to seek their expectations from the proposed MagNet project.

A database of 100 private agri-businesses operating in F&V sector, particularly in Maharashtra, has been prepared. The database comprises of companies engaged in the following type of operations:

- Input suppliers/ research & development agencies/ technology providers
- Service providers for transportation, storage, pack-houses, cold chain & logistics, agro-cluster projects, Mega Food Park projects etc.
- Agro/ Food companies and processors
- Trading companies, exporters
- Organized retailers/ e-marketplaces

The details of the private sector consultations have been compiled in the subsequent section on Assessment of Potential Buyers and Co-investors.

Based on the key gaps identified across the value chains and current availability of the state-level infrastructure, suitable recommendations and interventions have been incorporated in the final section.

2 Value Chain Analysis

2.1 Value Chain Analysis – Pomegranate

2.1.1 Introduction

2.1.1.1 Production Scenario– Country, State

Pomegranate is one of the major fruit crops cultivated in arid and semi-arid region, particularly due to its tolerance to biotic & abiotic stresses, low maintenance cost & high yield potential. Globally, the demand and commercial production of this crop is increasing owing to its high nutraceutical value. India is the world's largest producer of Pomegranate, followed by Iran, Turkey, Spain, Tunisia, Morocco, Afghanistan, China etc. India produces some of the finest varieties of pomegranate that have soft seeds, have fewer acids and have attractive colors. The total area under cultivation of pomegranate in India is about 216 thousand Ha and production is about 2.6 Million MT. In India, Pomegranate is mostly produced in Maharashtra, Karnataka, Gujarat, Andhra Pradesh & Madhya Pradesh.

2.1.1.2 Area, Production & Productivity

Maharashtra is the highest producer of Pomegranate in the country in terms of both area and production. The state produces about 1.6 Million MT pomegranate accounting for about 67% the total production in the country. Of the total area under fruit production in the state, 1/5th is devoted to cultivation of pomegranate. About 140.71 thousand Ha area in the State is under pomegranate cultivation, which is 65% of all India area for pomegranate cultivation. Despite the high production, the average productivity of Pomegranate in the state is about 11.5 MT/ Ha which is slightly lower than the national average productivity of 12.1 MT/ ha and is less than half the productivity of Tamil Nadu which has the highest productivity (27.43 MT/ Ha). Thus, there seems to be a potential for increasing crop productivity through investments in best crop management practices & technology integration.

2.1.1.3 Major Varieties

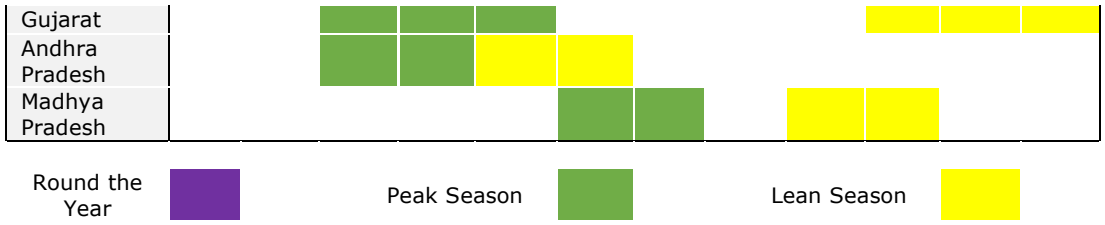
Important pomegranate varieties cultivated in the state are Ganesh, Mrudula, Aarakta, Bhagwa, etc. These varieties are quite good in quality and are suitable for export market. Ganesh and Arakta varieties, in particular, are in demand internationally. The Bhagwa variety has a thick peel and is considered suitable for long distance transport/ exports. The State also has strong research support for varietal development and scientific cultivation of pomegranate from institution has National Research Centre for Pomegranate based in Solapur in Maharashtra.

2.1.1.4 Seasonality Advantage

In terms of crop seasonality, the State has advantage of having harvesting season all-round the year for Pomegranate compared to seasonal peak production ranging 2-4 months in other pomegranate producing States. Tamil Nadu is the only other State where pomegranate is harvested round the year. However, overall production and area under cultivation is Tamil Nadu is relatively very low.

Harvesting Season of Pomegranate in Major Producing States

Major Producing States	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maharashtra												
Karnataka												

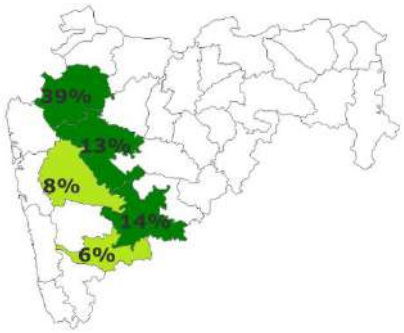


2.1.1.5 Major Production Clusters in the State

In Maharashtra, Nashik is the leading district, both in terms of area under cultivation and production of pomegranate. The district alone accounts for about 39% of the total production of the state. Apart from Nashik, the other districts of major productions are Solapur, Ahmednagar, Pune and Sangli. These five districts together account for more than 80% of the total production in the state. The major district wise area under production, total production (including percentage of state's production) and productivity are given in the table.[4] The adjoining map shows the major producing districts of pomegranate in the state. The districts shown in dark green are the districts having more than 10% of the total production of pomegranate in the state, which comprise of Nashik, Solapur and Ahmednagar.

Figure 2. Major Pomegranate production clusters in the State

District	Area (000 Ha)	% in Total State Production	Total Production (000 MT)	Productivity (MT / Ha)
Nashik	38.80	39%	628.11	16.19
Solapur	25.5	14%	229.50	9.00
Ahmednagar	21.50	13%	215	10.0
Pune	13.50	8%	136	10.07
Sangli	5.22	6%	89.16	17.08



The major production blocks of the identified Pomegranate producing districts are mentioned below[5] -

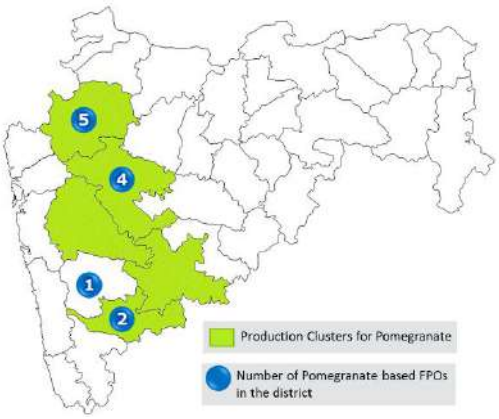
- **Nashik:** Kalvan, Peint, Igatpuri, Sinnar, Niphad, Yeola, Nandgaon, Satana Furgana, Dindori, Melgaon
- **Solapur:** Karmala, Barsi, Madha, Mohol, Mangalwedha, Singole, Malsira, Pandharpur, Akalkot.
- **Ahmednagar:** Srirampur, Sangamner, Akola, Rahuri, Nevasa, Parner, Pathardi, Srigonda
- **Pune:** Junnar, Ambegaon, Ghod, Rajgurunagar, Wadgaon, Sirur, Mulshi, Welhe, Purandhar, Bhor, Baramati, Indapur, Daund, Saswad
- **Sangli:** Atpadi, Khanapur, Islampur, Shirala, Valva, Tasgaon, Kavathe, Mahankal, Jath, Miraj

[4] Commissionerate of Agriculture, Maharashtra State, 2016-17
[5] APEDA Pomegranate Profile (http://agriexchange.apeda.gov.in/Market%20Profile/one/POMEGRANATE.aspx accessed on 02.09.2018)

2.1.2 Identification of Farmer Groups

2.1.2.1 Identification & selection of formal / informal producer groups / organization

Figure 3: Mapping of FPOs engaged in production of pomegranates in Maharashtra



The identification and selection of the FPOs has been done based on the secondary information gathered from the respective database of FPCs promoted under the different agencies and projects like SFAC, NABARD, MSAMB (MACP), and MSAMB (JFPR). As per this information, it was assessed that about 12 FPOs are involved in production and marketing of Pomegranates in the State. Mapping of FPO presence with the key production clusters of pomegranate reveals that majorly these FPOs are located within or in proximity to production clusters for Pomegranate. Majority of the identified FPOs for pomegranate are based in the districts of Nashik (5) and Ahmednagar (4), which account for maximum pomegranate production in the State. Other FPOs are located in Sangli (2) and Satara (1) district.

As a part of the selection process, telephonic interactions were initiated with these 12 FPOs to verify whether they are involved in production / marketing of pomegranate and to gather information on the following key parameters identified for shortlisting the prospective FPOs for the field visits.

- ✓ Year of establishment & commencement of commercial operations
- ✓ Associated number of farmer members, gender composition
- ✓ Contributed Share Capital
- ✓ Existing area under focus crop production under FPO
- ✓ Existing production volumes of focus crop
- ✓ Production and marketing related functions performed by FPO to facilitate backward& forward linkage
- ✓ Current sales/ Annual turnover
- ✓ Intent & ability to co-invest in market linkage development

- **Details of Farmer groups** – Out of the total 12 FPOs contacted, 10 FPOs gave their responses and provided information on the aforementioned key parameters. The details of these FPOs is provided below –

Key Parameter	Name of the Farmer Producer Organization (FPO)									
	Deola Agro Producer Company Limited, Nashik	Jamnadi Khore Farmer Producer Company Limited, Nashik	Bhojapur Khore Pomegranete Farmer Pro. Co. Ltd, Nashik	MMB Farmer Producer Co. Ltd, Nashik	Shetmall Agro Producer Co. Ltd, Nashik	Sangamner Fruits & Vegetable Producer Co. Ltd, Ahmednagar	Adarsha Grameen Agro Producer Company Limited, Ahmednagar	Varad Farmers Producer Company Limited, Ahmednagar	Gopalkrishna Farmer Agro Producer Co. Ltd, Satara	Manganga Shetkari Utpadak Co. Ltd., Sangli
Year of Establishment	2014	2016	2015	2015	2013	2013	2014	2014	2016	2015
Commencement of Operations	2016	2017	2016	2015	2014	2017	2014	2014	2017	2018
Associated number of farmer members	564	163	389	1000	250	220	340	300	360	280
Contributed Share Capital (in Rs. lakh)	12.00	2.53	4.82	28.79	3.50	1.00	4.50	1.00	5.00	5.00
Existing area under focus crop production under FPO (in acre)	-	600	150	500	50	600	250	70	450	500
Existing production volumes of focus crop (in tonnes)	-	5000	1200	2500	600	6000	2500	500	2000	1500
Production and marketing related functions performed by FPO to facilitate backward& forward linkage	The FPO is involved in production and marketing of vegetables, majorly Onion. It was shared by the FPO representative, that the member farmers do not produce pomegranate	The FPO is supplying pomegranate to local traders who supply to distant markets and FPC is also running an agri-mall through which it is supplying quality inputs to members	The FPO is involved in selling of inputs like pesticides, growth hormones, and trading of produce on commission basis in the local markets.	The FPO has two outlets selling inputs like seeds, fertilizers and pesticides. It has also carried out sale of Onion in distant markets of Haryana and Chandigarh.	The FPO is involved in purchase of vegetables from member farmers and sells in weekly market of Mumbai. It is currently searching for linkages to market pomegranate as well.	The FPO has started aggregating and selling the produce in local and few distant markets.	The FPO is involved in production and marketing of multiple commodities (pulses, fruits. Vegetables) including pomegranate. It has developed marketing linkages with Big Basket as well and supplies fresh pomegranates to Big Basket, based on the orders received from time to time.	The FPO had undertaken procurement of pulses under the Price Stabilization Fund Scheme of Small Farmers Agribusiness Consortium. It is currently involved in collection and storage of onion on behalf of National Agricultural Cooperative Marketing Federation of India Ltd (NAFED).	The FPO is involved in selling of inputs through its outlet and is exploring market linkages for sale of fresh pomegranates (aggregated from the member farmers)	The FPO has a grading unit for grains and pulses. The packing is done manually. They are involved in trading of pulses, grains, and pomegranates.
Current Sales / Annual Turnover	150.00	12.00	45.74	20.00	25.00	The FPO has started business operation in FY 2017-18	450.00	125.00	35.00	45.00

Key Parameter	Name of the Farmer Producer Organization (FPO)									
	Deola Agro Producer Company Limited, Nashik	**Jamnadi Khore Farmer Producer Company Limited, Nashik**	**Bhojapur Khore Pomegranete Farmer Pro. Co. Ltd, Nashik**	**MMB Farmer Producer Co. Ltd, Nashik**	**Shetmall Agro Producer Co. Ltd, Nashik**	**Sangamner Fruits & Vegetable Producer Co. Ltd, Ahmednagar**	**Adarsha Grameen Agro Producer Company Limited, Ahmednagar**	**Varad Farmers Producer Company Limited, Ahmednagar**	**Gopalkrishna Farmer Agro Producer Co. Ltd, Satara**	**Manganga Shetkari Utpadak Co. Ltd., Sangli**
Intent / Ability to co-invest in market linkage development	A 6000 sq.ft. pack-house has been constructed under JFPR project (75% grant support)	The FPO shared its willingness to co-invest for setting up of Aril packaging unit based on Modified Atmosphere Packaging Technology	The FPO is interested in setting up of processing unit for juice making, but does not have collateral for the availing infrastructure term loan from bank.	The FPO has constructed a pack-house with minimal processing facilities under MACP project (75% grant support). The FPO is even interested to set-up a pomegranate processing facility with a Cold Store, Aril Extraction, Packaging and Juicing Unit.	A pack-house has been constructed by the FPO under JFPR project (75% grant support)	The FPO has initiated the construction of pack-house under JFPR project (75% grant support)	The FPO has a pack-house facility constructed under MACP project (75% grant support). It has a grading unit and *daal* making-packaging unit at the pack-house.	The FPO has plans to set-up a pomegranate processing unit having Cold Storage (100 MT), Sorting Grading Line, Pulping Unit and Modified Atmosphere Packaging for pomegranate arils	The FPO shared that it has a requirement for a Cold Storage of 50-100 MT storage capacity.	The FPO expressed its willingness to co-invest for a juice-manufacturing unit.
Remarks	As, the FPO members are not involved in production of pomegranates, the FPO was excluded from the field visits.	The reported area under production is joint highest and the production volume is second highest among the FPOs contacted. In addition, as the FPO is already started trade of pomegranates (on a small scale), so the FPO was included for the field visit.		The FPO has the highest number of member farmers and third highest production volume among the FPOs contacted. In addition, the FPO also has plans to invest in a pomegranate processing facility. Therefore, the FPO was included for the field visit.		The reported area under production is joint highest and the production volume is highest among the FPOs contacted. Therefore, the FPO was included for the field visit.	The FPO has third highest production volume among the FPOs contacted. Further, it also reported the highest turnover as compared to the other FPOs. The FPO has already developed market linkages with Big-Basket and supplies fresh pomegranates to it. Therefore, the FPO was included for the field visit.	Although the reported production is less, the Chairman of the FPO expressed willingness to invest for a processing facility (Rs 2.0-2.5 crore outlay). The Chairman was of the view that, if a processing unit is established then he can source produce from non-members farmers as well. Therefore, the FPO was included for the field visit.		

2.1.2.2 Field visits and Outcome

- The district of Nashik accounts for 39% of the total production in the state and is known for the quality and taste of the Pomegranates produced there. In terms of productivity, the productivity of 16.19 tonne per hectare is better than the national average productivity of 12.10 tonne per hectare.
- **Trade Channel:** There are two major channels observed in the sale of the produce. In one channel, the produce is sold at the farm-gate and in the other channel; the farmer takes his produce to the market.
- Most of the harvested fresh produce is sent to distant markets like Delhi, Punjab, Chandigarh, Haryana, Lucknow, Kanpur, Kolkata, and Gorakhpur. The produce is sorted as per size and appearance, packed in corrugated cardboard boxes, and transported through trucks. The produce is transported at ambient temperature conditions and reaches the destination markets in 2-5 days depending upon the distance.
- Primary processing in case of Pomegranates is limited to only the sorting, grading operations. There were no dedicated pack-houses for pomegranate reported from the various discussions with the different stakeholders like farmers, FPOs, agricultural market committee, traders.
- Few FPOs, showed willingness in setting up of Processing Units - Pack house, Aril Extraction and Packaging.
- The processing companies opt to buy the Grade C produce (smaller sized fruits, with appearance defects, but having no internal damage) from the traders in the market yards. The processing companies prefer to do this, so that they keep their procurement cost to the minimum.
- The companies who are into trade / export of fresh pomegranates have a demand for good quality produce (larger sized fruits, with good appearance) from the farmers.

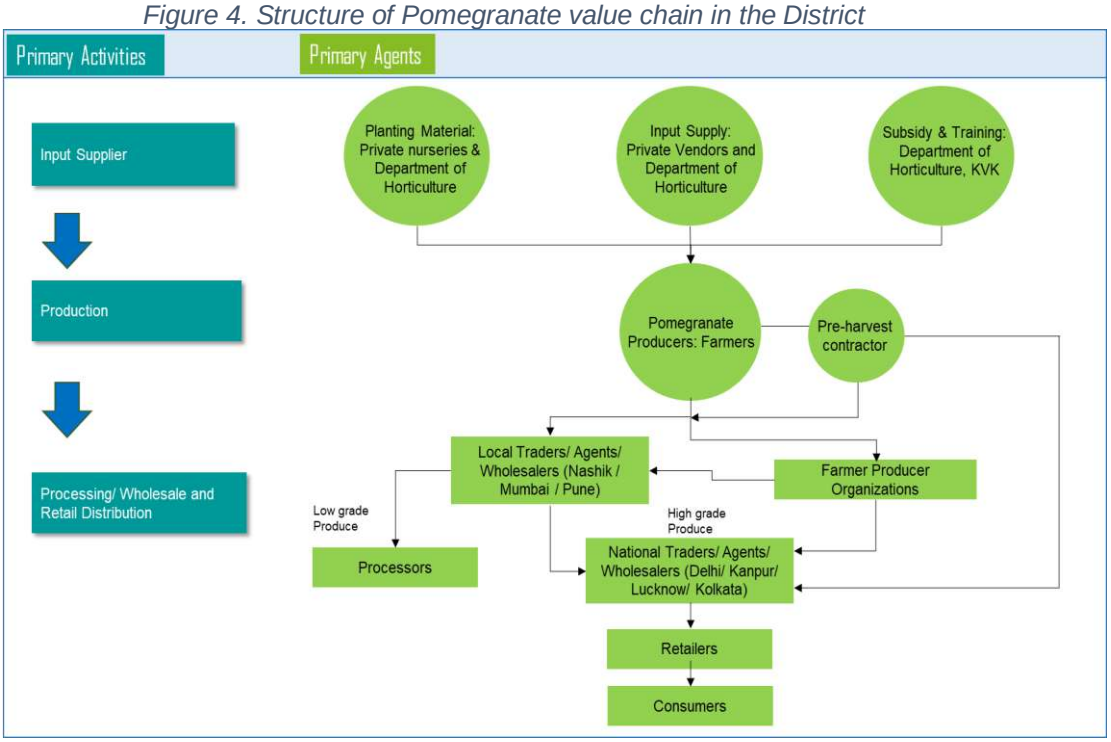
2.1.3 Value Chain Analysis

2.1.3.1 Value Chain Analysis – Structural, Functional & Commodity flow

Structural Analysis

The Pomegranate Value Chain begins with the pomegranate producers / growers. They grow pomegranate on orchards, with the average area under the orchards being 3-4 acre per farmer. The Producers are responsible for planting of the saplings, maintenance of the stand of trees and harvesting of the produce. Very few farmers practice sorting or grading of the produce after harvesting. Most of the pomegranate growers sell their produce to pre-harvest contractors or village level aggregators, who generally buy the harvested produce directly from the orchard (farm gate). These pre-harvest contractors carry out sorting, grading and packing and the produce is transported to nearby and distant markets in trucks / tempo. The farmer takes the produce that is rejected at the orchard, to the nearest APMC market, where it is sold to commission agents. The companies, which are involved in processing (juicing / aril extraction) generally, buy from the APMC markets, as farmers bring low quality produce to the markets.

Figure 4. Structure of Pomegranate value chain in the District



Functional Analysis

The role played by various members of the value chain is as follows:

Input Supplier: The pomegranate farmers may buy the planting material either from Private Nurseries, Agriculture Universities, Krishi Vigyan Kendras (KVK) depending upon their proximity to them and on the costing. Majority of the growers buy from Private Nurseries as they are spread across the production clusters. In Maharashtra, there are 16 government-accredited nurseries for production of Pomegranate Planting Material. Bhagwa is the most common variety

cultivated / preferred by the growers. Other varieties grown are Arakta and Ganesh. In addition to the Planting material, other inputs like pipes and equipments for Drip Irrigation, Fertilizers (including liquid fertilizers), Micronutrients and Pesticides are required for Pomegranate cultivation. The farmers buy these from private retailers or from Input Supply centres established by Farmer Producer Companies (if they are functional in the vicinity).

Grower: The Pomegranate growers undertake cultivation and maintenance of orchards throughout the year. The main operation carried out by the farmers includes land preparation, furrowing, sourcing and planting of planting material (for establishment of new orchards/ replacement of senile ones), nutrient application in form of manure/fertilizers, weeding, pruning, application of insect pest control measures, harvesting. Post-harvest management including farm gate sorting, grading and packing in plastic crates is carried out, only if the farmers want to sell their produce at the markets. The farmers who sell their produce at the farm-gate are involved till the harvesting stage as the pre-harvest contractor who buys the produce, collects it in crates and then re-grades the produce at collection center or shed near the orchard / farm itself.

Pre-harvest contractor: Around 50-60% of the farmers in the state, engage with pre-harvest contractors to sell their produce. The decision to sell through a Pre-harvest contractor depends on the distance of the farm / orchard from the nearest market and a comparative analysis of the cost offered by the pre-harvest contractor. The farmers informed that these contractors either are fellow farmers or arrived from outside of the region/state at the time before crop harvesting or fruit formation stage. They inspect each tree in the orchard and quote a lump sum price for the produce based upon a visual observation, taking into account the number of trees with matured fruits, fruit size and proportion of diseased or damaged fruits. If there is an agreement reached between the farmer and the pre-harvest contractor, then the farmer harvests the produce and it is given to the pre-harvest contractor. The sorting, grading and packing is done by the contractor at a collection / packing shed or at a suitable place near the farm. The pre-harvest contractor may also prefer to buy fruits only matching his desired quality parameters and reject the rest of the produce. In such case, the farmer takes the rejected produce to sell at the nearest market.

Commission Agents & Wholesaler: The commission agent facilitates the transaction process between wholesalers and farmer. In context to the Pomegranate value chain, it was notable from the interactions with the farmer as well as local traders (in Nashik Fruit Mandi and Satana APMC Mandi), that majority of agents are registered with Market yards as both commission agent and Wholesaler. The produce, which is brought by the farmers at the Market yard, is auctioned and bought by the Commission Agents. Commission Agents are liable and responsible for the payment to the farmers. The Commission Agents sell the produce to the Wholesalers; the Wholesaler pays commission to the Commission Agent.

Cold Storage/ Processing Facility: There are a number of cold storages in Niphad and Dindori block of Nashik district. However, these cold storages are mostly utilized for storage of grapes and raisins. Very few cold storage facilities

are utilized for storage of pomegranates. In context of pomegranate processing, there are few companies involved in aril extraction, juicing and sale of frozen arils. These companies usually have their in-house cold storage space. Freshtrop Fruits Ltd. and Sahyadri Farmers Producer Company Ltd. are the major processing companies operational in the district.

Table 1: Functional Analysis of the Value Chain

Activity	Agent	Output
Input Supply	Private vendors Department of Horticulture	Planting Material Drip Irrigation Apparatus Fertilizers & Micronutrients Pesticides Packing Material
Training and Subsidy	KVK Agriculture University National Research Centre on Pomegranate, Solapur Department of Horticulture	Training on Pomegranate cultivation Subsidies on input supply (machinery, chemicals, planting material)
Production	Farmers	Fresh Pomegranate
Post-Harvest Management	Farmers Pre-harvest Contractors Commission Agents	Harvested Pomegranate Primary processed produce (sorted, graded and packed pomegranate)
Transportation	Transport Service Providers	Logistic assistance
Secondary Processing	Processors	Pomegranate Arils (Fresh and Frozen), Pomegranate Juice
Wholesale & Retail distribution	Wholesalers Commission Agents Retailers	Sorted and Graded Fresh Pomegranate

Commodity Flow Analysis

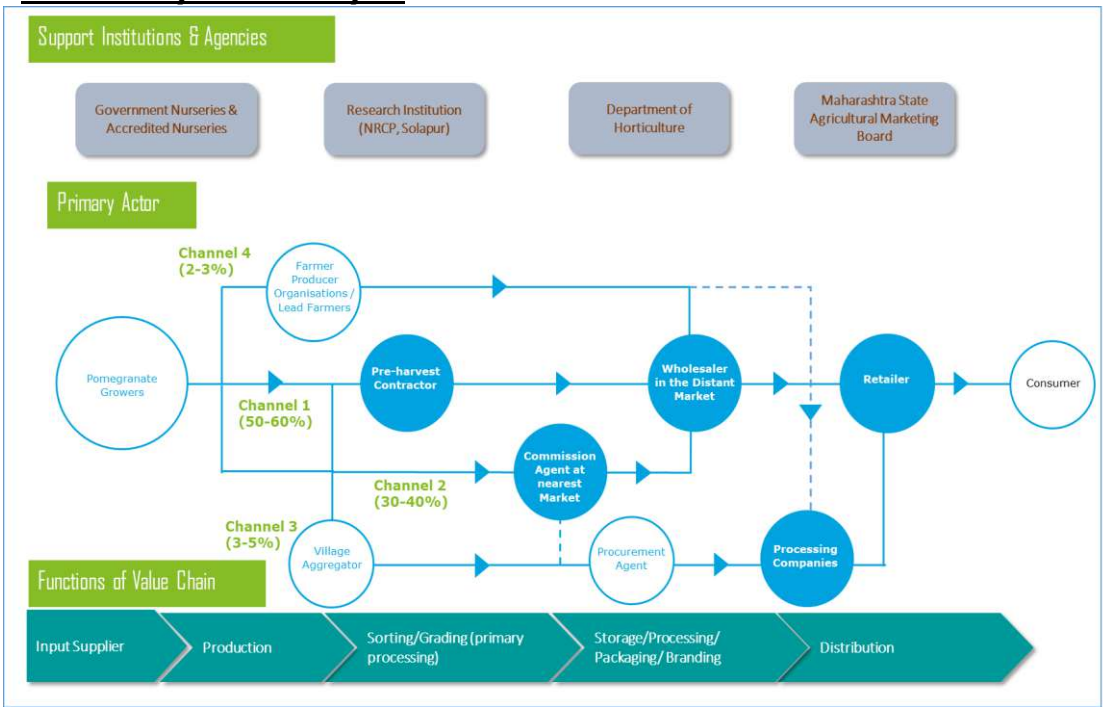


Figure 5: Commodity Flow and Trade Channels

Based on the stakeholder interaction four different marketing channels have been identified to be operating in the study area. The selection of marketing channel by the farmer is dependent on factors as scale of production, the prevalent market rate and the proximity to the market and the transportation cost involved in taking the produce to the market.

Channel 1.

Farmer → Post-harvest Contractor → Wholesaler in distant market (as Delhi/Lucknow/ Chandigarh/Bihar/Kolkata) → Retailer → Consumers

Channel 2.

Farmer → Commission agent at the nearest Market → Local wholesale suppliers/ vendors (retailers)/ Wholesalers in distant markets (as Delhi/Lucknow/ Chandigarh/Kolkata) →Local traders/retailers → Consumers

Channel 3.

Farmers → Aggregators / Commission Agent at the Nearest Market → Purchase Vendor → Processing Companies →Wholesaler/Retailer in distant market →Consumers

Channel 4.

Farmers → Farmer Producer Organizations / Lead Farmers → Commission agents/Wholesaler in local or distant market → Consumers

Channel 1: Channel 1 is one of the two most prevalent trade channels observed for Pomegranate. The Farmer sells his produce at the farm-gate to the pre-harvest contractor. The farmer opts to sell via this channel when his farm is located far away from the nearby market or when he feels that the cost offered by the contractor is equal or almost equal to the price, he would fetch at the Market. The advantage to the farmer is that he does not have to incur any transportation or evacuation cost. However, in most cases, the contractor is looking for a specific quality of produce. So, generally 20-30% of the produce is rejected, which the farmer has to then either sell to village aggregator or take the produce to the nearby market yard. The pre-harvest contractors who buy the fresh produce directly from the farms / orchards, generally select good quality fruits belonging to the first two Quality Grades. The produce is then sorted, graded and packed and sent to the Wholesalers in the Distant Markets of Delhi, Chandigarh, and Punjab and even to major markets of Maharashtra like Mumbai, Pune. The demand at these markets is for good quality produce with fruits having attractive appearance and uniform size. The Wholesaler at the Destination Markets then sell the produce to Semi-wholesalers / Retailers, from where it is bought by the end Customers.

Channel 2: Channel 2 is another prominent trade channel and more farmers are now opting to take their produce to the nearby APMC markets. These farmers are mostly the progressive farmers, who are updated with the prevalent market rates in major Markets of the district. The farmer bring the produce directly to State APMC market, where the produce is sold in open auction through commission agent cum wholesaler. The fruits are packed in plastic crates (of 20 kg capacity) and transported to the nearby market in tempo-trucks or Pick-up trucks. Under

this Channel, the farmers are responsible for payment of costs associated with post-harvest activities as on-farm sorting, grading, packing, transportation from farm to market, loading and unloading charges etc. There are a number of APMC markets in the survey district of Nashik, where Pomegranate trading takes place. The biggest one is the Sharad Chandraji Pawar Fruit Market located in Nashik city. Apart from this, there are other APMC markets in Satana, Pimpalgaon, Lasalgaon where also Pomegranate is traded. Further, there is also a Private Market named Perfect Krushi Market for trade and sale of fruits and vegetables. Arrival of each lot into the market is registered in the records of the market yard. The commission agents cum wholesaler arrange the stock in their shops in grower-wise lots for sale. The Commission Agents sell the produce of the Farmers to the Wholesalers of the local / distant markets and charge a fixed commission from the buyer (Wholesaler). The Wholesalers from the distant markets have their

Table 2: Grade Designation and Pricing (in Rs per kg)

Grade	Weight (in grams)	Price Paid (Rs/Kg)	% Share of grade procured produc
Extra Class	400	80	20-25%
	350	70	
	300	60	
Class I	250	50	25-30%
	200	40	25-30%
Class II	150	25	10%-15%
	Less than 150	20	10-15%

representatives at the markets, who inspect the produce and participate in the auction process. The responsibility of making the payment to the farmers lies with the Commission Agents. The proceeds of payment under the channel are mostly made in cheque or cash within few days of sale and sometimes immediate. The Wholesalers then sell the produce to Semi-wholesalers / Retailers, from where it is bought by the end Customers.

Channel 3: The Pomegranate Farmers indirectly supply fresh produce to the Pomegranate Processing Companies (Freshtrop and Sahyadri Farms) in the state either through the Village Level Aggregators or through the Commission Agents in the Market Yards. The Processing companies have different requirements depending upon the end-use of the produce. For manufacture of processed products like Pomegranate Arils (Fresh and Frozen), Pomegranate Juice, they prefer smaller sized fruits from Class II Grade, i.e. fruits which have some cosmetic defects like discolored appearance, defect in shape, etc. This is because; this produce is available to them at a cheaper rate. The Processing Companies have their Purchase Vendors / Managers, who buy the Grade C produce The Processed products are then marketed in the domestic / international market. Products such as Frozen Pomegranate Arils are exported to mostly European countries. Pomegranate Juice is sold to companies such as Dabur, Pepsi, to be packaged and marketed under the respective brands of these companies.

Channel 4: This Channel is observed where there are Farmer Producer Organisations (FPOs) / Lead Farmers involved in the marketing of the produce. The member farmers of the FPOs sell the produce to the FPOs. The FPOs are then responsible for sorting, grading, packing and transporting the produce to wholesale markets in Delhi, Lucknow, Kolkata, Kanpur, etc. Further, there are

some progressive lead farmers aggregate produce from the farmers and sell the produce to the distant markets. The price information is generally obtain based on direct conversation with traders based out of these mandis. There can also be an alternate channel, wherein the produce of Grade Class II, which have cosmetic defects, is sold to the Processing Companies. Sahyadri Farms is a Farmer Producer Company in Dindori taluka of Nashik. It has close to 5000 farmers of Nashik, who are registered with the Producer Company and sell their produce to it.

2.1.3.2 Status of Storage Infrastructure

There are a number of cold storages in Dindori and Niphad taluka of Nashik district. However, they are mostly utilized for storage of Grapes, Raisins and other Processed or Ready to Eat Products. Pomegranate is not stored in cold storage; it was reported that the harvested pomegranate fruits are evacuated within two days from Nashik and sent to distant markets of Delhi, Lucknow, Kanpur, Kolkata, Bihar, etc. for table consumption. The companies, which are into production of processed products of pomegranate, prefer to store the fruits for one-two months in their own captive facilities. Those who are involved in export of fresh pomegranates prefer to use facilities, which are closer to Mumbai / Jawaharlal Nehru Port Trust (JNPT). For e.g. Saastha Warehousing has a cold storage facility located at Panvel (Navi Mumbai), which is being used by Pomegranate Exporters to store their produce.

2.1.3.3 Status of Secondary and Tertiary Processing

Aforementioned there are a few companies involved in aril extraction, juicing and sale of frozen arils. These companies usually have their in-house cold storage space. Freshtrop Fruits Ltd. and Sahyadri Farmers Producer Company Ltd. are the major processing companies operational in the state. Freshtrop has been involved in supplying bulk quantities of pomegranate juice (packaged in Aseptic Drums) to brands like Dabur and PepsiCo. Recently, Freshtrop has launched its own brand of juice, by the name of Second Nature. This juice is being extracted by a special Cold Vacuum Extraction process and is being sold as a niche product to health conscious consumers in urban markets[6]. Sahyadri Farmers Producer Company Ltd. is another major company involved in secondary and tertiary processing of pomegranates. The products are marketed under the brand of Sahyadri Farms. The major pomegranate based products marketed are Frozen Pomegranate Arils and Pure Pomegranate Juice (without any additives). Besides fruit juice, there is significant potential for commercial production and up-scaling of various other value added pomegranate products as pomegranate seed oil, powder of dried pomegranate peels, etc.

Apart from the private sector encouragement, a number of Farmer Producer Organizations are also interested in undertaking processing activities with support under grant assistance from various government schemes to help them get integrated higher up in the value chain and realize greater returns.

[6] https://www.thehindu.com/business/freshtrop-fruits-forays-into-juices-segment/article23937599.ece

2.1.3.4 Price build-up across the Value Chain

Production

Land Preparation – This generally involves operations such as bed preparation, digging of pits and applying a basal dose of Farm Yard Manure. It was reported that on an average, the cumulative cost is around Rs 35,000 per acre, i.e**.** Rs. 86,450 per hectare.

Planting Material and Nutrition – Generally it was reported that, 400 plants are planted in one acre, i.e. 1000 plants in one hectare. The plants are either sourced from Agriculture Universities (if it is in vicinity of the production cluster), Krishi Vigyan Kendras, and accredited / private nurseries. The cost of the sapling varies from Rs 25 – Rs 40, depending on the quality of the planting material. For the sake of analysis, we have considered the cost of Rs. 40 per plant (rate at which the saplings are available at the Agriculture Universities).

The farmers generally prefer to use Farm Yard Manure (FYM) as a basal dose added to the soil. Around 4 tonnes of FYM is required per acre, i.e. around 9.88 tonnes in one hectare. One tonne of FYM costs Rs 10,000/-. Thus, per hectare cost for FYM is around 98,800/-. In addition, liquid fertilizers and micronutrients are supplied through drip irrigation from time to time. The cost on Liquid fertilizers is Rs 37,050/- per hectare, while that for micronutrients is around Rs. 19,760/- per hectare. Thus, the total cost on Nutrition works out as Rs. 155,610/- per hectare.

Irrigation – Drip Irrigation is the method of choice for irrigating the plants in the orchard. Water for drip irrigation is supplied through wells (if available in / near the farm) or ponds are constructed in nearby area to store water throughout the year (the ponds are lined with tarpaulin sheet to prevent percolation of water). The establishment cost for setting up the pipes and tanks for drip irrigation was reported as Rs 123,500/- per hectare.

Pruning and Thinning – Pruning and Thinning is done to maintain the shape of the tree, to spur growth of new leaves and to remove dead and damaged twigs and branches. Pruning and Thinning is done 2-3 times in a year. The average expense per pruning is Rs 6,175/- per hectare. Therefore, the total cost on Pruning and Thinning Operations is Rs. 18,525/- per hectare.

Plant Protection and Intercultural Operations – Fruit-bearing Pomegranate tree requires about 12-15 sprays of different chemicals throughout the year. Each stage has a scheduled spray with specific chemical requirements to curb crop damage. All the surveyed farmers spray plant protection chemicals to save the crop from insect, pests and diseases. Bacterial Blight and Root Rot were the two main diseases reported by the farmers, which caused considerable damage to the pomegranate fruits. Chemicals are usually procured from input supplier in local market or supplied through the horticulture department as part of government sponsored demonstrations of best practices. The average cost per spray was reported to be Rs 7410/- per hectare (including cost of labor for spraying). Thus, the cost for Plant Protection over the year is around Rs. 111,150/- (calculated for 15 sprays).

Weeding of unwanted plants is usually carried out four times in a year. The cost incurred on one weeding was reported to be around Rs. 7410/- per hectare. Thus, the total cost on weeding works out as Rs. 29,640/- per hectare.

Harvesting – The pomegranate trees start bearing fruits from the 4th/5th year from the year of planting. The harvest for the Ambe Bahar starts in the month of June and continues until the month of August, while the harvest for the Mrig Bahar starts in the month of November and may continue until the month of March. The fruits are harvested by plucking them from the trees. The farmers employ labor to harvest and collect the fruits at the farm-gate. The average labor cost on harvesting was reported to be Rs. 9880/- per hectare.

Post-Harvest Management

To realize potential value of the harvest, it is important to sustain the quality of the pomegranates until they are delivered to the consumer. Proper postharvest management and handling of produce is thus important to prolong the duration for which the fruits remain fresh, have a good external appearance and remain marketable.

Primary Processing (Sorting, Grading & Packing): The Pomegranate fruits are sorted and graded according to their size and appearance. The details of the different grades as per AGMARK standard are mentioned in the table below.

Table 3: Details of grade designation and sizing of pomegranate as per AGMARK standard

Grade Designation	Grade Requirements	Grade Tolerances
Extra Class	Pomegranate in this class must be of superior quality. They must have the shape, development and colouring that are typical of the variety and/or commercial type. They must be free of defects, with the exception of very slight superficial defects, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.	5% by number or weight of pomegranates not satisfying the requirements of the grade, but meeting those of class I grade or, exceptionally, coming within the tolerances of that grade.
Class I	Pomegranates in this class must be of good quality. They must be characteristics of the variety and/or commercial type. The following slight defects may be allowed, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package. - a slight defect in shape. - a slight defect in colouring; - slight skin defects (i.e. scratches, scars, scraps and blemishes) not exceeding 5% of the total surface area	10% by number or weight of pomegranates not satisfying the requirements of the class, but meeting those of class II or, exceptionally, coming within the tolerances of that grade.
Class II	This class includes pomegranates which do not qualify for inclusion in higher classes, but satisfy the minimum requirements. Following defects may be there provided the pomegranates retain their essential characteristics as regard the quality, the keeping quality and presentation:	10% by number or weight of pomegranates not satisfying the requirements of the grade, but meeting the minimum requirements.

Grade Designation	Grade Requirements	Grade Tolerances
	- defects in shape; - defects in colouring - skin defects (i.e., scratches ,scars, scrapes and blemishes), not exceeding 10% of total surface area	

The size is determined by the weight or maximum diameter of the equatorial section of the fruit, in accordance with the following table:

Table 4: Details of sizing in Pomegranate Fruits

Size Code	Weight in grams (minimum)	Diameter in mm (minimum)
A	400	90
B	350	80
C	300	70
D	250	60
E	200	50

Farmers who sell their produce directly at the farm-gate do not sort or grade the produce. The village aggregator or the post-harvest contractor, who buys the produce from the farmers, does the sorting, grading and packing of the fruits. In case, the farmers opt to sell their produce in the market yards, then they carry out sorting-grading operations and pack the fruits in plastic crates of 20 kg capacity. The sorting, grading is carried out by specialized labor, who are experienced in these operations.

Pomegranates as packed in corrugated cardboard boxes. These boxes are generally of 10 kg capacity (but can also be of 12 kg or 15 kg, depending on the requirements of the destination market). For example, the fruits sent to Delhi market are packed in 10 kg box, while those sent to Kolkata market is packed in 15 kg box. Paper cuttings are used as cushioning material inside the box.

Transportation and Logistic

Aforementioned, there are various marketing channels along the pomegranate value chain. The two most common channels are, the farmer selling the produce at his farm-gate and the farmer selling his produce at the nearest market yard. Very few farmers are involved in transporting their produce to the distant markets. Some of the FPOs showed interest in selling the aggregated produce to distant markets provided they have assured linkages with traders in the distant markets (along with the assurance of payment for the produce sent to these markets).

The farmers who opt to take their produce to the nearest market yards; sort, grade and pack their produce in plastic crates of 20 kg capacity and transport the produce in mini-trucks or pick-up vans. The average transportation cost per crate is around Rs 30.00 – 35.00 depending on the distance of the farm from the market yard. Majority of the pomegranates produced in Nashik region are marketed to the distant markets outside Maharashtra. The rest of the produce is marketed within the state to major cities like Mumbai, Pune, Aurangabad, etc. The pomegranate, which is marketed to the distant markets and to the major cities within Maharashtra, is packed in corrugated boxes (10-15 kg capacity). On an

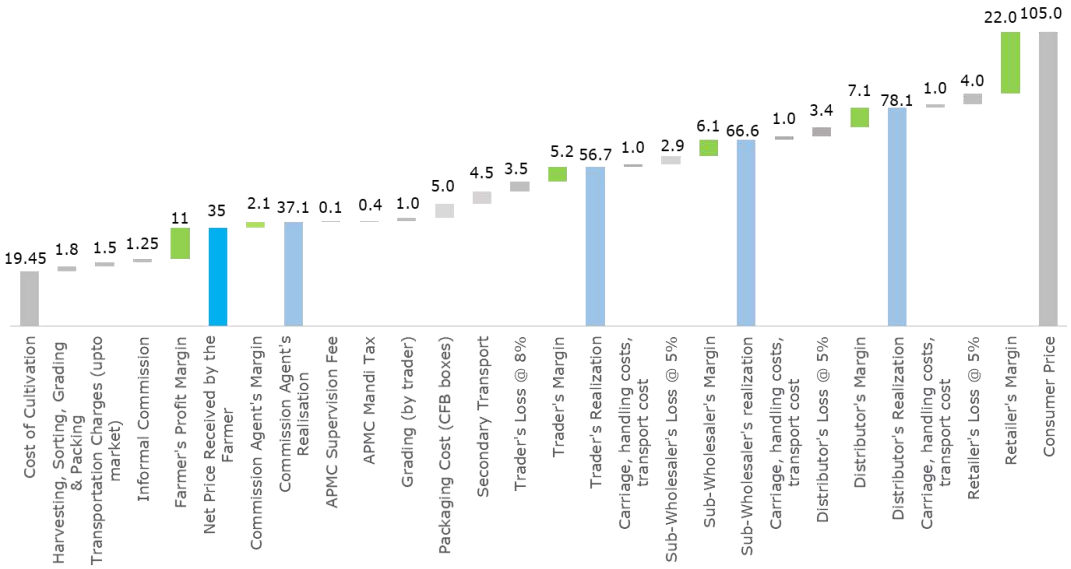
average, transportation of produce from Nashik to Delhi costs between Rs. 40-50 per box (for box weighing 10 kg). While that for other distant markets like Bihar and Kolkata ranges between Rs 70-100 per box (for box weighing 10 kg). The cost of transportation is decided by the transport unions, which operate locally.

Markets and Price Information

Nashik Fruit and Vegetable Market is the major market, where pomegranate is traded in the district. Other APMC markets, where Pomegranate trade occurs are Satana market, Pimpalgaon Baswant market and Lasalgaon Market. In addition to this, there is a Private Market (named Perfect Krishi market) in Nashik city, which has also developed as a major market for trade of pomegranates. It was reported that, the best quality pomegranates (those belonging to Extra Class) are sold at the farm-gate itself (bought by private vendors who supply to exporters / to markets like Delhi and Mumbai, where there is demand for best quality fruits). Apart from this, the best quality pomegranates are also supplied to organized retail companies like Big Basket and Reliance Retail. The fruits belonging to Class I, Class II quality grades and those with external marks or skin discoloration find their way to the APMC / Private markets. Some distant markets like Bihar and Uttar Pradesh have demand for Class II and discolored fruits, as these are available at cheaper rates. Due to the penetration of mobile internet, the farmers tend to have information about the markets rates. One of the FPO – Adarsh Grameen Agro Producer Company Limited (Ahmednagar) reported that, it regularly refers to the *"Aapli Bazaar Samiti"* YouTube channel to get information of the prevailing market rates for different commodities. However, the farmers / FPOs do not have information about the market rates of distant markets (which tend to influence the purchase price / auction price at local markets). Therefore, they are not able to take full advantage of the price information.

Analysis of price build up including a **comparison of farmers' realization in case direct marketing/ processing by farmer is done**

Figure 6: Price Build-up in Pomegranate Value Chain



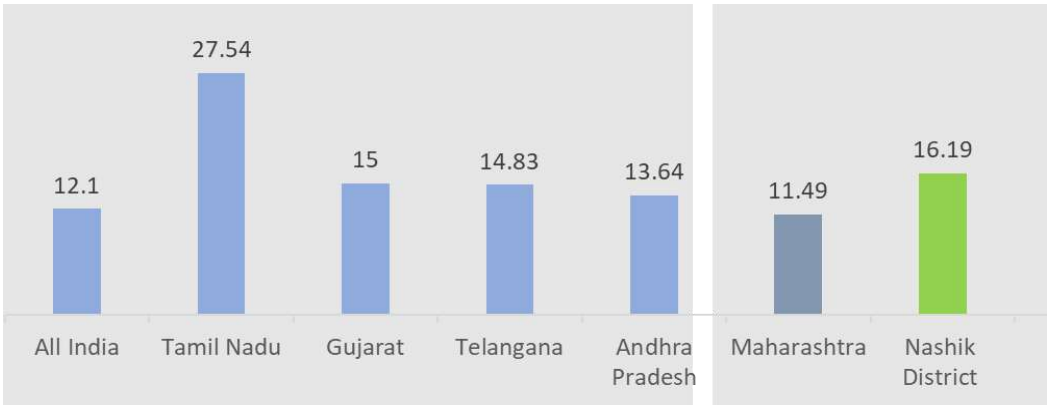
2.1.4 Gaps in the Value Chain

2.1.4.1 Identified gaps & constraints in Value Chain

Production Related

- The state of Maharashtra accounts for 65% of the total area under cultivation for pomegranate in the country and accounts for 62% of all India production of pomegranates. This marginal difference in the percentage area under cultivation and the percentage production may be accounted to the relatively less productivity in the state (11.49 MT / ha) as compared to the national average productivity (12.10 MT / ha). However, the state significantly lags behind other states. Tamil Nadu has the best productivity among all the pomegranate producing states in the country. Other leading states in terms of productivity are Gujarat (15.00 MT / ha), Telangana (14.83 MT / ha) and Andhra Pradesh (13.64 MT / ha). This means that, there is still a lot of scope for improving the productivity in the state by adopting recommended package of cultivation practices.

Figure 7: Comparison of Productivity of Pomegranate (in MT/ha)



However, on the other hand, Nashik district which is the leading pomegranate producing district in the state of Maharashtra, has a productivity of 16.19 MT / ha, which is even higher than the other aforementioned states (except for Tamil Nadu). This may be because the farmers in Nashik district have been cultivating pomegranates for many years and are familiar with the recommended package of practices. Having said that, the major production related constraints that were reported by the farmers in the state were that of water scarcity due to decreasing number of rainy days over the past few years and the damage caused to the fruits by Bacterial Blight. Both these may be attributed to climate change, as due to climate change the number of rainy days are reducing over the past decade and the increased temperatures are leading to more prevalence of pests and diseases.

Post-harvest Management

- *Primary processing including collection centers, pack-houses, etc.*

Primary processing is limited to just the sorting and grading operations, which is done either by the farmers or by the post-harvest contractor (who buys the produce at the farm-gate). Once, the produce is harvested, it is temporarily stored at a suitable open area around the farm or at temporary collection sheds of the farmers. Some of the FPOs, who have opted to construct a pack-house, use the same as collection center for temporary storage of produce. Apart from

this, there is a collection center-cum-packhouse of Big Basket located near Nashik city. The produce, which is procured by Big Basket from the different production areas in Nashik, is collected at this center, sorted-graded using an automated mechanical sorting-grading machine and then sent to Mumbai and Pune for final delivery to the end consumers.

The sorting and grading is carried out manually by employing skilled labor. However, the traders (at the market yard) interviewed on the quality aspect of the produce expressed that the quality of grading being done was not at par with the requirements. In addition, the farmers bring their produce in plastic crates to the market yards, while the traders have to pack the produce in corrugated boxes, before transporting it to the distant markets as well as the inter-state and local markets.

There were no pack-houses in the production cluster (except for the one of Big Basket, used for its own operations), where the harvested produce can be mechanically sorted, graded into the different grades and packed in a hygienic manner. The traders felt that, if such facilities were available on pay-per-use model at the market yards, then there would not be conflicts with regard to the quality and grade of produce brought by the farmers. The farmers may pay for these services and then present the graded produce for auction and sale.

- *Storage Related*

  Pomegranate has a shelf life of around 10-14 days when stored in shade at ambient temperature. Pomegranates, which are to be marketed for table consumption, are purchased by the post-harvest contractors at the farm-gate or by the commission agents / traders at the market yards and transported the same day to the distant markets. Therefore, there is no requirement of storage space felt by the traders / post-harvest contractors. Big Basket, which has its collection center in Nashik, also ensures that the produce, which is procured, is transported either the same day or next day, so that it reaches the end-consumers in 2-3 days after harvesting.

  The processors who develop value added products like pomegranate arils, juice, *anardana,* etc. and the exporters have a requirement for cold storage space, so that the fresh produce can be stored / stocked for 1-2 months depending upon their requirements. In Nashik district, almost all the private cold storage service providers are located in Niphad taluka. However, these facilities are mostly utilized for storage of grapes and raisins. Companies like Freshtrop, who are involved in export of fresh pomegranates to European and Gulf countries, packaging of pomegranate arils and manufacture of pomegranate juice, have their captive cold storage facilities, which are used to store the fresh produce. Jamnadi Khore Farmer Producer Company Limited, an FPO located in Sinnar taluka of Nashik district reported that, there is a Modern Marketing Facility[7], which has been constructed by Maharashtra State Agriculture Marketing Board in Thangaon (Sinnar). However, this facility is currently not functional. Apart from this, there is no other cold storage facility in Sinnar taluka of Nashik district.

- *Secondary and tertiary processing*

[7] It has a Cold Storage (25 MT), Pre-cooling chamber (5 MT), Pack-house (1500 sq. ft) along with supporting infrastructure like DG Set, Water Supply, Laboratory, Compound Wall etc.

Aforementioned, Freshtrop and Sahyadri Farms are the major processing companies in the district of Nashik involved in secondary and tertiary processing of pomegranate. For secondary and tertiary processing, smaller sized fruits, fruits with skin defects but not damaged from inside are procured by the companies, as such type of fruits are available at lower rate (Rs 10-15 per kg). These companies tend to procure from the market yards, as; such produce is readily available at a single location. Therefore, in this context, it would be a constraint for the farmers to forge direct tie-ups with such processing companies. FPOs may develop such linkages, but the private sector has certain perceived apprehensions with respect to FPOs like lack of accountability, professionalism and commitment to supply a sustained quantity of produce as per the required parameters at competitive rates.

Road connectivity & transport

The transportation of the produce from the farm-gate to the nearest market yard is dependent upon the quality of access roads. Most of the orchards, face the problem of lack of approachable roads to get their produce evacuated from the farm. Mostly, tractors are used to evacuate the produce from the farms to the nearest collection shed or directly to the market yard. This is one of the reasons, why infrastructure providers like warehouse / cold storage / pack-house operators, do not find it feasible to build / have their facilities near the farm-gate.

Marketing related

- Majority of farmers who market the produce themselves, have limited bargaining power either due to lack of market price information and demand in distant markets or low quantities of production, resulting in lower value realization for them. Moreover, the information flow from traders to the farmers is highly restricted. Except for a few progressive and large farmers, others are yet to develop direct linkages and hold negotiations with trader/ wholesaler in distant markets. The progressive farmers who have been able to sell their produce in distant markets, end up paying higher commission rates and incur higher transportation charges.
- Individual farmers have not been able access distant markets as they do not have bulk of supplies as demanded by the markets, lack awareness relating to grade specific pricing, lack of infrastructure for value addition, difficulty in arranging for labour & transportation for harvesting, loading & selling of produce. All these factors leads to the local traders taking advantage of the situation & offering lower prices to the farmers.
- Most of the produce from the state is traded through pre-harvest contracts between traders & farmers. Around 50-60% of the produce is traded through this medium. This arrangement results in low price realization for the farmers as they have very little information on the prices that are being offered for their produce in the distant mandis. This arrangement involves a high amount of estimation work from the trader and in most of the cases; it is the farmer who ends up on the losing side. Even with such high risks for the farmers in going for this arrangement, they prefer to sell their produce through pre-harvest contracts. The reason being the capacities of farmers to find market for their produce, negotiation with distant market traders, price realization etc.
- The farmers, who sell their produce at the APMC markets, are not required to pay any commission as per the revised rules of the Maharashtra government. In the new system, the traders who would buy the produce would be paying the commission to the commission agents. Although, this system may be brought for the benefit of the farmers, it was reported that, as the traders have

to bear the commission, so they have started bidding low for the produce (compared to what they would have bid in the earlier marketing system). Both the farmers as well as the traders gave this feedback during the field visits.

- With the growth of e-commerce platforms and organized retail like Big-Basket, Grofers, Reliance Fresh etc., there is an increasing demand from these players for fresh pomegranates. However, these companies avoid transactions with individual farmers. Big Basket is procuring pomegranate from few FPOs, but the volumes required are not much. Therefore, it cannot be an option to sale the fresh produce in bulk quantities.
- Some of the FPOs are planning to develop processing unit for Aril extraction or Juice making but they are low on confidence & have little information regarding retailing, branding, marketing & selling of Orange Juice. They need handholding & capacity building support for developing their retail chain, branding & marketing activities for value added products.
- There is tremendous rise in sale of fruits & other products through e-commerce and organized retail chains but there were very few linkages of these organized retail players with the farmers from the state.

Access to Finance

Availing credit from banks or other financial institutions for operational activities, development of post-harvest infrastructure, building processing facilities etc. is very difficult for farmers/ FPOs. The overall perception of FPOs/ farmers in terms of availing loans and repayment is not very healthy in the view of banks and they find it undesirable to extend loan facilities to FPOs/ farmers. Thus, FPOs/ farmers have to look for in-formal sector or NBFCs for availing credit facilities, which have very high interest rates.

2.2 Value Chain Analysis – Banana

2.2.1 Introduction

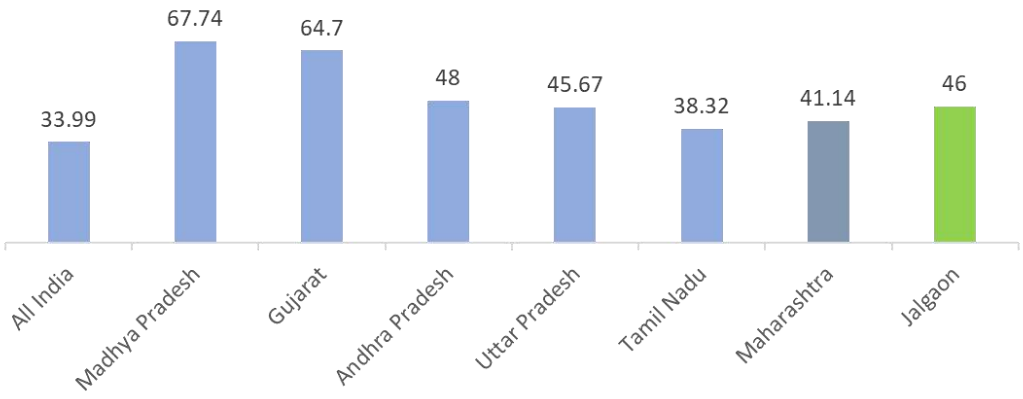
2.2.1.1 Production Scenario – Country, State

The production of banana in India has increased rapidly over the years. India is the largest producer of banana in the world. Besides India, China, Philippines, Ecuador, Brazil and Indonesia are the other major banana producing countries in the world. Banana cultivation in India is spread over about 860 thousand Ha area and the production in the country is about 30.477 Million MT. Tamil Nadu, Gujarat, Andhra Pradesh, Uttar Pradesh, Maharashtra & Karnataka are the leading Banana producing states of India[8] .

2.2.1.2 Area, Production & Productivity

The state of Maharashtra accounts for 9.5% of the total area under cultivation for banana in the country and 11.4% of all India production.

Figure 8: Comparison of Productivity of Banana (in MT/ha)



The average productivity of Banana in Maharashtra (41.14 MT / ha) is greater than the national average (33.99 MT / ha). However, the state significantly lags behind other states. Madhya Pradesh has the best productivity (67.74 MT / ha) among all the Banana producing states in the country. Other leading states in terms of productivity are Gujarat (64.7 MT / ha), Andhra Pradesh (48 MT / ha) and Uttar Pradesh (45.67 MT / ha)[9]. This means that, there is still a lot of scope for improving the productivity in the state by adopting recommended package of cultivation practices.

2.2.1.3 Major Varieties

Different types of banana varieties are cultivated in Maharashtra, which include Grand Naine, Dwarf Cavendish, Basrai, Robusta, Lal Velchi, Safed Velchi, Red Banana, etc. Grand Naine has one of the highest yields in all varieties of banana and is the major dominant variety grown in Maharashtra. It is a superior cultivar and among one the most accepted international varieties. The Red banana is also a preferred cultivar in some countries and it can create a niche market for itself with support.

[8] Source: Indian Production of Banana, APEDA. 2015-16. (http://agriexchange.apeda.gov.in/india%20production/India_Productions.aspx?cat=fruit&hscode=1042 accessed on 06.09.2018)
[9] The productivity figures are for the year 2016-17

2.2.1.4 Seasonality Advantage

In terms of seasonality, banana harvesting in Maharashtra spans all-round the year, which is similar to other leading producer states.

Figure 9: Harvesting Season of Banana in Major Producing States

Major Producing States	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Gujarat	Lean	Lean	Lean					Lean	Peak	Peak	Peak	Lean
Andhra Pradesh	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round
Tamil Nadu	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round
Uttar Pradesh							Lean	Peak	Peak			
Maharashtra	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round	Round
Karnataka	Lean	Lean	Lean	Lean	Lean	Lean	Peak	Peak	Peak	Peak	Peak	Lean

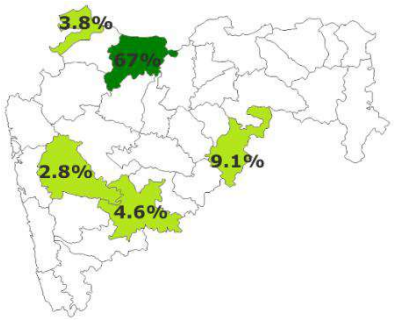
Round the Year | Peak Season | Lean Season

2.2.1.5 Major Production Regions in the State

In Maharashtra, Jalgaon is the leading district, both in terms of area under cultivation and production of banana in 2016-17. The district alone accounts for about 67% of the total production of the state and it is also the highest Banana producing district in the country. Apart from Jalgaon, the other districts with major production are Nanded, Solapur, Nandurbar and Pune. These five districts together account for about 88% of the total production in the state. The major district wise area under production, total production (including percentage of state's production) and productivity are given in the table.[10] The adjoining map shows the major producing districts of Banana in the state. The district shown in dark green is Jalgaon, which produces about 2/3rd of the state's Banana output.

Figure 10. Major Banana production clusters in the State

District	Area (000 Ha)	% in Total State Production	Total Production (000 MT)	Productivity (MT / Ha)
Jalgaon	49.27	67%	2266.72	46
Nanded	7.27	9.1	305.5	42
Solapur	6.11	4.6	152.4	24.94
Nandurbar	3.95	3.8	126.4	32
Pune	2.54	2.8	93.98	37



The major production blocks of the identified Banana producing districts are mentioned below:[11] [12]

- **Jalgaon:** Chopda, Yaval, Raver, Edalbad, Bhusawal, Jamner, Pachora, Bhadgaon, Chalisgaon, Parola, Amainer, Boradi
- **Solapur:** Akkalkot, Pandarpur, Malshiras, Akluj
- **Nandurbar:** Nandurbar, Shahade, Talode

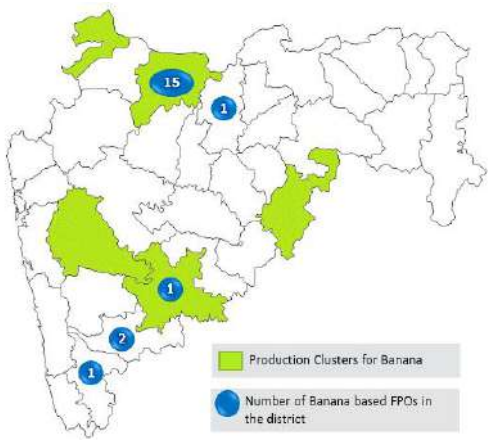
[10] Commissionerate of Agriculture, Maharashtra State, 2016-17
[11] APEDA Banana Profile - http://agriexchange.apeda.gov.in/Market%20Profile/one/BANANA.aspx accessed on 02.09.2018
[12] The major production blocks of Banana in Nanded and Pune were not found through secondary research.

2.2.2 Identification of Farmer Groups

2.2.2.1 Identification & selection of formal / informal producer groups / organization

The identification and selection of the FPOs has been done based on the secondary information gathered from the respective database of FPCs promoted under the different agencies and projects like SFAC, NABARD, MSAMB (MACP), and MSAMB (JFPR). As per this information, it was assessed that about 20 FPOs are involved in production and marketing of Banana in the State. Mapping of FPO presence with the key production clusters of banana reveals that majorly these FPOs are located within or in proximity to production clusters for banana. Jalgaon district, which accounts for 67% of the total banana production of the state, has the maximum number (15) of Banana based FPOs. Other FPOs for Banana are located in the districts of Solapur (2), Buldhana (1), Sangli (1) and Kolhapur (1).

Figure 11: Mapping of FPOs engaged in production of banana in Maharashtra



As a part of the selection process, telephonic interactions were initiated with these 20 FPOs to verify whether they are involved in production / marketing of pomegranate and to gather information on the following key parameters identified for shortlisting the prospective FPOs for the field visits.

- ✓ Year of establishment & commencement of commercial operations
- ✓ Associated number of farmer members, gender composition
- ✓ Contributed Share Capital
- ✓ Existing area under focus crop production under FPO
- ✓ Existing production volumes of focus crop
- ✓ Production and marketing related functions performed by FPO to facilitate backward& forward linkage
- ✓ Current sales/ Annual turnover
- ✓ Intent & ability to co-invest in market linkage development

- **Details of Farmer groups** – Out of the total 20 FPOs contacted, 19 FPOs gave their responses and provided information on the aforementioned key parameters. Out of these 19 FPOs, 2 FPOs were dormant and 5 FPOs did not have banana production area and were dealing in other commodities. The information for the remaining 12 FPOs is given in the table below.

Key Parameter	Name of the Farmer Producer Organization (FPO)											
	Satpuda Farmer Producer Co.Ltd, Jalgaon	Shramsadhana Farmer Producer Co. Ltd., Jalgaon	Dhartiputra Agro Producer co.ltd, Jalgaon	Tapi Valley Agro Producer co.ltd, Jalgaon	Reva Valley Agro Producer Co.ltd, Jalgaon	Navchaitanya Agro Producer co.ltd, Jalgaon	Chinaval Farmer Producer Co. Ltd, Jalgaon	Sant Changdev Tapi Poorna Producer Company Limited, Jalgaon	Svavlamban Shetkari Producer Co. Ltd, Jalgaon	Yeoti Agro Producer Company Ltd., Solapur	Ratna Farmer Producer Co. Ltd, Sangli	Family Farming Agro Producer Co. Ltd, Kolhapur
Year of Establishment	2014	2017	2014	2014	2014	2014	2015	2015	2015	2015	2015	2014
Commencement of Operations	2017	2018	2018	2018	2018	2018	2018	2016	2017	2017	2017	2015
Associated number of farmer members	500	200	100	60	89	100	279	536	350	559	305	260
Contributed Share Capital (in Rs. lakh)	24.00	19.90	1.00	1.00	1.00	1.00	4.46	8.50	4.50	8.69	10.00	4.00
Existing area under focus crop production under FPO (in acre)	750	700	700	80	270	300	600	220	180	100	150	70
Existing production volumes of focus crop (in tonnes)	27000	23000	28000	2880	9600	8100	18000	6160	7200	4000	4500	2800
Production and marketing related functions performed by FPO to facilitate backward& forward linkage	The FPO has started trading of Banana by selling to traders in the local markets as well in the distant markets. It has supplied 350 MT of Banana to Delhi and Amroha markets.	The FPO has started business in 2018 and has set up an outlet for the sale of plant nutrients and tissue culture plantlets (third party) of banana.	The FPO has started business in 2018 and has supplied close to 200 tonnes of Banana to Hapur in Uttar Pradesh	The FPO has started business in 2018 and has supplied close to 180 tonnes of Banana to Rajasthan.	The FPO is involved in aggregation and sale of banana in local and distant markets	The FPO has developed market linkages with an exporter based at JNPT, Mumbai and supplies fresh banana to the exporter.	The FPO has setup a Cold Storage-cum-Ripening Chamber with a total capacity of 10 MT and has plans to procure unripe banana produce from the member farmers and sell the ripened produce in nearby local markets.	The FPO is involved in selling of agri-inputs to the member farmers. It has also taken dealership from Jain Irrigation to sell Drip Pipes and Banana Tissue Culture saplings.	Although Banana is cultivated by the member farmers, the FPO business is focused around other commodities like Maize and Cotton	The FPO is involved in supply of Agri-inputs like drips, pesticides, etc. and trading of Banana, Pomegranate, Sweet Corn.	The FPO is involved in trading of Banana and Exotic Vegetables, Sale of Banana Chips in local market.	The company is involved in trading of Banana in local and distant markets.
Current Sales / Annual Turnover	23.00	7.22	The FPO has started business	The FPO has started business	The FPO has started business	The FPO has started business	The FPO has started business	121.00	NA	40.00	30.00	200.00

Key Parameter	Name of the Farmer Producer Organization (FPO)											
	Satpuda Farmer Producer Co.Ltd, Jalgaon	**Shramsadhana Farmer Producer Co. Ltd., Jalgaon**	**Dhartiputra Agro Producer co.ltd, Jalgaon**	**Tapi Valley Agro Producer co.ltd, Jalgaon**	**Reva Valley Agro Producer Co.ltd, Jalgaon**	**Navchaitanya Agro Producer co.ltd, Jalgaon**	**Chinaval Farmer Producer Co. Ltd, Jalgaon**	**Sant Changdev Tapi Poorna Producer Company Limited, Jalgaon**	**Svavlamban Shetkari Producer Co. Ltd, Jalgaon**	**Yeoti Agro Producer Company Ltd., Solapur**	**Ratna Farmer Producer Co. Ltd, Sangli**	**Family Farming Agro Producer Co. Ltd, Kolhapur**
			operation in FY 2018-19	operation in FY 2018-19	operation in FY 2018-19	operation in FY 2018-19	operation in FY 2018-19					
Intent / Ability to co-invest in market linkage development	The FPO is interested to set-up a Banana Chips Production unit using modern Vacuum Fried Technology with an estimated outlay of Rs. 1.5 crore.	The FPO is interested to set-up a tissue culture nursery where it can develop its own tissue culture plantlets.	The FPO has constructed a 1250 sq.ft packhouse with support from JFPR project. It plans to use it as a collection and packing centre for Banana and as a processing centre for Turmeric, which is another focus crop for the FPO.	The FPO has constructed a packhouse with support from JFPR project. It plans to use it as a collection and packing centre for Banana.	A pack-house has been constructed by the FPO under JFPR project (75% grant support)	The FPO has plans to set-up a Banana Fibre making unit to utilize the Banana stem and make value added items like fibre, liquid fertilizer etc. It has already initiated talks with a Coimbatore based company for technology support required for such a unit.	The FPO is interested to forge buy-back agreements for pre-cooled Bananas and is in talks with JK Seeds to supply 10 MT pre-cooled banana per day.	The FPO is interested to co-invest in a PPP mode for developing a tissue culture nursery, so that it can develop its own tissue culture plants for Banana.	The FPO has set up a pack house unit under support of MACP and has a Flour processing unit, along with cleaning-grading machinery for food grains.	The FPO has established a 1200 sq.ft. pack house for banana.	Packhouse (1100 sq.ft) for Banana set up with support under MACP. Banana Chips Production Unit (2.5 tonnes capacity) set up with an investment of Rs 55.00 lakh.	-

2.2.2.2 Field visits and Outcome

- The districts of Jalgaon, Nanded & Solapur accounts for 67% of the total production of the state. Raver, Chopda and Muktainagar are the major production blocks in the districts. (Raver being the highest contributor).
- Grand Naine (G9) is the variety, which is cultivated by majority of the farmers. Almost 100% of the Banana plantations are done using tissue culture plantlets, which are majorly supplied by Jain Irrigation and Systems Pvt. Ltd.
- During the field visits, the farmers reported that the erratic weather conditions over the past couple of years have led to Karpa disease – which has been causing damage to the crop. In addition to that, there have been instances of very high velocity winds in the district, especially during the month of May, which has damaged large areas under Banana production.
- **Trade Channel**: In case of Banana, the sale of the produce occurs directly at the farm. The Raver market board declares the Minimum sale price for the Good and Inferior quality produce (on a daily basis) and the sale of the produce happens accordingly. **The farmers have reported that over the past 2-3 years the traders are buying at a lower rate than the one declared by the Raver Marketing Board, so the price realization has reduced for the farmers.**
- Secondary Processing of Banana in the state is limited to manufacture of Banana Puree and Concentrates and production of Banana Chips. One of the major processor is Jain Irrigations and Systems Ltd which is involved in the manufacture of Banana Puree and Concentrate on an industrial scale.
- Most of the Banana Chips production is done on very small scale by roadside units, which manually slice and fry the banana chips. Apart from these small scale units, L. Venka Foods Pvt. Ltd is a manufacturer of Banana chips, which has a medium scale processing unit in Savda MIDC in Jalgaon.

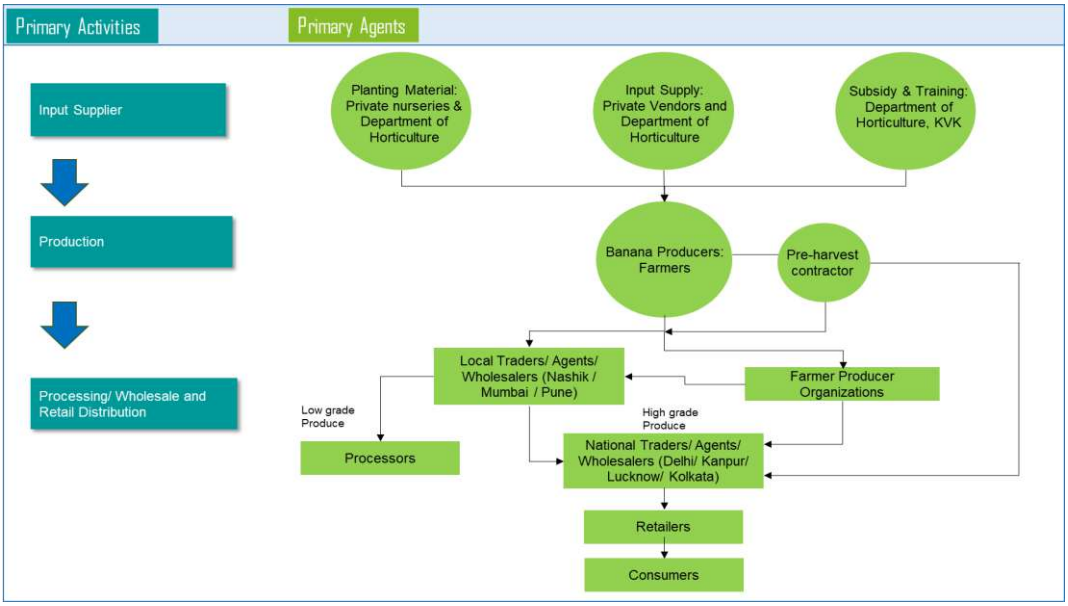
2.2.3 Value Chain Analysis

2.2.3.1 Value Chain Analysis – Structural, Functional & Commodity flow

Structural Analysis

The Banana Value Chain begins with the pomegranate producers / growers. They grow pomegranate on orchards, with the average area under the orchards being around 4 acre per farmer. The Producers are responsible for planting of the tissue culture plantlets, maintenance of the stand of trees and harvesting of the produce. Almost all the banana growers sell their produce to pre-harvest contractors or village level aggregators, who generally buy the harvested produce directly from the orchard (farm gate). These pre-harvest contractors carry out de-handing, washing, grading and packing of the produce, which is then transported to nearby and distant markets in trucks / tempo. The leftover produce which is slightly damaged / has smaller sized banana hands is bought by the local small-scale banana chips manufacturer at throw-away prices. The organized companies, which are involved in secondary and tertiary processing generally, buy from procurement agents, who source the produce from local traders or village level aggregators.

Figure 12. Structure of Banana value chain in the District



Functional Analysis

The role played by various members of the value chain is as follows:

Input Supplier: In Jalgaon, almost every banana farmer uses tissue culture plantlets as the planting material. Jain Irrigation Systems Ltd. is the pioneer company, which introduced this method of cultivation in the district. Jain Irrigation remains the major supplier of tissue culture plantlets, supported by other biotech companies. Grand Naine (G9) is the most common variety cultivated / preferred by the growers. In addition to the Planting material, other inputs like pipes and equipments for Drip Irrigation, Fertilizers (including liquid fertilizers), Micronutrients and Pesticides are required for banana growers. Again, here, Jain Irrigation is the pioneer and major supplier of micro-irrigation equipment. The farmers the other inputs from private retailers or from Input Supply centres established by Farmer Producer Companies (if they are functional in the vicinity).

Grower: The Banana growers undertake cultivation and maintenance of orchards throughout the year. The main operation carried out by the farmers includes land preparation, laying out of drip irrigation pipes, sourcing and planting of planting material (tissue culture plantations are replaced every 18 months), nutrient application in form of manure/fertilizers, weeding, crop protection and harvesting. They are involved till the harvesting stage as the pre-harvest contractor who buys the produce, does the post-harvest processing.

Pre-harvest contractor / Commission Agent: In case of Banana, almost all the produce is sold at the farm-gate itself. The Pre-harvest contractors are the representatives of traders from distant markets. At the time of the harvest, they come to the production cluster and start inspecting the orchards and start negotiations with the producers. Also, there are Banana Buyer Groups (Keli Group), which is an association of 4-5 big farmers or traders. These Banana Groups give credit to the farmers at a rate of 15-25% during the cropping season. As a result, the farmers are left with no option but to sell their produce to them. They inspect each tree in the orchard and quote a lump sum price for the produce based upon a visual observation, taking into account the number of trees with

matured fruits, fruit size and proportion of diseased or damaged fruits. If there is an agreement reached between the farmer and the pre-harvest contractor, then the farmer harvests the produce and it is given to the pre-harvest contractor / Commission Agent. These pre-harvest contractors carry out de-handing, washing, grading and packing of the produce, which is then transported to nearby and distant markets in trucks / tempo.

Primary Processors: The primary processors are mainly responsible for the post-harvest operations like de-handing of the produce, washing, grading and packing the produce in cardboard boxes. Some of these primary processors also have small cold store-cum-ripening chambers. They serve two functions – the unripe banana, which has to be transported to the distant markets, is pre-cooled, so that the damage during transportation is minimized. Further, if the produce has to be marketed in the local market, then it is kept in the Ripening Chamber for 4-5 days and then packed are marketed locally and in the neighboring districts.

Cold Storage/ Ripening Chambers: The banana, which are to be marketed in the local market or the nearby districts, are ripened in the ripening chambers, pre-cooled and then transported in cardboard boxes. These units also function as pack-house where the unripe bananas, are de-handed, washed and packed in cardboard boxes and then sent to the distant markets by road.

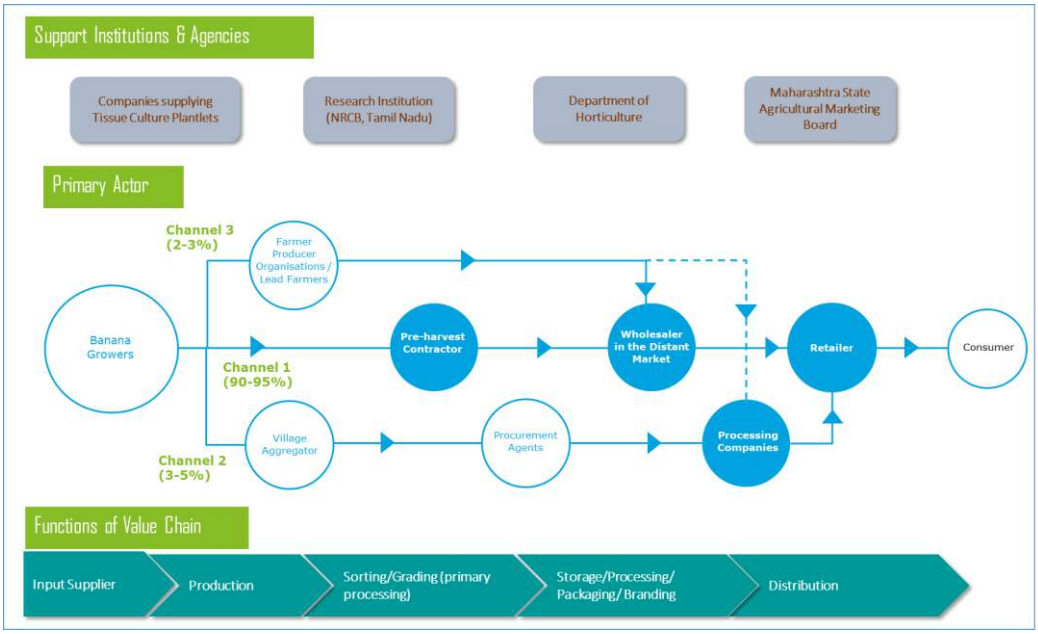
Secondary Processors: Secondary processors are the companies, which are involved in manufacture of processed products like banana chips, banana purees and concentrates, etc. Apart from the organized companies, there are a number of very small-scale road-side vendors who are involved in making banana chips.

Table 5: Functional Analysis of the Value Chain

Activity	Agent	Output
Input Supply	Tissue Culture units Private vendors Department of Horticulture	Planting Material Drip Irrigation Apparatus Fertilizers & Micronutrients Pesticides Packing Material
Training and Subsidy	KVK Agriculture University Jain Irrigation Systems Ltd. Department of Horticulture	Training on Drip Irrigation and Banana cultivation Subsidies on input supply (machinery, chemicals, planting material)
Production	Farmers	Fresh Banana
Post-Harvest Management	Farmers Pre-harvest Contractors Commission Agents	Harvested Banana Primary processed produce (sorted, graded and packed banana)
Transportation	Transport Service Providers	Logistic assistance
Secondary Processing	Processors	Banana Chips and Banana Puree and Concentrate
Wholesale & Retail distribution	Wholesalers Commission Agents Retailers	Sorted and Graded Fresh Banana

Commodity Flow Analysis

Figure 13: Commodity Flow and Trade Channels



Based on the stakeholder interaction four different marketing channels have been identified to be operating in the study area. The selection of marketing channel by the farmer is dependent on factors as scale of production, the prevalent market rate and the proximity to the market and the transportation cost involved in taking the produce to the market.

Channel 1.

Farmer → Post-harvest Contractor / Commission Agent→ Wholesaler in distant market (as Delhi/Lucknow/ Chandigarh/Bihar/Kolkata) → Retailer → Consumers

Channel 2.

Farmers → Village Aggregators → Procurement Agent → Processing Companies →Wholesaler/Retailer in distant market →Consumers

Channel 3.

Farmers → Farmer Producer Organisations / Lead Farmers → Commission agents/Wholesaler in local or distant market → Consumers

Channel 1: Channel 1 is the most prevalent trade channel observed for Banana. The market board declares the Minimum sale price for the Good and Inferior quality produce (on a daily basis) and the sale of the produce happens accordingly. Almost 90-95% of the produce is sold through this channel. The pre-harvest contractors / commission agents buy the produce from the farmers based on the quality and the rates declared by the Marketing Board. The produce is then packed and sent to distant markets like Delhi, Jammu, Kanpur, Kolkata, etc. The traders at the destination markets then sell the produce to the local distributors, from where it reaches the retailers and finally the end consumers.

In some cases, there are some pre-harvest contractors, who buy only export quality produce from the farmers. This produce is sold to the procurement agents of the exporters or directly to the exporters themselves.

Channel 2: The Banana Farmers indirectly supply fresh produce to the Secondary Processing Companies in the state either through the Village Level Aggregators or through the Procurement Agents. The Processing companies have different requirements depending upon the end-use of the produce. For manufacture of processed products like Banana Puree and Concentrates (Fresh and Frozen), they prefer to buy little ripe fruits. While for the manufacture of banana chips, smaller sized unripe fruits are preferred. The Processed products are then marketed in the domestic / international market. Products such as Frozen Banana Puree and Concentrates are exported to mostly European countries or supplied to companies involved in manufacture of baby food products. One of the major processor, Jain Irrigation Systems Ltd. markets its processed fruit products under the brand name of Jain Farm Fresh. It has recently started selling fruit purees in small pouch packaging under a product portfolio of Fru2go.

Channel 3: This Channel is observed where there are Farmer Producer Organisations (FPOs) / Lead Farmers involved in the marketing of the produce. The member farmers of the FPOs sell the produce to the FPOs. The FPOs are then responsible for de-handing, sorting, grading, packing and transporting the produce to wholesale markets in Delhi, Lucknow, Kolkata, Kanpur, etc. Further, there are some progressive lead farmers aggregate produce from the farmers and sell the produce to the distant markets. The price information is generally obtain based on direct conversation with traders based out of these mandis. There can also be an alternate channel, wherein the produce, is sold to the Processing Companies.

2.2.3.2 Status of post-harvest management

Primary Processing

The traders or village aggregators do primary processing. In recent years, they do these operations at the orchard or near the farm gate. Aforementioned, once the banana bunches are harvested, they are taken to a common location (either in the same orchard or to a nearby location), and then cut into smaller hands, washed and then packed in cardboard boxes. These operations are mostly done in open fields. There are a few private pack houses in Raver taluka, where the produce is aggregated and primary processing and packing is done. These pack houses, also have a pre-cooling chamber and the packed bananas are pre-cooled, before dispatch to distant markets. But, these facilities are owned by private traders themselves.

There is a Banana Export Facility constructed by Maharashtra State Agricultural Marketing Board at Savda[13], but the facility is not under use currently. This may be because the individual traders opt to do the primary processing at the field of the farmers with minimal equipment. Other than this facility, there are no, primary processing facilities in the production clusters (near the farm-gate), where the produce of group of farmers can be processed. Some of the FPOs, who have opted to construct a pack-house, use the same as collection center for temporary storage of produce. One FPO has a constructed a pack house with a cold storage cum ripening chamber. The FPO uses this facility for its own purpose, and not as a common facility center, and the capacity is only 8 MT.

[13] The facility has Pre-cooling facility, Cold Storage (25 MT), Ripening Chamber (25 MT per batch), Pack house area of 5700 sq. ft., and supporting infrastructure like D.G. Set, Plastic Crates, Weigh Bridge etc.

Status of Storage Infrastructure

There are 12 Storage Warehouses of the Maharashtra State Warehousing Corporation. These facilities are generally used for storage of food grains, as they do not have cold storage or pre-cooling facility. Nevertheless, some lead farmers in Raver, Chopda and Bodwad use these warehouses to store Raw Unripe Banana for a week, to protect themselves when the market prices are low. There are few private warehouses and cold storages located at M.I.D.C. Jalgaon and M.I.D.C. Savda, but they are used for storing cereals, pulses and some vegetables like green chilli.

There are a few cold storages and ripening chambers in Raver block of Jalgaon, which are exclusively used for banana. The capacity of these facilities range from 10 MT to 25 MT. The banana, which are to be marketed in the local market or the nearby districts, are ripened in the ripening chambers, pre-cooled and then transported in cardboard boxes. In addition, aforementioned the Banana Export Facility at Savda has a Cold Storage Capacity of 25 MT.

Status of Secondary and Tertiary Processing

Aforementioned, Jain Irrigations and Systems Pvt Ltd. is the major processing company in the state. The company is involved in manufacture of Banana Puree and Concentrates. In addition, L. Venka Foods Pvt. Ltd is a manufacturer of Banana chips based out of Savda in Raver taluka of Jalgaon. The company is a subsidiary of a trading company, which supplies fresh banana to distant markets outside Maharashtra. In addition, there are a number of very small-scale roadside vendors who are involved in making of banana chips.

2.2.3.3 Price build-up across the Value Chain

Production

Land Preparation – This generally involves operations such as ploughing, tillering and forming of ridge and furrow beds for planting. It was reported that on an average, the cumulative cost is around Rs 11,000 per acre, i.e**.** Rs. 27,170/- per hectare.

Planting Material and Nutrition – Generally it was reported that, 1800 plants are planted in one acre, i.e. 4500 plants in one hectare. Aforementioned, all farmers practice plantation of Tissue Culture Plantlets. The cost of one plant is Rs. 13.00. Thus, the cost for sourcing the planting material is Rs. 58,500/- per hectare.

In the first three months, the farmers provide a basal dose of NPK fertilizers. On an average, per acre 6 bags of Urea, 8 bags of Phosphate and 10 bags of Potash is the recommended dosage. Thus, the total cost for NPK fertilizers, works out as Rs. 19,900 per acre and Rs. 49150/- per hectare.

Type of Fertilizer	Number of Bags / acre	Cost per bag	Total Cost
Urea	6	300	1800
Phosphate	8	1200	9600
Potash	10	850	8500
		Total Cost per acre	19900

Once the plants are 3 months old, nutrients are provided through fertigation. It was reported that the average per hectare cost of fertigation is around Rs. 34,580/. Thus, the total cost on Nutrition works out as Rs. 83,730/- per hectare.

Irrigation – Drip Irrigation is the method of choice for irrigating the plants in the orchard. Water for drip irrigation is supplied through wells (if available in / near the farm) or ponds are constructed in nearby area to store water throughout the year (the ponds are lined with tarpaulin sheet to prevent percolation of water). The establishment cost for setting up the pipes and tanks for drip irrigation was reported as Rs 61,750/- per hectare.

Plant Protection and Intercultural Operations – Once the fruit bunches start developing on the trees, there are a number of intercultural operations, which are to be carried out. De-suckering, earthing up, pruning of surplus leaves, removal of male flower bud and bunch covering are some of the intercultural operations involved. Planters generally adopt bunch covering where export quality banana are grown. It was reported that, on an average the cost of intercultural operations is about Rs 12,350/- per hectare.

Fruit-bearing banana tree requires about 3-4 sprays of different chemicals throughout the year. Each stage has a scheduled spray with specific chemical requirements to curb crop damage. All the surveyed farmers spray plant protection chemicals to save the crop from insect, pests and diseases. Karpa (a type of Blight) was the main disease reported by the farmers, which caused considerable damage to the banana trees. Chemicals are usually procured from input supplier in local market or supplied through the horticulture department as part of government sponsored demonstrations of best practices. The cost of crop protection measures was reported to be Rs 17,290/- per hectare.

Regular weeding is important during the first four months. Spading is commonly used and normally four spadings a year are effective in controlling weeds. The cost on weeding was reported to be Rs. 12,350/- per hectare.

Harvesting

Aforementioned, the banana trees propagated by the tissue culture method are ready for harvest in 11-12 months after planting. The fruit bunches are cut from the tree and are transported on head load by labor. The average labor cost involved in the harvesting was reported to be Rs. 24,450/- per hectare.

Post-Harvest Management

To realize potential value of the harvest, it is important to sustain the quality of the bananas until they are delivered to the consumer. Proper postharvest management and handling of produce is thus important to prolong the duration for which the fruits remain fresh, have a good external appearance and remain marketable. This is very important in case of Banana as once they start ripening, the shelf life decreases very rapidly.

Primary Processing (Sorting, Grading & Packing): The Banana fruits are sorted and graded according to their size and appearance. The details of the different grades as per AGMARK standard are mentioned in the table below.

Table 6: Details of grade designation and sizing of Banana as per AGMARK standard

Grade Designation	Grade Requirements	Grade Tolerances
Extra Class	Bananas should be of superior quality and must have characteristics of the variety and/or commercial type. The fingers must be free of defects, with the exception of very slight superficial defects, provided these do not affect the general	5% by number or weight of bananas not satisfying the requirements of the grade, but meeting those of

Grade Designation	Grade Requirements	Grade Tolerances
	appearance of the produce, quality, the keeping quality and presentation in the package.	for Class I grade or, exceptionally, coming within the tolerances for that class.
Class I	Bananas shall be of good quality. They must have characteristics of the variety and/or commercial type. The following slight defects of the fingers, however, may be allowed, provided these do not affect the general appearance of the produce, quality, the keeping quality and presentation in the package. - slight defects in shape and colour; - slight defects due to rubbing and other superficial defects not exceeding 2 sq.cm. of the total surface area The defects must not affect the flesh of the fruit.	10% number or weight of bananas not satisfying the requirements of the grade but meeting those of Class II or, exceptionally, coming within the tolerances of that grade.
Class II	This includes bananas which do not qualify for inclusion in the higher classes, but satisfy the minimum requirements. The following defects may be there, provided the bananas retain their essential characteristics as regards the quality, the keeping quality and presentation. - defects in shape and colour provided the product remains the normal characteristics of bananas; - skin defects due to scrapping, scabs, rubbing, blemishes or other causes not exceeding 4 sq.cm. of the total surface area; The defects must not affect the flesh of the fruit.	10% by number or weight of bananas not satisfying the requirements of the grade, but meeting the minimum requirements.

The village aggregator or the post-harvest contractor, who buys the produce from the farmers, does the de-handing, washing, sorting, grading and packing of the fruits. The post-harvest operations are carried out by specialized labor, who are experienced in these operations.

Banana can be marketed loose, where the unripe bunches are directly loaded in trucks and sent to the destination markets. This practice is preferred over short distances or when it has to be marketed within the state. Sometimes the banana hands are packed in plastic crates (20 kg capacity) and sent over short distances. This practice is followed for sending the produce from Jalgaon to Bhopal.

However, when the produce is to be marketed to distant markets involving a transit period of more than three days, then they are packed in corrugated cardboard boxes. The capacity of these boxes varies from 14.5 kg or 16 kg depending upon the requirement of the buyer in the distant markets. Some traders also opt to pre-cool the packed produce before loading them into trucks, so that the ripening process is slowed down during the transit period.

Transportation and Logistic

Aforementioned, in case of Banana, the sale of the produce occurs directly at the farm-gate. Very few farmers are involved in transporting their produce to the distant markets. Some of the FPOs showed interest in selling the aggregated

produce to distant markets provided they have assured linkages with traders in the distant markets (along with the assurance of payment for the produce sent to these markets).

Aforementioned, the banana that is transported within the state is packed in the form of intact bunch, or packed loose in plastic crates. This is preferred over short distances. In case of crates, around 550 crates can be transported in a truck and it costs around Rs 10,000-15000 depending upon the distance. The produce, which is marketed to the distant markets, is packed in corrugated boxes and then sent by trucks. The average cost of transportation from Jalgaon to the respective destination markets is given in the table below.

Destination City	**Madhya Pradesh**	**Rajasthan**	**Delhi**	**Haryana / Punjab**	**Jammu-Srinagar**
Average Cost of Transportation (in Rupees)	20,000 – 25,000/-	45,000/-	50,000-55,000/-	60,000	65,000/-

Earlier there was a dedicated Rake service for evacuation of Banana produce through the railways. The rake service was available at Raver and Savda railway stations. The Rake Service was used to transport the banana produce from Jalgaon (Raver/Savda) to Delhi, Agra, Kanpur and Lucknow. During the peak season, the produce would be sent to Delhi and Agra, from where it would be sent to the terminal markets by road. When the good quality produce would get over, the second quality produce would be sent to Kanpur and Lucknow. The cost of transportation by railways was less as compared to the roadways. However, it was reported that, this service has stopped since the last 3-4 years. Some of the possible reasons reported are mentioned below-

- It was reported that, over the years, there developed a monopoly over the use of this service. Only few select traders had the stronghold to send their produce through this rake service. To counter the same, the farmers got together and got a dedicated *Kisan* Rake for themselves. Once this happened, a lot of produce from the traders and farmers started being sent at the same time to these markets (Delhi/Agra). This led to a glut in the prices offered at the destination markets, as the supply was more than the demand.
- Over the years, the road network also developed and the quality of roads improved. In addition, cold stores and ripening chambers started coming up at the destination markets. Therefore, now it was more practical to load the trucks in the production cluster and unload them directly at the terminal markets. This reduced the handling of the produce and so resulted in less wastage of the produce.

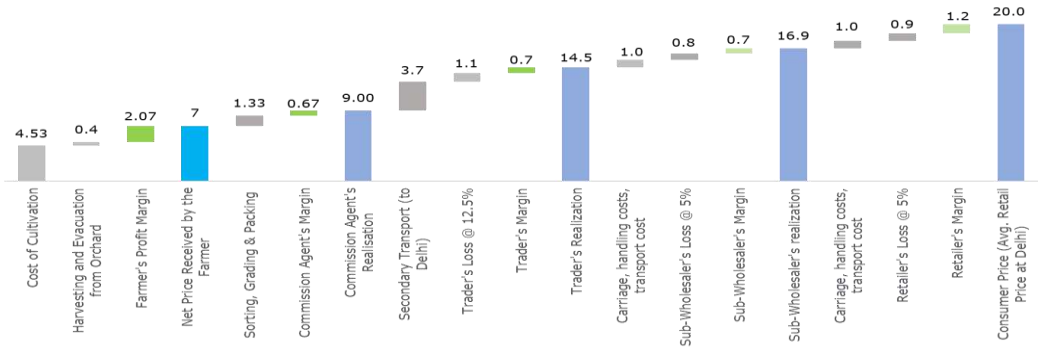
Because of these two reasons, the rake service has been discontinued since the last 3-4 years.

Markets and Price information

The marketing / sale of banana is governed by the rate declared by the Raver Agricultural Produce Marketing Board (Raver Board). The Raver Board has a seven member Rate Committee, which has representation of farmers, traders and Raver Board officials. The Rate Committee declares the rate of procurement at 6 pm every day. This rate is the applicable rate of procurement for the trade, which happens on the next day. Aforementioned, the trade takes place at the farm-gate itself and there is no auction which happens at the market yard. The farmers, who register their mobile numbers with the Raver Board, get the daily rates through SMS on their registered mobile numbers.

Analysis of price build up including a **comparison of farmers' realization in case direct marketing/ processing by farmer is done**

Figure 14: Price Build-up in Banana Value Chain



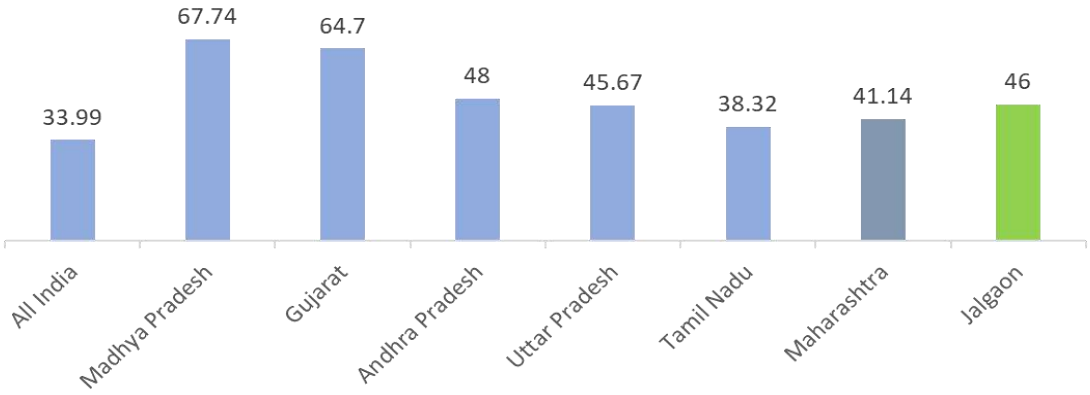
2.2.4 Gaps in the Value Chain

2.2.4.1 Identified gaps & constraints in Value Chain

Production Related

- The state of Maharashtra accounts for 9.5% of the total area under cultivation for pomegranate in the country and accounts for 11.4% of all India production of banana.

Figure 15: Comparison of Productivity of Banana (in MT/ha)



The average productivity of Banana in Maharashtra (41.14 MT / ha) is greater than the national average (33.99 MT / ha). However, the state significantly lags behind other states. Madhya Pradesh has the best productivity (67.74 MT / ha) among all the Banana producing states in the country. Other leading states in terms of productivity are Gujarat (64.7 MT / ha), Andhra Pradesh (48 MT / ha) and Uttar Pradesh (45.67 MT / ha)[14]. This means that, there is still a lot of scope for improving the productivity in the state by adopting recommended package of cultivation practices.

As per the production data for the year 2016-17, Jalgaon district accounts for 61% of area under production and 68% of the total production of banana in the state of Maharashtra. Thus, the production of the district has a major

[14] The productivity figures are for the year 2016-17

impact on the average productivity of the state. In 2014-15, the average productivity for Jalgaon district was 60.75 MT / ha (the average productivity of Maharashtra for the year 2014-15 was 54.45 MT / ha), which came down to 46 MT / ha in the year 2016-17. Thus, it is evident that the decrease in overall productivity of the state is due to the reduced productivity in the district of Jalgaon.

During the field visits, the farmers reported that the erratic weather conditions over the past couple of years have led to Karpa disease – which has been causing damage to the crop. In addition to that, there have been instances of very high velocity winds in the district, especially during the month of May, which has damaged large areas under Banana production. These two reasons might be responsible for the reduced production and thus the productivity for the district of Jalgaon and the state of Maharashtra has seen a reducing trend over the past few years.

Post-harvest Management

- Primary processing including collection centers, pack-houses, etc.

  The traders or village aggregators do primary processing. In recent years, they do these operations at the orchard or near the farm gate. Aforementioned, once the bunches are harvested, they are taken to a common location (either in the same orchard or to a nearby location), and then cut into smaller hands, washed and then packed in cardboard boxes. These operations are mostly done in open fields. There are a few private pack houses in Raver taluka, where the produce is aggregated and primary processing and packing is done. These pack houses, also have a pre-cooling chamber and the packed bananas are pre-cooled, before dispatch to distant markets. But, these facilities are owned by private traders themselves.

  There is a Banana Export Facility constructed by Maharashtra State Agricultural Marketing Board at Savda[15], but the facility is not under use currently. This may be because the individual traders opt to do the primary processing at the field of the farmers with minimal equipment. Some of the FPOs, who have opted to construct a pack-house, use the same as collection center for temporary storage of produce. One FPO has a constructed a pack house with a cold storage cum ripening chamber. The FPO uses this facility for its own purpose, and not as a common facility center, and the capacity is only eight MT.

- Storage Related

  Raw Bananas are harvested, as they have to be transported to the distant markets. The Raw Banana has a shelf life of 8-10 days at ambient temperature, if stored in shaded conditions. However, this can go down to 5-6 days in summer season, when the temperatures are high. There are 12 Storage Warehouses of the Maharashtra State Warehousing Corporation in the district of Jalgaon. These facilities are generally used for storage of food grains, as they do not have cold storage or pre-cooling facility. Nevertheless, some lead farmers in Raver, Chopda and Bodwad use these warehouses to store Raw Unripe Banana for a week, to protect themselves when the market prices are low. Some FPOs reported that there should be enabling provisions for FPOs to

[15] The facility has Pre-cooling facility, Cold Storage (25 MT), Ripening Chamber (25 MT per batch), Pack house area of 5700 sq. ft., and supporting infrastructure like D.G. Set, Plastic Crates, Weigh Bridge etc.

use these warehousing spaces. FPOs find it difficult to use them, as they are generally blocked for the big traders.

Apart from this, aforementioned the Banana Export Facility at Savda has a Cold Storage Capacity of 25 MT. The Banana growers in Muktainagar cluster shared that, there are no storage facilities in their cluster, so the farmers are forced to sell the harvested produce the same day to the local trader.

- Secondary and tertiary processing

Aforementioned, Jain Irrigations and Systems Pvt Ltd. is the major processing company in the district. The company is involved in manufacture of Banana Puree and Concentrates. However, the company does not procure directly from the farmers / FPOs, but from private vendors / traders. In addition, L. Venka Foods Pvt. Ltd is a manufacturer of Banana chips based out of Savda in Raver taluka of Jalgaon. The company is a subsidiary of a trading company, which supplies fresh banana to distant markets outside Maharashtra. Thus, the produce required for processing (chips making) comes from the trading company. Thus, a major constraint for the farmers / FPOs is that, the processing companies rely on private traders / vendors for sourcing their raw materials. FPOs may develop such linkages, but the private sector has certain perceived apprehensions with respect to FPOs like lack of accountability, professionalism and commitment to supply a sustained quantity of produce as per the required parameters at competitive rates.

Apart from this, there are other products, which can be manufactured like Banana powder and value added products (plates, bags, coir etc) by utilizing the fibre from the banana stem. Nevertheless, there is requirement of branding these products, as there is not much awareness about the usability and utility of such products.

Road connectivity & transport

The transportation of the produce from the farm-gate to the nearest market yard is dependent upon the quality of access roads. In case of Banana, more than 90% of the produce is sold at the farm-gate, so the farmers do not face much problem in the transportation of the produce. However, the distance of the orchard from the nearest approachable road is a factor determining the cost of evacuation of the produce from the orchard to a common collection point. This cost of evacuation (in terms of labour cost) has to be borne by the farmer himself. Thus, this cost adds to the overall cost of production of the farmer.

Marketing related

- Individual farmers always find it difficult to trade in the distant market as they do not have bulk of supplies as demanded by the markets, lack awareness relating to grade specific pricing, lack of infrastructure for value addition, difficulty in arranging for labour & transportation for harvesting, loading & selling of produce. All these factors leads to the local trader taking advantage of the situation & offering lower prices to the farmers.
- Majority farmers lack market information about price and demand in distant markets resulting in lower value realization for them. Even though some progressive ones have been able to sell the produce in distant market, they reportedly ended up paying higher commission rates and other charges like transportation charges.

- Most of the produce from the state is traded through pre-harvest contracts between traders & farmers. More than 90% of the produce is traded through this channel.
- The Raver market board declares the Minimum sale price for the Good and Inferior quality produce (on a daily basis) and the sale of the produce happens accordingly. The farmers have reported that over the past 2-3 years the traders are buying at a lower rate than the one declared by the Raver Marketing Board, so the price realization has reduced for the farmers. In addition to this, the farmers complained that the Raver Marketing Board should declare separate prices for Export quality produce, which is not being done currently.
- With the growth of e-commerce platforms and organized retail like Big-Basket, Grofers, Reliance Fresh etc., there is an increasing demand from these players for fresh Banana. However, these companies avoid transactions with individual farmers. Also, there were very few linkages of these organized retail players with the FPOs from the state.
- One FPO showed interest in using the leftover Banana plant material for manufacture of fibre, fibre products and extraction of liquid fertilizer from the stem of the plant. Another FPO has plans to set up a Vacuum Frying unit for making Banana Chips. However, they would need handholding & capacity building support for developing their retail chain, branding & marketing activities for value added products.

Access to Finance

Availing credit from banks or other financial institutions for operational activities, development of post-harvest infrastructure, building processing facilities etc. is very difficult for farmers/ FPOs. The overall perception of FPOs/ farmers in terms of availing loans and repayment is not very healthy in the view of banks and they find it undesirable to extend loan facilities to FPOs/ farmers. Thus, FPOs/ farmers have to look for in-formal sources, which have very high interest rates. In case of Banana, there are Banana Buyer Groups (*Keli Group*), which is an association of 4-5 big farmers or traders. These Banana Groups give credit to the farmers at a rate of 15-25% during the cropping season. As a result, the farmers are left with no option but to sell their produce to them.

2.3 Value Chain Analysis – Sweet Lime

2.3.1 Introduction

2.3.1.1 Production Scenario – Country, State

Sweet Lime (Mosambi) is the 2nd most common among citrus fruits grown in India, after Mandarin. It occupies about 30% of the area under Citrus fruit cultivation in India and account for about 36% of the total citrus production. The total area under sweet lime cultivation in India is 191 thousand Ha and production is about 3.209 million MT. Telangana & Andhra Pradesh are leading producer of Sweet Lime in India. Maharashtra ranks 3rd among Indian states in production of sweet lime accounting for about 11% of total production in the country.

2.3.1.2 Area, Production & Productivity

Table: Fruit Crop production in the State, 2016-17

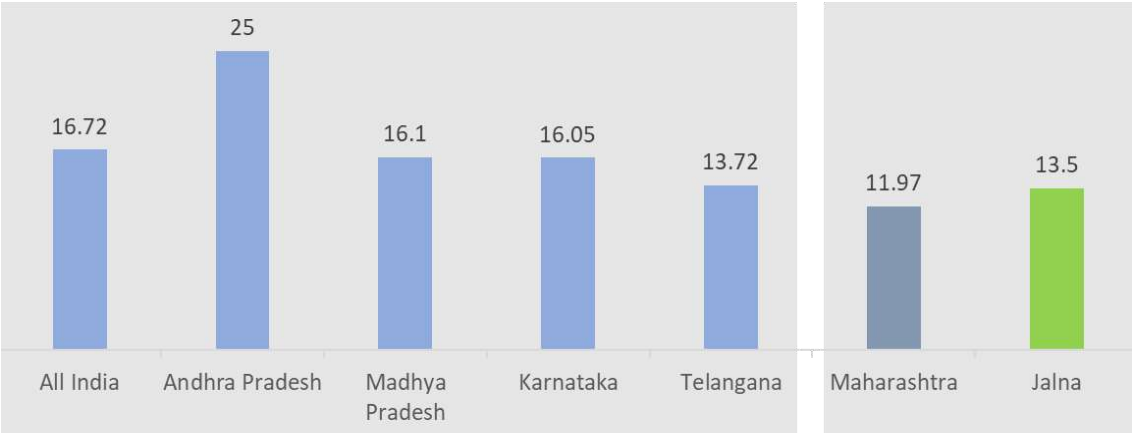
Fruit crops	Area (in Ha)	Production (in MT)
Sweet Lime	33.34	395.10
Custard Apple	13.65	90.1
Pomegranate	140.71	1616.5
Mango	156.83	576.29
Banana	81.33	3334.71
Lime & Lemons	24.34	222.91
Other fruits	38.30	170.1
Total	742.73	10205.42

Source: Commisnoerate of Agriculture, Government of Maharashtra

As per the production statistics for the year 2016-17, Maharashtra accounts for 26% of the total area under cultivation for Sweet Lime in the country and 19% of the total production. This difference in the percentage area under cultivation and the percentage production may be accounted to the lower productivity in the state (11.97 MT / ha) as compared to the national average productivity (16.72 MT / ha).

Andhra Pradesh has the best productivity among all the Sweet Lime producing states in the country. Other leading states in terms of productivity are Madhya Pradesh (16.10 MT / ha), Karnataka (16.05 MT / ha) and Telangana (13.72 MT / ha). This means that, there is a lot of scope for improving the productivity in the state by adopting recommended package of cultivation practices and addressing the specific constraints for lower productivity.

Figure 16: Comparison of Productivity of Sweet Lime (in MT/ha)



2.3.1.3 Major Varieties

In Maharashtra, Mosambi variety of sweet lime is grown. This variety is tolerant of low drought conditions and thus can survive in less than recommended irrigation. Based on secondary research, it is understood that the variety is much better than the Rangapui, Sathgudi which are varieties being cultivated in other states in terms tolerance to draught conditions.

2.3.1.4 Seasonality Advantage

The harvesting period of Mosambi in Maharashtra is spread over two seasons. The first and the main arrivals season starts in month of September, peaks in October and November and ends in December. The second harvesting season starts in February, peaks in April and ends in month of May. The state has an advantage as the peak season of Maharashtra (in April & October to November) does not coincide with the peak seasons of most other states

Harvesting Season of Mosambi in Major Producing States

Major Producing States	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Andhra Pradesh												
Telangana												
Maharashtra												
Madhya Pradesh												

Round the Year | Peak Season | Lean Season

2.3.1.5 Major Production Clusters in the State

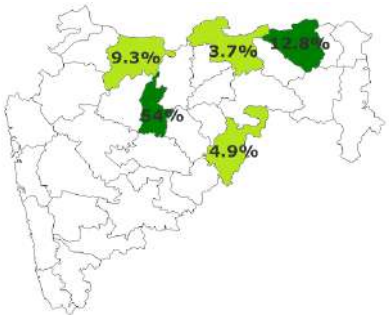
In case of Sweet Lime, Jalna is the leading district both in terms of area under cultivation and production of Sweet Lime in Maharashtra for the FY 2016-17. The district accounts for about 54% of the total production of the state. Apart from Jalna, the other districts of major productions are Jalgaon, Nagpur, Nanded, and Amravati. These five districts together account for about 84% of the total production in the state.

The major district wise area under production, total production (including percentage of state's production) and productivity are given in the table.[16] The adjoining map shows the major producing districts of Sweet Lime in the state. The districts shown in dark green are the districts having more than 10% of the total production of Sweet Lime in the state which comprise of Jalna and Nagpur.

[16] Commissionerate of Agriculture, Maharashtra State, 2016-17

Figure 17. Major Sweet lime production clusters in the State

District	Area (000 Ha)	% in Total State Production	Total Production (000 MT)	Productivity (MT / Ha)
Jalna	14.36	54%	193.88	13.50
Nagpur	6.11	12.8%	45.87	7.50
Jalgaon	3.05	9.3%	33.50	11
Nanded	1.15	4.9%	17.48	15.09
Amravati	2.12	3.7%	13.46	6.35



The major production blocks of the identified Sweet Lime producing districts are mentioned below:[17] [18]

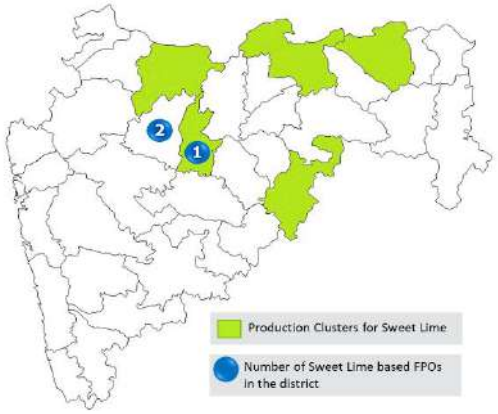
- **Jalna:** Jalna, Bhokardan, Ghansavangi, Ambad
- **Nanded:** Nanded, Limbgaon
- **Amravati:** Nandgaonpeth, Morshi

2.3.2 Identification of Farmer Groups

2.3.2.1 Identification & selection of formal / informal producer groups / organization

The identification and selection of the FPOs has been done based on the secondary information gathered from the respective database of FPCs promoted under the different agencies and projects like SFAC, NABARD, MSAMB (MACP), and MSAMB (JFPR). As per this information, it was assessed that about 3 FPOs are involved in production and marketing of Mosambi in the State.

Figure 18: Mapping of FPOs engaged in production of Sweet Lime in Maharashtra



Telephonic interactions were initiated with these FPOs to gather information on the following key parameters identified for shortlisting the prospective FPOs for the field visits.

- ✓ Year of establishment & commencement of commercial operations
- ✓ Associated number of farmer members, gender composition
- ✓ Contributed Share Capital
- ✓ Existing area under focus crop production under FPO
- ✓ Existing production volumes of focus crop
- ✓ Production and marketing related functions performed by FPO to facilitate backward& forward linkage
- ✓ Current sales/ Annual turnover
- ✓ Intent & ability to co-invest in market linkage development

- **Details of Farmer groups** – The details of these FPOs is provided below –

[17] DCMSME Potential Survey of Jalna, Nanded, Amravati districts (http://dcmsme.gov.in/publications/traderep/jalna.htm, etc. accessed on 02.09.2018)
[18] The major production blocks of Sweet Lime in Nagpur and Jalgaon were not found through secondary research.

Key Parameter	Name of the Farmer Producer Organization		
	Pratisthan Agro Producer Co. Ltd.	**Kalyani Farmer Producer Co. Ltd.**	**Karmad Farmer Producer Co. Ltd.**
Year of Establishment	2014	2014	2017
Commencement of Operations	2016	2018	2018
Associated number of farmer members	238	250	500
Contributed Share Capital (in Rs. lakh)	10.00	2.75	6.00
Existing area under focus crop production under FPO (in acre)	450	2500	250
Existing production volumes of focus crop (in tonnes)	2700	20,000	2000
Production and marketing related functions performed by FPO to facilitate backward& forward linkage	The FPO has constructed a Packhouse-cum-Collection Centre, and has started trading of Sweet Lime and has supplied Sweet Lime to Rajkot and Delhi markets	The FPO is exploring to set up market linkages to sell the aggregated produce (Sweet Lime) of the farmers in local as well as distant markets.	The FPO is involved in selling of crop inputs, providing technical guidance to farmers and marketing the produce of farmers. Pomegranate (8000 MT) and Tomato (40,000 MT) are other focus crops of the FPO
Current Sales / Annual Turnover	150.00	-	90.00
Intent / Ability to co-invest in market linkage development	The FPO showed interest in investing for setting up of a small Cold Store. It is also exploring sale of certified quality planting material for Sweet Lime.	The FPO has started construction of Packhouse with grant support under JFPR project and is interested in setting up a sorting-grading machine for Sweet Lime at the packhouse, which is being constructed by it.	The FPO has rented a Fruit and Vegetable Modern Facility Centre, since Feb 2018. The facility has a pack house, Pre-cooling Chamber and Cold Storage. It intends to use this for collection, primary processing and packaging of Sweet Lime, Pomegranate and Tomato.

2.3.2.2 Field visits and Outcome

- Jalna district accounts for 54% of the total production of the state. However, the productivity in the district is less than the national average productivity. Majority of the farmers grow the Nucellar variety, while the other varieties cultivated are Sathgudi and an indigenous *desi* variety.
- **Trade Channel:** There are two major channels observed in the sale of the produce. In one channel, the produce is sold at the farm-gate and in the other channel, the farmer takes his produce to the market. **Majority of the farmers harvest their produce in the peak season, so the rate realization is impacted. Further, during the auction process at the market yards, a single rate is quoted for the entire produce, based on visual observation by the traders.**
- Jalna APMC is the largest market for Sweet Lime in the country. But it lacks basic infrastructure like, unloading platforms, temporary storage sheds, which tends to increase the handling damage.
- There are very few companies involved in processing of Sweet Lime. Citrus Processing Pvt Limited based out of Nanded, is the major one. The company prefers to buy its produce through private vendors / traders.
- During the field visits, the major production related constraints that were reported by the farmers in this state were that of water scarcity due to decreasing number of rainy days over the past few years, leading to drought-like conditions. This has resulted in drying up of the trees and reduced yield over the past 3-4 years. As a result, some of the Sweet Lime farmers have switched to pomegranate cultivation, as pomegranate has one-third water requirement as compared to Sweet Lime.

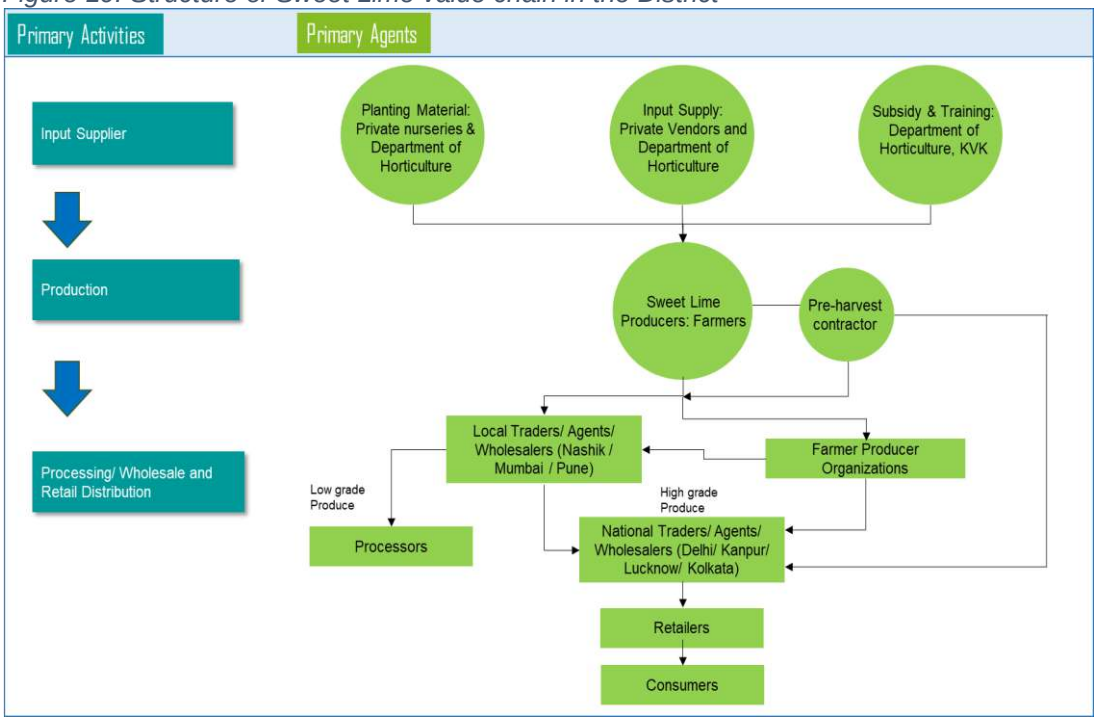
2.3.3 Value Chain Analysis

2.3.3.1 Value Chain Analysis – Structural, Functional & Commodity flow

Structural Analysis

The Sweet Lime (Mosambi) Value Chain begins with the pomegranate producers / growers. They grow mosambi on orchards, with the average area under the orchards being 2-3 acre per farmer. The Producers are responsible for planting of the saplings, maintenance of the stand of trees and harvesting of the produce. Very few farmers practice sorting or grading of the produce after harvesting. Most of the growers sell their produce to pre-harvest contractors or village level aggregators, who generally buy the harvested produce directly from the orchard (farm gate). The farmer takes the produce that is rejected at the orchard, to the nearest APMC market, where it is sold to commission agents. The companies, which are involved in processing (juicing) generally, buy from the APMC markets, as farmers bring low quality produce to the markets.

Figure 19. Structure of Sweet Lime value chain in the District



Functional Analysis

The role played by various members of the value chain is as follows:

Input Supplier: The farmers may buy the planting material either from Private Nurseries, Agriculture Universities, Krishi Vigyan Kendras (KVK) depending upon their proximity to them and on the costing. Majority of the growers buy from Private Nurseries as they are spread across the production clusters. In Maharashtra, there are two government-accredited nurseries for production of Mosambi Planting Material (Nucellar Variety). Nucellar is the most common variety cultivated / preferred by the growers. In addition to the Planting material, other inputs like pipes and equipments for Drip Irrigation, Fertilizers (including liquid fertilizers), Micronutrients and Pesticides are required for cultivation. The farmers buy these from private retailers or from Input Supply centres established by Farmer Producer Companies (if they are functional in the vicinity).

Grower: The Mosambi growers undertake cultivation and maintenance of orchards throughout the year. The main operation carried out by the farmers includes land preparation, furrowing, sourcing and planting of planting material (for establishment of new orchards/ replacement of senile ones), nutrient application in form of manure/fertilizers, weeding, pruning, application of insect pest control measures, harvesting. The farmers employ labour for harvesting the produce. In case of Mosambi, there are no post-harvest practices carried out by the grower. The unsorted produce is either sold at farm gate or taken in tractors or mini-vans to nearest market yard.

Pre-harvest contractor: Around 75-80% of the farmers surveyed in the state, engage with pre-harvest contractors to sell their produce. The decision to sell

through a Pre-harvest contractor depends on the distance of the farm / orchard from the nearest market and a comparative analysis of the cost offered by the pre-harvest contractor. The farmers informed that these contractors either are fellow farmers or arrived from outside of the region/state at the time before crop harvesting or fruit formation stage. They inspect each tree in the orchard and quote a lump sum price for the produce based upon a visual observation, taking into account the number of trees with matured fruits, fruit size and proportion of diseased or damaged fruits. If there is an agreement reached between the farmer and the pre-harvest contractor, then the farmer harvests the produce and it is given to the pre-harvest contractor. The pre-harvest contractor may also prefer to buy fruits only matching his desired quality parameters and reject the rest of the produce. In such case, the farmer takes the rejected produce to sell at the nearest market.

Commission Agents & Wholesaler: The commission agent facilitates the transaction process between wholesalers and farmer. The produce, which is brought by the farmers at the Market yard, is auctioned and bought by the Commission Agents. Commission Agents are liable and responsible for the payment to the farmers. The Commission Agents sell the produce to the Wholesalers; the Wholesaler pays commission to the Commission Agent.

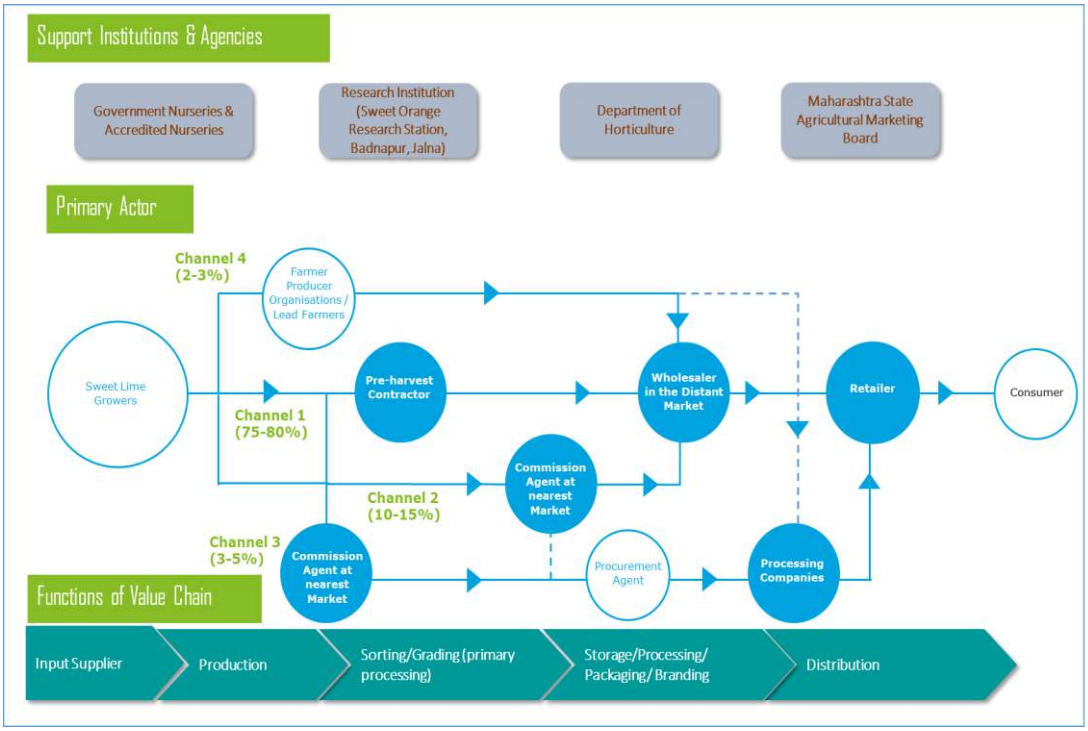
Processors: In context of Mosambi processing, there are few companies involved in manufacture of Mosambi Concentrate, which is supplied to manufacturers of ready-to-serve drinks. These companies usually have their in-house cold storage space.

Table 7: Functional Analysis of the Value Chain

Activity	Agent	Output
Input Supply	Private vendors Department of Horticulture	Planting Material Drip Irrigation Apparatus Fertilizers & Micronutrients Pesticides Packing Material
Training and Subsidy	KVK Agriculture University Agriculture Research Station, Badnapur, Jalna Department of Horticulture	Training on Mosambi cultivation Subsidies on input supply (machinery, chemicals, planting material)
Production	Farmers	Fresh Mosambi
Post-Harvest Management	Farmers Pre-harvest Contractors Commission Agents	Harvested Mosambi Primary processed produce
Transportation	Transport Service Providers	Logistic assistance
Secondary Processing	Processors	Mosambi Concentrate, Mosambi ready-to-serve drinks
Wholesale & Retail distribution	Wholesalers Commission Agents Retailers	Sorted and Graded Fresh Mosambi

Commodity Flow Analysis

Figure 20: Commodity Flow and Trade Channels



Based on the stakeholder interaction four different marketing channels have been identified to be operating in the study area. The selection of marketing channel by the farmer is dependent on factors as scale of production, the prevalent market rate and the proximity to the market and the transportation cost involved in taking the produce to the market.

Channel 1.

Farmer → Post-harvest Contractor → Wholesaler in distant market (as Delhi/Lucknow/ Chandigarh/Bihar/Kolkata) → Retailer → Consumers

Channel 2.

Farmer → Commission agent at the nearest Market → Local wholesale suppliers/ vendors (retailers)/ Wholesalers in distant markets (as Delhi/Lucknow/ Chandigarh/Kolkata) →Local traders/retailers → Consumers

Channel 3.

Farmers → Commission Agent at the Nearest Market → Procurement Agent → Processing Companies →Wholesaler/Retailer in distant market →Consumers

Channel 4.

Farmers → Farmer Producer Organisations / Lead Farmers → Commission agents/Wholesaler in local or distant market → Consumers

Farmers → Farmer Producer Organisations / Lead Farmers → Processing Companies →Wholesaler/Retailer in distant market →Consumers

Channel 1: Channel 1 is one of the most prevalent trade channel observed for Mosambi. The Farmer sells his produce at the farm-gate to the pre-harvest contractor. The farmer opts to sell via this channel when his farm is located far away from the nearby market or when he feels that the cost offered by the

contractor is equal or almost equal to the price, he would fetch at the Market. The advantage to the farmer is that he does not have to incur any transportation or evacuation cost. However, in most cases, the contractor is looking for a specific quality of produce. So, generally 20-30% of the produce is rejected, which the farmer has to then either sell to village aggregator or take the produce to the nearby market yard. The pre-harvest contractors who buy the fresh produce directly from the farms / orchards, generally select good quality fruits belonging to the first two Quality Grades. The produce is then loaded in trucks and sent to the Wholesalers in the Distant Markets of Delhi, Chandigarh, and Punjab and even to major markets of Maharashtra like Mumbai, Pune. The demand at these markets is for good quality produce with fruits having attractive appearance and uniform size. The Wholesaler at the Destination Markets then sell the produce to Semi-wholesalers / Retailers, from where it is bought by the end Customers.

Channel 2: Channel 2 accounts for around 10-15% of the produce sold in the district. Some farmers are now opting to take their produce to the nearby APMC markets. These farmers are mostly the progressive farmers, who are updated with the prevalent market rates in major markets of the district. The farmer bring the produce directly to the nearest APMC market, where the produce is sold in open auction through commission agent. The fruits are transported to the nearby market in tempo-trucks or Pick-up trucks. Under this Channel, the farmers are responsible for payment of costs associated with post-harvest activities as harvesting, transportation from farm to market, loading and unloading charges etc. Jalna APMC market in the survey district of Jalna, is the major market where Mosambi trading takes place. Arrival of each lot into the market is registered in the records of the market yard. The Commission Agents sell the produce of the Farmers to the Wholesalers of the local / distant markets and charge a fixed commission from the buyer (Wholesaler). The Wholesalers from the distant markets have their representatives at the markets, who inspect the produce and participate in the auction process. The responsibility of making the payment to the farmers lies with the Commission Agents. The proceeds of payment under the channel are mostly made in cheque or cash within few days of sale and sometimes immediate. The Wholesalers then sell the produce to Semi-wholesalers / Retailers, from where it is bought by the end Customers.

Channel 3: The Mosambi farmers indirectly supply fresh produce to the Citrus Processing Companies (Citrus Processing India Pvt. Ltd, Nanded) either through the Village Level Aggregators or through the Commission Agents in the Market Yards. The Processing Companies have their Purchase Vendors / Managers, who buy the Grade 4 produce. The processed products are then marketed in the domestic / international market. Mosambi Concentrate is sold to companies such as Dabur, Pepsi, Coca-Cola for manufacture of ready-to-serve drinks, which are then marketed under the respective brands of these companies.

Channel 4: This Channel is observed where there are Farmer Producer Organisations (FPOs) / Lead Farmers involved in the marketing of the produce. The member farmers of the FPOs sell the produce to the FPOs. The FPOs are then responsible for sorting, grading, packing and transporting the produce to wholesale markets in Delhi, Lucknow, Kolkata, Kanpur, etc. Further, there are some progressive lead farmers, who aggregate the produce from the farmers and

sell the produce to the distant markets. The price information is generally obtain based on direct conversation with traders based out of these mandis. There can also be an alternate channel, wherein the produce of Grade 4 is sold to the Processing Companies.

2.3.3.2 Status of post-harvest management

Primary processing

The mosambi growers do not do any type of primary processing. They harvest the fruits and sell them at the farm-gate or at the market yard. Even the Commission Agents who buy from the farmers do not practice sorting or grading. The unsorted and loose mosambi fruits are directly loaded in trucks lined with dry grass. Only a few select commission agents who supply to processing companies or organized retailers opted to do the sorting and grading operations. There were no dedicated pack-houses for mosambi reported from the various discussions with the different stakeholders like farmers, FPOs, agricultural market committee, traders.

The FPOs promoted under the Japan Poverty Reduction Fund had a provision of construction of pack-house with 25% self-contribution and 75% in the form of grant subsidy from the project. **Pratisthan Agro Producer Company Ltd** in Paithan, Aurangabad has constructed a packhouse, which also functions as a collection and sorting, grading center for multiple commodities. But the sorting and grading of the fruits is done manually by employing labor, there is no automated sorting grading line at the packhouse. **Kalyani Farmer Producer Company Ltd.**, Jalna had started the construction of the Packhouse, at the time of the field visit.

Status of storage infrastructure

Sweet Lime has a shelf life of around 20 days when stored in shade at ambient temperature. The produce is purchased by the post-harvest contractors at the farm-gate or by the commission agents / traders at the market yards and transported the same day to the distant markets. Therefore, there is no requirement of storage space felt by the traders / post-harvest contractors.

There is a Cold Storage facility of 2800 MT constructed in the premises of the Jalna APMC. A private entrepreneur has taken the facility on lease. However, it is majorly used for storage of pulses and food-grains. With respect to fruit commodities, Apples are stored in around 150 MT storage space. There is no demand for storage of Sweet Lime, as there is no pre-cooling chamber at this facility and Sweet Lime needs to be pre-cooled before storing under cold conditions.

Status of secondary and tertiary processing

In terms of processing of mosambi, Citrus Processing India Pvt. Ltd (Nanded) is the only major company, which procures its produce from Jalna and Paithan cluster. The company sources Grade C and Grade D produce from the market yards. It is involved in the manufacture of Mosambi concentrate, which is supplied to companies like Coca-Cola, Dabur who prepare ready-to-serve drinks/juices from the concentrate and market the products under their respective brands.

2.3.3.3 Price build-up across the Value Chain

Production

Land Preparation – This generally involves operations such as bed preparation, digging of pits and applying a basal dose of Farm Yard Manure.

Planting Material and Nutrition – It was reported that, planting is either done by maintaining a distance of 16 feet / 18 feet between two plants. The recommended spacing by the government technical institutions is 18 feet. Accordingly, 160 plants are planted in one acre (spacing of 18 feet). The average cost per plant is Rs 40.00. The plants are mainly sourced from Private Nurseries. The farmers generally have to replace 20% of the plants, so generally for one acre, 200 plants are required (while accounting for replacement of 20% of plants). Thus, the cost of planting material per acre is Rs. 8000/- i.e. Rs. 20,000/- per hectare.

Mosambi trees start fruiting from the 4th year onwards, but it is recommended not to take this harvest, so that the plant starts giving sustained production from the 5th year onwards. During the first five years, the cost of nutrition was reported to be Rs 100 per plant, which works out to be Rs 16,000/- per annum for one acre and Rs 40,000/- per hectare.

The requirement of nutrition is significantly reduced from the 5th year, once the plants start giving sustained production. The farmers reported that after the fifth year, 1 kg of farmyard manure is given to each plant. The cost of which is around Rs. 8000/- per annum and Rs. 20,000/- per hectare.

Irrigation – Drip Irrigation is the method of choice for irrigating the plants in the orchard. Water for drip irrigation is supplied through wells (if available in / near the farm) or ponds are constructed in nearby area to store water throughout the year (the ponds are lined with tarpaulin sheet to prevent percolation of water). The establishment cost for setting up the pipes and tanks for drip irrigation was reported as Rs 60,000/- per hectare.

Plant Protection and Intercultural Operations – Mosambi is generally a hardy crop and does not require significant investment on crop protection. The farmers reported that in favorable climate, there is no requirement of spraying of chemicals. But if the weather conditions are not favorable, then there can be a spread of powdery mildew, affecting the stem and the terminal branches of the tree. To protect the trees from this, the farmers reported that they apply paste of Bordeaux mixture to the stem and terminal branches. The cost incurred on this is around Rs 3700/- per hectare.

Before fruiting, weeding is carried out by using a small tractor. The cost incurred is around Rs. 2000/- per acre, i.e. Rs 4950/- per hectare. The farmers also reported that square shaped pits are created around the plants to help provide nutrition for each plant. The cost incurred on this is around Rs 5000 per acre, i.e. Rs 12,350/- per hectare.

Harvesting – The mosambi trees start bearing fruits from the 4th/5th year from the year of planting. The farmers employ labor to harvest and collect the fruits at the farm-gate. The average labor cost on harvesting was reported to be Rs. 9880/- per hectare.

Post-Harvest Management

To realize potential value of the harvest, it is important to sustain the quality of the fruits until they are delivered to the consumer. Proper postharvest management and handling of produce is thus important to prolong the duration for which the fruits remain fresh, have a good external appearance and remain marketable.

Primary Processing (Sorting, Grading & Packing): There is very little primary processing done in case of Sweet Lime. Once, the produce is harvested, it is temporarily stored at a suitable open area around the farm or at temporary collection sheds of the farmers.

The farmers sell the ungraded produce to the pre-harvest contractor at the farm-gate or to the Commission Agent at APMC market. The Produce that is sent to the distant markets is also not graded by the traders at the APMC. It was observed that, only a few large vendors, who were also supplying to processing companies or organized retail companies, carried the sorting and grading operations. The sorting and grading is carried out manually by employing skilled labor. It was reported that, on an average Rs 1.5 per kg is the cost incurred on the grading operations.

Transportation and Logistic

Aforementioned, the most common channels of marketing is the farmer selling the produce at his farm-gate. The second most common channel being the farmer selling his produce at the nearest market yard. Very few farmers are involved in transporting their produce to the distant markets. Some of the lead farmers the FPOs showed interest in selling the aggregated produce to distant markets provided they have assured linkages with traders in the distant markets (along with the assurance of payment for the produce sent to these markets).

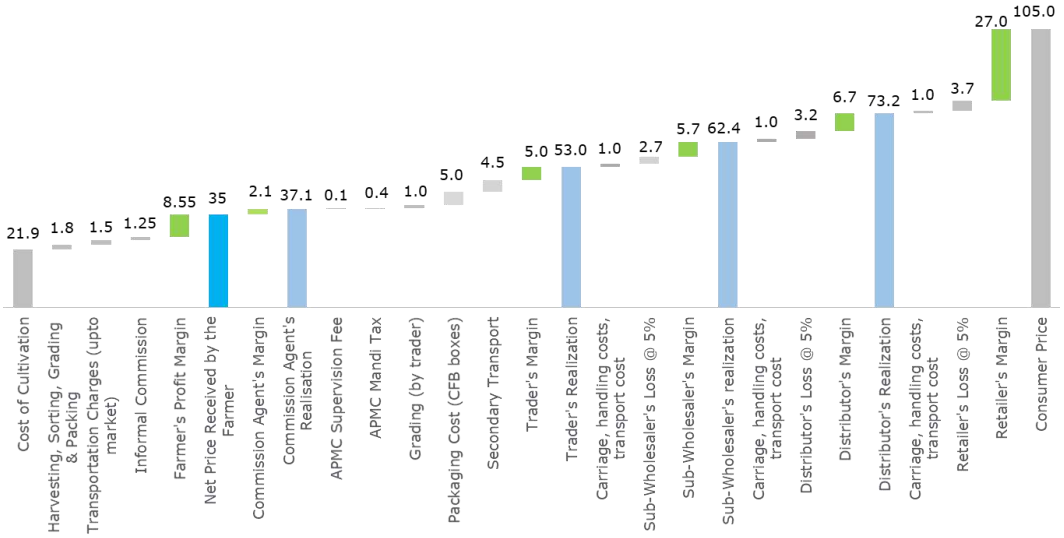
The farmers who opt to take their produce to the nearest market yards; load the produce directly onto the mini-trucks or pick-up vans. The average transportation cost incurred is Rs. 1.0-1.5 per kg depending on the distance of the farm from the market yard. Majority of the mosambi produced in Jalna-Paithan cluster is marketed to the distant markets outside Maharashtra. The rest of the produce is marketed within the state to major cities like Mumbai, Pune, Aurangabad, etc. On an average, transportation of produce from Jalna to Delhi costs around Rs. 4-5 per kg. While that for other distant markets like Bihar and Kolkata ranges between Rs 5.5-6.5 per kg. The cost of transportation is decided by the transport unions, which operate locally.

Markets and Price information

Jalna APMC market is the only market, where mosambi is traded in the district. It was reported that, the best quality fruits (Grade A) are sold at the farm-gate itself (bought by private vendors who supply to markets like Delhi and Mumbai, where there is demand for best quality fruits). Apart from this, the best quality fruits are also supplied to organized retail companies like Big Basket and Reliance Retail. The fruits belonging to Grade B, Grade C and those with external marks or skin discoloration find their way to the APMC / Private markets. Due to the penetration of mobile internet, the farmers tend to have information about the markets rates. However, the farmers / FPOs do not have information about the market rates of distant markets (which tend to influence the purchase price / auction price at local markets). Therefore, they are not able to take full advantage of the price information.

Analysis of price build up including a **comparison of farmers' realization in case direct marketing/ processing by farmer is done**

Figure 21: Price Build-up in Sweet Lime Value Chain



2.3.4 Gaps in the Value Chain

2.3.4.1 Identified gaps & constraints in Value Chain

Production Related

Jalna district, which is the leading Sweet Lime (Mosambi) producing district in the state of Maharashtra, has a productivity of 13.50 MT / ha, which is higher than the state average productivity, but still lower than the other states. The major production related constraints that were reported by the farmers in the state were that of water scarcity due to decreasing number of rainy days over the past few years, leading to drought-like conditions. This has resulted in drying up of the trees and reduced yield over the past 3-4 years. As a result, some of the Sweet Lime farmers have switched to pomegranate cultivation, as pomegranate has one-third water requirement as compared to Sweet Lime. In addition, the farmers also reported cases of fruit dropping (immature fruits falling to the ground) due to temperature stress. This in turn affects the overall appearance and quality of the produce. Both these may be attributed to climate change, as due to climate change the number of rainy days are reducing over the past decade and the increased temperatures are adversely affecting the quality of the produce.

Post-harvest Management

- Primary processing including collection centers, pack-houses, etc.

  There is very little primary processing done in case of Sweet Lime. Once, the produce is harvested, it is temporarily stored at a suitable open area around the farm or at temporary collection sheds of the farmers. There are no, common collection centers in the production clusters, where the produce of group of farmers can be aggregated.

  The farmers sell the ungraded produce to the pre-harvest contractor at the farm-gate or to the Commission Agent at APMC market. The Produce that is

sent to the distant markets is also not graded by the traders at the APMC. It was observed that, only a few large vendors, who were also supplying to processing companies or organized retail companies, carried the sorting and grading operations. The sorting and grading is carried out manually by employing skilled labor.

The FPO, which was visited during the field visit in Jalna, was in the process of constructing a pack house. Apart from this, the FPO in Paithan cluster had constructed a Pack house, which it was using as a collection and grading centre.

- Storage Related

  Sweet Lime has a shelf life of around 20 days when stored in shade at ambient temperature. The post-harvest contractors at the farm-gate purchase Sweet Lime, which is to be marketed for table consumption, or by the commission agents / traders at the market yards and transported the same day to the distant markets. Therefore, there is no requirement of storage space felt by the traders / post-harvest contractors.

  However, the traders at Jalna APMC shared that, currently the produce brought by the farmers is directly unloaded in open areas of the market yard. This sometimes, leads to physical damage to the fruits. The Chairman of the trader association shared that, APMC Nagpur has good basic facilities like Sale Hall, Unloading Area (with soft floor), where the produce (mandarin) is unloaded in a proper manner. Such infrastructure is also required for Sweet Lime in the Jalna market yard. In addition, majority of the produce, which is received during the day, is stored by the traders in heaps under open sun and covered only by gunny bags. Therefore, there was a need to have shaded structures / platforms, where the produce received at the market yards can be stored temporarily.

  There is a Cold Storage facility of 2800 MT constructed in the premises of the Jalna APMC. A private entrepreneur has taken the facility on lease. However, it is majorly used for storage of pulses and food-grains. With respect to fruit commodities, Apples are stored in around 150 MT storage space. There is no demand for storage of Sweet Lime, as there is no pre-cooling chamber at this facility and Sweet Lime needs to be pre-cooled before storing under cold conditions.

- Secondary and tertiary processing

  For secondary and tertiary processing, smaller sized fruits, fruits with skin defects but not damaged from inside are procured by the companies, as such type of fruits are available at lower rate (Rs 8-10 per kg). These companies tend to procure from the market yards, as; such produce is readily available at a single location. Therefore, in this context, it would be a constraint for the farmers to forge direct tie-ups with such processing companies. FPOs may develop such linkages, but the private sector has certain perceived apprehensions with respect to FPOs like lack of accountability, professionalism and commitment to supply a sustained quantity of produce as per the required parameters at competitive rates.

Road connectivity & transport

The transportation of the produce from the farm-gate to the nearest market yard is dependent upon the quality of access roads. Most of the orchards, face the

problem of lack of approachable roads to get their produce evacuated from the farm. Mostly, tractors are used to evacuate the produce from the farms to the nearest collection shed or directly to the market yard. This is one of the reasons, why infrastructure providers like warehouse / cold storage / pack-house operators, do not find it feasible to build / have their facilities near the farm-gate.

Marketing related

- Individual farmers always find it difficult to trade in the distant market as they do not have bulk of supplies as demanded by the markets, lack awareness relating to grade specific pricing, lack of infrastructure for value addition, difficulty in arranging for labour & transportation for harvesting, loading & selling of produce. All these factors leads to the local trader taking advantage of the situation & offering lower prices to the farmers.
- Majority of farmers who market the produce themselves, have limited bargaining power due to lack of market price information/ low quantities of production. Moreover, the information flow from traders to the farmers are generally not transparent. Except few progressive and large farmers, others are yet to develop profound direct linkages and negotiation skills with trader/ wholesaler in distant markets. Majority farmers lack market information about price and demand in distant markets resulting in lower value realization for them. Even though some progressive ones have been able to sell the produce in distant market, they reportedly ended up paying higher commission rates and other charges like transportation charges.
- Most of the produce from the state is traded through pre-harvest contracts between traders & farmers. Around 75-80% of the produce is traded through this medium. This arrangement results in low price realization for the farmers as they have very little information on the prices that are being offered for their produce in the distant mandis. This arrangement involves a high amount of estimation work from the trader and in most of the cases; it is the farmer who ends up on the losing side. Even with such high risks for the farmers in going for this arrangement, they prefer to sell their produce through pre-harvest contracts. The reason being the capacities of farmers to find market for their produce, negotiation with distant market traders, price realization etc.
- The farmers, who sell their produce at the APMC markets, are not required to pay any commission as per the revised rules of the Maharashtra government. In the new system, the traders who would buy the produce would be paying the commission to the commission agents. Although, this system may be brought for the benefit of the farmers, it was reported that, as the traders have to bear the commission, so they have started bidding low for the produce (compared to what they would have bid in the earlier marketing system). Both the farmers as well as the traders gave this feedback during the field visits.
- With the growth of e-commerce platforms and organized retail like Big-Basket, Grofers, Reliance Fresh etc., there is an increasing demand from these players for fresh Mandarins. However, these companies avoid transactions with individual farmers.
- There is tremendous rise in sale of fruits & other products through e-commerce and organized retail chains but there were very few linkages of these organized retail players with the farmers from the state. Reliance is procuring Sweet Lime from few Commission Agents in Jalna APMC (300 MT during one harvest season).

Access to Finance

The availability of affordable finance is one of the key challenges faced by the farmers and their FPOs engaged in the sweet lime value chain. The majority of financial institutions demand for collateral upto 150 to 200% of the loan amount, and majority of the farmers and even FPOs do not have the required assets to meet this condition. The farmers/FPOs seeking credit from banks or other financial institutions for operational activities, development of post-harvest infrastructure, building processing facilities etc. often end up taking loans from informal creditors such as moneylenders or micro—finance institutions (MFIs) on very high interest rates.

Moreover, the banks view the loans to farmers/FPOs as high risk investments as their repayment records has not been healthy, and are highly reluctant to extend credit facilities to FPOs/ farmers.

2.4 Value Chain Analysis - Mandarin (Orange)

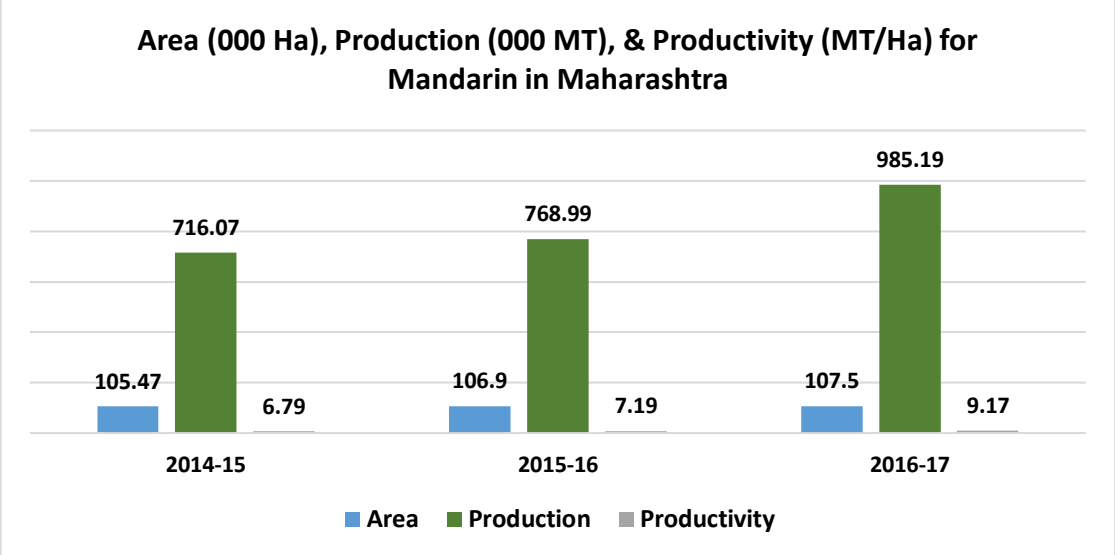
2.4.1 Introduction

Mandarin is the most important fruit in the Citrus category. It has the highest area under production and largest production among all the Citrus fruits in the country. Total area under Mandarin production was at 4.29 lakh Ha in 2016-17 while the total production stood at 47.54 lakh MT[19]. The overall production of Mandarin and its area under production have been on a constant rise for last few years. The table below highlights the status of Mandarin production in the country.

Crop	2014-15		2015-16		2016-17	
	Area	Production	Area	Production	Area	Production
Mandarin	299	3699	397	4113	429	4754

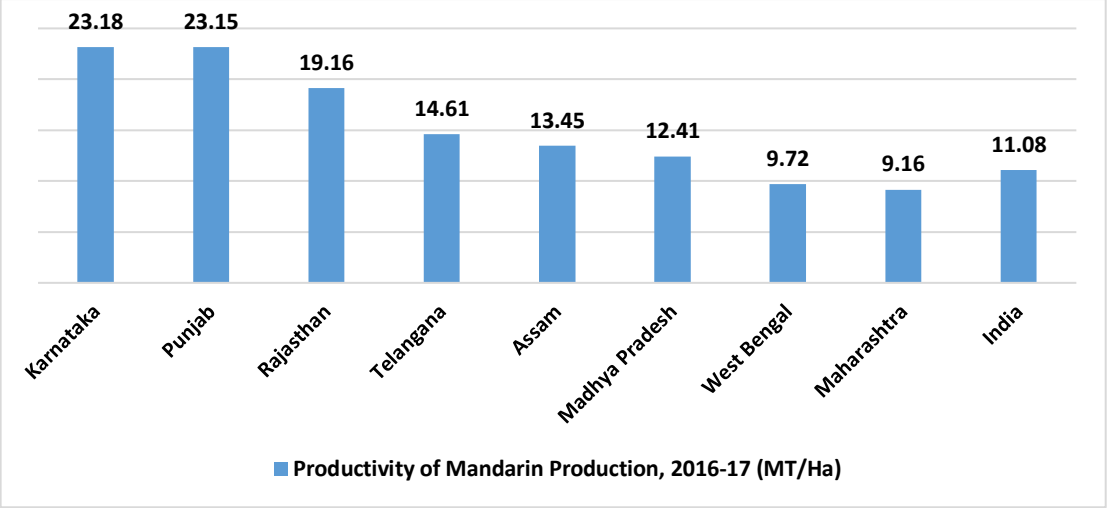
Source: Horticulture Statistics at a Glance, 2017. Area in 000 Ha, Production in 000 MT

State wise Maharashtra ranks 3rd in state wise production of Mandarin in the country. It lags behind Madhya Pradesh & Punjab in terms of production. It is one of the major producers of Mandarin with total production at 9.85 lakh MT and 1.07 lakh Ha of total area under production in 2016-17[19]. The production in the state has been gradually increasing from 7.16 lakh MT in 2014-15 to 9.85 lakh MT in 2016-17 with over same area under production. This implies that the productivity of Mandarin has been on a constant rise in the state. The following graph highlights the year wise production & productivity details[19].



But if compared to the productivity of Maharashtra with other states, it lacks behind Karnataka, Punjab, Rajasthan, Telangana, Assam, Madhya Pradesh & West Bengal. The graph below highlights the state wise productivity figures for Mandarin[19].

[19] Horticulture Statistics at a Glance, 2017

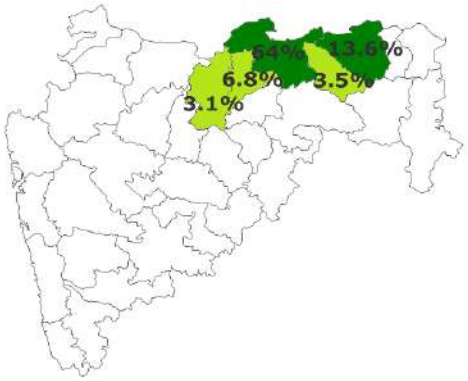


Amravati, Nagpur, & Akola are the leading districts, both in terms of area under cultivation and production.[20] These districts alone accounts for about 85% of the total production of the state. Apart from that, the other major Mandarin producing districts are Buldana and Wardha. All of these districts together account for more than 90% of the total production in the state. The major district wise area under production, total production (including percentage of state's production) and productivity are given in the table. The map below shows the major producing districts of Mandarin in the state. The districts shown in dark green colour are those having more than 10% of the total production of Mandarin in the state which comprise of Amravati and Nagpur.

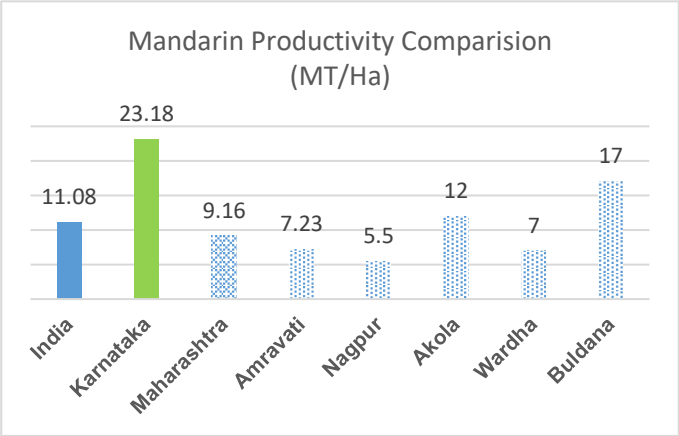
District	Area (000 Ha)	% of Total State Production	Total Production (000 MT)	Productivity (MT / Ha)
Amravati	70.66	64	510.8	7.23
Nagpur	19.97	13.6	109.87	5.50
Akola	4.57	6.8	54.94	12
Wardha	4.05	3.5	28.35	7.00
Buldana	1.5	3.1	25.32	17

Source: Commissionerate of Agriculture, Government of Maharashtra, 2016-17

As seen from the above table, Amravati district accounts for about 64% of the total production from the state. The major production blocks in Amravati are Warud, Morshi, Anjangaon Surji, Chandurbazaar & Acahlpur. The only variety that is grown in the region is 'Nagpuri Santra'.



[20] Commissionerate of Agriculture, Maharashtra State, 2016-17



A comparison of productivity of the major production clusters (districts) of Mandarin with average productivity of India & the state with highest productivity in the country (Karnataka) is shown in the graph alongside. It is evident from the graph, that the average productivity of Mandarin in Maharashtra (9.16 MT/Ha) is lower than the average productivity of India (11.1 MT/Ha) and less than half the productivity of Karnataka (23.18 MT/Ha). In terms of the productivity of Mandarin in the identified production districts, Buldana and Akola are the leaders having a productivity of about 17 MT/Ha and about 12 MT/Ha respectively, which are higher than the state average of about 9.16 MT/Ha. Amongst the major producing districts, Nagpur has the lowest productivity of about 5.5 MT/Ha which is less than half the average productivity of India.

2.4.1.1 Major Varieties

Only one variety of Mandarin is grown in the state. The variety is 'Nagpuri Santra'. It has been cultivated traditionally for generations and the knowhow about the variety has been passed on through generations among the farming community. The variety has also received Geographical Indicators (GI) tag under the Geographical Indication of Goods, (Registration and Protection) Act 1999.

The variety has a unique sweet-sour flavor and an aroma that is not found in any other variety that is grown in the country. The GI tag has been accorded on the basis of these unique qualities that can be attained only under specific soil and agro-climatic conditions of the Vidarbha region. It has a rustic and pockmarked exterior which is sweet and has juicy pulp.

In the recent years, there has been a spread of this variety to the neighboring districts of Madhya Pradesh & Rajasthan as they share the border with northern part of Maharashtra. Other major varieties of Oranges grown in the country are Kinnow in Punjab & Himachal Pradesh, Khasi Mandarin in Northeast and Coorg Mandarin in southern states.

Central Citrus Research Institute (CCRI), formerly called National Research Centre for Citrus (NRCC) is located in Nagpur has recently developed a seedless variety of Nagpur Mandarin. The institute has been giving planting material to farmers,

nursery owners, Krishi Vigyan Kendras, Agricultural Universities for the promotion of the newly developed variety[21].

2.4.1.2 Seasonality

There are two major seasons for the crop in the state. The first one is '**Ambiya Bahar'** which starts from September to December / early January. Fruits are harvested during this period and the peak harvesting time during this season is during the months of November & December. Around 40-45% production in the state comes during this season.

The next season is **'Murg Bahar'** which starts from Mid-February and lasts till April with the peak time in the months of March & April. This season accounts for around 55-60% of the production during the year. The below chart compares the seasonality of fruit in Maharashtra with other major producing states.

Harvesting Season of Mandarin (Orange) in Major Producing States

Major Producing States	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Punjab	Peak	Lean										Peak
Madhya Pradesh	Peak	Peak	Peak	Lean								
Maharashtra	Lean	Lean	Peak	Peak					Lean	Lean	Peak	Peak
Rajasthan	Peak	Peak	Lean									
Assam	Peak	Lean	Peak	Peak	Peak	Peak				Peak	Peak	Peak
Arunachal Pradesh											Lean	Peak

Round the Year | Peak Season | Lean Season

As we can see, Maharashtra has the longest period of Mandarin cultivation among the compared states.

2.4.1.3 Identification of Farmer Groups

The study focusses on identifying the major farmer groups/ FPOs who are involved in the cultivation, trading & processing of Mandarin, assessing their capacities, assessment of the current state of infrastructure for Mandarin in the state including Pack-houses, Sorting, grading & waxing units, Processing centers, export facility centers, cold storages etc.

Deloitte conducted a comprehensive secondary research for identification of farmer groups through interacting with officials from Small Farmers Agri Business Consortium (SFAC), NABARD regional offices & Maharashtra State Agricultural Marketing Board (MSAMB) and studying the list of FPOs promoted by various agencies & projects like SFAC, NABARD, MSAMB (MACP and JFPR) in Maharashtra and specifically working in Mandarin cultivation. We identified around 13 major FPOs working in Mandarin cultivation who were located in the major production cluster in the state. Out of those FPOs, 11 were located in Amravati district & two were located in Akola.

[21] https://timesofindia.indiatimes.com/city/nagpur/Seedless-variety-of-Nagpur-mandarin released/articleshow/49706271.cms

As a part of the selection process, telephonic interactions were initiated with these FPOs to verify whether they are involved in production / marketing of Mandarin and to gather information on the following key parameters identified for shortlisting the prospective FPOs for the field visits.

- ✓ Year of establishment & commencement of commercial operations
- ✓ Associated number of farmer members, gender composition
- ✓ Contributed Share Capital
- ✓ Existing area under focus crop production under FPO
- ✓ Existing production volumes of focus crop
- ✓ Production and marketing related functions performed by FPO to facilitate backward& forward linkage
    - ✓ Current sales/ Annual turnover
    - ✓ Intent & ability to co-invest in market linkage development

The farmers belonging to these FPOs have been involved in the cultivation of Mandarin for decades and they have come together to establish a FPO for supporting each other in Mandarin cultivation, post-harvest measures, trading, sharing common infrastructure etc. The detailed description of the FPOs with their capacities, members etc. is mentioned in the table below.

Parameter	Shubh labh Agro Producer Company Ltd	Seven Green Hills Agro Producer Company Ltd	Utkranti Agro Producer Company Ltd	Vidharba Agro Shetkari Utpadak Company Ltd.
Year of establishment	2014	2014	2015	2015
Commencement of commercial operation	2016	2017	2018	2016
No. of farmer members	214 members	280 members	813 members	1025 members
No. of women members	35 women members	80 women members	100 women members	80 women members
Contributed share capital	Rs. 10 lakhs	Rs. 10 lakhs	Rs. 13 lakhs	Rs. 10.25 Lakhs
Existing area under Mandarin production	650 Acres	640 acres	5000 acres	2500 acres
Existing volume of Mandarin production	3250 MT	2900 MT	30000 MT	11250 MT
Average Annual turnover of the FPO	Rs. 1.5 crore	Rs. 1 crore	Rs. 4.5 crore	Rs. 2.25 crore
Production & Marketing related activities undertaken by the FPO	They have a pack-house & waxing unit with capacity of 5 MT/day. They are planning to export the fruit to Bangladesh markets.	They operate a pack-house with capacity of 50 MT. They sell produce only in the domestic markets.	They have a pack-house with manual sorting & grading. They mostly sell to markets in New Delhi & Bhubaneswar.	They own a pack-house & use private rental waxing units for their produce. They sell their produce to organized retail like Big Basket, Reliance Fresh etc.
Selection criteria	FPC is a group of 214 members with about 650 acres of area under Mandarin production. They have built a pack-house & waxing unit with a capacity of 5 MT/day. They were interested in investing for a pulping unit if they get financial support from any external agency/ government department. They are one of the major FPOs operating in the Anjangaon region which is important part of the Mandarin growing cluster.	They are a group of 280 farmer members with around 640 acres of area under Mandarin cultivation. They have a pack-house of about 50 MT capacity. They have been planning to setup a sorting, grading & waxing unit as they have developed contacts within the export markets for exports of Mandarin. They wanted to invest in a waxing unit for capturing the export channel.	They are a group of 813 farmer members with around 5000 acres of land under Mandarin cultivation. They mostly trade in fresh fruit with manual sorting, grading & packaging. They want to develop marketing channels for export of fruit.	They are a group of 1025 farmer members mostly involved in Mandarin cultivation with around 2500 acres of area under Mandarin cultivation. They are currently selling their produce to organized retail chain of Big Bazaar, Big Basket, Reliance Fresh etc. by using waxing unit on rent from a private trader. They want to invest in their own waxing unit facility.

Parameter	Shramajeevi Nagpuri Santra Producer Company Ltd.	Vaipulya Rainfed Producer Company Ltd	Jilha Biyane Utpadak Company Ltd
Year of establishment	2015	2011	2015
Commencement of commercial operation	2017	2011	2016
No. of farmer members	368 members	595 members	305 members
No. of women members	30 women members	60 women members	30 women members
Contributed share capital	Rs. 3.68 lakhs	Rs. 5.95 lakhs	Rs. 5 lakhs
Existing area under Mandarin production	1640 acres	500 acres	350 acres
Existing volume of Mandarin production	7380 MT	2500 MT	1600 MT
Average Annual turnover of the FPO	Rs. 50 lakhs	Rs. 25 lakhs	Rs. 1 crore
Production & Marketing related activities undertaken by the FPO	They are currently developing a 5 MT/ day waxing unit.	They have linked farmers directly to Juice processing companies and they charge a commission of 2% from farmers. They also have a pack-house with 50 MT capacity & one in-progress juicing unit with 2000 LPD capacity.	They are a group of farmers which trade in many products like food grains & other fruits and vegetables. They engage in manual sorting, grading & packaging for the fruit.
Remarks	They are a group of 368 members with about 1640 acres of area under Mandarin production. They operate in Warud region which is a major production belt for Mandarin. They are interested in investing in development of infrastructure with the help of government support.	They are a group of 595 farmer members with around 500 acres of area under Mandarin cultivation. They have a pack-house of about 50 MT capacity. They have been planning to setup a Juice processing unit as they have developed contacts within the local markets for setting up retail stores.	They are a group of 305 farmer members with around 350 acres of land under Mandarin cultivation. They want to develop a waxing unit with required support from the government.

2.4.1.4 Field Visits & Outcomes

For Mandarin, Amravati, Akola & Nagpur district contributes to around 85% of the total production from the state. The major Mandarin producing regions are Varud, Achalpur, Anjanegaon Surji, Chandoor Bazaar, Morshi, etc.

Field visits were conducted to these regions to study the capacities of FPOs, their infrastructure, existing market linkages, overall assessment of the mandarin infrastructure scenario in the region and readiness of FPOs to co-invest market infrastructure.

Interactions were made with farmer members from FPOs belonging to Varud, Morshi, Anjanegaon Surji, Achalpur, and Chandur bazaar regions, private traders cum pack-houses owners, sorting grading & waxing unit owners & export facility center owners. Mandarin is the most important crop cultivated in the region. Only one variety of crop is cultivated i.e. Nagpuri Santra. There are other crops that are cultivated in the region but Mandarin forms the major part.

The overall area under Mandarin cultivation in the state stood at 107.8 Ha and overall production stood at 801.12 MT. The production of Mandarin is heavily dependent on rainfall and there has been a significant decline in the production during the last year & the current year due to less than average rainfall for these two years. Farmers do engage in irrigation facilities majorly through ground water sources such as wells, bore-wells etc. The overall productivity of the crop has been affected due to scanty rainfall. A few of the observations from the field discussions are –

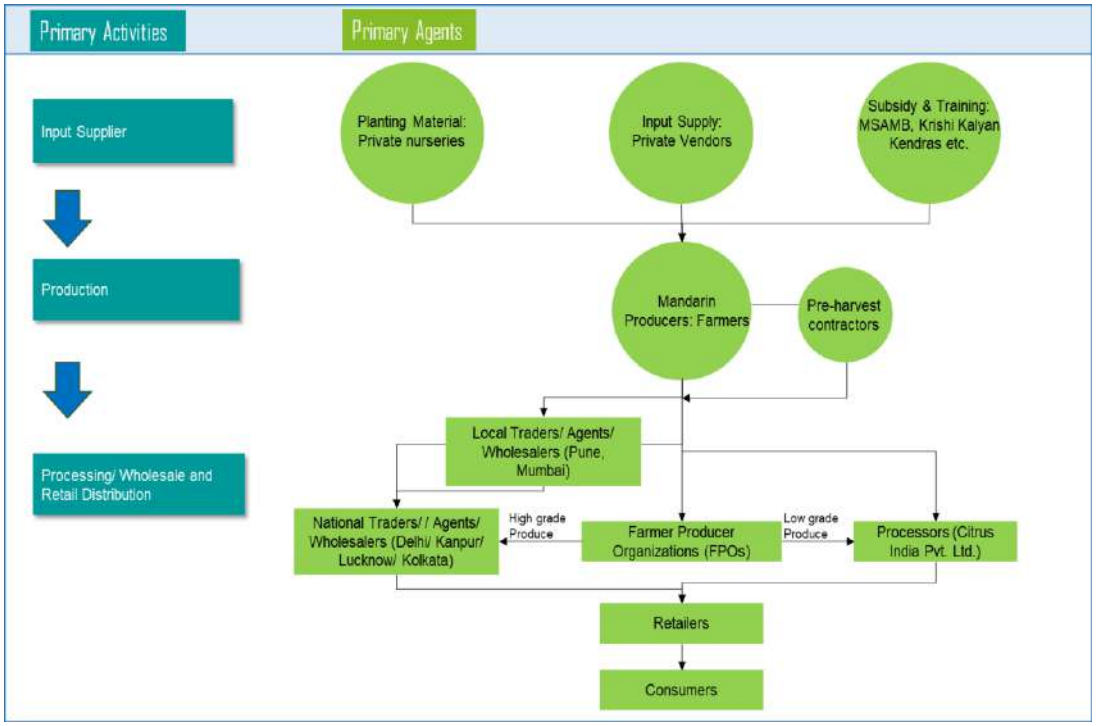
- The overall production belt is highly dependent on rainfall for meeting the water needs. Fluctuations in rainfall severely affects the prospects of bumper crop.
- They traditionally grow just one variety of Mandarin i.e. Nagpuri Santra. There has been very minimal research in terms for varietal development for Mandarin.
- The current variety has very low shelf life, loose outer skin, and small size of fruit. This leads to many hurdles in export of fruit and it does not receive good prices in the international markets.
- Major trading of the crop happens through traders by undergoing a pre-harvest contract with the farmers. Around 80-85% of the crop is traded through this channel.
- There are no major processing units in the major production districts, many of the farmers have to sell their produce to the processing facilities located in the nearby districts.
- There are around 10-12 major sorting, grading & waxing units in the state but they are majorly owned by private players and they rent out their facilities to FPOs for value addition on the crop.
- There no proper export channels developed for the fruit as the shorter shelf life renders the fruit useless for exports.
- There are no existing operational cold storage facilities in the state for Mandarin & all of the produce is through fresh fruit trading.

2.4.2 Value Chain Analysis

2.4.2.1 Structural Analysis

In general, the Mandarin value chain in the state begins with Farmers/ Producers, FPOs/ Pre-harvest Contractors (PHC), Traders, Processors, Wholesalers & Retailers. From farmers it flows to FPOs or PHCs (who procure directly from

farmers and sell it to distant markets) or processors (who procure Mandarin in fresh form directly from farmers). The PHCs then sell the produce in distant markets to further traders or distributors who sell it to wholesalers/ retailers. Processors either buy directly from farmers or through traders and extract pulp/ concentrate for further use in the Juicing unit.



2.4.2.2 Functional Analysis

The roles played by various actors in the value chain is as follows:

***Farmers/ Growers**:* The Mandarin growers undertake cultivation activities of orchards throughout the year. The main operation carried out by the farmers includes land preparation, furrowing, sourcing and planting of planting material (for establishment of new orchards/ replacement of senile ones), nutrient application in form of manure/fertilizers, weeding, pruning, application of insect pest control measures, harvesting and post-harvest management including farm gate sorting, grading and packing. Exception to such cases were the farmers undergoing direct contract with traders, where the procuring trader collects the produce in crates directly from the farms and then re-grades the produce at collection centre and processing facility.

Farmer Groups/ FPOs: There are many FPOs/ Farmer groups who are operating in the state. They are involved in procuring Mandarin from the farmer members, undergoing sorting grading & packaging and trading of the produce. Most of the FPOs undertake the sorting, grading packaging work at the farm level itself as currently they do not perform waxing of the fruit. Few of the FPOs have built waxing unit for Mandarin, once the unit gets operational they would bring the fruit to the unit for performing sorting, grading, waxing & packaging. Some of the FPOs also use private waxing units on rental basis for performing value addition of the fruit.

Pre-harvest Contractors/ Traders: Most of farmers in the state engage with a pre-harvest contractor for sale of their produce with traders. These contractors are either fellow farmers or purely traders who engage in aggregation of fruits from other farmers and sell it to distant markets. The contractor/ trader inspects the field, forecast the estimated orchard production and then negotiate price with the farmer based on size & grade of the crop, expected price during the season etc. Accordingly, mostly verbal contract is agreed into between the farmer and trader. Onwards, the trader becomes responsible for all risks and expenses related to undertaking the remaining farm operations including harvesting, sorting, grading, packing, transportation and marketing of produce. Thus, the farmers get an assured rate for sale of produce and price risk is relatively reduced and the payment for the fruit is done within 3-4 days to the farmers.

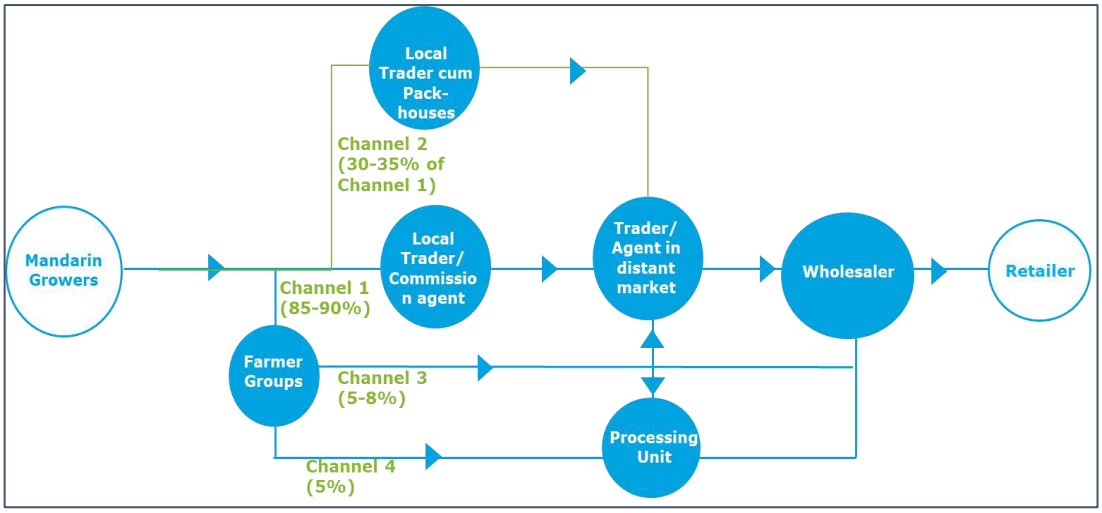
Processors: Processors are involved in procuring the fruit directly from the farmers or FPOs. Few FPOs are planning to set up a juicing unit for Mandarin. Currently the FPOs/ farmers are selling majorly to processing unit located in Nagpur & Nanded district. These processing units only procures fruit of the lowest grade (Grade D or lower) and the packaging, transportation of the fruit is responsibility of the FPOs/ farmers. The pricing of the fruit is generally fixed for the whole season and the supply takes place twice or thrice a week. The payment of the supply is generally provided within 2-3 days.

Table: Functional Analysis of Value Chain

Activity	Agent	Output
Production	Farmers	Fresh Mandarin
Post-Harvest Management	FPOs/ Farmers Pre-harvest Contractors Traders	Harvested Mandarin Primary processed Mandarin (sorted, graded waxed and packed Mandarin)
Transportation	Transport service Providers Aerial ropeway service provider	Logistic assistance
Secondary Processing	Processors	Mandarin Juice
Wholesale & Retail distribution	Wholesalers Retailers	Sorted and Graded Fresh Mandarin

2.4.2.3 Commodity Flow Analysis

Based on the stakeholder interaction four different marketing channels have been identified to be operating in the study area. The selection of marketing channel by the farmer is dependent on factors as scale of production and ability and accessibility to market information by the farmers



Channel 1.

Farmer → Local Trader/ PHC → Trader/ commission agent in distant markets → wholesaler/ Retailer → Consumers

Channel 2.

Farmer → Local Trader cum Pack-house/ Waxing unit → Trader/ exporter in distant market → Wholesaler/ Retailer →Consumers

Channel 3.

Farmers → FPOs → Trader/ Wholesaler in distant market → Retailer →Consumers

Channel 4.

Farmers → FPOs → Processors → Retailer/ Wholesaler → Consumers

Channel 1: This channel is the most prevalent channel for Mandarin trading. The farmer undergoes a pre-harvest contract with the trader. The trader inspects the orchard and offers a price to the farmer based on the size, colour of the fruit, and prevalent market rates. Based on the field survey, around 80-85% of the produce is traded in this channel. The responsibility of harvesting, collecting, sorting, grading, packaging & transportation is completely rested on the trader. Farmers find this mode of operation as most safe & risk free as they receive the payment within 6-7 days. All the risk of fruit damage, transportation losses, and market price fluctuations is borne by the trader. Traders who undertake just sorting, grading of the fruit generally prefer packaging at the farm level itself to save the transportation cost. These traders also have their own pack-house facilities where they undertake sorting, grading & packaging for transporting the fruit to the distant markets. This channel of operation is being followed traditionally and farmers in spite of getting low prices for their produce, follow this channel as they find it risk free with payments for their produce made within 6-7 days. All the four grades of A, B, C & D are traded through this channel. The fruit is then transported to traders in the distant markets of Delhi, Lucknow, Kerala, Jaipur, Haryana, Srinagar etc.

Channel 2: This channel is the sub-channel of channel 1. Here the mode of operation remains the same with farmers undergoing a pre-harvest contract with the trader and the trader offers a price to the farmer based on an inspection carried out of the orchard. The additional component added in this channel is the cleaning & waxing carried out by the trader. The trader here is also a pack-house

operator with cleaning, sorting, grading & waxing unit. Around 30-35% of the produce of channel 1 is traded through channel 2. Cleaning & waxing gives a shiny glow to the fruit and also improves its shelf life thus demanding higher prices in the market & also making it eligible for exports. Major export market through this route is Bangladesh.

Traders bring the produce from the farms to the pack-houses or farmers themselves collect the fruit in plastic crates and transport them to the pack-house. Here the fruit is cleaned, waxed, sorted, graded & packaged in plastic crates. Then the crates are loaded in trucks for transportation to distant markets. Farmers are generally paid after 6-8 days by the trader. Most of the farmers are working with the traders for decades so there wasn't much issue regarding the payment even if it gets delayed by a week or so. The trader for any delay of payments compensates the farmers.

Channel 3: This is a relatively new mode of operation wherein the FPO directly buys the produce from the farmers. The FPO arranges for the labour for plucking, sorting, grading, packaging & transportation of the fruit. If the FPO is selling the produce without any cleaning or waxing then the entire process of sorting, grading & packaging happens at the farm level itself. If cleaning or waxing of Mandarin is required, then it is transported to the pack-house (rented or owned) and there it undergoes value addition. Then it is packed in plastic crates, loaded in trucks & transported to the distant markets. FPOs generally charge a commission of 1.5 – 2% per kg of Mandarin and pass the rest of amount to the farmers. This is one of the best profitable mode of operation for the farmers but very few farmers take this route. Most of the FPOs sell the produce without cleaning & waxing, some of them use private player's facility on rental basis for cleaning, waxing & packaging of produce.

FPOs have been recently formed in the state with around 2-3 years of operational experience. They do not have adequate market linkages for buying & trading the whole produce of the farmer members. Some of the FPOs have started supplying to organized retail chain such as Big Basket, Big Bazaar, and Reliance Fresh. These retail stores pay a premium compared to traders from distant markets but their demand for the produce is limited & they only procure best quality Mandarin (Grade A & Grade B) from the FPOs.

Channel 4: In this mode of operation, Processors directly buy from FPOs/ farmers for further value addition to the produce. FPOs sell their produce to processors in the districts of Nagpur & Nanded. Processors buy only the grade 4 or lower category of produce and they generally keep fixed prices over the season. Processors procure around 5% of the produce from the state.

2.4.2.4 Status of Post-Harvest Management Practices in the State

To realize higher potential value for the harvested crop, it is important to sustain the quality of the Mandarins until they are delivered to the consumer. Proper postharvest management and handling of produce is thus important to prolong the duration for which the crop remains fresh and marketable.

Primary Processing

Primary processing includes sorting, grading, waxing & packaging. There are many private traders cum pack-houses operating in the state. They form the major procurement players to buy produce from the farmers and undergo value

addition through sorting, grading, waxing & packaging. Some of the FPOs have also started building their pack-houses and waxing units for handling the produce.

Mandarins are generally harvested in the morning and collected at the farm level. Majority of the produce is sold through pre-harvest contracts between traders & farmers. In cases where there is no cleaning & waxing performed on the fruit, then sorting & grading happens manually at the farm level itself. The fruits are then packed in wooden boxes or plastic crates depending on the requirement of the distant markets. Now-a-days most of the packaging happens in plastic crates due to ease of use and lower cost.

Grading of Mandarin happens based on size. Sorting happens based on fruit structure, colour, physical damages, tightness of skin, maturity etc. After proper grading, fruits are packed either in wooden boxes or plastic crates. Now-a-days plastic crates are in more demand due their long life and ease of availability. A standard plastic would carry around 22-24 kg of fruit. A horizontal layer of fruit is placed in the plastic crate with covering of newspaper and cardboard over it. Then another layer of fruit is placed with same covering. Depending upon the size of the fruit, the number of layer can vary from 4-6.

Old newspapers or cardboard sheets are placed between the two layers to protect the fruit from friction damage & reduce moisture loss. The plastic crate is then finally covered with cardboard sheet on the top and packed with plastic ropes. The size of plastic crates is around 18" x 12" x 12". Now-a-days, the plastic crates that are being used are of one-time use, made of low quality plastic. The crates once sent are not required to be brought back, thus no return transportation cost is involved. On an average, a plastic crate cost around Rs. 60-75 depending upon the quantity purchased, current market prices, etc.

If the value addition process involves cleaning sorting grading & waxing then the fruit is collected in plastic crates at the farm level and taken to the waxing unit in pick-up vehicles. At the waxing unit, fruit is passed through mechanized cleaning unit then through the waxing unit.

After proper waxing of the fruit, they are passed through a laser-guided grader which grades the produce as per their size. Then they move through a conveyer belt and are sorted as per grades. Majorly the fruit is graded in four grades i.e. Grade-A, Grade-B, Grade-C, and Grade-D. The fruits are collected in different crates and they are brought at the packing area. At the packing area, they are packed in plastic crates as per the grades with newspaper or cardboard sheet in between layers of fruit and loaded in trucks for transportation.

Fruits are transported majorly through roads using trucks. Even export to countries like Bangladesh, Nepal etc. are carried through trucks. Few years back, traders had exported fruits to middle-eastern countries through ships but the channel was not profitable enough to continue export of raw fruits to those countries.

Storage Infrastructure

Mandarin harvesting in the state happens in two seasons. The first one is 'Ambiya Bahar', which lasts from Mid-September to Mid-January and second one is 'Mrug Bahar' which ranges from Mid-February to April. At the production areas, Mandarin is majorly traded in raw form. The fruit is harvested early morning and is sorted, graded, waxed and packaged in plastic crates and loaded in trucks till late evening for dispatch.

There are no major cold storages infrastructure in the state for Mandarin. As per field discussion during survey of FPOs, traders etc., there is no requirement of establishing a cold store for Mandarin near the production areas in the state. Fruits are generally kept in pack-houses for a day for undergoing cleaning, sorting, grading etc. & then transported to the distant markets.

Secondary & Tertiary Processing

As per the discussion with the FPOs and traders, there are around 80-85 small, medium & large processing units in the state for Mandarin. There are two major processing units located in Nagpur & Nanded district which are the major procurers of raw fruit from the farmers. They majorly procure directly from the FPOs / farmers and the produce is transported from the production clusters to the processing units through trucks. Around 5% of the produce is sold to the processing sector from the state.

Other Infrastructure

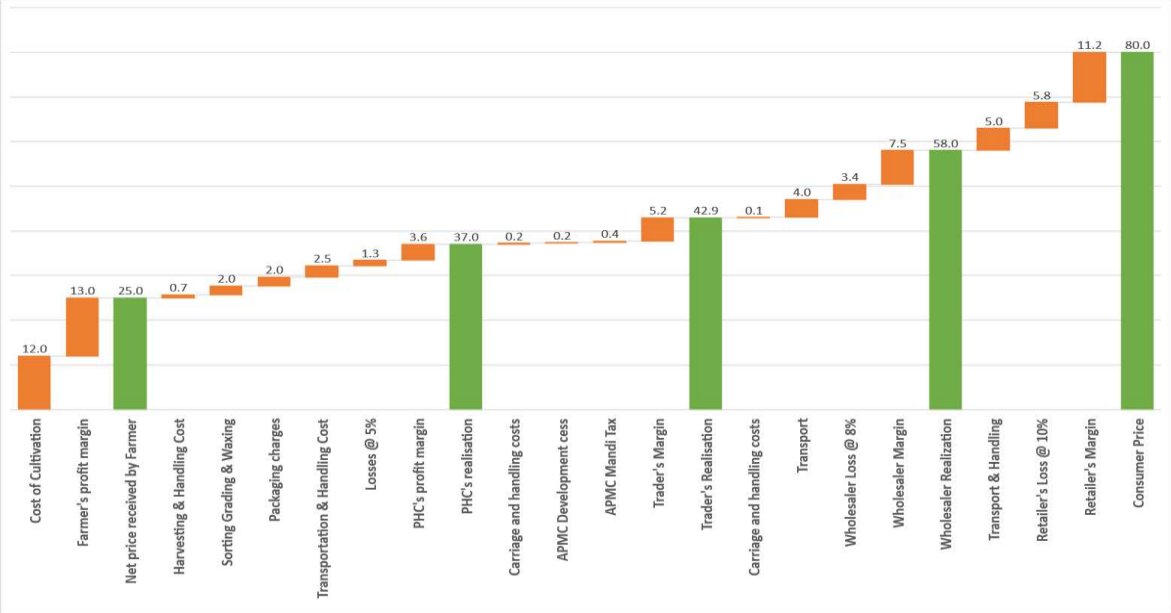
Maharashtra State Agricultural Marketing Board (MSAMB) has established two orange export facilities centres in the state. One of them is located at Warud, Amravati and other one at Wardha. The infrastructure has been built by MSAMB on a private land and given on lease to the private player to operate. The export facility center has precooling facility of 5 MT, cold storage of 25 MT, Sorting & Grading line of 2MT/Hr, Weigh bridge, D.G. sets, etc.

2.4.2.5 Price build-up across the Value Chain-

For analysis of Price build-up across the value chain, we have taken the following points into consideration-

- The marketing channel follows the channel-1, i.e. farmers to Pre-harvest contractors to distant market traders to Retailers to consumers
- The cost of production for the farmer is only the variable cost for maintenance of one acre orchard per year. It does not include the cost for the first five years of Mandarin orchard where there are no returns
- The distant consumption market considered for this case is Azadpur APMC Mandi, in New Delhi
- Cost of capital and opportunity cost for the all the intermediaries has not been considered in cost build up analysis.

The price build-up analysis along the value chain is as shown below-



Cost of Production- The steps involved in production of crop include land preparation, sowing of planting material, application of nutrition in the form of manure, fertilizers etc., pruning & thinning of the plant, and watering. Although farmers in the state are highly dependent on rainfall to meet their water requirements, some of the farmers use drip irrigation through groundwater, well etc. to meet their water requirements. The overall cost of production for a kg of Mandarin comes to around Rs. 14.03.

Cost of Harvesting- The Mandarin tree start bearing fruits from the 6th year from the year of planting. The fruits are harvested by plucking them from the trees. The farmers generally themselves pluck the fruit or employ labor to harvest and collect the fruits at the farm-gate. In the current marketing channel, it is the responsibility of the PHC to harvest the fruit. The average labor cost on harvesting was reported to be Rs. 5000/- per acre.

Post-Harvest Management: The fruit requires sorting, grading, cleaning, waxing & packaging to maintain its shelf life and to transport it to destination markets. It costs around Rs. 2.5-3 per kg for sorting grading & waxing of Mandarin. The fruits are packaged in plastic crates with cardboard sheets/ newspapers in between and tied with plastic ropes. It cost around Rs. 80-90 per plastic crate for packaging. Earlier wooden boxes were used for packaging of Mandarin but lately the cost of production of plastic crates have reduced and many plastic crates manufacturing industries have come up in the production clusters in the state leading to shift from wooden boxes to plastic crates for packaging. The average weight per crate is 24 kg. The average cost for sorting, grading & packing comes around Rs. 6 per kg.

Transportation: The transportation of the Mandarin happens mostly through trucks. PHC harvests the fruit from the orchards, brings it to the pack-house then transports it to the destination markets. It cost around Rs. 40,000 to transport a truck of Mandarin with 700 crates to Delhi. Loading & handling of truck costs around 7-8 person-days of work force. It costs around Rs. 2.55 per kg for transportation.

Losses: The variety of Mandarin grown in the state has a thinner outer skin which leads to fruit damage even through slightest rough handling of fruits. The overall

wastages in the value chain (from farmer to consumer) of Mandarin comes at around 20-22% of the total production. Earlier, when wooden crates were predominantly used, wastages were higher at the PHC level due to uneven & rough surface of wooden boxes. Since plastic crates are being used for harvesting & packaging, losses have come down at the PHC level to around 5%.

2.4.2.6 Identified Gaps & Constraints in Value Chain-

Production Related

The average productivity of Mandarin in the state is lower than the overall India productivity. The state productivity lags far behind the highest productivity state. The issue of low productivity, besides, quality may be attributed to quality of planting material, low quality seed variety, rainfed cultivation, changing weather conditions as long summers, long dry spell, temperature variation etc., resulting in low spur formation, poor coloration and delayed maturity. There is immense scope for improving productivity of Mandarin in the State through technology infusion, introduction of global best practices and various market led interventions.

There is a requirement of developing better varieties in the Nagpuri Santra variety as there has been very little varietal development and farmers have been cultivating the same variety for decades. The current variety has very low shelf life as compared to varieties from other countries leading to non-feasibility for exporting to most of the countries, low juice content thus lesser demand in the processing industry, thinner outer skin of the fruit which makes it susceptible to damages,

Orange varieties from Brazil, Australia (Valencia, Navel), Egypt (Baladi) and other countries are performing better in the export market as compared to Mandarin Oranges due to high juice content, few seeds (Valencia) or seedless (Navel), high brix level & juice content (Baladi). These are in huge demand in the European & US markets for processing, table fruit & other uses.

Post-Harvest Management

There are many private pack-houses in the state which are operated by traders who are also engaged in export of Mandarin. Very few FPCs/ Farmers have their own waxing & packaging units. Most of the FPCs have been formed in last five years and the initial grant or support that some of the FPCs received through government has been exhausted for building minimal infrastructure and running operations.

Most of the FPcs/ farmers carry out grading and packing activities at respective farm level. This leads to high resource cost, improper grading due to shortage of skilled workforce, wastages and time loss. FPCs are generally involved in manual sorting, grading & packaging thus limiting their market access as there lot of demand for value added Mandarins through waxing. Some of the FPCs depend on private traders to use their waxing unit on rental basis which limits their options for supplying large quantities of produce to the distant markets.

There is an Orange Export Facility centre developed by MSAMB in Warud. The facility has been provided on a lease to a private operator but it is not fully functional even after two years of completion. The facility lacks a proper cleaning & waxing unit machinery for Mandarins as the existing one incurs high amount of

damages on the fruit while cleaning. This has resulted in under-utilization of the overall infrastructure which includes pack-houses, cold rooms & storages.

Over the years, there have been very less research & development in varietal improvement for Mandarins. The shelf life of existing variety is low compared to other varieties available in the market thus it requires for the fruit to undergo cleaning, waxing, sorting grading & packaging on the same day of harvesting. Thus, this limits the overall capacities of value added fruit from the state.

FPCs/ farmers from the major production districts sell their produce to the processing units located in the nearby district of Nanded. There is a lot of scope for value addition in Mandarin as many value added products are in huge demands in the market. FPCs/ farmers have to arrange for their own transport & logistics for sending the fruit to the processing centers, leading to high transportation cost and lowered profits for farmers. Many private traders/ FPOs are interested in setting up of processing units in the production district but they require adequate government support in terms of credit. FPCs/ farmers find it very difficult to avail credit for infrastructure development from banks & other financial institutions and interest rates are very high if burrowing is done through informal lending.

Road Connectivity & Transport

Nearly 100% of the transport of Mandarins from the state till the end consumer point happens through roadways. It limits the destinations to which the fruit may be supplied till its shelf life is maintained. One of the major reasons for the untapped export market is lack of development of proper transportation channel for shipping of Mandarin in the required amount of time.

Marketing Related

Majority of farmers who market the produce themselves, have limited bargaining power due to lack of market price information/ low quantities of production. Moreover, the information flow from traders to the farmers are generally not transparent. Except few progressive and large farmers, others are yet to develop profound direct linkages and negotiation skills with trader/ wholesaler in distant markets. Majority farmers lack market information about price and demand in distant markets resulting in lower value realization for them. Even though some progressive ones have been able to sell the produce in distant market, they reportedly ended up paying higher commission rates and other charges.

Individual farmers always find it difficult to trade in the distant market as they do not have bulk of supplies as demanded by the markets, lack awareness relating to grade specific pricing, lack of infrastructure for value addition, difficulty in arranging for labour & transportation for harvesting, loading & selling of produce. All these factors leads to the local trader taking advantage of the situation & offering lower prices to the farmers.

Most of the produce from the state is traded through pre-harvest contracts between traders & farmers. Around 80-85% of the produce is traded through this medium. This arrangement results in very low price realization for the farmers as they have very little information on the prices that are being offered for their produce in the distant mandis. This arrangement involves a high amount of estimation work from the trader and in most of the cases it is the farmer who ends up on the losing side. Even with such high risks for the farmers in going for this arrangement, they prefer to sell their produce through pre-harvest contracts.

The reason being the limited capacities of farmers to find markets for their produce, negotiation with distant market traders, price realization etc.

With the growth of e-commerce platforms and organized retail like Big-Basket, Grofers, Reliance Fresh etc., there is an increasing demand from these players for fresh Mandarins. But, individual farmers/ FPOs have constraints supplying to these players as they require high quality waxed Mandarins and very few FPOs have waxing units of required capacities to supply to them.

Some of the FPOs are planning to develop processing unit for Juice making but have little information regarding retailing, branding, marketing & selling of Orange Juice. They need handholding & capacity building support for developing their retail chain, branding & marketing activities for Orange Juice.

There is tremendous rise in sale of fruits & other products through e-commerce and organized retail chains but there were very few linkages of these organized retail players with the farmers from the state.

Access to Finance

Availing credit from banks or other financial institutions for operational activities, development of post-harvest infrastructure, building processing facilities etc. is very difficult for farmers/ FPOs. The overall perception of FPOs/ farmers in terms of availing loans and repayment is not very healthy in the view of banks and they find it undesirable to extend loan facilities to FPOs/ farmers. Thus, FPOs/ farmers have to look for in-formal sector or NBFCs for availing credit facilities which have very high interest rates.

2.5 Value Chain Analysis - Custard Apple

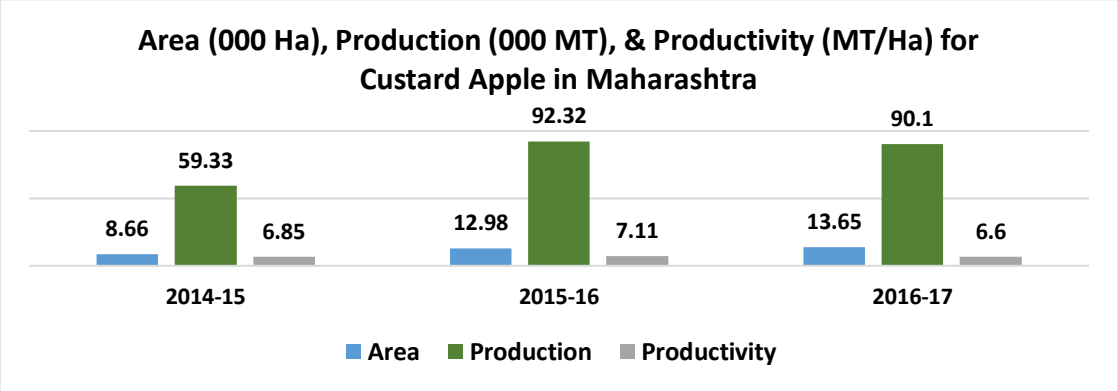
2.5.1 Introduction

Custard Apple is one of the important fruit grown in Maharashtra. Very few states in the country have Custard Apple production. Total area under Custard Apple production was at 0.44 lakh Ha in 2016-17 while the total production stood at 3.67 lakh MT[22]. The overall production of Custard Apple and its area under production have been on a constant rise for last few years. The table below highlights the status of Custard Apple production in the country.

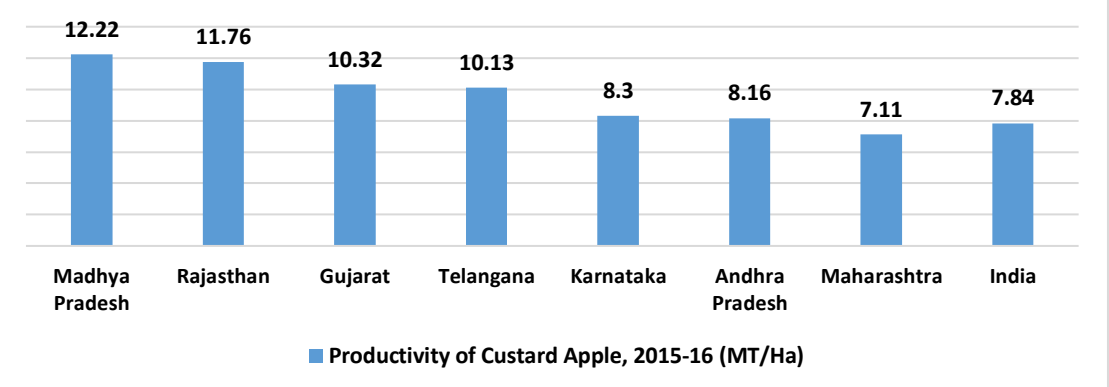
Crop	2014-15		2015-16		2016-17	
	Area	Production	Area	Production	Area	Production
Custard Apple	30	228	37	298	44	367

Source: Horticulture Statistics at a Glance, 2017. Area in 000 Ha, Production in 000 MT

State wise Maharashtra ranks 1st in state wise production of Custard Apple in the country. The state of Gujarat, Madhya Pradesh & Chhattisgarh are other major states in terms of production. It is one of the major producers of Custard Apple with total production at 0.90 lakh MT and 0.13 lakh Ha of total area under production in 2016-17[19]. The following graph highlights the year wise production & productivity details[19].



But if we compare the productivity of Maharashtra with other states, it lacks behind Madhya Pradesh, Gujarat, Telangana, Karnataka & Andhra Pradesh. The graph below highlights the state wise productivity figures for Custard Apple[19].



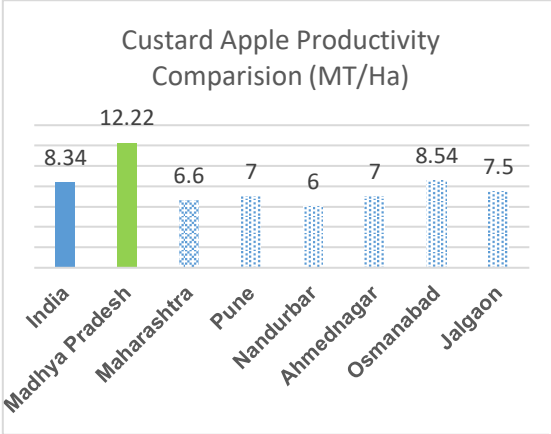
[22] Horticulture Statistics at a Glance, 2017

In Maharashtra, Pune is the leading district, both in terms of area under cultivation and production[23]. The district alone accounts for about 35% of the total production of the state. Apart from that, the other major Custard Apple producing districts are Nandurbar, Ahmednagar, Osmanabad and Jalgaon. These districts together account for around 81% of the total production in the state. The major district wise area under production, total production (including percentage of state's production) and productivity are given in the table. The map below shows the major Custard Apple producing districts in the state. The districts shown in dark green are the districts having more than 10% of the total production of Custard Apple in the state which comprises of Pune and Nandurbar. These district together form the most important production cluster in the state.

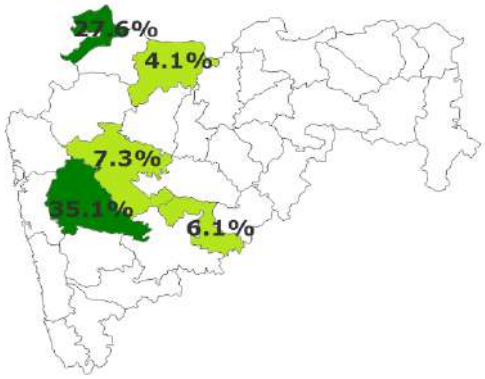
District	Area (000 Ha)	% of Total State Production	Total Production (000 MT)	Productivity (MT / Ha)
Pune	4.52	35.1	31.6	7.0
Nandurbar	4.15	27.6	24.9	6.0
Ahmednagar	0.95	7.3	6.65	7.0
Osmanabad	0.64	6.1	5.51	8.54
Jalgaon	0.5	4.1	3.76	7.50

Source: Commissionerate of Agriculture, Government of Maharashtra, 2016-17

As seen from the above table, Pune district accounts for about 35.1% of the total production from the state. The major production blocks in Pune are Purandhar, Shirur, etc. The varieties that is grown in the state are Phule Purandhar, Balanagar, NMK 1.



A comparison of productivity of the major production clusters (districts) of Custard Apple with average productivity of India & the state with highest productivity in the country (Madhya Pradesh) is shown in the graph alongside. It is evident from the graph, that the average productivity of Custard Apple in Maharashtra (6.60 MT/Ha) is lower than the average productivity of India (8.34 MT/Ha) and around half the productivity of Madhya Pradesh (12.22 MT/Ha). In terms of the productivity of Custard Apple in the identified production districts, Osmanabad and Jalgaon are the leaders having a productivity of about 8.54 MT/Ha and about 7.5 MT/Ha respectively, which are higher than the state average of about 6.60 MT/Ha. Amongst the major



[23] Commissionerate of Agriculture, Maharashtra State, 2016-17

producing districts, Nandurbar has the lowest productivity of about 6 MT/Ha which is less than half the average productivity of Madhya Pradesh.

2.5.1.1 Major Varieties

Major variety of Custard Apple that is grown in the state is 'Phule Purandhar'. It has been cultivated traditionally for generations and the knowhow about the variety has been passed on through generations among the farming community.

The other major varieties grown in the state are Balanagar, NMK 1. NMK 1 has been recently developed by Solapur-based innovative farmer and chairman of the Pune-based Custard Apple Producers Training & Research Board, Navanath Malhari Kaspate. This variety is famous for its large fruit size which helps in promoting it as a table fruit[24].

Phule Purandhar variety has unique highly sweet creamy flesh, which makes it highly desirable for pulping in the processing industry. Being a hardy fruit tree, Custard Apple thrives naturally in rocky terrain with shallow, gravelly, well-drained soils. A cross-pollinated crop, it has wide variations in forms and sizes of fruit as well as the color of the pulp. Phule Purandhar variety has light green colour fruit, which is the most demanded variety in the markets.

2.5.1.2 Seasonality

There is only season for the crop in the state. It starts from September to December / early January. The fruit is harvested during this period and the peak harvesting time during this season is during the months of November & December.

2.5.2 Identification of Farmer Groups

The study focusses on identifying the major farmer groups/ FPOs who are involved in the cultivation, trading & processing of Custard Apple, assessing their capacities, assessment of the current state of infrastructure for Custard Apple in the state including Pack-houses, Sorting, grading units, Processing centers, export facility centers, cold storages etc.

Deloitte conducted a comprehensive secondary research for identification of farmer groups through interacting with officials from Small Farmers Agri Business Consortium (SFAC), NABARD regional offices & Maharashtra State Agricultural Marketing Board (MSAMB) and studying the list of FPOs promoted by various agencies & projects like SFAC, NABARD, MSAMB (MACP and JFPR) in Maharashtra and specifically working in Custard Apple cultivation. There is only one farmer group registered as cooperative society operating in the cultivation of Custard Apple in the state.

Most of the Custard Apple farmers are individual farmers who have been involved in the cultivation of Custard Apple for decades. They mostly sell their produce in the local Mandis, local traders, commission agents etc. Most of the local traders are lead farmers who have themselves started aggregating produce from other farmers over the years and entered into trading of Custard Apple to send it to distant markets.

The detailed description of the FPO and selected lead farmers with their capacities, members etc. is mentioned in the table below.

[24] https://yourstory.com/2018/04/custard-apple-farmers-houses-maharashtra/

Parameter	Jay Malhar Phal Prakriya Cooperative Society	Lead farmer – Sampath Khedekar	Lead farmer – Masku Khedekar
Year of establishment	2003	-	-
Commencement of commercial operation	2005	1998	1993
No. of farmer members	600 members	Lead Farmer-cum-trader with procurement from 100-150 farmers	Lead farmer-cum-trader with procurement from 300-400 farmers
No. of women members	25 women members	-	-
Contributed share capital	Rs. 30,00,000	-	-
Existing area under production	1350 Acre	1 acres	2 acres
Existing volume of production	10,000 MT	4.5 MT	12 MT
Average Annual turnover of the FPO	Rs. 1 crore	-	-
Production & Marketing related activities by the FPO	The members of the cooperative society mostly sell their produce individually through local mandi/ trader. The FPO has pulping unit of 5 MT/ day capacity but that is not sufficient for processing the produce of its members.	The lead farmer is engaged in operating a pack-house with capacity of 3 MT/Day. He majorly supplies the produce to Delhi & Kolkata Mandi after packaging through air transport.	The lead farmer is engaged in operating a Pack-house with capacity of 8 MT/ Day and also operates a processing unit with current capacity of 0.25 MT/ Day. He majorly sells his produce to Delhi, Kolkata, Mandi through air transport.
Selection criteria	They are a cooperative society of 600 members with about 1350 acres of area under Custard Apple production. They also have a pack-house & pulping unit with a capacity of 5 MT/day. They were interested in investing for expansion of pulping unit if they get financial support from any external agency/ government department. They are only major FPO operating in the Saswad region which is important part of the Custard Apple growing cluster.	The lead farmer is one of the oldest operating traders in the cluster. He engages in packaging & trading of Custard Apple & Mangoes.	The lead farmer is engaged in operation of pack-house for around 10-15 years and has recently started processing of Custard Apple pulp. He wants to expand his pulping capacity from 0.25 MT/day to 1 MT/day and is ready to invest for expansion with financial support from banks/ government agencies.

2.5.2.1 Field Visits & Outcomes-

The districts of Pune, Nandurbar & Ahmednagar contributes to about 65% of the total production from the state for Custard Apple. The regions in the district forms the major production clusters for Custard Apple production. The major Custard Apple producing regions are Purandhar, Shirur, etc. Custard Apple is grown in large quantities in Nandurbar district which accounts for about 27.1% of total state production but Custard Apple production in Nandurbar happens mostly in forests areas.

Field visits were conducted to major production areas in the state to study the capacities of FPOs/ lead farmers, their infrastructure, existing market linkages, overall assessment of the post-harvest infrastructure scenario in the region and readiness of FPOs to co-invest market infrastructure.

Interactions were done with farmer members from FPOs, lead farmers, private traders cum pack-houses owners, sorting grading unit owners & processing facility center owners belonging to major production regions. Custard Apple is the most important crop cultivated in the region. Only one variety of crop is cultivated i.e. Phule Purandhar. There are other crops that are cultivated in the region but Custard Apple forms the major part.

The overall area under Custard Apple cultivation in the state stood at 13.65 Ha and overall production stood at 90.1 MT. The production of Custard Apple in the state is dependent on rainfall for meeting its water requirements. Farmers do engage in irrigation facilities majorly through ground water sources such as wells, bore-wells etc. A few of the observations from the field discussions are –

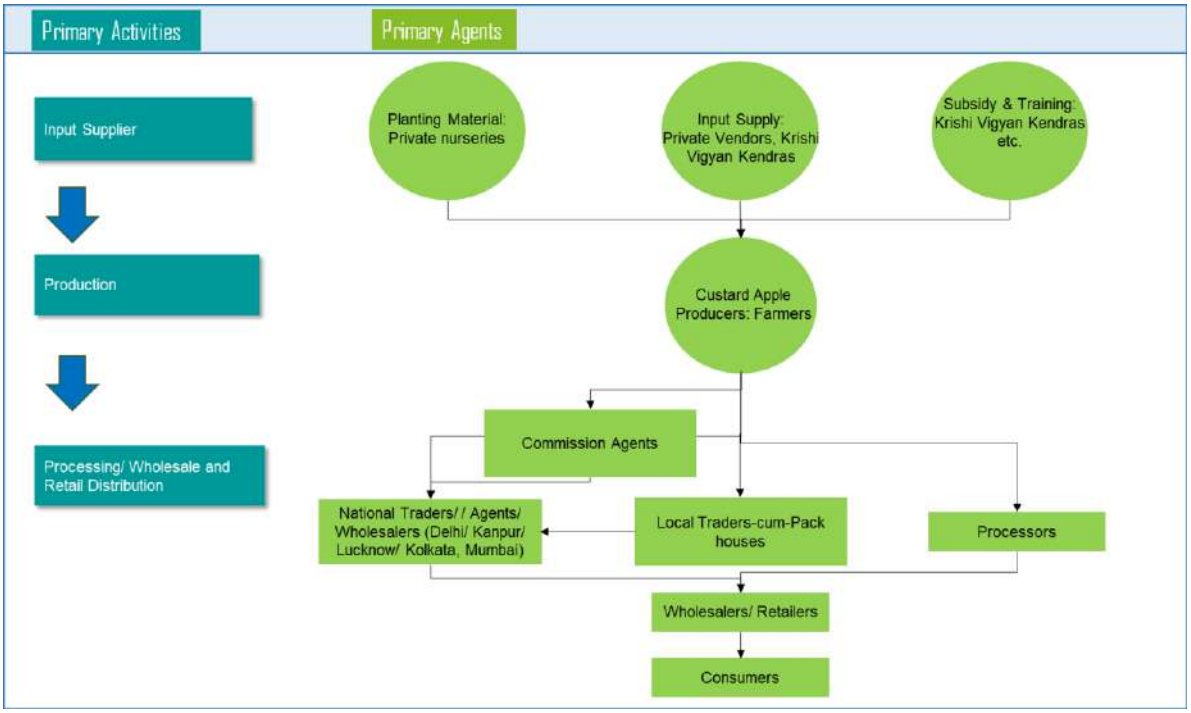
- There are no major farmer producer groups in Custard Apple cultivation other than one cooperative society.
- Only one variety of Custard Apple is grown in the major production region. Major improvements in varietal development is needed to increase the shelf life of the fruit.
- There are many processing units in the state but they engage majorly in manual process of pulping thus requiring huge amount of labour to run the processing unit.
- Adequate research & machinery technology identification is required for persuading the processing units to shift from manual to automatic process for pulp extraction.
- Market infrastructure in the major production region requires a lot of make-over through investment in developing proper market yard.
- Currently, trading in the major production cluster happens in the local market in open thus leading to high losses due to rains, un-hygienic market yard etc. The market yard land is provided to the Custard Apple farmers and traders by the local municipality on a temporary basis for trading and municipality charges a minimal fee.

2.5.3 Value Chain Analysis

2.5.3.1 Structural Analysis

In general, the Custard Apple value chain in the state begins with farmers, then leading to traders, processors, commission agent & distant market wholesalers/ retailers. From farmers it flows to traders (traders procure directly from farmers and sell it to distant markets) or processors (processors procure Custard Apple in fresh form directly from farmers) or commission agent (commission agent collect Custard Apple from farmers and send it to distant market traders). Local traders

then sell the produce in distant markets to further traders or wholesalers/ retailers. Processors buy directly from farmers and then extract pulp for further use in the ice cream/ juicing unit.



2.5.3.2 Functional Analysis

The roles played by various actors in the value chain is as follows:

***Farmers/ Growers**:* The Custard Apples growers undertake cultivation activities in orchards throughout the year. The major operations carried out by the farmers includes land preparation, furrowing, sourcing and planting of planting material (for establishment of new orchards/ replacement of senile ones), nutrient application in form of manure/fertilizers, weeding, pruning, application of insect pest control measures, harvesting and post-harvest management including plucking of fruit & trading it in mandis or supplying directly to traders/ commission agents/ processors.

Farmer Groups/ FPOs: There is only one FPO operating in the state for cultivation of Custard Apple. It is a cooperative society located in Saswad region which is the main production cluster in the state. They are currently involved in sorting, grading, packaging, trading, and processing for extraction of pulp. There are many farmers-cum-traders who are currently into farming but are also involved in aggregating produce from other local farmers & trading it with traders from distant markets.

Traders: Most of farmers located in the state engage in harvesting the fruits themselves. The harvesting of the fruit is done in the morning and then it is sold to the traders as per the prevailing daily market rates. These traders are either fellow farmers or purely traders who engage in aggregation of fruits from other farmers and sell it to distant markets. Trader receives the fruit from the farmer in plastic crates but sells it after sorting, grading & packaging it in corrugated boxes. The payment to the farmers are done within a week time depending upon the mutual agreement between the trader & farmer.

Commission Agent: Commission agents are basically aggregators who collect produce directly from farmers on behalf of traders from distant markets. Farmers mostly sort, grade & pack the produce in corrugated boxes by themselves and bring it to the transport vehicle of the commission agent for sending it to the distant trader. The volume of produce traded per farmer is low and farmer generally performs the sorting, grading & packaging of Custard Apple at his home or some common community place.

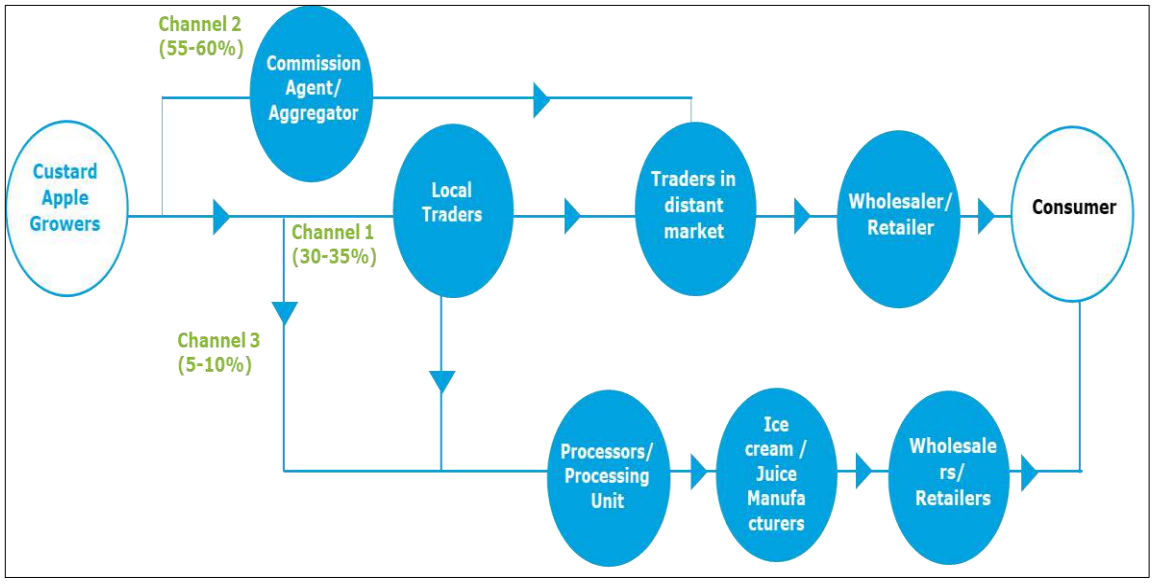
Processors: Processors are mostly involved in procuring the fruit directly from the farmers. Currently there many operational processing unit for Custard Apple in the state. All of the units are engaged in extraction of pulp from the fruit. The extracted pulp is further sold to Ice Cream manufacturers, Juice making companies & other wholesalers. These processing units prefer procurement of fruit of the lowest grade (Grade D or lower). But most of the farmers supplying to the processors do not perform sorting, grading of the collected produce so the processors have to buy a mix of grades of fruit through minimal visual inspection of fruit size from the crates.

Table: Functional Analysis of Value Chain

Activity	Agent	Output
Production	Farmers	Fresh Custard Apple
Post-Harvest Management	FPOs/ Farmers Traders	Harvested Custard Apple Primary processed Custard Apple (sorted, graded and Corrugated packing)
Transportation	Commission Agent Transport service Providers	Logistic assistance
Secondary Processing	Processors	Custard Apple Pulp
Wholesale & Retail distribution	Wholesalers Retailers	Sorted and Graded Fresh Custard Apple

2.5.3.3 Commodity Flow Analysis

Based on the stakeholder interaction, three different marketing channels have been identified to be operating in the state. The selection of marketing channel by the farmer is dependent on factors as scale of production and ability and accessibility to market information by the farmers and prices offered.



Channel 1.

Farmer → Local Trader → Trader in distant markets → wholesaler/ Retailer → Consumers

Channel 2.

Farmer → Commission agent → Trader in distant market → Wholesaler/ Retailer → Consumers

Channel 3.

Farmers → Processors/ Pulping units → Ice cream/ Juice Manufacturers → Retailer/ Wholesaler → Consumers

Channel 1: This channel is one of the most prevalent channel for Custard Apple trading. Farmer harvests the fruit from the orchards in the morning and collects it in plastic crates. Farmer does not perform sorting, grading at the farm level. He just collects the fruit in different crates based on approximate sizes. He carries the fruit in crates to the mandi or directly to the trader. Here, the farmer has lot of flexibility of either taking the fruit to the mandi or trader or commission agent. The farmer decides the selling channel as per the prices offered on that specific day and mutual agreement/ relation between the trading parties. There are instances where the farmer first enquires about the price from the trader then decides whether to harvest the fruit on that day or the next day. Around 30-35% of the produce is traded in this form from the region. Trader performs sorting, grading & packaging of the fruit in corrugated boxes which are locally called 'Jota', meaning pair of two boxes with each box weighing around 6-7 kg. Sorting & grading is performed based on the size of the fruit. Bug affected, hardened fruit or damaged pieces are discarded at the trader level. Mostly A, B, C grade fruit is traded through this medium. Grade D fruit are also traded in some quantities but they fetch low prices for the farmers. The fruit is then transported to the nearby Lohegaon airport by pick-up vehicles/ trucks and shipped to distant markets of Delhi, Lucknow, Kolkata etc. through flight. As the shelf life of the fruit is around 5-8 days after harvesting, so the fruit cannot be transported through roads to these markets.

Channel 2: This channel is the most widely used channel in the state for trading of Custard Apple. Farmers harvest their produce in the morning and collect them in plastic crates for sorting & grading. The crates are generally carried by the farmers to their houses and sorting grading activity is performed and fruits are packaged in corrugated boxes as per their sizes. These packed boxes are supplied to the commission agent who is present in the village. The commission agent carries the produce to the trader in distant markets of Mumbai & Pune through trucks/ pick-up vehicles. All the payment related transactions, inspection of the fruit & other formalities are done between the farmer & the trader. The commission agent just performs the work of collecting the produce & transporting it to the trader. Payments are generally made with 2-7 days after the fruit is supplied. The farmers have been dealing with the traders for many years so a mutual trust has been developed them & there are hardly any issues relating to payment to the farmers. Mostly A, B, C grade are supplied to the trader and the quantities are decided as per the market demand information supplied by the trader for that specific day. Only roadways are used as a means of transport for the produce.

Channel 3: In this channel, Processors/ pulping units directly buy from farmers for further value addition to the produce. There are currently around 40-45

processing unit in the state which includes small, medium & large players. These processors mostly directly buy from the farmers at the local mandi. Farmers bring their produce in plastic crates to the mandi & as per the prevailing price for that day, processors buy the required produce from the farmers. The produce brought by the farmers in plastic crates is not sorted, graded so the processors conduct a visual inspection of the fruits in the crates & mutually agree to a price depending upon the grades of fruit in the crates. Around 5-10% of the produce from the state is bought by the processors.

Individual farmers also sell their produce directly to the local consumers and local traders/ wholesalers in the nearby areas of production clusters. This channel accounts for around 2-4% of the total production from the state.

2.5.3.4 Status of Post-Harvest Management Practices in the State

To realize potential value of the harvest, it is important to sustain the quality of the fruit until they are delivered to the consumer. Proper postharvest management and handling of produce is thus important to prolong the duration for which the fruits remain fresh and marketable.

Primary processing

Primary processing of Custard Apple includes sorting, grading, & packaging. There are many private traders cum pack-houses operating in the state. They form the major procurement players to buy produce from the farmers and undergo value addition through sorting, grading, & packaging. Some of the farmers also perform sorting grading & packaging at their houses for their own produce.

Custard Apple are generally harvested in the morning and collected at the farm level in plastic crates. The fruit does not require any cleaning or waxing and needs to be handled with delicate care as its skin is easily damaged by rough handling. The farmer collects the produce in the crates and sells it to the trader. Only the produce is sold to the trader and the empty plastic crate is used again by the farmer thus reducing the recurring expenditure on farmers. Traders sort and grade the produce based on the size of the fruit. Bug infected, damaged or hardened fruit are discarded. The produce is then graded in 4 grades- A, B, C, and D. Grade A, B, and C are majorly traded as fresh fruit and Grade-D are procured by the processors. However, as farmers do not sort & grade the produce themselves so all of the produce is collected by the trader.

After proper grading, trader packages the fruit in corrugated boxes with just one layer of fruit. Each box has about 6/8/10 fruit based on the size of the fruit. The boxes are paired together and called a 'Jota'. A Jota consist of two corrugated boxes tied by plastic ropes. These Jotas are further packed in bigger corrugated box consisting of 4, 6 or 8 Jotas based on the size of packaging required in the destination market.

The packaged fruits are then transported through trucks or pick-up vehicles to the Lohegaon Airport in Pune for transporting it to the distant markets of Delhi, Kolkata etc. For selling the fruits to the markets in Mumbai, Nashik & other nearby cities, it is transported through trucks.

Storage Infrastructure

Custard Apple harvesting in the state happens in just one season. There are no cold storage infrastructure in the state for Custard Apple. All the fruits are traded fresh and dispatched from the production clusters on the same day of harvesting. As per feedback received during discussions with farmers, traders etc., there is

no requirement of establishing a cold store for Custard Apple at the production side as the quality of the fruit deteriorates when kept in cold storages. Fruits are generally kept in pack-houses for few hours for undergoing sorting, grading and packaging etc.

However, there are cold infrastructure owned by private players for storing Custard Apple pulp. The cold storage infrastructure players provide rental deep freezers services to store hardened pulp for processors. They charge around Rs. 1.5-2/ kg/ month for storing the pulp. They also provide blast freezing services to harden the pulp on rental basis at around Rs. 8/kg of pulp. The stored pulp from these cold stores are then sold in the markets as per demand. Most of the processors hold the pulp during the peak season and sell it during the off-season as it fetches higher prices.

Secondary & Tertiary Processing

There are around 40-45 small, medium & large processing/ pulping units in the state. These units procure Custard Apple directly from the farmers either at the mandi or through direct contact with the farmers. The pulping industry in the state is highly labour intensive as they follow the manual process of pulping.

The overall process of pulping involves manual sorting of fruit and separating the damaged, bug infected produce as it might affect the whole pulp. The fruits are then kept for around 2-3 days so that they reach the last stage of ripening before it starts decaying. Then from the highly ripened fruit, pulp with seeds is removed manually using spoons. Then the pulp is manually separated from the seeds and collected in a plastic bucket/ container. The pulp is then spread over a work table to remove any impurities, external agents etc. The pulp is then manually packed in retail packets and hardened at very low temperatures through blast freezing process.

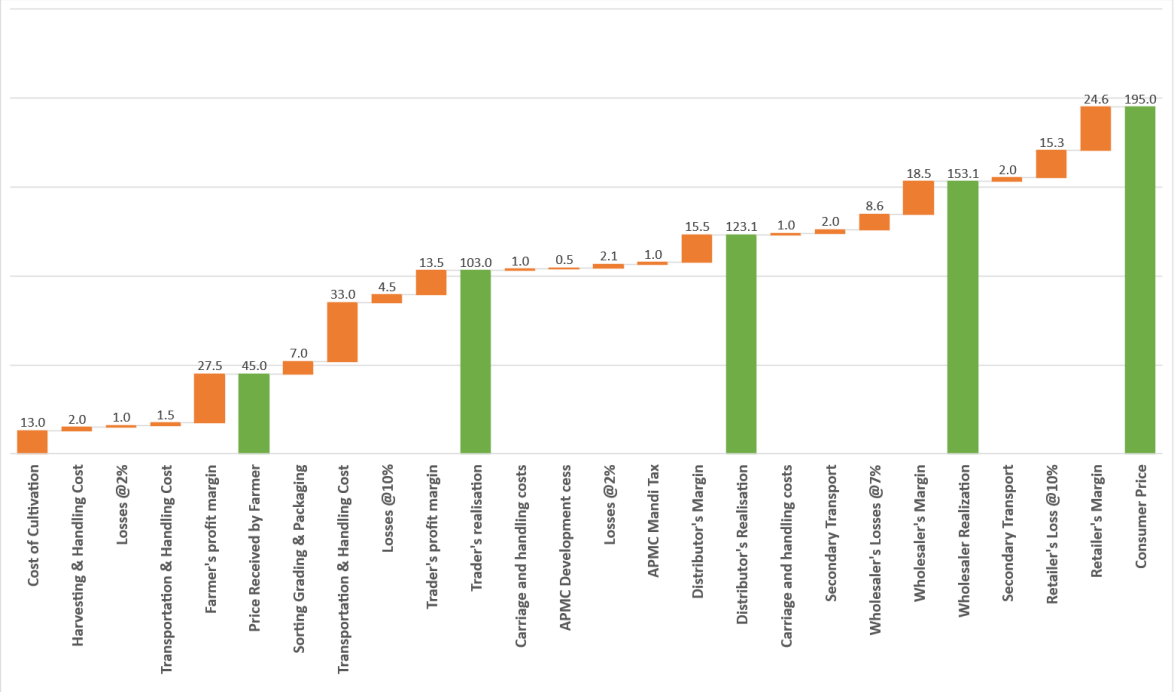
The hardened pulp is then kept in deep freezers, maintaining sub-zero temperatures to maintain the quality of pulp. Most of the large processors hold the pulp to sell it in off season as the prices offered during the off season are around 40-50% higher than the prices offered during the season. Around 5-10% of the produce is channeled through the processing sector from the state.

2.5.3.5 Price build-up across the value chain

For analysis of Price build-up across the value chain, we have taken the following points into consideration-

- The marketing channel follows the channel-1, i.e. farmers to local traders to distant market traders to wholesalers/ Retailers to consumers.
- The cost of production for the farmer is only the variable cost for maintenance of one acre orchard per year. It does not include the cost for the first two years of Custard Apple orchard where there are no returns.
- The distant consumption market considered for this case is Azadpur APMC Mandi, in New Delhi
- Cost of capital and opportunity cost for the all the intermediaries has not been considered in cost build up analysis.

The price build-up analysis along the value chain is as shown below.



Production Costing

Land Preparation: This generally involves operations such as bed preparation, digging of pits and filling Cow Dung Manure. As per the discussions with farmers, it was reported that on an average, the cumulative cost for land preparation is around Rs 25,000 per acre.

Planting Material and Nutrition: Generally it was reported that, 250-300 plants are planted in one acre. The saplings are either sourced from Krishi Vigyan Kendras, and accredited / private nurseries. The cost of the sapling varies from Rs. 20- 25, depending on the quality of the planting material. For the sake of analysis, we have considered the cost of Rs. 25 per plant. It takes around 10 man-days for one acre of plantation.

The farmers generally prefer to use Farm Yard Manure (FYM) as a basal dose added to the soil. Around 4-5 tonnes of FYM is required per acre. One tonne of FYM costs Rs 7,000. In addition, other pesticides are supplied 5-6 times a year. The cost on pesticides is Rs. 7000 per acre in a season. The overall nutrition need comes at around Rs. 47,000 per acre. In an acre average production comes around 8250 kg.

Pruning and Thinning: Pruning and Thinning is done to maintain the shape of the tree, to spur growth of new leaves and to remove dead and damaged twigs and branches. Pruning and Thinning is done 2-3 times in a year and just before the start of the harvesting season. The average expense for pruning is Rs 15,000/- per acre.

Weeding of unwanted plants is usually carried out twice in a year. The cost incurred on one weeding was reported to be around Rs. 2500/- per acre. Thus, the total cost on weeding works out as Rs. 5000/- per acre.

Irrigation: Although the region is highly dependent on rainfall to meet its water requirement, Drip Irrigation is the method of choice for irrigating the plants in the orchard. Water for drip irrigation is supplied through wells, bores (if available in / near the farm) or ponds. The cost of irrigation was reported as Rs 25,000/- per acre per year.

The overall cost of production for an acre comes at around Rs. 92,000 per season and Rs. 11.5 per kg.

Harvesting: The Custard Apple tree start bearing fruits from the 3rd year from the year of planting. The fruits are harvested by plucking them from the trees. The farmers generally themselves pluck the fruit or employ labor to harvest and collect the fruits at the farm-gate. In the current marketing channel, it is the responsibility of the farmers to harvest the fruit. The average labor cost on harvesting was reported to be Rs. 16,000/- per acre.

Post-Harvest Management: The fruit requires sorting, grading & packaging to maintain its shelf life and to transport it to destination markets. It costs around Rs. 2.5-3 per kg for sorting grading & packaging of Custard Apple. The fruits are packaged in corrugated boxes and tied with plastic ropes. The average cost for sorting, grading & packing comes around Rs. 6 per kg.

Transportation: The transportation of the Custard Apple happens through trucks/ pick up vehicles from the pack-house to the airport. Then from airport to the destination city to the mandi through trucks. It cost around Rs. 2000 to transport a truck of Custard Apple with 250-300 boxes to Airport. Loading & handling of truck costs around Rs. 2000. It cost around Rs. 30 per kg for transport from Pune to Delhi in flight. So it costs around Rs. 33 per kg for transportation.

2.5.3.6 Identified Gaps & Constraints in Value Chain-

Production Related

The average productivity of Custard Apple in the state is lower than the overall national productivity. The state productivity lags far behind the highest productivity state. The issue of low productivity may be attributed to quality of planting material, low quality seed variety, rain-fed cultivation, changing weather conditions as long summers, long dry spell, temperature variation etc. There is immense scope for improving productivity of Custard Apple in the State through technology infusion, introduction of global best practices and various market led interventions.

Farmers have been cultivating Custard Apple from the knowledge & practices that has been transferred from generations. There has been no formal training or skill development of farmers to adapt to better cultivation practices.

As per the discussions with the farmers, the seeds for the 'Phule Purandhar' variety have seen little or no research over the years. The farmers either buy the saplings from the nurseries located nearby or they themselves develop saplings which they have learnt over the years.

The shelf life of the variety grown is around 5-6 days. The fruit is harvested in the morning & packed till the late afternoon and transported on the same day. Due to its low shelf life, the fruit is transported through airways to the distant markets. This leads to very high transportation cost and lower profits to the farmers. There is a requirement for development of better variety for improvement of shelf life so that other less expensive modes of transportation may be explored.

Post-Harvest Management

There are many trader-cum-pack-house operators working in the state. They engage in buying the produce from the farmers and then sort, grade & pack the produce in corrugated boxes for selling it to distant markets. Most of the farmers have been trading in this mode for many years and have developed trust/ relation

with the traders, thus they find it very convenient to sell their produce to the traders, sometimes even at low prices.

There is just one farmer producer organization (FPO) operating in the state in the form of cooperative society. There is a need for capacity building and handholding of farmers to form FPOs so that they could develop post-harvest infrastructure in the form of packing units, processing units etc.

Marketing Related

Majority of the farmers sell their produce to the local traders either directly or through local mandi. The farmer arranges for his own transport to bring the produce in the plastic crates to the mandi. The local mandi for Custard Apple in the major production region is an open ground with no provision of boundary walls, basic hygiene facilities or drinking water for farmers or traders. This leads to damage to the produce when brought to the mandi due to rains, dust or heat. These conditions sometimes leads to reluctance of farmers to bring their produce to the mandi and so they chose to directly sell it to the trader, leading to non-competitive prices being offered to the farmers.

There are no organized farmer groups (except one) in the state. This reduces the bargaining power of individual farmers when trading with the local traders or commission agents. Farmers generally have a fixed informal agreement with the local traders for the whole season. They tend to sell their produce to the same trader based on the local relation / trust gained over the years. This arrangement leads to lower profits to the farmers as they do not engage in obtaining current market pricing information before selling the produce as they go by the word of the trader. Thus, a support is required for training the farmers/ farmer groups to develop market linkages by assisting them in linking up with traders in the distant markets.

Access to Finance

Availing credit from banks or other financial institutions for operational activities, development of post-harvest infrastructure, building processing facilities etc. is very difficult for farmers/ FPOs. In the view of banks/ Financial Institutions, the overall perception of farmers/ FPOs in terms of availing loans and repayment is not very healthy and thus banks/ FIs find it undesirable to extend loan facilities to FPOs/ farmers. Thus, FPOs/ farmers have to look for in-formal sector or NBFCs for availing credit facilities which have very high interest rates.

3 State-level Infrastructure Assessment

The growth of the agricultural sector and its output shares a close relationship with the level of investments made in agricultural infrastructure in the state. To facilitate efficient handling of agricultural commodities, the State Government has been facilitating establishment of storage, processing and marketing infrastructure. The current scenario for each of these segments has been collated below along with state-level infrastructure available for the selected 5 focus crops.

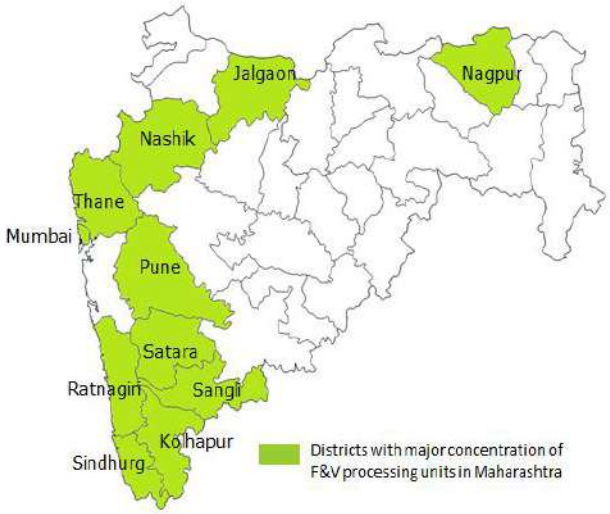
3.1 Status of Cold Chain Infrastructure

Presently, the state has about 604 installed cold storage units with an overall capacity of about 9.8-lakh MT. In addition, the state has about 158 pack-houses, which are registered with APEDA. However, these are mostly for specific fruits such as grapes, mango & pomegranate. Review of secondary information reveals that Government of Maharashtra is already undertaking significant measures to address the infrastructure requirement in the State. MSAMB has established about 21 export facility centres, 20 fruit, and vegetable modern market facility centers in the state. Through such infrastructure about 1919 MT Cold Storage, 225 MT of pre-cooling and 200 MT of Ripening chamber capacity have been created in the State by MSAMB.

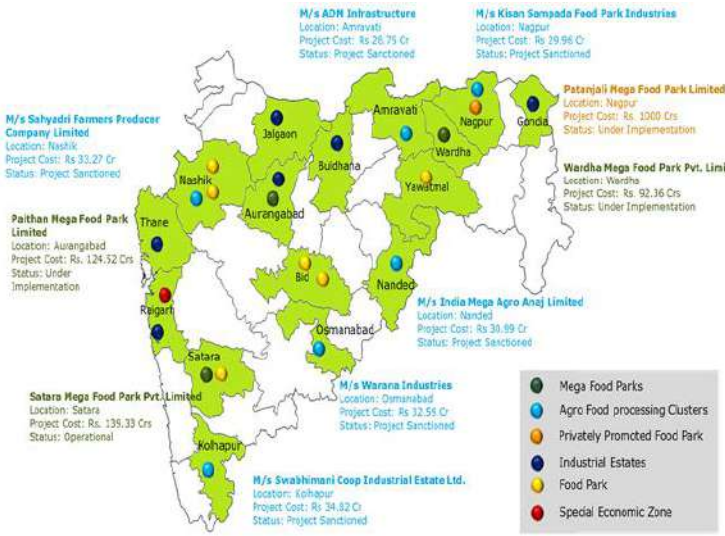
3.2 Status of Processing Infrastructure

Maharashtra has many small, medium & large food processing units in the State. It is estimated that there are about 2804 Fruits & Vegetable processing units in the State. These are majorly concentrated in 11 out of 36 districts of the state, which include Mumbai, Pune, Kolhapur, Sindhudurg, Satara, Nashik, Jalgaon, Ratnagiri, Thane, Nagpur and Sangli. The Ministry of Food Processing Industries (MoFPI), Government of India is also facilitating development of agri-infrastructure projects for value chain development in the State. It has sanctioned 3 Mega Food Parks in the state – 1 each in the districts of Aurangabad, Satara and Wardha. Out of these 3 Mega Food Parks, the one in Satara is operational and the other two are under implementation. Moreover, 6 agro-processing Clusters have been sanctioned by MoFPI in the districts of Amravati, Nashik, Nanded, Kolhapur, Osmanabad and Nagpur. Additionally, the state also has 6 Food Parks, 6 Industrial Area & 1 SEZ for food processing in the state.

Map of Districts with major concentration of F&V units



Map of Food Food Parks/ Industrial Areas for Food Processing in Maharashtra



Source: Ministry of Food Processing Infrastructure & preliminary analysis by Deloitte

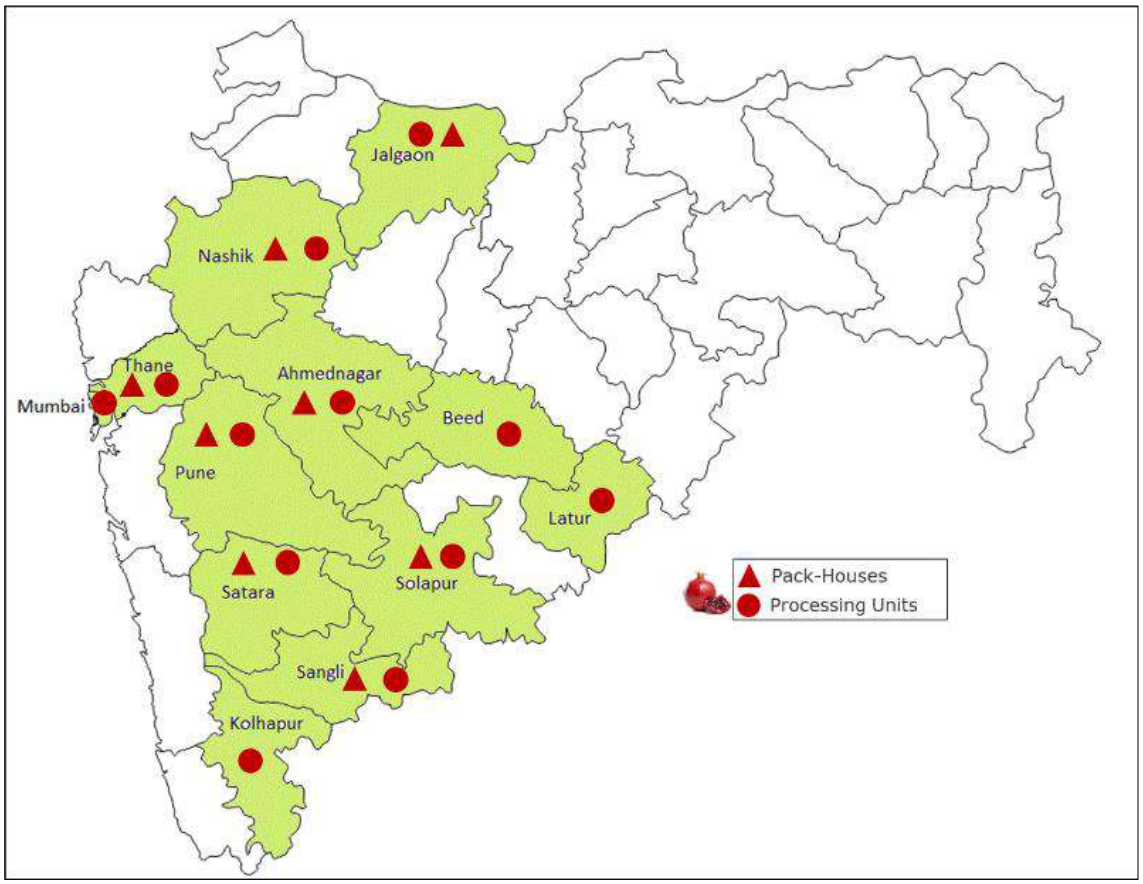
3.3 Status of Market Infrastructure

The State has 306 main market yards and 596 sub market yards to facilitate marketing of agri-produce. In addition, 3 Terminal Markets are planned to be set up in Mumbai, Nasik & Nagpur. The State has also an established network of computerized Agricultural Produce Market Committees (APMCs), called as 'MARKNET' which provides daily arrival and price information to farmers and has built greater efficiency and transparency in the functioning of APMCs by computerizing the system. The state is also promoting exports of fresh fruits, vegetables & flowers from Maharashtra to various countries. Eight Agro Export Zones have been set up in state to focus on and give direction to the exports of key agricultural produce such as grapes, pomegranate, onions, mangoes, banana, flowers etc.

3.4 State Infrastructure for Focus Crops

3.4.1 Pomegranate

Processing infrastructure for pomegranate can be classified as primary and secondary. For primary processing, pack-houses are used. These pack-houses may or may not have an in-house cold store facility for stocking of produce. Generally, the pack-houses owned by the Pomegranate exporters do have a Pre-cooling Chamber and a Cold Store in addition to the Grading-Packing Line. Secondary processing of pomegranates involves extraction of arils and manufacture of juice concentrates and other products such as *anardana.* Freshtrop (Nashik), Sahyadri Farms (Nashik), Jain Farm Fresh Foods (Jalgaon) are the major companies involved in manufacture of Pomegranate Juice concentrates.



Depending upon the type of product, the processing units can have the following facilities–

- Tables, Trays and supporting equipment for Aril Extraction
- Modified Atmosphere Packing line
- Individual Quick Freezing
- Integrated Juice Production and Aseptic / Bottle Packaging

It is evident from the diagram that, the pack-houses and processing units are located in and around the major production clusters of pomegranate. Nashik, Pune, Solapur, Sangli, Ahmednagar and Mumbai have more number of such units. There are around 120-130 processing units in the state for Pomegranate (including the small scale and large-scale processors). The overall capacities of the processing units is around 121,200 MT per year which forms around 7-8% of the overall Pomegranate production of the state. There are around 50-60 modern pack-houses in the state for sorting, grading and packing of Pomegranates.

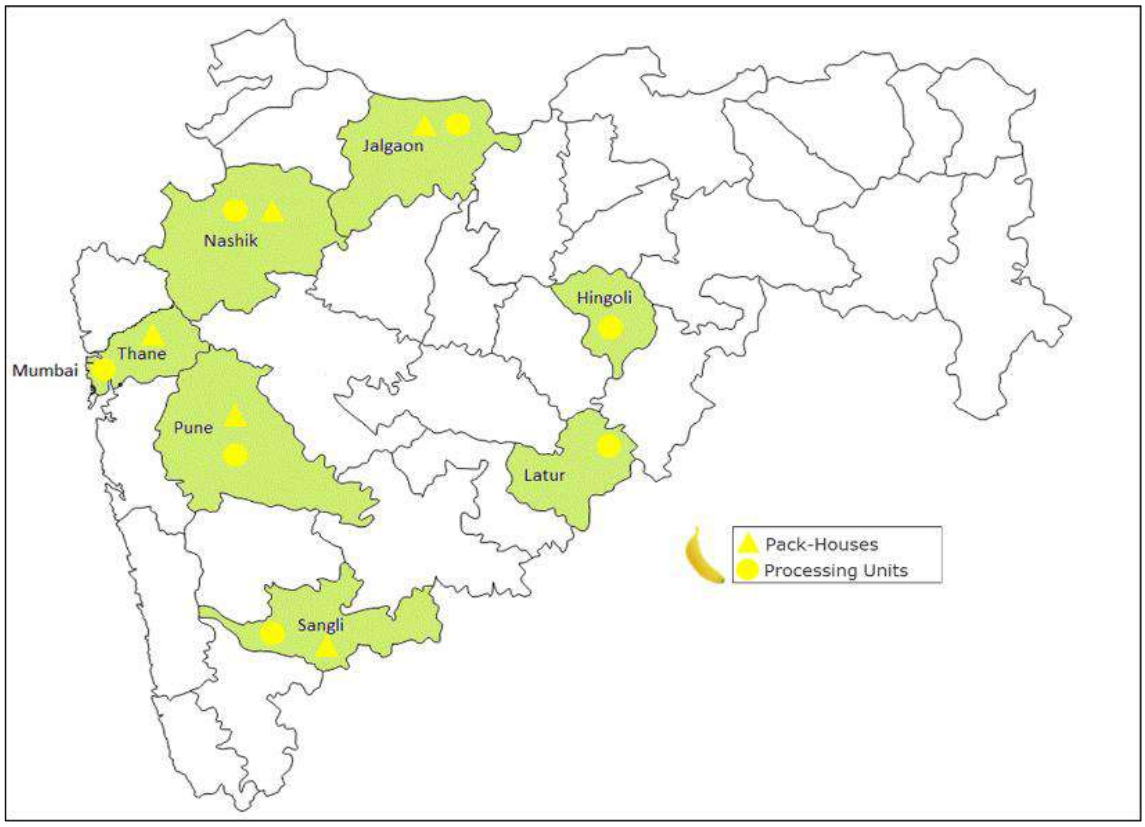
In addition to these, there are six Export Facility Centres established by MSAMB at Chandwad, Nashik; Kalvan, Nashik; Baramati, Pune; Atpadi, Sangli; Beed and Latur. These Export Facility Centres have a combined Pre-cooling Capacity of 30 MT, Cold Storage capacity of 350 MT and total packhouse space of 24,675 sq.ft.

3.4.2 Banana

Primary processing of Banana comprises of the following key sub-operations: de-handing, washing, grading and packing. Primary processing is carried out in case of fresh fruits, which are to be marketed, either in local or distant markets. In case of Banana, the packing operations are mostly done on fields or near the farm-gate. Some of these primary processors also have small cold store-cum-ripening chambers. They serve two functions – the unripe banana, which has to be transported to the distant markets, is pre-cooled, so that the ripening during transportation is minimized. Further, if the produce has to be marketed in the local market, then it is kept in the Ripening Chamber for 4-5 days and then packed are marketed locally and in the neighboring districts. The exporters have Integrated Pack-house facilities (packing and cold store) and the facilities are located mainly in Mumbai region, Pune and Nashik.

Secondary processors are the companies, which are involved in manufacture of processed products like banana chips, banana purees and concentrates, etc. Banana processing units are mainly located in Jalgaon and Nashik districts. Jain Farm Fresh Foods has one of the largest Banana Puree and Concentrate manufacturing facility in Jalgaon. Aditi Foods (Sangli), Chitale Agro (Sangli), Varun Agro Processing (Nashik) are some of the other major Puree and Pulp manufacturing companies located in Maharashtra. Export Facility Centres are established by MSAMB at Savda, Jalgaon; Indapur, Pune and Vasmat, Hingoli. These 3 Export Facility Centres have a combined Pre-cooling Capacity of 15 MT, Cold Storage capacity of 125 MT, Ripening Chamber of 150 MT and total packhouse space of 16,285 sq.ft.

There are around 40-50 processing units in the state for Banana (including the small scale and large-scale processors). These processing units are majorly located in Pune, Sangli, Thane, Nashik, Jalgaon, Hingoli and Latur districts. The overall capacities of the processing units is around 66,700 MT per year which forms around 2% of the overall Banana production of the state. Further, the total Ripening Chamber capacity across the state is estimated to be around 20,000 MT, which is less than 1% of the total production of the state.

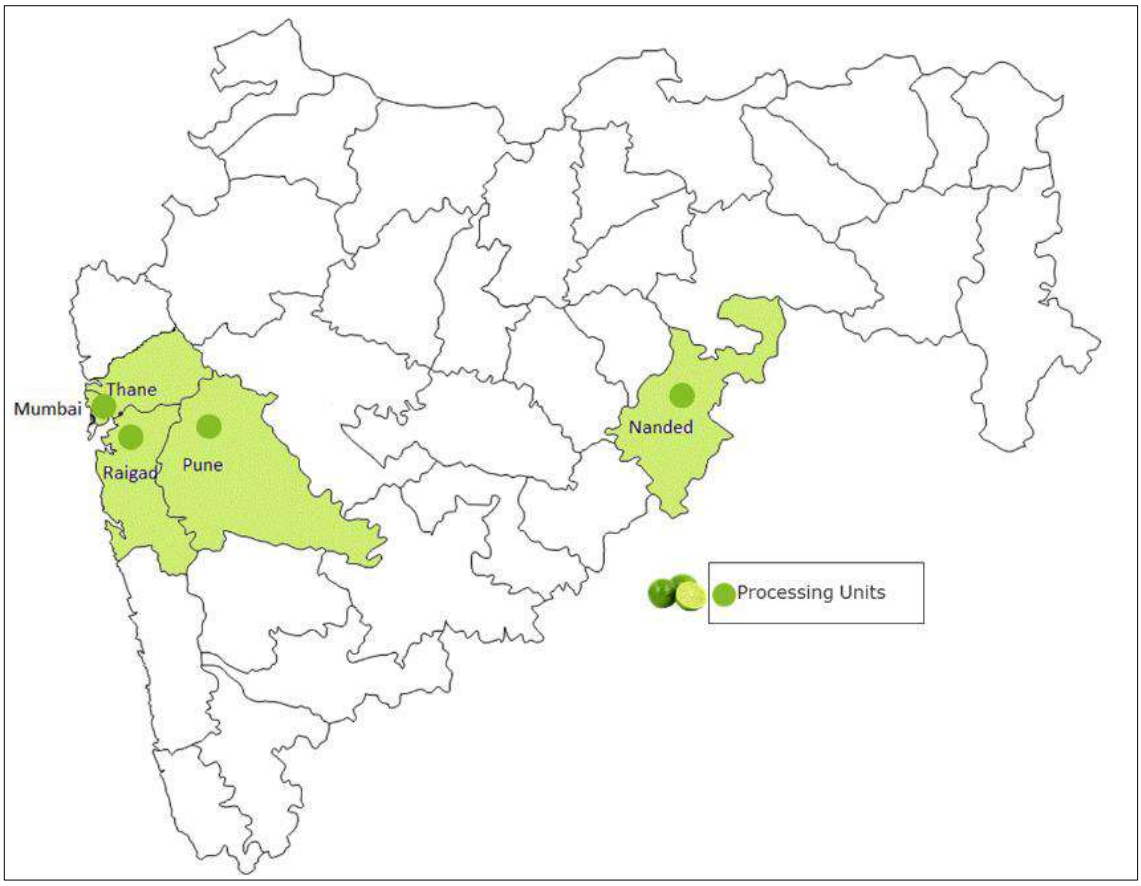


3.4.3 Sweet Lime

In context of Sweet Lime or Mosambi processing, there are few companies involved in manufacture of Mosambi Concentrate, which is supplied to manufacturers of ready-to-serve drinks. These companies usually have their in-house cold storage space.

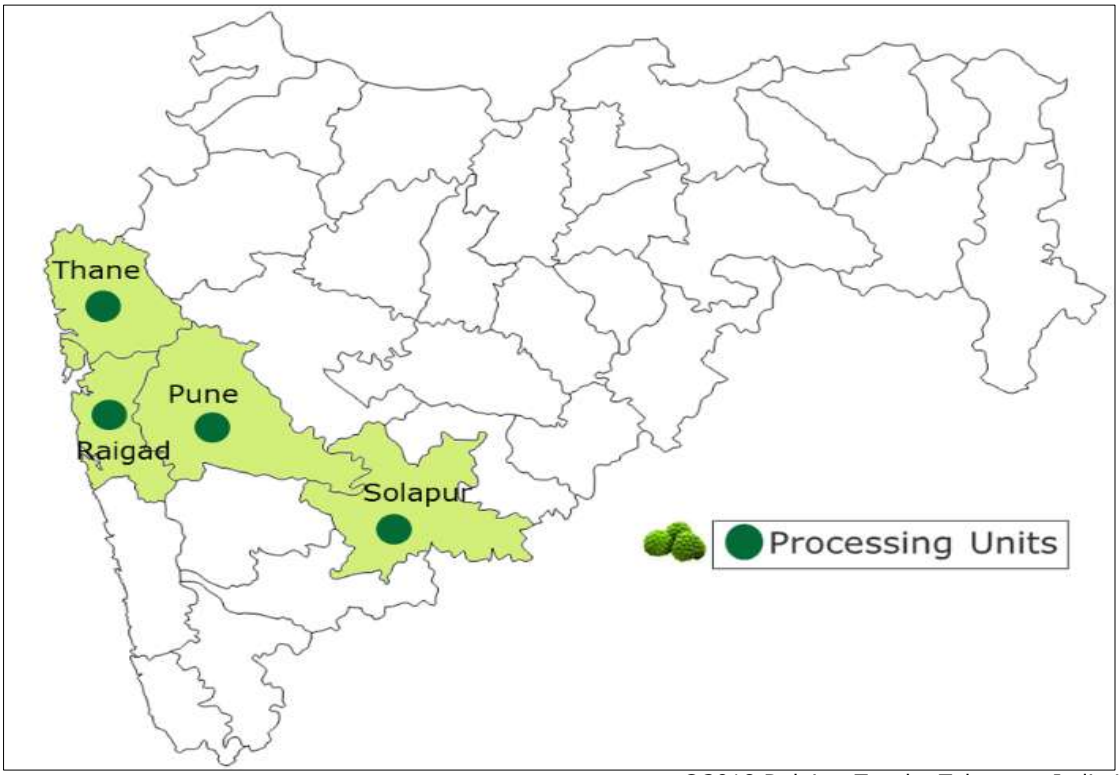
Citrus Processing India Pvt. Ltd (Nanded) is the major company, which procures its produce from the major production clusters. The company has its processing facility in Nanded district. The processing capacity is up to 400 MT of citrus fruits per day. Apart from this company, there are some other smaller processing units in the districts of Pune, Raigad and Thane, which manufacture Mosambi Pulp and Concentrate. This is generally exported to the Gulf countries from Mumbai port.

Thus, there are around 35-40 processing units in the state for Mosambi (including the small scale and large-scale processors). The overall capacities of the processing units is around 10,775 MT per year which forms around 3% of the overall Mosambi production of the state.



3.4.4 Custard Apple

The post-harvest infrastructure for Custard Apple in the state includes manual sorting and grading units at the production clusters and pulp-processing units at different locations.



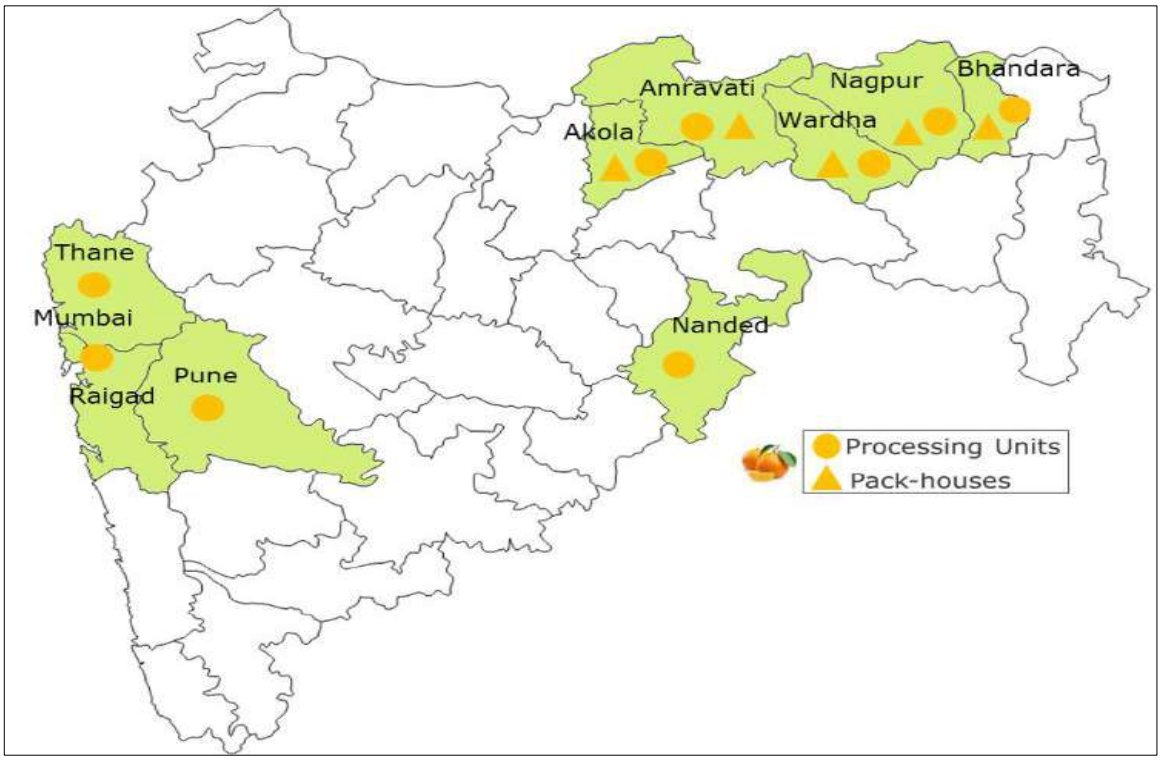
There are around 50-60 manual sorting grading units in the state located in the major production districts of Pune, Solapur, Beed, etc. The units engage in manual sorting, grading & packaging of Custard Apple in corrugated boxes. Each box contains 6/8/10 numbers of fruit depending upon the size of the box and grade of the fruit. Most of these manual packing units are owned by local traders who procure fruit directly from the farmers or through mandis.

There are around 40-45 pulp processing units in the state for Custard Apple. These processing units are majorly located in Pune, Solapur, Thane, Raigad & Navi Mumbai. The overall capacities of the processing units is around 2000 MT per year which forms around 2% of the overall Custard Apple production of the state. Most of the processing units engage in manual process of extraction of pulp leading to high requirement of skilled labour during the peak seasons. There is huge demand from the Ice Cream, Squash manufacturers for the manually extracted pulp as compared to machine extracted pulp. The prices offered for the manually extracted pulp are also high as compared to the pulp extracted through machines. Major processing units generally hoard the extracted pulp during the peak production season and sell the pulp during the lean seasons as prices fetched during the lean season are around 45-55% higher.

3.4.5 Mandarin

The post-harvest infrastructure for Mandarin in the state includes Integrated Pack-houses, Pulp Processing units, Manual sorting grading units, etc.

The districts of Amravati, Akola, Nagpur and Wardha forms the major production cluster in the state and also has most of the Pack-houses. There are around 12-14 Integrated Pack-houses in the state which are majorly located in the districts of Amravati, Akola, Nagpur and Wardha. The overall capacities of these pack-houses is around 120,000 MT per year, which forms around 10-12% of the overall Mandarin production of the state. Most of these pack-houses are owned by local trader/ Pre-harvest contractor who procures the fruit directly from the farmers and after cleaning, waxing, sorting, grading and packing, sells it to distant market traders/ distributors.



Mandarins are generally packed in plastic crates with cardboard/ newspaper packing in between and transported through trucks to distant markets.

There are around 220-250 small sorting grading units located in the state who undertakes manual process for packaging of Mandarin. They are majorly located in the districts of Amravati, Akola, Nagpur, Wardha & Bhandara.

There are around 80-85 small, medium & large processing units for Mandarin in the state which are majorly located in the districts of Nanded, Amravati, Akola, Nagpur, Pune, Thane & Navi Mumbai. The largest processing unit for Mandarin is 'Citrus Processing India Pvt. Ltd.' Which is located in the district of Nanded and has an annual processing capacity of around 20,000 MT. The overall processing capacity of the processing units in the state comes to around 30,000 MT which forms about 3-4% of the overall Mandarin production of the state.

Jain Farm Fresh Foods, a subsidiary of Jain Irrigation Systems, is planning to set up 24,000 MT per annum Mandarin processing unit in Amravati in collaboration with Hindustan Coca Cola Beverages.

There are two Orange Export Facility Centers built by MSAMB in district of Amravati & Wardha which have facilities like sorting grading line, pre-cooling centre, waxing line, and cold storages. The combined capacities of these facility centers is around 4 MT/Hr sorting grading line, 10 MT/batch of pre-cooling unit and 50 MT of cold storages.

3.4.6 Overall State Infrastructure

The overall post-harvest infrastructure in the state for all the five focus crops is shown in the tables below.

Crop	Total State Production (MT)	Ripening Capacity[25] (MT)	% of State Production
Banana	33,34,711	20,000 MT	Less than 1%

Crop	Total State Production (MT)	Processing Capacity (MT)[26]	% of State Production	Pack-House Capacity[27] (MT)	% of State Production
Custard Apple	90,103	2000	3-4%	0	0
Mandarin	8,01,125	30,000	3-4%	120,000	10-12%
Banana	33,34,711	65,000	2%	100,000	3%
Pomegranate	16,16,502	120,000	7-8%	160,000	9-10%
Sweet Lime	3,59,194	10,000	2-3%	18,000	4-5%

[25] Secondary information regarding ripening capacities are not available. These are rough estimates based on interaction with relevant stakeholders
[26] Secondary information regarding processing capacities are not available. These are rough estimates based on interaction with relevant stakeholders
[27] Secondary information regarding packhouse capacities are not available. These are rough estimates based on interaction with relevant stakeholders

As seen from the above table, the average processing capacities of the units in the state cater to around 3-8% of the overall state production which is very low. Around 4-12% of the produce of the focus crops are value added & packed through Integrated Pack-houses while rest of the produce is traded through manual handling.

4 Assessment of Potential Buyers and Co-investors

To ensure holistic coverage of the value chain under the study, the demand side of the value chain- majorly comprising of the private sector agri-business and service providers were also extensively covered during the study. In this context, a mapping of key private sector agri-businesses was conducted, and were reached out to seek their inputs and expectations from the proposed MagNet project. The key objective was to identify/ assess the key gaps constraining their growth and development, their willingness to engage with the FPOs as buyers/ co-investors, and seek their suggestions for bridging the existing gaps in a time bound manner.

A database of around 100 private sector companies (comprising of food processors, cold storage, warehousing & logistics service providers, exporters, suppliers/ traders of fresh produce, input suppliers, etc.) was developed based on both primary and secondary research. To capture the relevant information from these organizations, discussions were initiated with them through e-mail, telephonic conversations and face-to-face meetings based on the preference and availability of the respective companies. More than 50 companies were covered through detailed discussions / interactions from the database. The category-wise segregation of these companies is as under.

Category / Type of Companies	Number of Companies
Direct Procurement/ Trading	25
Procurement for Food Processing	36
Exporters	12
Agri-infra companies	10
Agri-input companies	05
Agri-services (including Technology providers)	10
Logistics Service Providers	03
Others	04

4.1 Framework for Private Sector Consultations

The purpose of this exercise was to gather relevant information, which would enable us to identify the potential areas of collaboration / co-investment with the private sector organizations for development of the horticulture value chains. The key underlying principles adopted while developing the framework for these private sector consultations have been mentioned below.

- Establishing linkages between the key agri-businesses and the selected FPOs operating in the focus crops for long-term market opportunities. This would ensure direct benefit to the farmers and would also help the private sector to reduce their cost of procurement and dependence on intermediaries in the existing value chains.
- Encourage investments/ co-investment by private sector businesses to establish vital post-harvest and processing infrastructure to ensure the viability of the potential infrastructure and market linkages.
- Extend sufficient flexibility (in terms of locations, size and capacity, focus crops, stage of the value chain) to the private sector to identify their specific infrastructure needs and develop sub-projects based on their business interests.

These would ensure active participation of private sector players and FPOs in the designing of the interventions leading to higher success in addressing the challenges of the sector. Some of the key parameters, on which the information was collected from the private sector, are mentioned below.

- Crops of Interest

- Existing procurement systems
- Crop-wise target volume of procurement
- Possibility of procurement from FPOs
- Existing challenges in procurement from FPOs
- Existing challenges in investment in value chains in the state
- Need / plans for development of infrastructure
- Need / plans for soft interventions
- Willingness to co-invest in the supply chain
- Willingness to partner with the FPOs
- Support required from the State Government for procurement or investment in the supply chain infrastructure

4.2 Summary of Private Sector Interactions

It has been observed that majority of the companies that were reached out to, are willing to engage with the FPOs in various capacities and support the proposed MagNet project. All the companies, with exception of a few which are exporting, are presently procuring fruits/ vegetables are willing to procure directly with the FPOs identified. Although many companies are dealing/ focused on all types of fruits & vegetables, however, the major focus crops, which were identified during the interactions, are:

- **Fruits:** Oranges, Pomegranate, Custard Apple, Sweet Lime, Banana, Grapes, Amla, Mango, Papaya
- **Vegetables:** Sweet Corn, Okra, Spinach, Bitter Gourd, chilli, potato, onion

Some of the key suggestions and recommendations received from the private companies have been compiled below.

4.2.1 Improved Production Practices

- The processing companies involved in production of fruit juice which were interacted with have expressed need for focus on promoting production of processable varieties (e.g. promoting the plantation of Brazilian Orange and Sweet Lime varieties, which have more juice content and desired sugar/acid ratio). In order to achieve this, there is a need for providing financial assistance to farmers who are keen to adopt plantation of better varieties
- Some companies involved in export have expressed their willingness to promote global best practices such as residue-free farming and Good Agriculture Practices (GAP) amongst the farmers to ensure that the produce is safe and nutritious.
- It was suggested that a dedicated Residue Management Program needs to be undertaken to address critical issue of Residue Limits in pomegranate cultivation, which is making the pomegranate ineligible to be exported to European markets (even though the quality, taste and all-year production, makes Indian Pomegranates an attractive produce for the European market)

4.2.2 Capacity Building and Skill Upgradation:

- Most of the agri services companies have expressed their willingness to partner with the State Government as technical service providers for providing capacity building support on farm management as well as post-harvest handling of produce to the farmers and their FPOs. They suggested that these services should be institutionalized for all FPOs/ farmers through State Government assistance along with provision for financial support for implementation of such initiatives.
- One of the key concerns for the private sector companies for procuring directly from FPOs was lack of effective organizational and business management expertise

of the FPO leadership. Therefore to ensure long term associations with the FPOs, the private sector companies have recommended that appropriate capacity building initiatives on effective enterprise & business management should be organized for the FPOs

- Support has been sought for organizing awareness programs for farmers/FPOs regarding electronic warehouse receipts & access to easy finance from empaneled banks/MFIs, and access to repository database for potential buyers, and access e-auctions facilities through repository's portal
- The organizations have expressed the need for training & hand holding support on quality and packaging aspects which will ensure high quality of produce and reduction in wastages along the transportation

4.2.3 Creation of Infrastructure

- Majority of the companies have indicated the lack of post-harvest infrastructure at the farm-level such as collection centers, pack houses, cold storage, processing etc. Some have suggested a phased shared-ownership model wherein the rentals for setting up such facilities can be borne through 100% Govt grant funding for 1st year; 50% Govt grant, 25% by FPO and 25% by private sector partner in 2nd year; or in similar manner with decremental funding pattern
- Some companies proposed that the State Govt. can fund setting up of collection centers and capacity building to FPOs at locations where they initiate procurement
- There were suggestions for special promotional schemes either from the Centre / State government to promote Food Processing Industry in the Vidarbha-Marathwada region
- One of the companies is keen to set up a distribution-collection center in co-ownership with the FPOs- financing through a mix of grant & loan
- For adoption of Global GAP certification standards, it is required to that the FPO should have access to basic infrastructure such as toilets, bathrooms, changing rooms, separate rooms for fertilizer and pesticide storage near the farms, etc. Therefore, subsidy support from the State Government is required for the farmers and FPOs, who intend to adopt the Global GAP norms.
- During the interactions, it was suggested that the quality of access roads from farm-gate to main markets and from market yards to nearby cities has to be improved, to accelerate the evacuation of the produce.

4.2.4 Financial Support

- Access to favorable credit and financial support from banks and financial institutions have been a major challenges for the private agri-businesses as well
- It has been recommended that there should be provisioning of easy loans from banks with the support of State Government, having flexible repayment options rather than the conventional monthly repayment schedules, especially for agri-businesses engaging directly with farmers and their FPOs.
- One of the key recommendations received during the consultations was setting up of a venture capital model with the objective of providing funding or incubation support to private sector businesses for creation of infrastructure and undertaking business expansion through the program
- One of companies has requested support from State Government for financial assistance in form of loan on the following suggestive terms: repayment tenure of 15 years (as against the prevailing term of 7-8 years); rate of interest at 6-7%
- Some of the companies (especially the procurement companies) sought support in working capital loans

- One of the social enterprises, which are helping to develop backward and forward linkages to the producers through a central data repository sought financial support from Govt. as a grant for certain operational expenditure (survey work, resource & farmer mobilization, rentals for warehouses, etc) for initial 1-2 years; and loan for other working capital requirements.

4.2.5 Innovation

- Some of the organizations are willing to associate with the program to develop effective sourcing strategy for private sector players by using satellite and socio-economic datasets like number of farmers growing a particular commodity, their landholdings, season of sowing etc.
- The organizations are keen to provide technology transfer support (post-harvest processing) & farm management handholding for quality & productivity enhancement directly to the farmers
- During the interactions some of the companies have expressed the need for extending support to private organizations which provide-i) digital technical farm advisory (soil health management, crop selection & recommendations, use of agri inputs, crop protection measures, etc), ii) equipment on lease, or iii) mobile infra solutions
- Some of the retailers have expressed the need for adoption of innovative packaging solutions at the farm level to enhance the shelf-life of the produce as well as minimize losses incurred during transportation

Thus to summarize, most of the companies have recommended the need for capacity building of the farmers & FPOs in terms of quality, standards, governance, etc. along with provision for financial support for creation of post-harvest infrastructure and adoption of innovation & technology at farm level. One of the other key observations has been the need for more flexibility in terms of location and operations while seeking support from State Governments.

The details of the interactions along with the feedback received from the private sector companies have been enclosed as annexures for each of these companies.

5 Lessons Learnt from Past Initiatives

The different initiatives for overall value chain development & inclusion of farmers, which has been taken so far, have achieved different levels of success in achieving the objective to transform the agricultural/ horticultural value chains in the state. However, there are still major gaps in the agricultural value chains in the state particularly in terms of equitable income growth of the farmers. The agricultural value chains are still not integrated fully to the high end and organized markets. There are multiple intermediaries in the value chains and farmers mostly have limited access to post-harvest infrastructure/ value addition and markets leading to low value realization and frequent distress despite higher productivity and production.

There have been many central & state government schemes that have been implemented over the years and have been mentioned below. These schemes have been selected to study under the program as have large coverage in terms of geography covered, they cover most of the components of the value chain, their wide scope covering most of the agricultural & horticultural produce etc. The list of the schemes that have been analysed to highlight the lessons learnt are as follows-

- Pradhan Mantri Kisan SAMPADA Yojana, Ministry of Food Processing Industries, Government of India
    - Scheme for Mega Food Parks
    - Scheme for Creation of Backward & Forward Linkages
    - Cold Chain Scheme
    - Scheme for Creation/ Expansion of Food Processing/ Preservation Capacities (Unit Scheme)
    - Operations Green Scheme
- Public Private Partnership for Integrated Agriculture Development Programme (PPPIAD) under RKVY, Ministry of Agriculture & Farmers Welfare, Government of India
- Mission for Integrated Development of Horticulture, Ministry of Agriculture & Farmer Welfare, Government of India
- Agribusiness Infrastructure Development Investment Program (Maharashtra)
- Japan Fund for Poverty Reduction (J.F.P.R), Maharashtra
- Maharashtra Agricultural Competitiveness Project

Brief details about the above mentioned schemes are as mentioned below-

5.1 Scheme for Mega Food Parks, Ministry of Food Processing Industries, Government of India

The Ministry of Food Processing Industries launched the Scheme of Mega Food Parks in 2008-09 aiming to provide a mechanism to link agricultural production to the market by bringing together farmers, processors and retailers. The Scheme is based on a "Cluster" approach and envisages creation of state of art support infrastructure in a well-defined agri / horticultural zone for setting up of modern food processing units in the industrial plots provided in the park with well-established supply chain. Mega food park typically consist of supply chain infrastructure including collection centers, primary processing centers, central processing centers, cold chain and around 30-35 fully developed plots for entrepreneurs to set up food processing units.

The Mega Food Parks are implemented by Special Purpose Vehicles (SPVs) which are specially created for this purpose. In case State Government entities and Cooperatives are setting up the Parks, then it is not required to form a separate SPV for implementation. The Ministry provides a grant as capital subsidy of up to Rs 500 Million to build a Mega Food Park with a minimum land area of 50 acres.

Till date, 42 Mega Food Parks have been approved by the Ministry under the Scheme, out of which only 12 are functional. Moreover, many of the functional Parks have not been able to attract sufficient number of private sector players to set up food processing units in the Parks. In case of the Parks which are under implementation, some of them have not been able complete the construction even after 6-7 years since the approval. Also, about 17 allotments were cancelled by the Ministry as implementation of these Parks could not start due to various reasons and these were given to new bidders.[28]

Major Lessons Learnt

Considering the limited results of the Scheme, some of the major lessons that can be learnt from the program which are relevant to the present study are given below.[29]

- The Scheme guidelines had certain rigidities in terms of SPV composition, land requirements, components, Government controls etc. which the private sector found restrictive.
    - The Scheme has certain basic requirements, 50 acres of contiguous land in possession of the developer being one. Obtaining 50 acres of contiguous land at reasonable prices has been a challenge and this has led to approval of projects in remote locations and /or inappropriate locations
    - Initially, no SPV member was allowed to own a majority stake in the SPV which became a disincentive for large private players to participate in the Scheme. This along with the perceived issues of control of Government led to very less interest from large private players in the Scheme.
    - Along with the main processing and common infrastructure, the SPVs were to set Primary Processing Centres (PPCs) and Collection Centres (CCs) compulsorily, which were designed from a perspective of establishing backward linkage. However, the actual requirement of the private sector was not taken into account for these facilities and they did not find positive response from the SPVs
    - Scheme design envisaged pre-marketing of the projects by including at least 5 food processors being part of SPV. Due to various reasons (interpersonal, political, bureaucratic, financial etc.) the same did not happen which led to ineffective composition of SPVs.
    - As per the present model, the plots inside the Mega Food Parks cannot be sold by SPVs to the units being set up in the park, lease being preferred mode of land transfer. This has led to challenges in getting bank loans by the SPVs due to non-acceptance of leased land as collateral by the banks.
    - Moreover, the business model was found to be restrictive as the SPVs can only charge rentals from the units but not undertake processing and marketing on their own.
    - Hence, appropriate flexibility in the Scheme guidelines are very important along with the understanding of the business interests, capacities, existing infrastructure and focus of the private sector players. The private sector especially the large players may not be interested in highly regulated end-to-

[28] https://www.business-standard.com/article/economy-policy/mega-food-park-plan-needs-to-be-redesigned-icrier-115101300080_1.html (accessed on 14.09.2018)

[29] Deloitte's own assessment and also other sources such as "Report on Evaluation of the Impact of the Scheme for Mega Food Park of the Ministry of Food Processing Industries", ICRIER (2015)

end value chain development projects. Hence, stakeholders' consultations should be held with the private sector during designing of such interventions to understand the stakeholder preferences.

- This being a Central Scheme, collaboration with State Governments was not done effectively resulting in limited participation from State Governments leading to delays in statutory approvals and other support.
- It is mainly an infrastructure Scheme with no emphasis or allowance for expenditure on forging backward linkages with farmers through linkage creation, extension work etc. Although the CCs and PPCs are supported under the Scheme as physical infrastructure however, there is no focus on engaging farmers or FPOs directly with the Parks. Understanding of the private sector business interests in terms of procurement from farmers/ FPOs directly were lacking which led to less interest from the private sector.
    - The linkages with farmers groups/ FPOs are very important in creating an integrated value chain which would create a win-win situation for both the private investors and the farmers/ FPOs. Hence, the geographical spread of the farmers' organizations and the crops grown (in terms of both type and volume) by them should be studied and then matched with the interest of private sectors in procuring such crops during the designing of such projects.

5.2 Scheme for Creation of Backward & Forward Linkages, Ministry of Food Processing Industries, Government of India

Ministry of Food Processing Industries (MoFPI) has launched the Scheme for Creation of Backward & Forward Linkages in 2017-18 with an objective to provide effective and seamless backward and forward integration for processed food industry by plugging the gaps in supply chain in terms of availability of raw material and linkages with the market. The scheme is applicable to perishable horticulture and non-horticulture produce such as fruits, vegetables, dairy products, meat, poultry, fish, Honey, Spices etc. The scheme envisages components of Backward linkages which can include Integrated Pack-houses, Milk Chilling Units, Pre-cooling Units, Minimal Processing (Cutting, Dicing, Pulping, Canning, Waxing) Units, cold storages; Forward linkages which can include Retail chain of outlets with facilities of frozen stores, deep freezers, chillers, etc., Distribution centre associated retail chain and transport vehicles associated with Backward & Forward linkages.

The scheme allows FPOs/FPCs/SHGs, individual entrepreneurs, PSUs, Promoters of Food Processing units, Corporate entities to be eligible for financial assistance. Ministry approves grant for each project @35% of the eligible project cost for general areas & @50% for difficult areas subject to maximum of Rs. 5 crore per project.

Till date, 64 projects have been approved by the Ministry under the scheme. There are total 12 project been approved in Maharashtra with two projects for Farmer Producer Organization (FPO)[30]. The scheme had started inviting Expression of Interest from the FY 2017 and since then extended the deadline for application multiple times as very few applications were received over the period.

Major Lessons Learnt

Considering the limited result of the scheme, some of the major lessons that can be learnt from the program which are relevant to the present study are given below-

[30] www.mofpi.nic.in, http://mofpi.nic.in/sites/default/files/website_notice_0.pdf

- The Scheme provided grant of maximum of 35% only on eligible components in general areas. There are many infrastructure support schemes run by different state governments which provide grant up to 75% thus leading to limited participation of entrepreneurs in the Ministry's scheme.
- The scheme had a mandatory component of 20% of project cost to be taken as term loan from Bank/ FI but there was no component in the scheme for facilitation for access to finance. This was a major hurdle for the participants, specifically for FPOs applying under the scheme.
- The scheme required industrial land/ industrial converted land for setting up of infrastructure. Many of the FPOs/ Farmer groups had agricultural land which they found difficult to convert to industrial land so they couldn't participate in the scheme.
- The scheme allowed participants to choose any land with no restrictions on location or type of land, thus this provided a flexibility to participants to choose project land location.
- The scheme focussed only on hard interventions such as developing infrastructure for value addition & processing. The need for capacity building & developing soft skills of agri-entrepreneurs/FPOs/FPCs was not addressed through this scheme.
- There was no scheme component for supporting marketing/ e-marketing & advertisement activities that should be carried out by private entrepreneurs/FPOs for selling of processed goods thus developing marketing linkages was the sole responsibility of the applying FPOs.
- The scheme covered most of the perishable crops including fruits & vegetables, coconuts, spices, honey, meat, dairy, poultry etc. thus providing better flexibility to entrepreneurs/FPOs to participate in the scheme.

5.3 Cold Chain Scheme, Ministry of Food Processing Industries, Government of India

Ministry of Food Processing Industries (MoFPI) has launched the Scheme of Cold Chain in the year 2008 with an objective to provide integrated cold chain and preservation infrastructure facilities, without any break, from the farm gate to the consumer. The scheme covers creation of infrastructure facility along the entire supply chain which can include multi product/multi level cold storage, CA storage, IQF, Blast freezing in distribution hub, reefer vans, mobile cooling units etc. with emphasis on creation of cold chain infrastructure at farm level.

The applicant can be Partnership firm, Corporations, Cooperatives, SHGs, Farmer Producer Organizations, NGOs, PSUs etc. Ministry approves grant for each project for storage infrastructure including pack-houses @35% of the eligible project cost for general areas & @50% for difficult areas, for value addition & processing infrastructure including frozen storage, irradiation facility @50% for general areas & @75% for difficult areas.

Till date, 274 projects have been approved by the Ministry under the scheme. There are total 59 project been approved in Maharashtra with 29 having started commercial operations and 30 ongoing projects[31].

Major Lessons Learnt

Considering the vast coverage of the scheme, some of the major lessons that can be learnt from the program which are relevant to the present study are given below-

[31] www.mofpi.nic.in

- The scheme had a mandatory component of 20% of project cost to be taken as term loan from Bank/ FI but there was no component in the scheme for facilitation for access to finance. This was a major hurdle for the participants, specifically FPOs for applying under the scheme.
- The scheme required the applicant to have a net worth of more than 1.5 times the grant applied for, thus limiting the participation of FPOs/ Farmer Groups/ Entrepreneurs in the scheme.
- The scheme allowed submission of In-principle term loan sanction letter instead of only final sanction letter from a Bank/FI to apply under the scheme, thus allowing certain flexibility to the applicants to apply under the scheme.
- The scheme focussed only on hard interventions such as developing infrastructure for value addition, processing & cold storage. The need for capacity building & developing soft skills of agri-entrepreneurs/FPOs/FPCs was not addressed through this scheme
- The scheme mandated the applicant to establish farm level infrastructure along with distribution hub/ refrigerated vans. There was no scope for establishing a standalone minimal processing unit/ value addition centre thus limiting participations from FPOs/ Farmer Groups.

5.4 Scheme for Creation/ Expansion of Food Processing/ Preservation Capacities (Unit Scheme), Ministry of Food Processing Industries, Government of India

Ministry of Food Processing Industries (MoFPI) has launched the Scheme of Creation/ Expansion of Food Processing/ Preservation Capacities (CEFPPC) in the year 2017 with an objective for creation/ modernization /expansion of food processing units which will help in increasing the level of processing, value addition and thereby lead to reduction of wastage and enhancement of farmer's income. The scheme covers creation of infrastructure facility along the entire supply chain including pack-houses, preservation units, packing facilities, cold storage, IQF, Blast freezing, reefer vans, mobile cooling units etc. with emphasis on creation of processing capacities at farm level.

The applicant can be Partnership firm, Corporations, Cooperatives, SHGs, Farmer Producer Organizations, NGOs, PSUs etc. Ministry approves grant for each project @35% of the eligible project cost for general areas & @50% for difficult areas. The scheme will give preference to processing units that will be setup in Mega Food Parks, Agro-Processing Clusters assisted by Ministry or designated food parks in the state.

Till date, 134 projects have been approved by the Ministry under the scheme. There are total 15 project been approved in Maharashtra with all of them under implementation stage[32]. The scheme had started inviting Expression of Interest from the December 2017 and since then extended the deadline for application multiple times as very few applications were received over the period.

Major Lessons Learnt

Considering the coverage of the scheme, some of the major lessons that can be learnt from the program which are relevant to the present study are given below-

- The scheme gave preference for processing units that are proposed to be set up in Mega Food Parks, Agro-Processing Clusters or designated food parks thus limiting the flexibility of entrepreneurs/ FPOs to choose the location of their

[32] www.mofpi.nic.in

processing units. Entrepreneurs/ FPOs should be given the freedom to setup the processing unit on their own land/ near the production cluster.

- The scheme had a mandatory component of 20% of project cost to be taken as term loan from Bank/ FI but there was no component in the scheme for facilitation for access to finance. This was a major hurdle for the participants, specifically for FPOs applying under the scheme.
- The scheme required the proposed project to have eligible project cost of more than Rs. 3 crores in general areas & more than Rs. 1 crore in difficult areas, thus limiting the participation of FPOs/ Farmer Groups/ Entrepreneurs in the scheme.
- The Scheme provided grant of maximum of 35% only on eligible components in general areas. There are many infrastructure support schemes run by different state governments which provide grant up to 75% thus leading to limited participation of entrepreneurs in the Ministry's scheme
- The scheme focussed only on hard interventions such as developing infrastructure for value addition, processing & cold storage. The need for capacity building & developing soft skills of agri-entrepreneurs/FPOs/FPCs was not addressed through this scheme
- There was no scheme component for supporting marketing/ e-marketing & advertisement activities that should be carried out by private entrepreneurs/FPOs for selling of processed goods thus developing marketing linkages was the sole responsibility of the applying FPOs.

5.5 Operations Green Scheme, Ministry of Food Processing Industries, Government of India

Ministry of Food Processing Industries (MoFPI) has launched the Operations Green Scheme for integrated development of Tomato, Onion, and Potato (TOP) value chain in the November 2018 with an objective of enhancing value realisation for TOP farmers, price stabilization for consumers & producers, reduction on post-harvest losses, increase in processing capacities & setting up of market intelligence network. The Scheme proposes to have two-pronged strategy of price stabilization measures & development of integrated value chain development.

The major components of the scheme are-

- Short Term Price Stabilization Measures
  - Support for arranging transportation of TOP crops from production to storage
  - Support for arranging storage facilities for TOP crops
- Long Term Integrated Value Chain Development Projects
  - Support for capacity building of FPOs & their consortium
  - Support for improving quality of production through providing quality seeds, setting up nurseries, mechanization of farm practices, promoting contract farming, and varietal change based on market demand
  - Post-harvest management through support for development of processing infrastructure at farm level, secondary processing facilities, transportation facilities etc.
  - Agri-logistics support for development of integrated multi-mode transportation facilities
  - Support for creation of marketing yards, retail outlets, storage facilities at market level, creation of e-market etc.

Ministry has appointed National Agricultural Cooperative Marketing Federation of India (NAFED) as the nodal agency for implementing short-term prices stabilization measures. For long term integrated value chain development projects, the applicant can be State Agricultural & other Marketing Federations, FPOs/ Farmer Groups, Cooperatives, SHGs, Food Processors, Logistics Operators, State & Central Government entities etc.

Ministry will approve subsidy @50% for price stabilization measures for each project and @50% of the eligible project cost for integrated value chain development projects for each project. It the applicant is a FPO, then the grant will be @70% for integrated value chain development projects.

5.6 Public Private Partnership for Integrated Agriculture Development Programme (PPPIAD) under RKVY, Ministry of Agriculture & Farmers Welfare, Government of India

Ministry of Agriculture & Farmers Welfare has launched the scheme of PPPIAD in 2012-13 for facilitating large scale integrated projects, led by private sector players in the agriculture and allied sectors, with a view to aggregating farmers, and integrating the agricultural supply chain, with financial assistance through RKVY. The objective of the scheme is to address all concerns relating to production & post-harvest management in agriculture/ allied sectors, enhancing production & productivity through technologies, employment creation, improvement of value chain & ensuring farmer's profitability.

The Ministry has designated Small Farmers' Agribusiness Consortium (SFAC) as a National Level Agency to examine the proposals from technical viewpoint and thereafter propose it for funding to the concerned state government. Application under the scheme are allowed from technology providing companies, end user companies (processors, exporters, retailers), Farmer Producer Organizations (FPOs), business entities, corporates, etc.

The scheme mandated the applicants to ensure development of an integrated value chain approach covering all aspects from production to marketing which will include mobilizing farmers into producer groups, technology infusion, value addition, marketing solutions etc.

Major Lessons Learnt

Considering the vast coverage of the scheme, some of the major lessons that can be learnt from the program which are relevant to the present study are given below-

- The scheme proposed to develop integrated agricultural development projects with a mandate to cover at least 5000 farmers in each individual project. This led to deterrence to participation from small private players/ entrepreneurs and to some to some extent from the corporates as covering such large number of farmers in each project would be difficult
- Applicants had to develop complete integrated value chain solutions covering formation of farmer producer groups, technology infusion, marketing, and value addition. Thus eliminating participation for development of individual components of the value chain.
- Applications were invited from technology providers, processors, input supplier companies but they had to partner with other organizations for covering aspects of the scheme which was not related to their domain. This led to a hurdle for participation as partnering with multiple organizations for delivering such large project has its own complexities.

- The amount of investment required from the applicants was pegged at minimum average of Rs. 100,000 per farmer in each project leading to a very high investment cost for the project thus making it difficult for FPOs/ farmer groups and even corporates to participate in the scheme.
- The scheme had capped government support at 50% or Rs. 50,000 (whichever is lower) per farmer investment cost by the applicants. Thus any additional investment cost had to borne by the applicant leading to high investment cost.
- The scheme has provided the applicants the flexibility to select project land as per their needs & availability. This added to the freedom of corporates/ applicants/ FPOs to apply for grant under the scheme.
- Most of the projects under the scheme had maximum expenditure made on providing subsidized agri-inputs followed by agri-extension activities. Thus limiting the scope on value addition through processing & post-harvest management activities.

5.7 Mission for Integrated Development of Horticulture, Ministry of Agriculture & Farmer Welfare, Government of India

Ministry has launched the Mission for Integrated Development of Horticulture (MIDH) in 2014 which subsumed individual schemes for development of horticulture and integrated various schemes to harness the potential of horticulture in the country. The objective of the mission are holistic growth of horticulture sector through improved productivity, enhance horticulture production, augment farmer's income, aggregation of farmers into farmer groups, skill development & employment creation.

Major components covered under the scheme are establishment of nurseries, area expansion, development of water harvesting structures, mechanization of horticulture, development of post-harvest infrastructure, capacity building of farmers, establishment of Centre of Excellence (CoEs) etc. The scheme contributes to around 35% to 50% grant of the eligible project cost in most of the components with applicants from corporates, entrepreneurs, FPOs, cooperatives, SHGs, private players eligible to apply under the scheme. The CoE can only be established by public sector entities with maximum grant of Rs. 10 crore per centre.

Till date, 4650 cold storages with 20.65 million capacity, 478 repining chambers, 411 Reefer Trucks, 28 Centres of Excellence have been established with training & capacity building to 22.29 lakh farmers under the scheme[33].

Major Lessons Learnt

Considering the vast coverage of the scheme, some of the major lessons that can be learnt from the program which are relevant to the present study are given below-

- The scheme has focussed component on hard interventions such as developing infrastructure for value addition, processing & cold storage as well as soft interventions such as training of farmers, study tours, etc. This led to the overall capacity building of farmers along with development of supporting infrastructure.
- The scheme provides only credit linked back-ended subsidy of development of port-harvest infrastructure such as pack-houses, cold storages, cooling units. Thus the entrepreneur/ FPO has to invest the complete project amount upfront and then after completion of the project may avail the grant leading lower participation from FPOs/ Farmer Groups.

[33] http://midh.gov.in/PDF/Presentation%20on%20MIDH,%20October-2018.pdf

- The scheme has a focussed component on developing Centre of Excellence (CoE) centres with international collaboration that will act as demonstration and training centres for latest technologies, source of planting material etc.

5.8 Agribusiness Infrastructure Development Investment Program (Maharashtra)

The program was approved by Asian Development Bank to establish to Integrated Value Chains (IVCs) in Maharashtra. The program was expected to be completed by 31 December 2015.

The program was expected to increase private sector investment in IVC infrastructure and returns of producers of high-value crops in Maharashtra leading to expanded agriculture value chains and better integration of small-scale farmers into IVCs in Nashik and Aurangabad–Amravati regions. The IVCs in these two regions were to be established under PPPs on land provided on lease by the Maharashtra Government and they were supposed to leverage private sector investment and management into agribusiness and market infrastructure.

However, the program was unable to award PPP contracts in spite of two rounds of bidding as there was little interest from the private sector. The major challenges which were identified by ADB with the program design included:

- Reluctance of private sector players to invest in rigid pre-selected IVCs in land owned by government with a fixed concession period
- Fear of complexities regarding facilities to be set up in government owned land and potential related political interference
- High lease rentals charged by the state government for land
- Many private players wanted to focus on developing certain parts of the value chain were their business interest lies instead of investing in the whole value chain

Major Lessons Learnt

Based on the above challenges, some of the major lessons that can be learnt from the program which are relevant to the present study are given below.[34]

- It is important to understand the business interests and infrastructure needs of the private sector players when designing such agriculture intervention programs. This could be in terms of the size and capacity of the businesses, their focus crops and existing infrastructure and their infrastructure needs. Incorporating such feedback from the private sector in the program design would ensure the participation of the private sector in the program.
- Involvement of the stakeholders in the process of the development of the business models is critical for success implementation of the program.
- Sufficient flexibility of the project design (locations, size and capacity, focus crops) should be allowed in the program design to let private sector to identify their infrastructure needs and submit sub-project proposals based on their business interests. This may be a more successful model. Also, limiting their investments to government land may not encourage their participation.
- In line with a dynamic business environment, private players require flexibility to source raw materials, other inputs and technologies, hence, a government

[3434] Completion Report, India: Agribusiness Infrastructure Development Investment Program (Tranche 2) , Asian Development Bank (2017)

managed arrangement for entire IVC may not be suitable for private sector participation.

- Instead of only capital grants or subsidies, alternative options financing through an investment vehicle may also be considered.

5.9 Improving Small Farmers' Access to Market in Bihar and Maharashtra (JFPR Grant), Maharashtra

The program was approved by Asian Development Bank in the year 2012 with the basic objective of connecting small farmers of Maharashtra directly to markets and increasing income of small farmers through providing multiple marketing options. The project design aimed at connecting the fruits & vegetables farmers to the integrated value chain through formation of groups & producer companies and undertaking training of farmers for collective production, post-harvest handling, value addition & marketing.

Under the project, a total of 22,417 farmers & growers of focus crops were organized into 1404 groups from the selected 8 locations[35]. Leaders from the group were trained after assessing the training needs, technology workshops were conducted, buyer-seller meets, melas & exhibitions were organized. These groups were federated into 18 Farmer Producer Companies (FPCs) with 5300 members.

So far, these FPCs have marketed around 5787 MT of produce after undergoing proper post-harvest management practices. These FPCs are also being provided grant support up to 75% for establishment of primary handling & processing facilities[36].

Major Lessons Learnt

Considering the coverage of the scheme, some of the major lessons that can be learnt from the program which are relevant to the present study are given below-

- The program intended to connect farmers/ FPCs to the integrated value chains to be developed through the participation of private players. Thus, keeping in mind the business interest of private players and involving them in decision making for program design is very important.
- The program had specific focus of soft interventions which included assessing training needs of FPOs and capacity building interventions for farmer groups. This led to the overall growth of the FPOs as business promoting entity. Such interventions are required along with infrastructure support for overall growth of FPOs.
- Working capital requirement of the FPOs were also addressed by the program by setting up revolving funds for the FPOs which was found to be a critical component for sustainability of FPOs' operations

[35] https://www.msamb.com/Documents/f07596db-a2e6-483a-a743-c80304c2811e.pdf
[36] https://www.msamb.com/Documents/f07596db-a2e6-483a-a743-c80304c2811e.pdf

5.10 Maharashtra Agricultural Competitiveness Project (MACP), Maharashtra

The program was approved by World Bank in 2009-10 with overall responsibility for project execution resting with Department of Cooperation and Marketing, Government of Maharashtra. The project has been completed on 31 October 2018. The objective of the project is to increase the productivity, profitability and market access of the farming community in Maharashtra by providing farmers with technical knowledge, market intelligence & market networks to support agricultural productions aimed at responding to the market demand.

The program covered a wide range of interventions, which are as mentioned below:

- Market led agricultural technology transfer through strengthening of Agricultural Technology Management Agency(ATMA) model activities
- Agri-business Promotion through formation of farmer groups, capacity building, providing credit & market linkage facilities
- Expanding the scope & coverage of market information dissemination
- Strengthening of Livestock markets & support services
- Improving farmer's reach to markets through promoting alternative markets in the form of strengthening of rural haats, warehouse receipt financing, providing e-marketing platforms etc.
- Modernizing of existing markets

As a part of the project, over 400[37] Farmer Producer Companies involving 2 lakh farmers have been guided with business plans, over 770 individual enterprises have been facilitated over the period of project[38]. Around 81 Agriculture Produce Market Committees (APMC) have been modernized by creation of infrastructural facilities within the market area.

Major Lessons Learnt

Considering the vast coverage of the scheme, some of the major lessons that can be learnt from the program which are relevant to the present study are given below-

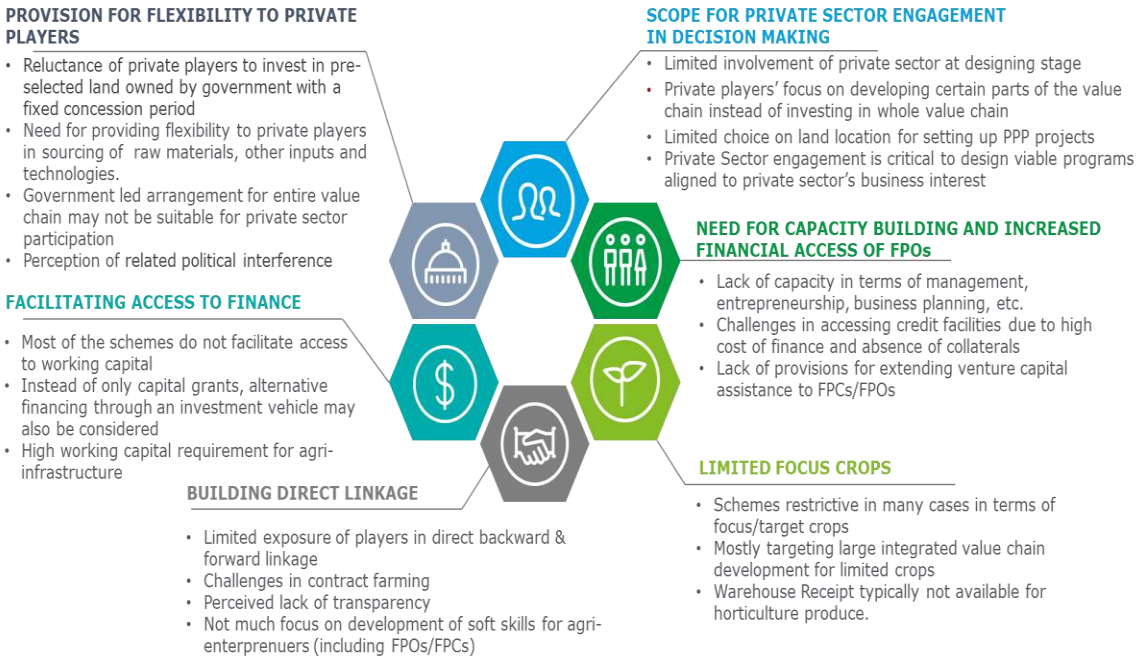
- The program has established 409 new Farmer Producer Companies and mobilized and trained around 2.5 lakhs farmers thus leading to direct marketing of produce by farmer groups and fetching higher prices. Similarly, farmers also saved by purchasing inputs in bulk. Promotion of FPOs/ FPCs should be an essential part of the development program to achieve the objective of enhancing farmer's income.
- There was a 26.35% increase in farmers adopting sorting & grading after formation & mobilization of farmers into farmer groups/ FPOs under the program[39].
- The program has also initiated promotion of produce through alternate markets by supporting direct marketing arrangements and it has led to 42% increase in price realization of participating farmers as compared to traditional markets. Promoting alternate marketing channels can go a long way in enhancing farmer's income[40].

[37] http://www.punekarnews.in/5-thousand-farmers-to-get-benefit-with-double-gross-income/
[38] http://projects.worldbank.org/P120836/maharashtra-agricultural-competitiveness-project?lang=en&tab=results
[39] http://projects.worldbank.org/P120836/maharashtra-agricultural-competitiveness-project?lang=en&tab=results
[40] https://www.msamb.com/Documents/f07596db-a2e6-483a-a743-c80304c2811e.pdf

6 Recommendations

6.1 Introduction

As discussed earlier, although several central and state government schemes have been designed and implemented for development of horticulture sector in the state, however, there is a huge scope for further improvement in the horticultural value chains in the state through appropriate interventions. During the value chain assessments of the focus crops, gaps were identified in terms of both soft and hard interventions for linking farmers/ farmer collectives with the evolving markets and private players who are procuring or plan to procure such products from Maharashtra. Moreover, it is also critical to draw lessons from the experience of the existing schemes/ programmes to design future interventions for more effective implementation and larger impact. Based on detailed study of the key schemes and programmes implemented/ being implemented in the agriculture sector in Maharashtra, key lessons were drawn in terms of the major challenges and bottlenecks in implementation and also the aspects which were successful in improving the implementation of such schemes/ programmes. A detailed analysis in this regard is given in the earlier chapter. The main lessons learnt from the analysis is summarized in the diagram below.



Based on such learnings, the following considerations have been taken into account in the interventions proposed for the present programme:

6.1.1 Coverage of both Hard and Soft Interventions

The proposed interventions would cover both hard and soft interventions of the value chains with a focus on upgrading the value chains leading to development of direct market linkages. The interventions would aim to increase value addition in the chains through creation of hard infrastructure such as packhouses with modern sorting, grading, packaging and storage, processing units, waxing lines and ripening chambers (as applicable), transport vehicles (including reefer trucks), distribution centres, etc. along with a focus of soft components such as capacity building of farmers/ farmer collectives, credit access and working capital loans for / private businesses, creation

of venture capital fund for agribusiness enterprises, etc. The objective would be to create an enabling environment for the farmers/ farmer collectives to link with the evolving markets by proposing both hard and soft interventions at each level of the value chains.

6.1.2 Involvement of Private Sector in the Programme Design

In most of the existing schemes and programmes, there had been a limited private sector involvement in the designing of the programmes, which many times led to lack of interest from the private sector to participate in the programmes during the implementation. Considering this, under this study, a major focus was on private sector interactions to understand their interest in Maharashtra, the challenges faced by them in the horticulture supply chains in the state, type of projects they are interested in and the support they require from the state government. The feedback received from the private sector in these interactions have been incorporated in the designing of the proposed interventions under the study. It is expected that this will ensure private sector's interest in participating in the proposed programme.

6.1.3 Flexibility to Develop Customized Projects

The proposed programme would provide the flexibility to private sector for customizing individual projects/ sub-projects in terms of locations, size and capacity, focus crops, stage of the value chain based on their interest to ensure project viability. This would allow private sector businesses to identify their infrastructure and other needs and develop project/ sub-projects based on their business interests. This would ensure the participation of the private sector in the proposed programme.

6.1.4 Integration of Farmer Collectives with Mainstream/ Emerging Markets

The key to enhance the viability of any programme is through value addition and integration of the value chains with emerging markets. In the proposed program, the main focus has been on value addition and linking of farmer collectives to the key agri-business value chain players to ensure direct benefits to the farmers by identifying accessible market opportunities. Such linking would also help the private sector to reduce cost of procurement by bypassing middlemen.

6.1.5 Multi-crop Coverage for Enhanced Viability

In order to increase the viability of the interventions, the programme would encourage the proposed interventions to have multi-crop coverage based on suitability. The objective would be to increase the days of operations based on multi-crop seasonality. The stakeholders would be free to decide the combination of crops based on their business interest and plan.

6.2 Programme Contours

Based on the above considerations, it is proposed that the programme contours would include the following:

6.2.1 Programme Components

It is proposed that the programme interventions would cover the entire value chain targeting all the major stakeholders such as farmers and their collectives, agribusiness SMEs, large agribusiness players, etc. The proposed interventions are classified in three broad categories such as:

- Capacity Building & Strengthening of Farmer & their Collectives
- Promotion of SMEs in Horticulture
- Facilitating Overarching Development of Horticulture Sector

For each of the categories, soft interventions (as Technical Assistance) and hard interventions (as Creation of Infrastructure) are proposed to upgrade the value chains and create an enabling environment for linking the farmers with the evolving markets by developing capacity, providing access to finance & technology and creating infrastructure. The interventions proposed under the programme are summarized in the table below.

	Technical Assistance	Creation of Infrastructure
Capacity Building & Strengthening of Farmer & their Collectives	▪ Capacity building & training of Farmer Collectives ▪ Enterprise Management & Operation handholding for FPOs ▪ Market Intelligence & Price Discovery ▪ Training of FPOs on e-marketplaces/ auctions & other digital marketing services ▪ Leveraging economics of scale by linking Farmer Collectives through processing & marketing FPCs ▪ Brand & Market Development and Export Promotion	▪ Pack Houses ▪ Primary processing facilities ▪ Storage & Warehousing ▪ Retail Outlets in major markets
Promotion of SMEs in Horticulture	▪ Dissemination of Innovative Practices, Technology & Tools ▪ Brand & Market Development and Export Promotion ▪ Creation of backward & forward linkages	▪ Processing & value addition facilities ▪ Storage & Warehousing ▪ Logistics
Facilitating Overarching Development of Horticulture Sector	▪ Access to finance and Creation of Venture Capital Fund ▪ Innovation in Post Harvest & Market Access ▪ Creation of quality standards ▪ Market development through promotion of digital e-market places and export promotion	▪ Strategic Distribution Centers (SDCs) ▪ Logistics

6.2.1.1 Enhancing Value Addition and Processing Capacity of Horticulture Crops

As discussed in the earlier chapters, the present value addition and processing capacity of the focus horticulture commodities in an organized manner is very limited. The total estimated processing capacity in the state for the focus crops is about 0.23 Mn MT per annum which is less than 4% of the total production of the focus crops in the state. Similarly, the total capacity of modern packhouse for the focus crops is about 0.4 Mn MT per annum which is about 6.5% of the total production of those crops in the state. Considering such low capacities of value addition and processing, it is proposed that the programme focuses on creation of such facilities to increase value addition and processing of the horticultural crops which would lead to higher value realization for both the farmers/ farmers collectives and the private sector companies including agribusiness SMEs who are a part of the value chains. As the production of the focus crops in the state is very large, it is proposed that the focus of the interventions under the programme would be on creating additional capacity by 5-10% for value addition and processing in an organized manner.[41]

[41] Except for banana, where it is proposed to increase the additional capacity by 2% as the production of banana in the state is much higher (at about 3.3 Mn MT) than the other focus crops.

6.2.1.2 Flexible Programme Interventions

The proposed programme will allow flexibility in terms of ownership, location, size and capacity of the interventions, focus crop combination, technology, etc. to the farmer collectives and private sector players as project promoters. Each component of the interventions along the different stages of the value chains can be owned by a different stakeholder based on their interest and expertise. This would aim to create individually viable enterprise facilities at each level, improving the overall performance and sustainability of the value chain. The interventions are also proposed to cater to suitable multi-commodities, wherever possible, to increase capacity utilization for improving viability.

6.2.1.3 Enterprise Development at the Farmer Collective Level

The proposed programme will aim to develop farmer collectives into commercially viable business enterprises that would not only engage in production but also set up value addition facilities in terms of pack houses and processing facilities. Thus, the farmer collective enterprises would need professional handholding support for all business aspects like operational, financial and technical services. In activity terms, it would translate into professional expertise for developing business and marketing plans, planning the investment – one time vis a vis phased inflow, market linkages, identification and selection of appropriate technology, partners, linkages, networks and service providers (legal, accounting, secretarial, sales & marketing, finance, human resources, tax planning etc.), leadership training, book keeping, etc. The main objective of these activities would be to develop entrepreneurship in the farmer collectives and helping them run successful enterprise.

6.3 Details of Programme Interventions

As mentioned earlier, the proposed interventions include Technical Assistance (soft interventions) and Creation of Infrastructure (hard interventions) for each stage of the value chains. The details of the subcomponents of the Technical Assistance and Creation of Infrastructure are given below.

6.3.1 Technical Assistance (TA)

6.3.1.1 TA for Capacity Building & Strengthening of Farmers & their Collectives

Lack of capacity of the farmers and their collectives have been a major challenge for all the focus value chains. During the stakeholders' consultation, it was highlighted repeatedly that there is a huge scope in development of capacities of the farmers and farmer collectives in terms of cultivation best practices, post-harvest practices, enterprise and operations management, market intelligence, knowhow of e-marketplaces and digital marketing services, market development and branding. Considering this, the following interventions are proposed as TA for Capacity Building & Strengthening of Farmer & their Collectives:

- ***Capacity building & training of Farmer Collectives***

  One of the key concerns for the buyers for directly procuring from FPOs is the lack of competence and effectiveness of the FPO leadership in management of the FPOs and providing effective support to their FPO members which many times leads to the inability of the FPOs to meet the expected quantity and quality of products as per the requirement of the buyers.

To address this issue, it is imperative that suitable capacity building and institutional handholding support is provided to the FPOs in form of mentorship and trainings programs, along with know-how and ability (including retail licensing) for providing agri-inputs & technical advisory to farmers. It is proposed that these training and institutional handholding support shall be funded by the State Government under the programme through implementation partners which may be organizations working closely with farmer collectives. In case any private sector intends to provide such support to the farmer collectives, such initiatives should also be covered under the programme.

- ***Enterprise Management & Operation handholding for FPOs***

  During the field study, it was learnt that majority of the FPOs lack professional expertise to run and manage the enterprise operation within their FPOs, which impede their operations. Similar feedback was received from private sector players during the interactions.

  As a part of the programme, it is proposed to identify suitable candidates from the existing leadership of the FPOs and train them in enterprise management aspects including preparation of business plans & operational manuals. It is also proposed to provide financial assistance to certain FPOs to hire professionals for critical roles in the FPOs, where candidates are not available internally.

- ***Market Intelligence & Price Discovery***

  As mentioned earlier, farmers in general they have very little information on the prices that are being offered for their produce in the wholesale markets. This is particularly acute in case of awareness of grade specific pricing. In most of the orchard crops, a significant volume is traded through pre-harvest contracts which involves a high amount of estimation work from the trader. In most of cases, the farmer ends up on the losing side as they have limited information on price and demands trends etc.

  Hence, market Intelligence and market information services (especially grade specific pricing) are essential to ensure maximizing the farmer margins. In this regard, it is proposed under the programme to make available various web/app based models of Agriculture Market Information Systems (AMIS) available in the market to the Farmers and their collectives. These information systems should provide accurate market information to the farmers free of cost. The grade specific information should be including in the systems as it is a critical component which can contribute to higher value realization by the farmers.

- ***Training of Farmer Collectives on best cultivation practices, e-marketplaces/ auctions & other digital marketing services***

  The field study revealed that majority of farmers lack proper training on best farm management practices including productivity enhancement techniques such as high density plantation, INM, Soil Moisture Management (mulching), cultural practices such as weeding, etc. and post-harvest handling to extend shelf life and maintain quality. There is also an urgent need for training on e-marketplaces/ auctions and other digital marketing services. It is proposed that various training programs in on these topics in line with the nationally accredited skill qualification frameworks will be provided to the farmers as per their specific requirements. In case, accredited skill training programs are not available for certain topics, the same may be developed for the training

purpose. The State Government shall fund and implement these training programs through training partners.

- ***Leveraging economics of scale by linking Farmer Collectives through processing & marketing FPCs***

  In order to leverage benefits of economies of scale, collectivizing the Farmer collectives under Farmer Producer Companies (FPCs) is very important. Such FPCs would play the role of a processing and marketing company. Such collectivization increases bargaining power of the farmers for marketing, helps them to raise capital for setting up of processing facilities and reduce operational cost of such facilities. It is proposed that such FPCs shall be promoted under the programme.

➢ ***Brand & Market Development and Export Promotion***

Interaction with different farmer groups revealed that the key marketing challenges faced by farmers include lack of direct access to buyers, low farm gate prices due to limited marketing options, etc. Focus on developing marketing development for farmers and their collectives will help them to access different markets by bypassing middlemen and hence ensure better returns.

Various market development and access initiatives including developing FPO-owned brands (including improved packaging), promoting quality/ organic certifications, encouraging collective members to attend exhibitions, national conferences, workshops, etc. for displaying their products and linkage development shall be promoted by the State Government with support of private sector agri-businesses and other relevant organizations.

Implementation Model

The Technical Assistance (TA) for Capacity Building & Strengthening of Farmers & their Collectives is proposed to be implemented by the State Government through its implementation partners. The primary beneficiaries will be the farmers and their collectives. The initiatives should be market led and should be implemented with close coordination and constant feedback from private sector (agribusiness companies and export houses) regarding the utility and the relevance of the proposed interventions.

6.3.1.2 TA for Promotion of SMEs in Horticulture

➢ ***Dissemination of Innovative Practices, Technology & Tools***

Promotion of innovations in agriculture sector is critical for upgradation of value chains. Such innovations can improve productivity, reduce wastages, reduce cost, increase shelf life and improve product quality that would fetch higher returns. This would include adoption of global Good Agricultural Practices (including solutions such as BioSwitch for diminishing microbial activities in fruits like pomegranate, custard apple, etc.) along with low-cost technology at farm-level such as solar water pumps, auto-regulated micro-irrigation systems, hydroponic systems of cultivation, fertilizer deep placement technology, etc.

In order to promote and disseminate agriculture sector innovations in form of tools, techniques or technologies developed by private sector organizations,

research organizations, etc., appropriate institutional and financial support are proposed under the proposed programme. The State Government can promote and fund pilot testing and commercialization of such innovations.

- ***Creation of Forward and Backward Linkages for the SMEs in Horticulture***

  Brand & Market Development and Export Promotion for Forward Linkages: Private sector agri-businesses which need critical support for enhancing marketing and promotion of their produce in both domestic and export markets, are proposed to be supported under the scheme for availing professional services for these activities provided they procure certain prescribed percentage of their raw material directly from the farmer collectives.

  Assistance in creation of backward linkages: Also, various agri-produce marketing organizations (including e-market places) should be directly incentivized for forging long term partnerships with farmers and their collectives for procurement of their produce.

6.3.1.3 TA for Facilitating Overarching Development of Horticulture Sector

- ***Access to finance and Creation of Venture Capital Fund***

  One of the key challenges faced by farmer collectives and other private agri businesses is access to favorable credit for term loans and working capital requirements. During the field study, the interactions with farmer collectives revealed that the majority of financial institutions and commercial banks generally seek a minimum collateral of about 150% to 200% of loan value from the collectives. It is very difficult for the farmer collectives to arrange for collateral of such values leading to unavailability of loan for setting up of value addition/ processing facilities. Moreover, in some Government Subsidy Schemes, such as Cold Chain Scheme and Scheme for Creation of Backward and Forward Linkages (Ministry of Food Processing Industries), term loan of a certain percentage of the project cost is a mandatory eligibility criterion. Due to the inability to raise bank loan, many of the farmer collectives are unable to avail subsidy under these Schemes for developing infrastructure for storage and forward & backward linkages. Similar is the case for working capital loans. Interactions with private agribusiness also revealed similar challenges faced in terms of availing bank loans. Considering this, it is recommended that soft loans (both term and working capital) at 4-5% interest rates should be provided to Farmer collectives and agri-business private companies.

  Also, during the study, it was found that there is an acute need for seed/ venture capital along with enterprise incubation especially for startup agribusiness ventures. Such enterprise/ business incubation would provide a nurturing, instructive and supportive environment during the critical phase of new business by supporting the startups to overcome their lack of business skills and inadequate finance. Experience of having such funds and incubation support for agribusiness startups in other states have shown encouraging results.

Case: INVENT Programme

Innovative Ventures and Technologies for Development (INVENT) programme is a DFID funded program (through Technology Development Board, Government of India), which aims to create a viable social enterprise pipeline for impact investments in the 8 low income states of India (Uttar Pradesh, Madhya Pradesh, Bihar, Chhattisgarh, Jharkhand, Rajasthan, Odisha and West Bengal). The programme aims to handhold Innovative businesses at seed or early stages of enterprise development that benefit the poor in the LIS of India while being commercially successful through reputed incubators such as IIM Calcutta Innovation Park, IIT Kanpur, Startup Oasis and KIIT in the low income. Agriculture is one of the focus areas of the programme and several agri-startups have been funded and incubated under this programme with positive outcomes.

It is proposed to establish a Venture Capital Fund under the programme for expansion & valuation, technology induction, marketing, etc. specifically for social agri-business enterprises and FPCs. The Fund will extend financial support through equity infusion, debt or convertibles through identified incubators in the state, which would also provide incubation support. A suitable fund manager shall be appointed to manage the proposed fund and provide the required mentoring support and along with financial due diligence.

- ***Innovation in Post Harvest & Market Access***

Post-harvest innovations stimulate agricultural production, prevent post-harvest losses, and add value to agricultural produce, thereby opening new marketing opportunities and enhancement of farmer incomes. It is proposed that suitable post-harvest interventions shall be identified and supported for promotion under the proposed programme. For example, solar/ biomass powered small pre-coolers and cold storages at the farm level can be supported in some of the perishable clusters to reduce wastages at the farm level. These units can be owned by farmer collectives and would be used by the member farmers. Similarly, other innovations can also be promoted under the programme such as promoting R&D on packaging based on bio-polymers derived from renewable sources, low cost ethylene dispensers for uniform and healthy ripening of fruits, etc.

- ***Creation of quality standards***

There is a need to standardize the quality parameters of the fruits and vegetables based on grade (size), appearance, colour, etc., which influence the pricing and also helps in maintaining the quality of these commodities. These standards should be widely disseminated so that all stakeholders including farmers and their collectives, trader/intermediaries and consumers have a shared understanding of the same.

This would help reduce/ eliminate "ocular" quality determination currently in prevalence by the trade wherein a small sample from a produce bag is used to determine the grade and quality of the produce in question and the resultant price. Most of the time, it is subjective and is generally against the farmer. Additionally, the requirements of the processors in terms of organoleptic characteristics (flavor, colour, aroma, texture) and product safety characteristics (pH or water activity) also need to be standardized. Similar is

the case at the production level which would require standardization of maturity indices, temperature during picking, use of colour charts, process/protocols to be followed just after harvest, etc. Some of these initiatives will also include improving traceability (GS1 standards- barcoding), Good Agri Practices (GAP) standards for safe & nutritious food, etc.

- ***Market development through promotion of digital e-market places and export promotion***

  It is proposed to encourage market development through promotion of digital e-market places and export promotion. Various initiatives should be undertaken to enhance marketability of produce across the state. Several Government and private sector promoted e-market places are already operational in India. Special packages to promote these e-market places should be undertaken by the State Government under the proposed programme.

Implementation Model

The Technical Assistance (TA) for promotion of SMEs and Facilitating Overarching Development of Horticulture Sector is proposed to be implemented by the State Government by providing appropriate subsidies, soft loans, venture capital, etc. to the beneficiaries (mostly private agribusiness enterprises and FPCs) directly. It is envisaged that a Programme Management Agency (PMA) would be engaged by the State Government for overall implementation, management and monitoring of the programme.

6.3.2 Creation of Infrastructure

As mentioned in earlier chapters, the constraint faced by the horticulture sector encompasses the complete range of activities starting from production to marketing. However, the current study focuses on issues related to post harvest activities associated with the focus crops in question. These include but not limited to low holding capacities of farmers and their collectives, limited access and availability of credit, lack of information, lack of appropriate post-harvest infrastructure, cold storage, inadequate space, poor market network and high transportation cost and post-harvest losses, etc. Additionally, as also mentioned earlier, the long supply chain results in extensive wastages and multiple handling resulting in high inefficiencies. The physical wastage is one component of the inefficiency of the supply chain, the other being deterioration of quality, loss of value and cost of intermediation.

Assured availability of right produce – free from injuries and diseases and which lend themselves to storage over a long period, leading to arbitrage benefits – along with efficient market linkages for both domestic and export markets are critical for the viability of Farmers Organizations and Collectives. Requisite infrastructure that needs to be created for catering to the market requirements are also equally important. Developing efficiencies in the supply chain management is of paramount importance given the fact that the production of raw material is relatively unorganized, seasonally and spatially dispersed and any break in the chain negates any advantage gained through either storage or transportation.

All this requires well thought out strategies to address the requirements of the post-harvest chain from farm gate to the consumer including an enabling investment climate and investment catalysts. This is more so as "Attracting a huge investment to

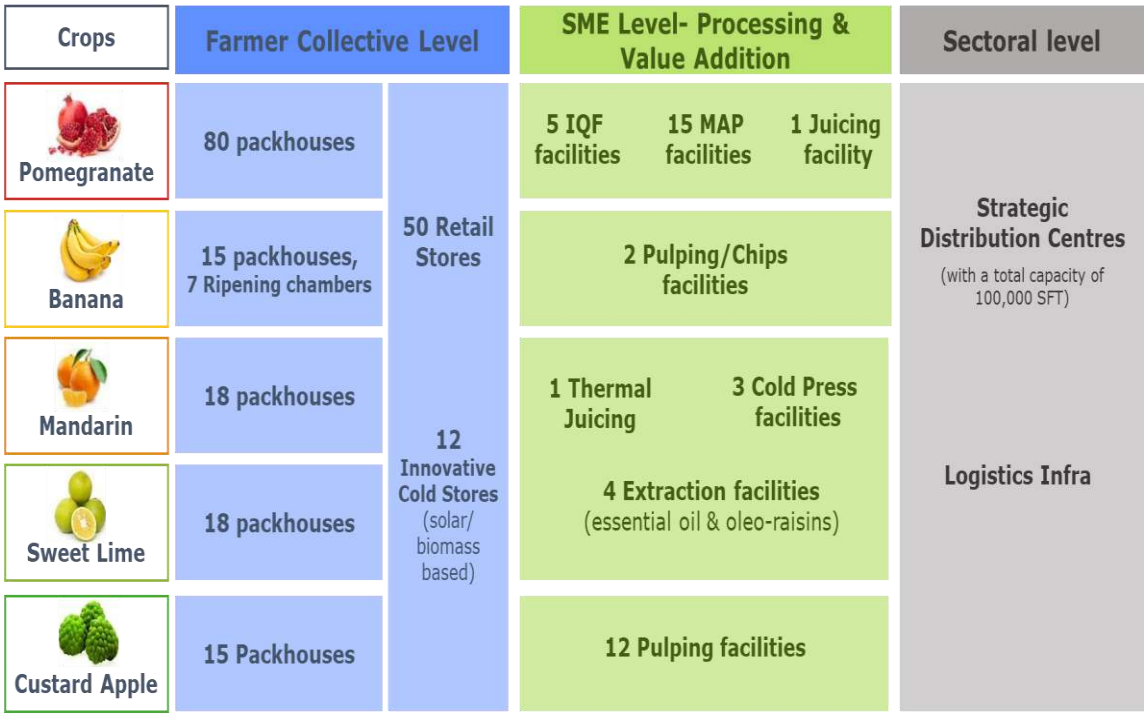
a sector which has little or no history of attracting investments needs bold and dynamic policies to attract investment in the sector in an integral manner". (GOI-CII Task Force Report on Cold Chain Development in India).

Under the proposed programme, creation of infrastructure is envisaged for value addition, processing, logistics and marketing at three levels: farmer collective level, agribusiness SME level and sectoral level. The objective is to create suitable facilities and infrastructure at all key stages of the value chains, which along with the TA interventions would lead to upgradation of the value chains.

While the need for the creation of such physical infrastructure is significant, however, considering the limited resources available with the project, it is proposed to create additional capacity by a minimum of about 5-10% for value addition and processing of the focus crops in an organized manner under the programme.[42] The table below provides the estimated throughput of the proposed facilities of the focus crops that would result in increase in the capacities upto the desired percentage levels.

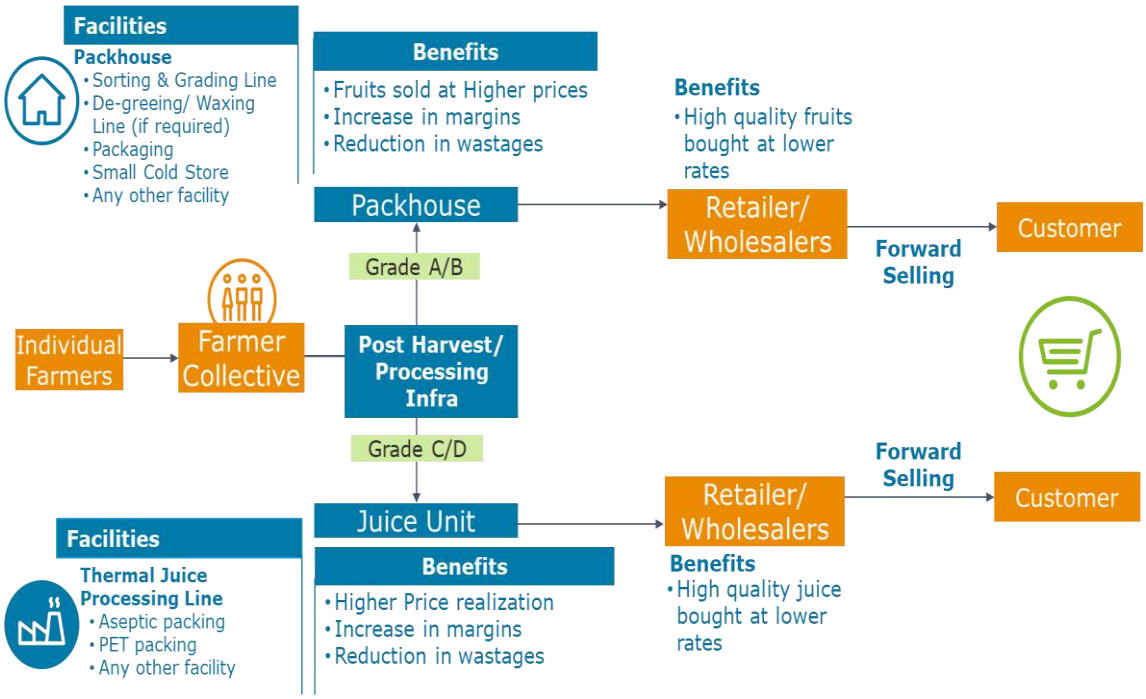
Focus Crops	Total State Production (`000 MT)	% increase in capacity	Additional Throughput to be created (`000 MT)
Pomegranate	1616	5%	80
Banana	3334	2%	66
Mandarin	801	5%	40
Sweet Lime	359	5%	17
Custard Apple	90	10%	9
	6201		**214**

Based on the gaps identified during the study and feedback received from various stakeholders, the following facilities/ infrastructure are proposed at different levels of the value chains of the focus crops:



[42] Except for banana, where it is proposed to increase the additional capacity by 2% as the production of banana in the state

The increase in value addition and processing in an organized manner lead to proper segregation of the produce different grades. The pack house operations will enable the farmer to segregate the produce into table grades (Grade A & B) and processing grades (Grade C & D). This would be a paradigm shift as the farmer collectives will be able to take advantage of returns from the higher prices of table grades produce and will also be able to dispose of the processing grades given the interest on processing by private players. The processing interventions would provide a market for processing grades. These interventions, while providing a market, would also result in adding value to the produce not only from a perspective of just increasing the shelf life but also in terms of changing the physical nature of the produce which will enable availability of the products across far geographies. These would leverage technological advancements made over time in processing and value addition. An illustrative diagram of the interventions with potential benefits is given below:



6.3.2.1 Proposed Facilities/ Infrastructure at Farmer Collective Level

Development of appropriate infrastructure at the farm gate is one of the biggest challenges across the value chains due to various reasons, limited capacity of individual farmer (in terms of production and capital) being one of the primary reasons. However, adoption of the farmer collective approach can help circumvent the challenge as it involves aggregation of produce from many farmers leveraging economy of scale for which infrastructural facilities (such as that required for pre-cooling and pack houses in case of fruits and vegetables) can be established.

This would not only provide stability to the operations in terms of scale and sustainability but also lead to an increase in the general level of quality of the produce. This Collective approach would enable risk sharing, improved marketing and negotiating power for the producers. It would also go a long way in assuring quality and economies of scale. Towards this end, various initiatives being undertaken by the Government such as Rural Business Hubs, strengthening of cooperative/farmer organizations, Doubling Farmers income etc. can be undertaken to fully realize the benefits.

The following section describes the facilities/ infrastructure proposed at farmer collective level.

- ***Pack Houses***

A Pack House comprises of a Building (Pre Engineered or otherwise), Grading and Sorting area with suitable process-lines, Pre-coolers, Multi-commodity Transit Cold Rooms, Ripening Chambers, Crates, Material Handling Equipment and Laboratory etc. depending on the crop.

Pack houses are generally the first point of aggregation of farm produce where minimal processing is undertaken to extend the shelf life. Generally, pack houses are of two types- transit pack house and holding pack house. While a transit pack house is used for pre-cooling, cleaning, sorting, grading and packing of perishables for immediate onward supply to markets, holding pack houses also have cold room where the produce can be stored for a few days before sending to the markets depending on the demand supply scenario. Although there can be various different components in a pack house based on the crop, however, the main components are as follows:

Pre-cooling[43] – Temperature management is one of the most important factors affecting the quality of fresh produce. There is an optimum storage temperature for all products. The ideal temperature often depends on the geographical origin of the product. The product must be cooled to the appropriate temperature and then held in refrigeration at the same temperature prior to departure. Pre-cooling is the first step in good temperature management. Rapid cooling after harvest has been clearly shown to prolong the shelf life of freshly harvested produce. During busy harvest times, it is important to have practical systems in place to minimize the amount of field heat[44] accumulating in harvested fruit, as well as having an efficient system for removing that heat at the cool store. Most storage rooms designed for holding produce under refrigeration do not have the refrigeration capacity, or the air movement needed for rapid cooling. Pre-cooling refers to the rapid removal of field heat shortly after the harvest of a crop. Field heat should be removed as fast as possible since, for most produce, an hour delay at field conditions of about 35°C will lead to a loss in shelf-life of about 1 day – even at optimal storage conditions. According to the FAO, precooling is "amongst the most efficient quality enhancements available" and is regarded "as one of the most value-adding activities in the horticultural chain".

Pre-cooling benefits include:

- Restricting and minimizing respiratory activity, thereby conserving the weight of the produce, and enzymatic degradation of the produce harvested; thus preventing softening, water loss and wilting
- Preventing microbial growth, such as bacteria and fungi thereby decreasing the rate of decay
- Decreasing rate of ethylene production and the impact on ethylene sensitive produce
- Delaying chilling injuries for certain fruits
- Lowering the required workload of a cold storage since optimum storage temperature is reached more quickly
- Increasing the daily intake into storage facilities which should not exceed 10% of its cooling capacity if produce is not pre-cooled

[43] Source - Various

[44] Field heat is defined as the difference in temperature between the temperature of the crop harvested and the optimal storage temperature of that product.

Cleaning, Sorting and Grading - Processing techniques including minimal processing activities such as cleaning, sorting, screening, grading, trimming, de-stemming, waxing etc. are necessary to obtain the required uniformity and acceptable quality of raw commodity by the customers and processing industries. Under this program automated sorting and grading lines are proposed as a part of the pack houses.

Ripening Chambers – Ripening Chambers are proposed as a part of some of the banana packhouses which would be near the consumption markets. Ethylene is naturally produced by a number of fruits and vegetables. However, the level as well as concentration of ethylene production varies from crop to crop. Due to this, crop is not uniformly ripened. In order to ensure uniform ripening of the produce, optimal and controlled ripening conditions have to be initiated and maintained by way of exposure to ethylene gas at desired dosage and intervals at prescribed temperature and carbon-dioxide level. Such treatment in a ripening chamber has helped uniform ripening of banana, mango etc. adding tremendous market value to it.

Ripening chambers comprise of gas tight and insulated multiple chambers of desired capacity for ripening a variety of fruits and vegetables under controlled temperature and humidity conditions. Ripening is done by injecting ethylene directly or through a generator. Air circulation and cooling requirements are important criteria while designing. If ripening is to be done in boxes as generally practiced all over the world, the air circulation system is pressurized to induce cool air and ethylene through the produce for uniform and correct ripening. An ideal ripening system includes the refrigeration, multiple insulated chambers with Gas Tight Doors, Ethylene Generator and Controls.

De-greening Chambers - This is a crop specific requirement, which will be part of the pack houses wherever required. De-greening chambers are used for citrus fruits such as Mandarin and Sweet Lime to remove green colour from the fruit by application of a specific concentration of ethylene at a specific temperature and relative humidity. This is to ensure that the fruit has its characteristic colour as preferred by the consumers.

Waxing line- In case of waxing facility, a layer of wax is applied artificially to the fruit with appropriate consistency and thickness to prevent anaerobic growth within the fruits which increases the shelf life. Waxing is generally recommended for fruits such as pomegranate, mandarin, sweet lime, custard apple, etc. and is especially important for sealing of tiny injuries and scratches on the fruit surface. Waxing also enhances the appearance of the fruits due to the resulting gloss on the surface which enhances the acceptability and price of the fruit.

Multi Commodity Cold Stores –These are Multi Chamber Cold Store Facilities for multi commodity storage and varying storage conditions. They may also function as Modified Atmosphere Cold Stores (MA). They include a Pre Engineered Insulated Building, Processing Area, Grading and sorting lines, Multiple Cold Rooms, Pallet Racks, Material Handling Equipment, Docks, Laboratory and Sanitation etc.

Packaging to minimize loss - Use of correct packaging materials and techniques, stacking and storing can reduce the incidence of losses. Packaging fresh fruits and vegetables is one of the more important steps in the long and complicated journey from grower to consumer. Bags, crates, hampers, baskets, cartons, bulk bins, and palletized containers are convenient containers

for handling, transporting, and marketing fresh produce. The trend is toward greater use of bulk packages for processors and wholesale buyers and smaller packages for consumers. The advantages of a system where all involved use the same standard sizes and preferably the same type of packaging are:

- A uniform handling method and the use of combined, larger, quantities at one time, resulting in reduction of handling time, labour cost and damage to the produce.
- If the produce in the combined unit (e.g. a pallet full of boxes with oranges) has the same quality grade, this combined unit can be marketed as a whole.
- Higher production volumes of crates of only a few sizes will decrease the cost per crate, decrease the storeroom size for the different crates and guarantee a more stable supply of crates.

Under the programme, the following packhouses are proposed:

Crop	Facilities Proposed	Capacity (MT/ Day)	Days of Operation	No. of Pack Houses Proposed	Total annual Throughput (MT)
Pomegranate	Sorting & Grading Line (2-10 MT/day), Waxing Line (2-10 MT/day), Packing Line, Small Cold Store (100 MT)	10	100	80	80,000
Banana	Sorting & Grading Line (2-15MT/day), Dehanding facility, Pre-cooling, Ripening Chamber, Packing Line and Warehousing	15	300	15 (7 having Ripening Chambers)[45]	67,500
Mandarin	Sorting & Grading Line (2-30 MT/day), Degreening Chamber, Waxing Line, Packing Line, Small Cold Store (100 MT)	30	70	18	38,000
Sweet Lime	Sorting & Grading Line (2-15 MT/day), Degreening Chamber, Waxing Line, Packing Line, Small Cold Store (100 MT)	15	70	18	19,000

[45] It is proposed that 7 out of 15 pack houses for banana will have ripening chambers. Ripening chambers will be in pack houses which are near the consumption markets either local or state level.

Crop	Facilities Proposed	Capacity (MT/ Day)	Days of Operation	No. of Pack Houses Proposed	Total annual Throughput (MT)
Custard Apple	Sorting & Grading Line (2-10 MT/ Day), waxing line, MAP Packing Line, Small Cold Store (100 MT)	10	60	15	9,000

These modern pack houses are proposed to be setup at farm gate level and would be mostly owned and operated by the farmer collectives. The modern pack houses would enable the farmer collectives to forge marketing linkages directly with the wholesalers/ organized retailers for high quality products (mostly Grade A and B) leading to increase in margins by about 20-40% for the farmers depending on the crop and reduction in wastages by about 5-15%.[46] The lower grades (Grade C and D) of the produces will be sold to processors. The wholesalers/ organized retailers would benefit through procurement of high quality fruits from the packhouses at 10-15% lower rates by bypassing the other intermediaries in the value chains.

- ***Innovative Cold Stores***

As discussed earlier, it is proposed to set up innovative small cold stores (with a capacity of about 10-120 MT) at the farm level which would be owned and operated by the farmer collectives. Such cold stores can be powered by solar or biomass to reduce dependence on grid power and this would also ensure lower operational costs. The small storages may also have pre-cooling units for quick removal of field heat. Such innovative small cold storages at farm level would enable the member farmers to store their produce immediately after the harvesting, which would increase the shelf life and reduce wastages. This would also help the member farmers to hold the produce temporarily to get a better price in the market.

It is proposed to set up about 12 such innovative small cold stores at the farm level.

- ***Retail Stores***

Interactions with farmers and their collectives during the field study revealed that there is a scope for direct selling of produce by the farmer collectives through their own retail outlets. This is particularly true for the farmer collectives which are closer to the major urban consumption centres. Setting up of such retail outlets by the farmer collectives would provide them the opportunity to directly access the urban markets which would ensure higher margins to the member farmers. Moreover, it also presents an opportunity to develop their own branding which would eventually assist in expansion of sale and target distant markets.

Under the programme it is proposed to set up 50 such retail stores in urban consumption markets which would be owned and operated by the farmer collectives.

[46] Illustrations given in the subsequent sections of the report

6.3.2.2 Proposed Facilities/ Infrastructure at Horticulture SME Level for Processing and Value Addition

The interventions proposed in this stage is from a perspective of adding value in terms of changing the physical nature of the produce and at times chemical composition which would lead to increase in shelf life and making the products available across far geographies. These interventions also aims to leverage technological advancements made over time in processing and value addition. These would also involve much larger financial investments and hence proposed to beowned and operated mostly by private sector especially the SMEs in horticulture.

Some of the interventions suggested under this are although crop specific but can be used for additional crops with slight modifications or additions in the processing process. The crop wise proposed interventions are given below:

- ***Pomegranate***

In case of pomegranate, considering the trends in processing for this fruit crop, the following interventions are proposed:

- Aril (Red Hued Seed) Extraction Units – 20 no.s having (with a capacity of 2 MT/ Hr each)
  - ✓ Out of which 5 no.s will have Individual Quick Freeze (IQF) facility along with deep freezers for storage
  - ✓ The remaining 15 no.s will have Modified Atmosphere Packaging (MAP) (instead of IQF) and cold store (instead of frozen store) for storage
- Thermal Juice Processing Line (50-100 MT/day)

Aril Extraction Units

Minimally processed ready-to-eat pomegranate arils have become popular in the export markets of US, Middle East & Europe due to their convenience, high value, unique sensory characteristics, and health benefits. There has been interest from several pomegranate based farmer collectives to set up their own pomegranate aril extraction units for fresh arils. There has also been interest from some private players to set up such units based on the demand. Considering such interest, it is proposed to promote about 20 aril extraction units for fresh arils in the state under the programme.

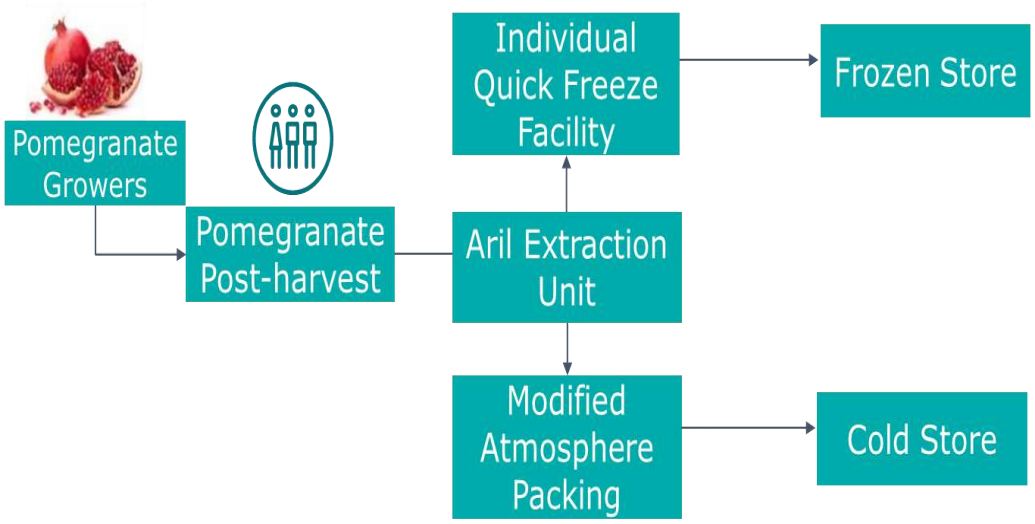
Individual Quick Freeze (IQF): Once the arils are extracted, they can be frozen using IQF technology. This system involves the use of a blast of cold air which, when directly on the food products, quickly freezes them. IQF technology implies placing the product inside a freezer that makes better use of thermodynamics by continuously moving the product. The product is placed on a fluidized bed that transports and moves the product while an efficient air flow is blown through fans. IQF freezes the product faster to the core. This type of freezing results in the product free rolling and not clotting into lumps. IQF freezing technology has a quick freezing time and the expansion of ice crystals is limited, thus the membrane and structure of the product is not destroyed. By limiting the freezing time, taste, texture and nutritional value is better preserved in food.

For Pomegranate, arils will be extracted from sorted and washed pomegranate fruit. The pomegranate arils will then be passed through the IQF at controlled temperatures. These will then be sorted, inspected and finally packed,

maintaining strict hygienic and product safety conditions. The frozen arils will be stored in a frozen store at -18° C as this is the ideal minimum temperature for optimum storage of frozen pomegranate arils. The stored pomegranate arils will be further delivered to customers as per the order received.

It is proposed that, out of the 20 proposed aril extraction units, 5 will have IQF technology for freezing arils along with frozen stores for storage.

Modified Atmosphere Packaging (MAP): In the remaining 15 aril extraction units, it is proposed to have Modified Atmosphere Packaging and cold store. Modified Atmosphere Packaging (which is also known as protective atmosphere packaging or reduced oxygen packaging) enables fresh and minimally processed packaged food products to maintain visual, textural and nutritional appeal. The MAP environment enables food packaging to provide an extended shelf life without requiring the addition of chemical preservatives or stabilizers. Processors and marketers of food products rely on MAP to assure fresh products that continually meet the consumer's expectation for brand quality, consistency, freshness and in-stock availability. The MAP arils will then be stored in cold store for further delivery based on orders.



Integrated Pulping and Juicing Facility

There is a growing demand for pomegranate juice in both domestic and export markets. It is sometimes a difficult fruit to handle pomegranate at the consumer level as deseeding or aril extraction is a cumbersome process especially when done by hand. However, technological interventions have resulted in the arils being processed into juice concentrate for ease of consumption. At the same time essential oils can be extracted from the leftover seed and peels of the fruit.

Considering this, it is envisaged to promote establishment of one such plant (with a capacity of about 50-100 MT/ Day) in the pomegranate production cluster so that not only juice but also essential oils can be extracted. This would help the juice being made available to the consumers at more affordable than the current prices.

Fruit based beverages market in India is one of the fastest growing market with a CAGR of over 30% in the last decade. It is expected to grow at average CAGR of 15% over the next few years. There is a growing demand for pomegranate juice in the market. Many organized retail players like Dabur, PepsiCo, Parle, Godrej, Paper Boat, Coca Cola etc. have forayed into production of pomegranate juice in the domestic market. Globally too, the demand for pomegranate juice have been increasing due to awareness for adoption of healthy lifestyles, ease of availability, developing trade channels from producing countries etc.

- ***Banana***

In case of banana, 5 banana chips making units are proposed to be promoted under the programme, each having a capacity of about 0.2 MT/ Day. These units can be owned and operated either by the farmer collectives or by the SMEs, given that investment is not very high. In case of farmer collective owned facilities, they will be an alternative revenue generating opportunity from banana for the farmers.

For chip making, banana is thinly sliced and then the slices are immersed in a sodium or potassium metabisulphate solution (to improve the colour of the final product or to prevent discolouration) and fried in hydrogenated oil. The fried slices are dusted with salt and antioxidants (e.g. butylatedhydroxytoluene) to delay rancidity.

Alternatively, the banana slices may be dried before frying and the antioxidant and salt are added with the oil. Fried chips should have moisture content of about 1.5 to 2.0%. The temperature at which the chips are fried and the frying time affects their oil content, appearance, texture and flavour. The chips must be packed in moisture proof bags to prevent them absorbing moisture and losing their crispness.

Euromonitor's report "Savoury Snacks in India" (December 2016) estimates that savoury snacks are likely to register a constant value CAGR of 12% over 2016-2021. The Indian chips market, sized at Rs 7,000-7,500 crore, has been growing at a robust pace of 15% over the past five years and going forward, is expected to grow at a similar pace. Growth will come from rising disposable incomes, changing lifestyles, product innovations and strengthening of distribution to have better selling opportunities in lower-tier cities and rural areas.

According to research report by RNCOS entitled, "Opportunities in Indian Banana Processing Outlook 2022", Banana chips are gaining wide acceptance in Indian households as tasty snack food. MTR, Haldiram, Balaji, Bikaji etc. are the major organized players in the Banana chips market but the chips are majorly sold by local players through unorganized sector. Also, increasing willingness and ability to pay a premium for banana products that is cleaner, safer and has other quality attributes by the consumers,

- ***Custard Apple***

In case of custard apple, given the short shelf life especially with the fruit being climacteric in nature, there is a pressing need for using technology to add value or process for increasing the shelf life of the produce. The recommendation builds on some of the processing activities (though small in nature) already being practiced in the production clusters and also the intended use of these value added products. One of the major value added products from custard apple is its pulp which is then frozen and stored to increase the shelf life for more than 6 months. The pulp is an intermediate product which is used as a flavouring agent in ice cream industry and as a binding agent (using pulp powder) in pharmaceuticals industry, etc.

It is proposed to promote pulping lines along with blast freezer and frozen stores for storage for processing of custard apple. Twelve such pulping units are proposed to be developed in the production clusters with a capacity of 4 MT/ Day per unit. The proposed units are of lower capacity since the fruit is to be de-seeded manually and it becomes a limiting factor for larger operations.

A longer storage life without much alteration to the natural content and flavour is a main factor boosting domestic market demand for custard apple pulp by the ice cream manufacturers, flavouring companies etc. Indian ice cream industry is one of the fastest growing sector in the dairy industry. Presently, it is growing at a rate of 15-20% year-on-year. Many ice cream manufacturers in the country have started offering custard apple flavoured ice cream leading to a rising demand for custard apple pulp.

Moreover, India exported custard apple worth Rs. 681 lakhs in the year 2017-18 as compared to Rs. 111 lakhs in 2010-11. This shows the growing global demand for custard apple & its products.

- ***Citrus Fruits – Mandarin and Sweet Lime***

Globally, tomato, orange and apple are the top three crops which are processed into pulp/ concentrates. India is amongst the top 5 producers of these three crops but has negligible presence in terms of processing. In India, most of the processing of mandarin and sweet lime (mostly to concentrate/ juice) happens in the unorganized sector and there is a huge scope of development of organized concentrate/ juice processing.

Moreover, the orange and sweet lime peel which is considered as a waste can be used for the extraction of essential oil which has many applications ranging from food flavoring agent to cosmetics. Mandarin contains 1.5% essential oil including D-limonene which has a lemon-like odor and is a major constituent in several citrus oils. Limonene can also be used as an active ingredient in pesticide products. Citrus oils can be extracted by various conventional methods like steam distillation, solvent extraction, etc.

In India, most of the citrus processing units (with few exceptions) are limited to making only juice/ juice concentrates with little or no emphasis on processing the by-products such as peel oil, animal feed[47] from rejected fruit

[47] Washed pulp, waste peel and other solid waste are sent to the feed mill where it is dried and pelletized for animal feed

peel, etc. This makes the final product commercially less viable in comparison to the internationally available products.

It is therefore, proposed to promote establishment of integrated pulping and juice concentrate unit along with peel oil recovery system and animal feed unit. These units will use the Grades C and D of mandarin and sweet lime for processing. Such integrated units will enable production of juice/ juice concentrate with high viability as almost the entire fruit will be utilized for processing into commercial products. In terms of the technology to be used for juice/ concentrate making, both thermal breaking press (Pulping unit where heat is used to pasteurized the pulp) and the emerging technology of cold press juices along with the requisite packaging are suggested to be promoted. Cold-pressed technology uses a hydraulic press to extract juice from fruit. Here, heat is not used for pasteurization. It is generally more expensive as there are no added ingredients and it is made of 100% fruit ingredients. Cold press technology is largely able to retain the intrinsic nutritional quality of the fruits as during thermal process some of the nutritional properties get compromised.

Presently, the orange juice market in India is pegged at USD 9 million with a projected annual growth of 6% over the next few years. The market size is small as compared to the developed global markets of US & European countries having a revenue of USD 4000 million & USD 2238 million respectively. Thus, there is a high scope for development of domestic market for citrus juice as well as capturing the supply market to the leading countries in North America, Europe etc. The unorganised sector in India accounts for over 75% of the market share in the fruit based juice market but FMCG companies have started marketing fruit juices, introducing fusions & mix of new flavours to attract consumers. There have been investments from major beverages firms such as Dabur, PepsiCo, Coca Cola, ITC, Rasna etc. in the fruit juice segment leading to high demand & growth of the fruit juice market including orange & sweet lime juices.

As a part of the programme, 4 such integrated units are proposed (1 Thermal Juice Unit having a capacity of about 100 MT/ Day and 2 Cold Press Units with a capacity of 20 MT/ Day per unit). In case of thermal juice unit, aseptic packaging is proposed along with ambient storage whereas in case of the cold press units, cold stores are proposed for storage.

Implementation Model

Creation of Infrastructure at farmer collective and horticulture SME level for value addition and processing is proposed to be implemented by farmer collectives and agribusiness SMEs with support from State Government through the proposed programme in terms of appropriate subsidies, loans, etc. It is envisaged that the Programme Management Agency (PMA) engaged by the State Government would be responsible for overall implementation, management and monitoring of the activities.

6.3.2.3 Proposed Facilities/ Infrastructure at Sectoral Level

The interventions proposed in this stage aims to complement the Technical assistance initiatives at the sectoral level by creating infrastructure at the state level. The focus of these interventions would be to create large storage, distribution and logistics infrastructure for perishables and other commodities leading to sectoral development. These infrastructures would assist in developing bulk-marketing linkages with distant markets (including exports) and also establish distribution hubs for large corporates which would drive the evacuation of agricultural commodities in the state. Based on the gaps identified during the study and feedback received from various stakeholders, the following facilities/ infrastructure are proposed at the sectoral level under the programme.

- ***Strategic Distribution Centres (SDCs)***

  SDCs are proposed to be the last node of the supply chain from where both fresh and value added/ finished products shall be sent for retail/ wholesale outlets and export/ processing destinations. Along with large storage facilities, the SDCs will have facilities for primary processing such as sorting, grading and packaging facilities for fresh produce and further processing along with facilities for wholesale and retail distribution. In this way, the SDCs will assist in the large scale evacuation of both fresh and value added products by creating large distribution network with the end markets. The SDCs are proposed to have the key logistics components for food items such as integrated cold chain having different temperature zones such as ambient, cold, chilled and frozen for different types of fresh and value added products and will be equipped to handle products of different temperature and humidity zones. It shall also have dry warehouses, bulk material handling equipment, primary processing lines, packaging lines, refrigerated logistics, etc. SDCs will be connected to the production clusters and the forward markets by different types of reefer vehicles, pre-cooling vehicles and ambient/ normal vehicles. It is envisaged that the SDCs will be owned and operated by large organized retail/ wholesale players, Third Part Logistics (3PL) players, etc. depending on their business plans and interests.

  Under the programme, it is proposed to set up about 100,000 sq. ft. area of SDCs (which may be divided amongst 2-3 SDCs in different regions in the state catering to different large consumption centres) that will be used by the organized retails/ wholesalers for distribution of their products.

- ***Cold Logistics***

  During the field study, it was observed that refrigerated vehicles are mostly not used for transportation of perishable horticultural produces. There is a dearth of such cold transport in the state. Thus, there is an acute need to strengthen the cold logistics in the state for transportation of perishable produces. This is critical for maintaining an uninterrupted cold chain without any break along the supply chain and for avoiding temperature shocks. It is proposed to promote at least 100 refrigerated vehicles in the state each having a capacity of about 10 MT.

Implementation Model

Creation of Infrastructure at sectoral level is proposed to be implemented ideally by large organized retail chains and/ or Third Party Logistic (3PL) companies with support from State Government through the proposed programme in terms of appropriate subsidies, loans, etc. In case the infrastructure is set up by the organized retail chains, it would be used for their own operations and can also be given on rent to other potential users including other organized retailer/ wholesalers. In case of 3PL owned SDCs, these will be given mostly on rent to potential users.

It is envisaged that the Programme Management Agency (PMA) engaged by the State Government would be responsible for overall implementation, management and monitoring of the activities.

6.4 Estimated Programme Budget

The total programme budget for the proposed interventions is estimated at **Rs 10,328 Mn** or **USD 143.5 Mn** for a project implementation duartion of 5 years.

The component-wsie break up of the same has been provide below:

#	Proposed Interventions	Remarks	Proposed Budget in Rs Mn	Proposed Budget in USD Mn
A	**Technical Assistance (TA)**	**-**	**3704**	**51.5**
	Assistance for Working Capital	Working Capital requirement is estimated at ~30% of sale of produce of the proposed infrastructure capacity creation	2160	30.0
	Assistance for Venture Capital Fund	Estimated at 5% of total budget	515	7.2
	Assistance for all other TA activities	Estimated at 10% of total budget	1030	14.3
B	**Creation of Infrastructure**	Detailed break of cost estimates provided below	**5543**	**77.0**
C	**Project Management Cost**	Estimated at 9% of total budget	**927**	**12.9**
D	**Contingency**	Estimated at 1% of total budget	**154**	**2.1**
E	**Total Estimated Budget (A+B+C+D)**		**10328**	**143.5**

* 1 USD = Rs 72

6.4.1 Budget Break-up of Creation of Infrastructure

#	Type of Interventions	Type of Infra	Crop	Infra Details/Assumptions	No of Units	Per unit cost in Rs Mn	Total Cost in Rs Mn	Total Cost in USD Mn
B1	Capacity Building & Strengthening of Farmers & their Collectives	Pack Houses	Pomegranate	1 packhouse- 10MT/day	80	10	800	11.11
			Banana	1 packhouse- 15MT/day	15		150	2.08
			Mandarin	1 packhouse- 30MT/day	18		180	2.50
			Sweet Lime	1 packhouse- 15MT/day	18		180	2.50
			Custard Apple	1 packhouse- 10MT/day	15		150	2.08
					146		1,460	20.28
								-
		Ripening Chambers	Banana	1 ripening chamber- 10MT/day	7	3	21	0.29
								-
		Innovative Cold Stores	Multi Crop	Renewable (Bio mass and solar)	12	1	12	0.17
								-
		Retail Outlets in major markets	Multi Crop	10 Stores per year for 5 years	50	2	100	1.39
								-
		Sub Total B1					**1,593**	**22.13**
								-
B2	Promotion of SMEs in Horticulture	Processing facilities	Pomegranate	Integrated Frozen Aril Facility	5	150	750	10.42
				Integrated Fresh Aril Facility (MAP)	15	20	300	4.17
				Thermal Juice Processing Line	1	250	250	3.47
			Banana	Integrated Chips Making Unit	5	10	50	0.69
			Mandarin / Sweet Lime	Thermal Juice Processing with Essential Oil, Oleo Resin Extraction & Animal Feed facility	1	300	300	4.17
				Cold Press Juice Processing with Essential Oil, Oleo Resin Extraction & Animal Feed Facility	3	250	750	10.42
			Custard Apple	Integrated Pulping Facility	12	25	300	4.17
		Sub Total B2					**2,700**	**37.50**
								-
B3	Facilitating Overarching Development of Horticulture Sector	Logistics	Multi Crop	Approx 90 to 100 vehicles	-	-	250	3.47
		Strategic Distribution Centers (SDCs)	Multi Crop	SDCs with total area of 1,00,000 SQFT	1,00,000	0.01	1,000	13.89
		Sub Total- B3					**1,250**	**17.36**
B	**Total Estimated Budget for Creation of Infrastructure (B1+B2+B3)**						**5,543**	**76.99**