A Report on the study of Onion Value Chain

COLLEGE OF AGRICULTURAL BANKING

RESERVE BANK OF INDIA PUNE

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2018

Acknowledgements

The authors are thankful to the College for providing the opportunity to take up this special study on the contemporary topic of Agriculture Value Chain in Onion.

The authors are especially grateful to the Smt. Madhumita Sarkar Deb, Principal CAB for her support and encouragement without which the report would not have been completed.

The team wishes to acknowledge the excellent suggestions, comments and feedback provided by fellow faculty members Dr S. Subbaiah, Dr K.C. Badatya, Shri N. Madhumurthy, and Shri M. Sundaramoorthy that have added value to this report.

A special thanks to the district administration of Nashik, especially the District Magistrate and Collector Shri Radhakrishnan B, for his support in ensuring maximum cooperation from the departments of Agriculture, Horticulture, NHRDF and various APMCs.

Lastly, and most importantly, the authors would like to thank all the respondents viz. farmers, FPOs, commission agents, wholesalers / traders / exporters, food processors (Sahyadri Farms and Varun Agro Processing Foods Pvt Ltd), bankers (Bank of Maharashtra, SBI, HDFC Bank, Yes Bank, and Nashik DCCB), secretary, APMC, Pimpalgaon, Baswant, secretary, APMC, Lasalgaon, market committee members of APMC Nashik, NHB, NHRDF and others for participating in the interviews and discussions and furnishing valuable information for successful completion of this report.

Contents

Executive summary

The College conducted a study on the Onion value chain in Nashik district to identify, understand and document the role of and relationships between different stakeholders/drivers in the supply/value chain of onion from producer to consumer in selected markets.

Onion is the most market sensitive agri-commodity known for its huge price volatility. Maharashtra is the largest onion producing State in the country, and within it Nashik district is a major onion production centre being home to some of the biggest onion mandis located in Pimpalgaon and Lasalgaon, and also to onion research institutes. The study endeavored to be hands-on and has utilized both the primary and secondary source of information.

The fragmented supply chain, lack of adequate storage and perishable nature of onion, high marketing margins, and dominance of few traders, are significant challenges in the value chain and need measures to overcome them. The major observations of the study are as below:

1. **Low productivity and low seed replacement ratio**

   Though India ranks second in onion production, Indian onion productivity is among the lowest. Inadequate certified seeds, poor seed replacement ratio (< 20%) and absence of investment in farm mechanization / improved farming practice are the main reasons for the low productivity. Commercial seed production and seed replacement ratio are to be improved. Banks need to step up their credit to commercial seed production and term loans which will augment asset creation and improved productivity.

2. **Inadequate storage facility**

   Inherently, onion crop exhibits an asymmetry in production and storage. While Onion is cultivated in all seasons (kharif, late kharif and rabi), only the onion grown during *rabi* season is amenable to storage. About 60% of onion production is in *rabi* season (arrival at April - May) which is stored to meet domestic as well as export demand till the arrival of the kharif onion crop (arrival at October-November). The prices tend to rise when *rabi* onion stocks are almost depleted and kharif onion is yet to hit the market. Lack of storage facility is one of the prime reason behind high volatility in onion prices. Additional storage facilities may be planned to store *rabi* onion (storage facilities to store at least 25% of *rabi* onion production need to be ensured in all major onion growing taluks).

3. Inadequate processing facility

Onion processing facilities are meagre despite Nashik district being a major production centre. Though Nashik is considered as onion capital, Bhavnagar district of Gujarat has emerged as a hub for onion processing in India. More onion processing industries can be set up here which will spur contract farming. Banks may scout for such projects which will encourage farmers to cultivate other types of onion (white onion) in the region.

4. **Market reforms and market infrastructure**

The APMC markets are characterised by poor competitiveness, inefficient and having scope frequent price manipulations. The traders are having asymmetric power in their favour while trading. The e-NAM model which is supposed to overcome these problems is yet to be implemented. Quick implementation of e-NAM in the onion markets will enable better realization for farmers. There is no grading and sorting facility available at the market yard which hinders the farmer in getting remunerative pricing. Hence, the farmers are not able to good remunerative prices. The market yards may be equipped with state of art of storage facilities so that farmers / traders may grade, sort and store their produce after paying appropriate rent.

5. Absence of agri value chain finance

The concept of agri value chain finance in onion crop is absent. Banks including private sector banks are predominantly focusing on crop loans (KCC) only. The upstream players (input suppliers, farm equipment sellers etc.) and the downstream players (processors, retail distributors) are left out from the value chain finance. Even when the banks understand the structure in the value chain, they do not focus on the relationship and drivers of the value chain.

6. **Inadequate crop loan**

DCCBs continue to be the main purveyors of credit to farmers. Considering the financial health, capital requirement and non-performing loans of DCCB, commercial banks perhaps need to reach out more to small and marginal farmers. The scale of finance for onion crop is at Rs 25000 / acre for the year 2018-19. The farmers felt that it is inadequate considering the escalation of labour cost in the region.

7. **Absence of warehouse receipt financing**

Banks are hesitant to finance against the storage of onions due to huge storage loss and volatility in prices. Banks may come out with specific product for finance against onion storage and overcome the limited DRA accredited warehouses. A mechanism of providing pledge finance to farmers to hold onion at the farm for longer period will help in getting remunerative price to the farmers and avoiding undue shortage in lean season.

8. Absence of informational flows / demand forecast

Though onion is one of the major crop cultivated in the district, banks do not maintain a record of credit flow to onion in the region. The crop gets subsumed with other vegetables. A robust demand and supply forecast model for onion crop will address the volatility in onion prices. NHRDF is conducting Crop Area Calculation Model using ground level survey and satellite images, which calculates area under cultivation for onion. This initiative may be strengthened and popularized among bankers so that banks can use the data for their credit decisions.

9. Government's export policies

Government of India to tide over the shortage of domestic onion supply imposes curbs on onion exports. However, the measure adversely affects the export market and makes room for price volatility. A stable export policy regime will aid in reducing the volatility.

Chapter I

Background of the study

Agriculture is believed to be a potential engine for poverty reduction and sustainable development across the world. Globally agriculture is shifting swiftly from fragmented production and marketing relationships to integrated market systems or chains. These changes are being driven by the market and sensitivity to consumer interests, including stricter compliance, food safety and traceability requirements, higher quality standards and enforcement of environmental regulations. This evolution requires an improved understanding of the agricultural value chains and that of the agricultural sector within which they operate. The future of farmers, traders, agri-lenders and agribusinesses in the agricultural value chain – and consequently the quality of their loan or investment – depends upon their ability to adapt and compete in the markets. *(Miller and jones: AVCF)*

In India too, agri-food systems are experiencing rapid transformations and the advent of integrated food supply chains is a perceptible market change. Growing focus on processing, trading, marketing and retailing is witnessed in all supply chains' segments. The traditional way of food production is being substituted by practices not unlike manufacturing methods, with greater co-ordination across farmers, processors, retailers and other stakeholders in the value chain. Demand for high-value commodities like fruits, vegetables, meat products and fisheries is rising and farmers are trying to diversify their production systems accordingly. Consumers are becoming more demanding in terms of quality and safety of food commodities. Also, demographic and income trends are encouraging more consumers to demand convenience foods such as frozen, pre-cut, pre-cooked and ready-to-eat items. Accordingly, production, processing and distribution systems are adjusting to such changes.

It was in the above backdrop, that the topic of studying Agricultural Value Chains (AVC) in India was chosen when the College Advisory Committee of College of Agricultural Banking in its 56th meeting held on April 7, 2017 recommended to conduct a few special studies on issues of topical interest in Agricultural Finance.

Having selected Agrivalue chain as the topic for special study, the next step was to select the specific agri commodity whose value chain could be studied. Onion selected itself as the ideal agri commodity for the purpose, owing to it being one of the most market sensitive commodities,

as also (reportedly) the vegetable with highest consumption in India. Its significant position in the diets across all income groups and as an important ingredient in most Indian recipes contributes to wide ranging effects of any significant price change. Maharashtra is the largest onion producing state in the country and is also home to some of the biggest onion mandis like Pimpalgaon and Lasalgaon located in Nashik district.

Organization of agriculture along the value-chain framework has been considered as one of the approaches to bring more competence in the sector. There is, therefore, a need to understand the onion value chain, its operational mechanism and various issues at grassroots level impeding its growth. The present study is an attempt to understand the status of value chain of onion, particularly in Nashik, examine the role of different players in the chain, and opportunities to strengthen the value chain, especially from the perspective of institutional financing.

Chapter II

Methodology of the study

2.1 Objectives

The objectives of the study are as under:

1. To identify, understand and document the market structure of onion including the role of and relationship between different stakeholders/drivers in the value chain of onion from producer to consumer in selected markets;
2. To analyze trends in area under cultivation, production and productivity of onion at state, national and international level;
3. To identify gaps in the onion value chain and ways to strengthen the chain with the aim of minimizing price volatility and improving productivity;
4. To understand the role of banks/ bank finance in Agri value chain of onions; and
5. To provide policy recommendations based on the findings of the study.

2.2. Sample Design / Study area

Nashik District of Maharashtra has been selected as the study area for this case study. Besides the three major APMC mandis, viz. Pimpalgaon APMC, Lasalgaon APMC, and Nashik APMC, there are many other agencies/ institutions that operate in Nashik in the supply chain process for onion, for example, the National Horticultural Research and Development Foundation (NHRDF), National horticulture Board (NHB) and various export/trade houses. While markets like Pune and Mumbai are basically consumption oriented markets, production hubs like Nashik are the major domestic suppliers and exporters of onion, especially the red onion variety.

2.3. Data Collection and Methodology

The study has endeavored to be hands-on and has utilised both the primary and secondary sources of data. The primary data has been collected through interaction with all the stakeholders in the Onion Value Chain:

1. Discussions / Interviews with the onion farmers; and
2. Interviews and semi-structured questionnaires for various value chain players like bankers, APMC office bearers, traders/exporters, wholesalers, state government departments of agriculture and horticulture, food processors, transporters etc.

Secondary data has been gathered from the websites like those of Ministry of Agriculture & Farmers Welfare, Food and Agriculture Organization, NHRDF, APEDA, NHB, NITI Aayog, Agriculture Marketing Department of Maharashtra, Indiastat.com, Competition Commission etc. Additionally, some unpublished data has also been procured from APMCs and district agriculture and horticulture departments.

The sample for the study had been selected randomly from among the population available in the study area.

Table 2.1: Type and Number of value chain players visited/ interviewed

Value chain Player	Sample	Details
Input supplier	01	Sahyadri Farms
APMC/ Mandi officials	03	Meeting with Nashik, Pimpalgaon, Lasalgaon APMCs. Secretary and other officials
Onion cultivating farmers	10 farmers	Farmers in fields, mandis and at FPO
Farmer Producer Organisation	1FPC	Sahyadri farms
Large traders/ exporters/ wholesalers	05	At APMC mandis, and their own godowns/warehouses
Bank officials	5 Banks	Lead Bank- Bank of Maharashtra, State Bank of India, Yes Bank, HDFC Bank, Nashik District Central Co-operative Bank
Processing Units	02	Sahyadri Farms Varun Agro Processing Foods
Other institutions	5	District Administration, Govt. Departments, NHRDF, National Horticulture Board

2.4 Limitations of the Study: A major limitation of the study is that its study area has been restricted only to Nashik district, notwithstanding the fact that it is the foremost onion producing district of the country. The size of the sample is an additional limitation. Also, while the commission agents and wholesalers were willing to interact and show their operations, they did not reveal much information about the sale/purchase prices etc. The data provided by the farmers and some other market intermediaries is based on their memory. Also, the crop-wise loan disbursement data was not readily available with the banks.

Chapter – III

Overview of Onion crop

Onion (*Allium cepa*) has been cultivated on Earth for the last 5000 years. It is the largest vegetable produced and consumed not only in India but also in the world. In India, onion is an extremely important commercial vegetable, having both food and medicinal values and grown almost across the country, mainly by small and marginal farmers, for domestic consumption as well as export. Indian onions are famous for their pungency and are available round the year, although with varying supply volumes, which sometimes creates volatility in prices. India produces all three varieties of onion – red, yellow and white. In the northern part of the country, onion is usually grown in the winter (rabi) season; while in the southern and western states, it is grown in winter (rabi) as well as in the rainy (kharif) seasons.

3.1 Onion production- World scenario

India is the second largest producer of Onion in the world (20% of global production) after China, even though in terms of area under onion cultivation, India stands first among all nations.

Table 3.1- Major Onion producing Countries- area, production and productivity

Area Name	Area (Lakh Hectares)	Production (Lakh Tonnes)	Productivity (Tonnes/ha)
China	10.86	238.49	21.97
India	12.26	209.96	17.13
U.S.A.	0.54	30.25	56.39
Egypt	0.85	31.15	36.71
Iran	0.62	23.46	37.95
Russian Federation	0.89	20.23	22.84
Turkey	0.66	21.21	32.32
Pakistan	1.36	17.40	12.80
Brazil	0.57	16.57	28.84
Republic of Korea	0.20	12.99	65.27
Netherlands	0.33	14.49	44.29
Mexico	0.52	16.35	31.75
Bangladesh	1.77	17.35	9.78
Spain	0.23	12.54	54.14
World	49.55	931.7	18.8

Source: FAO (2016) http://www.fao.org/faostat/en/#data/QC and NHRDF for India

The Republic of Korea has the highest onion productivity of 65 tonnes/ha in the world followed, by USA at 56 tonnes/ha. India lags far behind in productivity at only 17 tonnes per hectare.

3.2 Onion production- Indian Scenario

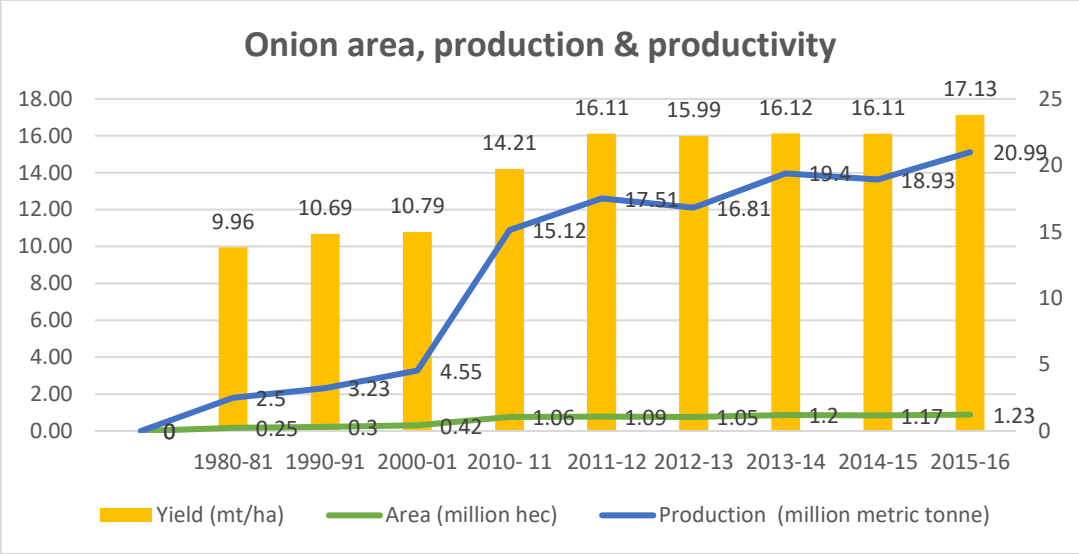
Over the years, there has been a sizeable increase in area under cultivation, and production of onion in India. In terms of area, there is an increase from 0.25 million hectares in 1981-82 to 1.23 million hectares in 2015-16, while in terms of production it has increased from 2.5 million metric tonnes (MMT) in 1981-80 to 20.99 MMT in 2015-16.

The production of onion in 1961 was only 1.20 MMT, which went up to 4.55 MMT in 2001, growing almost 4 times in 40 years. **In the 15 years from 2001 till 2016, there has been a growth in production of almost 5 times to 20.99 MMT.** Fall in production was seen in 2002, 2009, 2012 and 2014 during the last 15 years mainly because of reduction in sowing area, unseasonal rains, drought and unplanned sowing in the subsequent season after realising better prices in a particular season, etc. **However, productivity has not improved much during the last many years. The productivity which was around 10 MMT/ hectare in 1980-81 remained almost stagnant till 2000-01 and increased gradually thereafter to reach around 17 MMT/hectare in 2015-16.**

Table 3.2: All India area, production and productivity of onion

Year	Area (million hectares)	Production (million metric tonne (MMT))	Yield (MT/ha)
1980-81	0.25	2.5	9.96
1990-91	0.3	3.23	10.69
2000-01	0.42	4.55	10.79
2010- 11	1.06	15.12	14.21
2011-12	1.09	17.51	16.11
2012-13	1.05	16.81	15.99
2013-14	1.2	19.4	16.12
2014-15	1.17	18.93	16.11
2015-16	1.23	20.99	17.13

Source: NHRDF, Indiastat



Wide price fluctuations make onion a risky crop, thus limiting large scale adoption of input intensive production techniques and good management practices by farmers. In addition, shortage of good quality seeds, high incidence of pests and diseases typical to tropical conditions, high moisture or excess rains during critical growth stages, poor irrigation facilities, higher post-harvest losses, small land holdings and poor economic background of farmers and absence of adequate storage facilities are the major factors constraining the yield.

In India, onions are cultivated both as kharif and rabi crop. This is because onions are grown in almost all the Indian states. The time and season of onion cultivation depends on the geographical location and weather at the particular place.

Place	**Season**	**Time of Sowing**	**Time of Harvest**
Punjab, Haryana, UP, Bihar, Rajasthan	Kharif	June- July	October- November
	Rabi	October- November	May-June
Orissa and West Bengal	Kharif	June- July	November- December
	Late Kharif	August- September	February- March
	Rabi	September- October	March- April
Maharashtra and parts of Gujarat	**Early Kharif**	**February- March**	**August- September**
	Kharif	**May- June**	**October- December**
	Late Kharif	**August- September**	**January- February**
	Rabi	**October- November**	**March- May**
Andhra Pradesh, Tamil Nadu, Karnataka	Early Kharif	February- April	July- September
	Kharif	May- June	October- November
	Rabi	September- October	March- April

Source: NHRDF

3.3 Onion Production-- State-level scenario

Table 3.3: Selected State-wise Area, Production and Productivity of Onion in India

Selected State-wise Area, Production and Productivity of Onion in India (2014-2015, to 2016-2017)									
States	Area (In ' 000 Hectare)			Production (In ' 000 Tonne)			Productivity (In MT./Hectare)		
	2014-2015	2015-2016	**2016-2017**	2014-2015	2015-2016	**2016-2017**	2014-2015	2015-2016	**2016-2017**
Maharashtra	441.9	522.4	471.7	5361.0	6529.3	6773.1	12.1	12.5	14.4
Madhya Pradesh	117.9	118.2	120.1	2842.0	2848.0	3254.5	24.1	24.1	27.1
Karnataka	187.0	190.2	195.5	3227.0	2696.0	2768.0	17.3	14.2	14.2
Gujarat	44.3	53.2	53.2	1126.6	1355.8	1355.8	25.4	25.5	25.5
Rajasthan	61.4	86.3	85.0	960.8	1435.1	1350.0	15.7	16.6	15.9
Bihar	54.3	54.0	54.6	1247.3	1247.3	1259.8	23.0	23.1	23.1
Andhra Pradesh	38.4	45.0	37.8	575.6	885.4	831.6	15.0	19.7	22.0
Haryana	28.7	30.7	32.5	640.2	705.8	797.5	22.3	23.0	24.6
West Bengal	25.3	34.0	29.0	380.2	544.6	465.5	15.0	16.0	16.1
Uttar Pradesh	24.5	25.0	25.4	413.6	422.8	423.8	16.9	16.9	16.7
Chhattisgarh	20.1	23.5	25.3	308.1	376.0	410.9	15.4	16.0	16.3
Odisha	33.2	33.5	33.4	396.0	378.6	378.7	11.9	11.3	11.3
Tamil Nadu	25.7	36.7	34.1	259.6	381.0	347.0	10.1	10.4	10.2

Source: nhrdf.org / indiastat.com

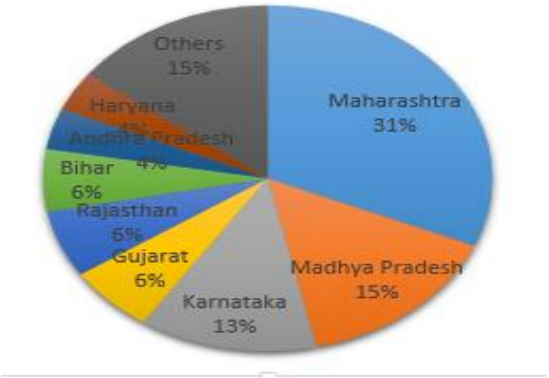


Fig. 3.2-State-wise Onion Production – 2016-17

Although onion is cultivated almost all over the country, the major producing states are Maharashtra, Madhya Pradesh, Karnataka, Gujarat, and Rajasthan.

Maharashtra is the leading producer of onion in the country with a contribution of 31.4 % of total onion production (2016-17).

Source: nhrdf.org / indiastat.com

Box item

In a bid to increase availability of onion in Orrisa round the year, the State Government had in 2017 launched **'onion value chain improvement' project** in six districts with the support of The Asian Vegetable Research Development Centre (AVRDC), a not-for profit international agricultural research institution to deal with post-harvest loss reduction of the vegetable and by promoting onion production during kharif season. The programme is funded by the State Government with support from the Centre's Rashtriya Krishi Vikas Yojana (National Agriculture Development Scheme). It has given a new alternative to the farmers of the State by promoting onion production during the wet summer or kharif season, a practice that was never considered possible because of waterlogging problems.

(Source: Express News Service; 28th July 2017)

3.4 Onion Production in Maharashtra

Nashik, Ahmednagar, Pune, Satara Solapur, Dhule, Jalagaon, Osmanabad, Beed, Aurangabad, Bhandara, Nandurbar and Latur are the major onion producing districts of Maharashtra. Majority of the crop (~50-60%) is produced in Rabi season which has good storage quality as the variety grown in this season has higher Total Soluble Solids (TSS), dry matter and more number of outer dried intact scales.

Table 3.4: Onion Production Season in Maharashtra

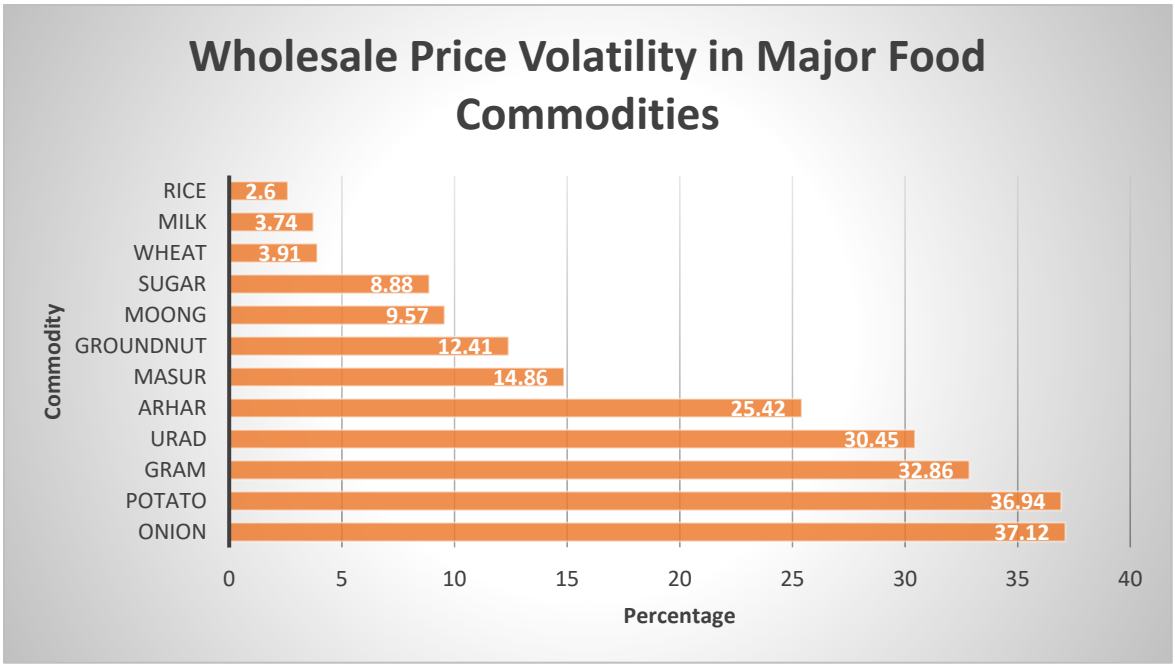
S . No.	Season	Varieties grown	Storage Quality	Remarks
1	**Early Kharif**	N-53, Baswant-780	**Poor (1 month)**	10-20 % of production
2	**Kharif and Late Kharif**	Phule Suvarna,	**Poor (1 month)**	30-40 % of production
3	**Rabi /Winter**	**AFDR, AFLR, N2-4-1**	**Good for storage (4-6 month)**	50-60 % of production
4	**All year**	Phule Safed	**Good for Dehydration**	
5	**Late Kharif /Rabi**	Phule Suvarna	**Good for export to Europe**	

Source: NHRDF/ MSAMB

3.5 Price Volatility in Onion:

Onion exhibits the highest price volatility (coefficient of variation at 37.12) among all the major food commodities.

Fig 3.3 - Wholesale Price Volatility in Major Food Commodities



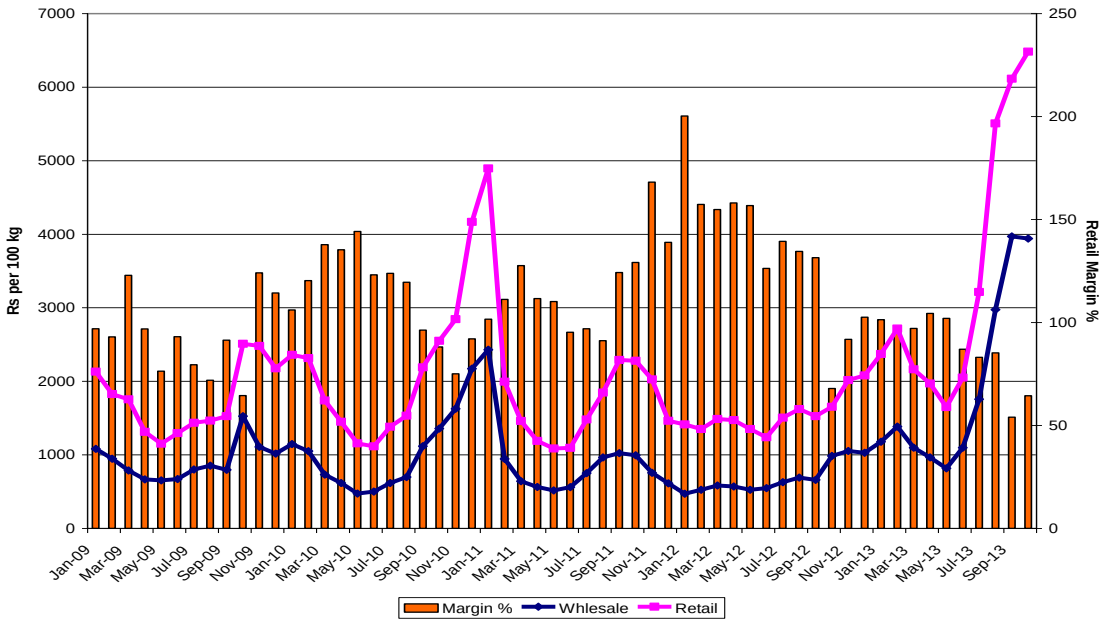
Source: NCEAR, 2017

Onion prices typically exhibit a seasonal trend peaking during the lean season of July-October and falling during April – May coinciding with the peak arrival season of the major rabi season crop. However, there were aberrations in 2011, 2012, 2013 and 2014. For example, in 2010-11, y-o-y onion inflation peaked in January 2011 instead of September–October, 2010, apparently due to a decline in kharif season output. Although damage to the kharif crop due to heavy untimely rains was one of the factors contributing to high volatility in onion prices, distribution network bottlenecks and suspected trade cartel are believed to be the other factors. India's chronic failure in dealing with surplus/ deficient harvests is due to lack of adequate storage and processing capacity which highlights the inefficiencies of the agriculture value chain

The increase in retail prices has been even steeper many times due to high retail margins. For example, in a major consumption market such as Delhi, the onion 'retail markup' in the past has

ranged from 50 percent to 200 percent- the markup percent is high when wholesale prices are low and vice versa (Source: NCAER_ Indian Onion Scenario , 2014)

Figure 3.4: Delhi onion wholesale and retail prices and retail margin (%)



Source: Department of Consumer Affairs, Ministry of Consumer Affairs, Food & Public Distribution, Government of India

3.6 Storage Conditions

Onions are stored in a cool and dry environment. When humidity levels and temperatures are too high, the onions may decay or begin to sprout. The ideal storage condition for onions is 0-2°C at a relative humidity (RH) of 65 - 70%. Cold storage increases the shelf life. Under ambient conditions the onions are stored at a temperature of 30-35°C and RH of 60-65%. Refrigerated storage can be used to hold onions for approximately six months. Cold storage of onion, however, is not a common practice in India, due to prohibitively high costs. Considering the low prices of onions, expensive storage models have viability issues and hence there is a need for cheap and efficient storage structures.

Generally, onion bulbs harvested in rabi season have better shelf-life than kharif. Light red onion varieties have better storage potential than the dark red varieties. They are stored in jute bags or wooden baskets or netted bags. This is important because onions emit gas, which, if not allowed to escape, may lead to rotting.

Chapter IV

Agri Value Chain of Onion in India

Financial institutions generally perceive that lending to small and marginal farmers involves high cost of delivery and risky too. Value chain finance is considered to be one of the best ways to overcome the perception. Banks, though, are yet to enter into the onion value chain in a significant way at Nashik district. In order to participate successfully in agri-value chains, the role of each player in the value chain, and constraints therein need to be understood.

4.1 What Is Agriculture Value Chain (AVC)?

In the traditional forms of agri finance, be it internal value chain financing such as trade credit or external value chain financing such as bank finance, etc., the view of the overall activity for which the finance is availed, is less comprehensive. It is mostly asset based and "*one size fits all*" and the risks associated with farming are mostly transferred to farmers. The value chain approach is mostly cash flow and contract based, and the risks associated with farming are leveraged between various payers in the value chain. The value chain is designed to offer services at *"Points of High Impact (PHI)"* to the farmers to maximize the outcome.

Agriculture Value Chain refers to a range of goods and services needed for an agricultural product to move from the farm to the consumers (farm to fork). Various actors and activities are involved from production process to delivery of product to the market and finally to the end consumer. The whole idea of a value chain is to generate value for all the actors while analyzing how the various actors in the chain exchange knowledge to enter the market. Under Value Chain Finance approach, the decisions about financing are based on the health of the entire value chain, including market demand, and not just on the financial health of the individual borrower. To understand agri value chain, two possible approaches can be used (Wong 2016):

- Supply chain management approach; and
- Agriculture++ (Agriculture Plus Plus) strategy.

Supply chain management approach

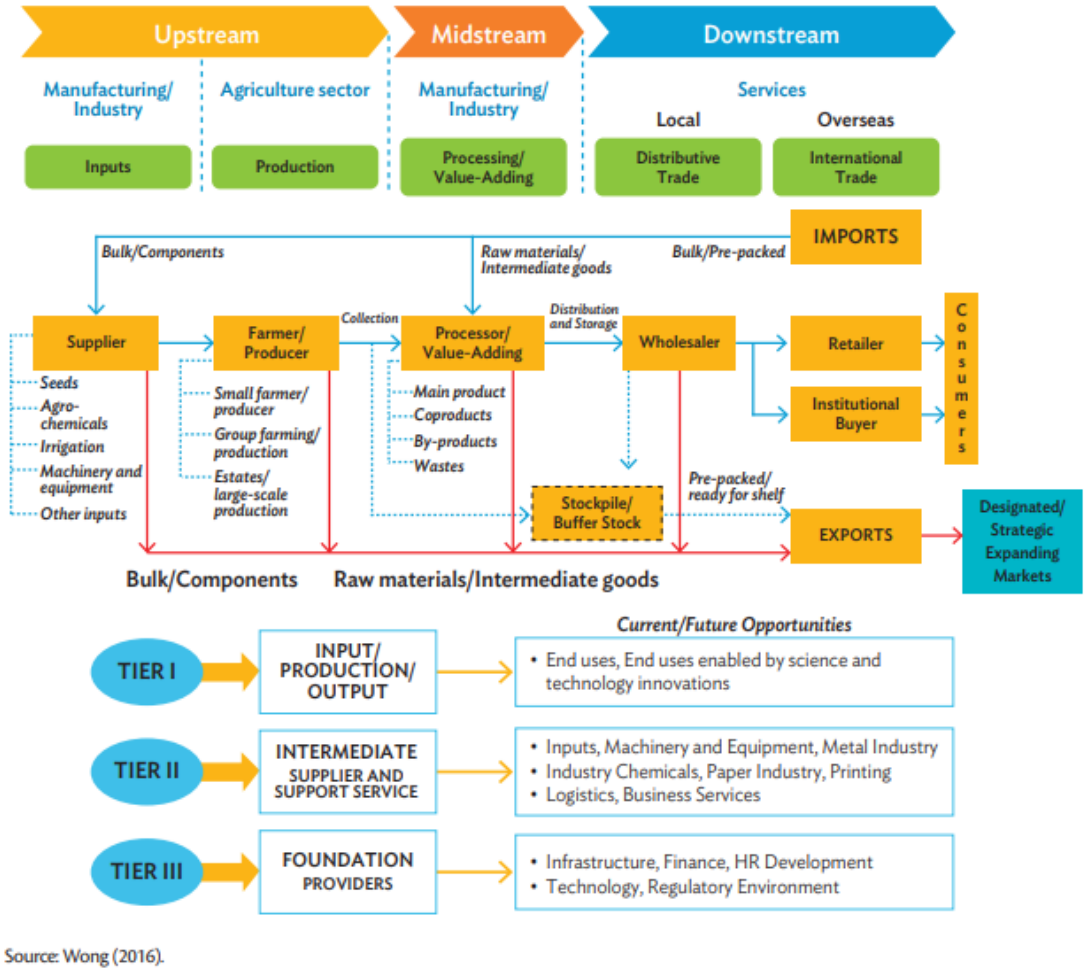
Unlike a normal production centric approach of focusing exclusively on the production level, the supply chain management approach employs a more holistic agribusiness approach of

considering the sequence of key activities and their supporting economic activities at the various levels of the chain, such as delivery of agricultural inputs, production and processing of agricultural products, and marketing and distribution of those products. It links agriculture with the manufacturing and services sectors of the economy along the supply/value chain and trading network.

The Agriculture++ (Agriculture Plus Plus) Strategy

Agriculture++ is a strategy based on Michael Porter's value chain analysis and cluster development. It attempts to encourage investments in the economic activities in the upstream (research and development, certified seeds, high yielding varieties, better agronomic practices and farming systems), midstream (grading, sorting, processing,), and downstream (packaging, food safety, traceability, branding, targeted markets) segments of the value chain (Wong 2016).

Fig. 4.1- The Value Chain concept



Source: Wong (2016).

4.2 The Onion Value Chain – Financing and Other Perspectives

The value chain for onion is a little different from other products. This is owing to the fact that marketing this unique crop is complex and risky on account of its seasonality and bulkiness. Proper planning for production, post-harvest management and marketing may help growers to get better prices for good quality produce. Close coordination is needed between all stakeholders like growers, researchers, entrepreneurs, financial institutions and intermediaries to develop a more sustainable chain. The thrust areas for value chain in the onion ecosystem are as below:

4.2.1 Value chain finance at pre- production stage

Production credit

The expenditure towards application of seed, manure and fertilizer, labour, and machine hiring accounts for the major share in total input cost of onion farmers. The seed alone accounts for 12-15% of cost of cultivation, and therefore seed supply chain needs to be strong. The pre-production VC players consists of NHRDF / Govt agencies, private seed agencies and farmers. Given the low levels of investment in agriculture and inefficiencies in production, technology led interventions and improved agronomic practices like drip irrigation, mulching, soil & water testing could result in higher productivity.

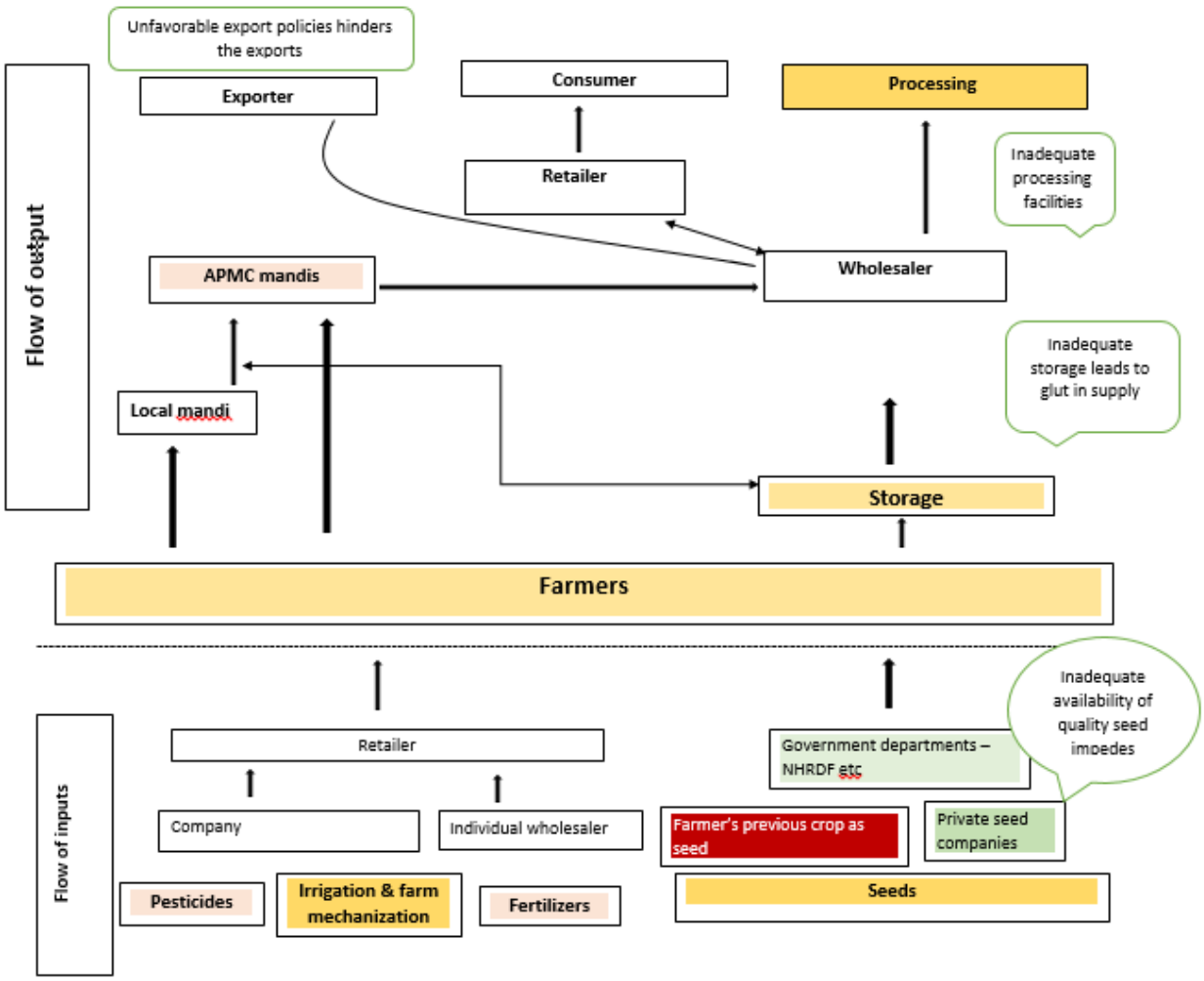
The conventional onion value chain in Nashik is depicted on the next page.

4.2.2 Value chain finance to post production

a) Storage facilities

Storage infrastructure capacity and quality is imperative for the seasonal and perishable crop. Onions kept in the conventional storage suffer from high losses. There is a need to construct scientific storage structures to prevent storage losses and to prevent price volatility. A total of 8 lakh MT storage capacity has been created in the State under different Government schemes through scientifically built onion storage structures. Out of this 7.00 lakh MT has been created under Rashtriya Krishi Vikas Yojana (RKVY) through Maharashtra State Horticulture and Medicinal Plant Board (MSHMPB) & Maharashtra State Agriculture Marketing Board (MSAMB) with ₹. 112.00 Crore as subsidy from RKVY.

Fig. 4.2- Onion value chain at Nashik (Author's computation)



b) Onion processing and value chain products

Dehydrated onions are an important product in world trade and India is the second largest producer of dehydrated onions in the world. Dehydration increases the storage period of onions and makes them available throughout the year including in off-season, and also supplying the important nutrients in a concentrated form. India produces a range of fresh, semi-processed and processed onion products which include whole peeled onions, onion powder, onion puree, diced, sliced, granulated, ground, minced, chopped, toasted, dehydrated, and frozen onions and other specialty products, etc. Another advantage of dehydrated onions is that they are easy to store, being lighter in weight and smaller in bulk than fresh or other processed onions.

4.3 Export Potential of Onion from India

There is a good demand for Indian onion in the world and India exported around 1.8 million MT of fresh onion during 2015-16 worth ₹ 32.3 billion; and 3.5 million MT of fresh onion during 2016-17 worth ₹ 46.5 billion. Maharashtra contributes approximately 80% to the Indian onion exports. Major export destinations are Bangladesh, Malaysia, Sri Lanka, UAE, Indonesia, Pakistan, Nepal and Singapore. (Annexure 2)

USA, Canada, UK, Germany and other European countries are among the biggest onion importers in the world, but India exports a miniscule quantity to these countries, mainly due to its crop not being able to meet their trait requirements in terms of pungency, size, colour etc. However, in order to improve the overall export price realisation per tonne, it is necessary to explore the potential in these markets, and possibly produce the variety for these niche markets.

Red onions are not suitable for dehydration due to low solid content, low pungency levels and high content in reduced sugars. White onions used for dehydration are grown on a commercial scale only in a few districts in the states of Maharashtra and Gujarat. In addition to exporting fresh onion, India also exports roughly around 50,000 tonnes of dehydrated onions annually. This constitutes around 85% of the 60000 tonnes of production of dehydration units, while the balance 15% is consumed by domestic wholesale consumers. Dehydrated onions constitute more than 80% of the exports of dried & preserved vegetables. As the dried onions are a different variety than those consumed by Indian households, its exports does not impact the domestic prices. While the share of household consumers is negligible, there is a potential for sale of upto 40,000 tonnes/annum in the domestic wholesale market (hotels, restaurants, canteens etc.), driven by its low usage cost of around ₹ 8-10 per kg. (Source: NHRDF / All India Dehydration Association)

Exports of fresh onion from India are permitted by the Government only after meeting the domestic requirements, which leads to fluctuations in the exports volume and value. Due to the strategic significance of onion, the Government often intervenes in the market by way of Minimum Export Price (MEP) — the least price at which a commodity can be exported-- to regulate the domestic prices and safeguard the interests of domestic consumers. The MEP was introduced in onion export in 2010 as a policy measure to control the rise in price of onion in domestic markets.

4.4 Market Structure for Agri-Commodities

Agricultural marketing in India is undertaken by both government agencies and private traders. However, private traders largely dominate the sector. A number of government agencies like Food Corporation of India (FCI), National Agriculture Cooperative Marketing Federation of India (NAFED) and Directorate of Marketing and Inspection (DMI), specialized marketing boards and a network of cooperatives at the local, state and national level involve themselves at different stages with different responsibilities in marketing of agricultural produce. In order to improve the marketing system of farm products, GoI had, in the sixties, brought the model Agricultural Produce Marketing Committee (APMC) Act for implementation at states level.

Maharashtra APMC Act, 1963 under which agricultural markets in Maharashtra are regulated, contains several positive features such as sale through auction method, reliable weighing, standardized market charges, payment of cash to farmers without undue deductions, dispute settlement mechanism, and reduction in physical losses of produce and availability of several amenities in market yards.

The Act was amended in 2006-07 to add the concept of development along with regulation. The amended Act (i) allows greater freedom to farmers to sell their produce directly to consumers, food processors or retailers through private markets, etc. (ii) for declaration of certain markets as special commodity markets on the basis of arrivals, turnover, and geographical area with the intention of development of specialized markets having modern infrastructure and storage facilities with private sector participations; and (iii) makes provision for contract farming.

This was expected to bring an end to monopolies of organized traders and commission agents currently operating in the regulated markets and improve the overall market efficiency. However, inspite of the changes, there continues to be a large number of intermediaries in agricultural marketing who dominate the sector, and deprive the farmer of his due share in the final consumer's rupee. These intermediaries perform the distribution function like consolidation of

produce several times before it reaches the final consumer, but operate on high margins for little value addition. As such both the farmer and consumer lose in terms of price. The presence of intermediaries in India has become a substitute for infrastructure. A better integrated market structure where the farmer is provided both backward and forward linkages as per the amended Act will help to minimize inefficiencies in the marketing system. (Source: CCI, 2012)

4.5 Risk Mitigation and Price Stabilisation

a) Market Intervention Scheme (MIS)

Onion is known for its price volatility. To insulate the farmers from price volatility and ensure remunerative price realization of their produce Government of India has in place a **Market Intervention Scheme (MIS).** The Department of Agriculture, Cooperation and Farmers Welfare implements the MIS for procurement of agricultural and horticultural commodities which are perishable in nature and are not covered under the MSP. The objective of intervention is to protect the growers of these commodities from undertaking distress sale in the event of a bumper crop during the peak arrival period when the prices tend to fall below cost of production. The Scheme is implemented when there is at least 10% increase in production or 10% decrease in the rates over the previous normal year. Proposal of MIS is approved on the specific request of State Government, if the State Government is ready to bear 50% loss (25% in case of North-Eastern States), if any, incurred on its implementation. Under MIS, funds are not allocated to the States upfront, but funds are released by Central Government based on specific proposals received from them in appropriate proportion. The loss is to be shared on a 50:50 basis between the Central Government and the State Government is restricted to 25 percent of the total procurement value which includes cost of the commodity procured and permitted overhead expenses. The details of MIS implemented during the year 2015-16 and 2016-17 as on 31.12.2016, given in the table below shows that except Karnataka and Telangana, no other State has invoked MIS despite a glut in production.

Sl. No.	Year	Commodity	Market Intervention Price (Rs. Per MTs)	State Sanctioned	Qty. (in MTs)
1	01.11.2016 to 30.11.2016	Onion	6240/-	Karnataka	1,00,000
2	01.12.2016 to 30.12.2016	Onion	7,070/-	Telangana	5000

(Source: Ministry of Agriculture and Farmer's welfare, Annual report 2016-17)

b) Pradhan Mantri Fasal Bima Yojana (PMFBY)

Onion crop is covered under PMFBY with an annual premium varying between 5.00 to 6.06% (while 5% of the premium is borne by farmers, the excess of 5% is borne by Government of India and State Government). (Source: www.pmfby.gov.in). Reportedly, there are issues of delay in settlement of claims. Delays in crop cutting experiments (CCE) and States not paying up their share of the premium are some of the reasons for settlement delays.

c) Commodity Derivatives

Derivatives trading in onion may be explored to mitigate the volatility in onion prices. While the Government has already notified onion as a permissible commodity for derivatives trading on regulated exchanges, the futures trading in onion has not been introduced by any exchange so far. The challenge in introducing futures, or even forwards in onions is the absence of a transparent spot market price which can be used to arrive at a settlement price. Forward trading with settlement in delivery, and grading, assaying and delivery centres could be the starting point, which could be followed by futures trading with a price band, based upon the experience gained. (Source: https://www.business-standard.com)

Chapter V

Analysis and Study Findings

There are various challenges and critical gaps in the Onion Value Chain, which prevent the farmers from getting a fair price. They are low productivity low and high storage losses, and the resultant volatility in onion prices in the Indian market and thwart the growth in export of Onions.

Demand side issues

5.1 Onion is almost a staple in India being an essential ingredient of all Indian food items, and is also eaten raw as salad. The demand for onion in India is evidently increasing, both domestically and for exports, due to various factors like growing population, increase in per capita income, increasing taste consciousness and health awareness of the consumer, proliferation of eating joints along with a growing trend of eating out. This demand is mostly met from the domestic supply, save for weather affected seasons. According to NSSO data, onion consumption per head has increased in both rural and urban areas by at least 100 and 150 gram, respectively per month between 2002-03 and 2012-13, and is likely to increase further. **National Horticultural Research and Development Foundation (NHRDF) Vision 2050 projects that India will require 35.0 million tonnes of onion in 2050 against 21 million tonnes in 2015-16, to cater to the needs of the projected population of 1.7 billion. This demands an increase in average productivity from 17.00 MT/ha to 30 MT/ha**.

As it is difficult to increase the area under cultivation substantially, there is a need to focus on increasing the yield to meet the requirements. Concerted efforts are required to enhance productivity and to minimize the post-harvest losses and to ensure quality production even under marginal conditions of soil and irrigation water, with increased input use efficiency.

The supply chain issues

5.2 Pre-production/ Production Stage

5.2.1 Seeds: While a lot of research is taking place at universities and institutes like NHRDF and Directorate of Onion and Garlic Research (DOGR) for developing new varieties of onion

seeds and plants, which are high yielding and more resistant to weather, diseases and pests; the technology transfer to farmers' fields is very slow.

Poor quality seeds and low seed replacement ratio are among the major factors contributing to low onion productivity in India. NHRDF officials informed during the interactions that seed replacement ratio in onion is less than 20% in India *(Seed Replacement Rate is the percentage of area sown out of the total area of crop planted in the season by using certified/quality seeds other than the farm saved seed)*. The low replacement rate in onion indicates that farmers use either the crop retained for seed purpose or obtained from fellow farmers. As per NHRDF, only 8 to 10% requirement of quality seeds of onion is catered to by the public sector organisations like NHRDF, NSC and ICAR institutes. The balance required quantity of seed is supplied either by private seed companies or produced and distributed by farmers themselves.

During the interactions with the farmers, it was found that there are not enough commercial nurseries supplying good quality high yielding varieties and hybrid seeds to the farmers. It was also observed that there is little awareness regarding usage of quality seeds and the benefits of proper seed replacement among the farmers.

Therefore, there is an urgent need to produce and distribute high quality seeds of improved varieties to meet the demand of farmers. There is a space for private players in seed production and banks may find an opportunity to finance seed production on a massive scale. As the selection of good quality seed can almost double the value of the output, it is a critical link which has to be addressed by the stakeholders in the value chain.

5.2.2 Technology: Onions require frequent and light irrigation at weekly intervals .It results in good bulb development and increase in yield. Sprinkler and drip irrigation methods increase onion yield significantly. They can save water and labour costs while also improving productivity. Despite these advantages, they are not being widely used. Though the farmers in Nashik are aware about it, the high capital investment acts as a dampener. This is an area of possible intervention by the banks and input suppliers and the Government.

5.2.3 Labour: High labour costs add up substantially to the cost of production. Shrinking family sizes, and the farmers' children's reluctance to join farming has increased the dependence on **external labour.**

Other links in the chain like availability of proper extension services, soil test based fertilizer application, water health test etc. are also weak and call for remedial interventions. This

emphasizes the need for exploring options like setting up of Agri Clinics and Agri Business Centres, promoting collective farming, and setting up farm machinery and equipment renting agencies / custom hiring agencies to improve mechanization among small and marginal farmers.

5.3 Post- harvest Stage

5.3.1 Poor Storage infrastructure at farmer's end:

About 60-65% of the total onion production is consumed domestically; 15-20% exported and the rest 20-25% is lost due to post-harvest damages. The losses are on account of decay, sprouting and driage. Decay losses and sprouting are 10% and 45% respectively and the rest by driage. Onions can lose weight up to 20-25% depending upon the period of storage. The method and type of storage play a major role in reducing various kinds of storage losses particularly the weight loss. Most of the farmers in Nashik bring onion directly to the market after harvesting as proper storage facilities are not available. (Source: NHRDF)

The light and dark red varieties grown in Rabi season have good storage capability of around 5-6 months (unlike Kharif crops which are poor storers). If they are kept in good ventilated storage the losses can reduce to an extent of 25-30 % from the normal losses. Nearly, 60% of the onion produced in Maharashtra during Rabi/ summer is available for storage i.e. 27 lakh MT out of total 45 lakh MT. The storage capacity created in the State through different Govt. Schemes is 8 lakh MT. These are scientifically built onion storage structures. Farmers store 5.00 Lakh MT onion in traditionally built local storage structures. Thus the total storage capacity in the state is 13 lakh MT. To store 27 lakh MT storable production, there is need to create Onion Storage Structures to store additional 14 lakh MT onion. (Source: http://rkvy.nic.in). **This is an area for bank financing. Some banks are giving loans for building onion storage structures, but there is scope for banks to further increase lending for this purpose.**

One of the prime reasons behind high volatility in onion prices stems from the lack of storage facilities that have not kept pace with rising production. The traditional kanda chawls are quite inadequate and unscientific. NHRDF has developed some scientific and frugal designs for onion storage structures with raised flooring, proper ventilation etc. But knowledge dissemination of post-harvest management (PHM) measures is inadequate. To encourage the farmers for setting up of scientific onion storage systems, Maharashtra State Agriculture Marketing Board (MSAMB) has formulated a subsidy scheme for scientific onion storage to provide subsidy to the farmers at 25% of the cost of construction for Scientific Onion Storage under RKVY. The subsidy under the

scheme is available through lottery system where only 5% of the applicants stand a chance to receive the subsidy. The quantum of support may be enhanced to cover large number of farmers. **Though Onion storage structures have come up in large numbers in Nashik in the recent past, Government may undertake efforts to increase the storage capacity.**

5.3.2 Absence of bulk storage capacity meeting humidity and temperature requirements

A few big traders and wholesalers in the country have huge private storage capacity and are able to buy and stock up onions and influence the supply and prices in the market. While public agencies like NAFED does procurement from the market, it does not purchase directly from farmers. Many farmers felt that the Government should procure directly from them or help them in selling or exporting their onion or at least help them in getting a price of Rs.1000 per quintal so that they cover their cost of production and earn a reasonable return on cultivation of onion. The Government of India through NAFED and other organisations like National Cooperative Consumers' Federation of India Limited (NCCF) and Small Farmers' Agri-business Consortium (SFAC) could maintain adequate buffer stock of Rabi onions in proper storage conditions to ensure both price stability and remunerative prices for farmers.

Irradiation, a cold preservation method, is highly effective in controlling sprouting of onion and preventing losses. Govt. of India had approved irradiation of onion in 1994 for internal marketing and consumption and Department of Atomic Energy (DAE) had set up two 500 kg/hour capacity irradiation plants at Lasalgaon (2002) and Navi Mumbai (2000) (KRUSHAK - Krushi Utpadan Sanrakshan Kendra). More such facilities can be considered to prevent large spoilage of onion in the country and extending the shelf life.

The cold storage infrastructure for onions like ultra-low oxygen controlled atmosphere (CA) storage etc. while technically feasible, is not financially viable due to prohibitive costs and power shortage conditions.

The Essential Commodities Act restricts traders from transporting and storing their produce beyond a limit. The stock holding limits preclude investments in the supply chain as the food processing and retail companies need stocks in order to shield themselves from price shocks. Moreover, stock holding allows a smooth supply of produce, reducing price volatility.

5.3.4 Sorting and grading

Farmers follow different practices for marketing of onion once it is harvested. It was noticed that some farmers do the preliminary sorting immediately after harvesting at field level to remove pest / disease infested and damaged bulbs. However, most farmers do not undertake grading at field level based on size (small/medium /large). During interactions, farmers conveyed that the labor cost of plucking the produce itself is very high and they are hardly able to recover even the harvest charges at times. The additional cost incurred for grading does not give them commensurate price advantage.

Indian end-consumers prefer well-dried, medium sized onion, while the demand from restaurants and canteens is for large sized onions. Also, export requirements differ depending upon the country of export in terms of size, colour and packing lot. Traders/ wholesalers carry out the sorting / grading activity and add a mark up to the price

5.3.5 Transportation

Transportation plays an important role in marketing of onion. It is necessary to have quick movement from onion producing areas to onion consuming areas so that the produce reaches without much damage within a short time. Normally onions are transported in bullock carts and tractor trolleys by the farmers to local APMC Mandis, and in trucks and Railway Wagon by traders for transporting to distant markets within the country. For exports, onions are transported in ventilated ships by using 40 feet containers for loading on ships. It is desirable to have cushioning material below the bags to avoid damage to onions from jerks due to poor roads. The losses on account of rotting are lower in trucks than in railway wagons, but transport by trucks is costlier than the wagons. Lasalgaon railway station is just 2 kms from Lasalgaon APMC, and adequate wagon arrangements are in place for the last few years. Use of modified ventilated wagons can save the crop from damage due to heat.

5.3.6 Processing of Onions:

Onion can be processed into onion paste and dried or dehydrated products like powder, flakes and grits. There are about 100 onion dehydration units in Gujarat (maximum in Mahuva taluka of Bhavnagar district) and one large export oriented dehydration unit at Jalgaon, Maharashtra set up by Jain Irrigation Systems Ltd. (JISL).The raw white onions are dehydrated and processed at JISL's Food Park into sliced, diced, chopped, granulated, powdered, roasted, and fried products. JISL, which is the third largest producer and exporter of dehydrated onion in the world has

integrated backwards with more than 6,000 contracted farmers in Maharashtra and Gujarat for onion supply and also integrated forward. The company has been able to become a market leader in dehydrated onion by addressing the entire value chain. The local demand for processed onion is limited but is on rise due to use in Hotel industry etc.

As indicated in NABARD PLP 2018-19, there are only 2 small onion processing units in Nashik district which are highly inadequate for the district's onion production capacity. There is a scope for intervention by the state government, bankers, and entrepreneurs in Nashik here to strengthen the value chain by setting up more onion processing units.

5.4 Market Infrastructure for Onions

The major marketing channels for onions were observed to be APMC Mandis, which are under the administrative control of Maharashtra State Agricultural Marketing Board (MSAMB). It was also observed that, a large number of small and marginal farmers usually sell their produce to the local brokers who collect the produce at the village level and transport to nearby APMC mandis in transport vehicles. However, bigger farmers having onion cultivation in more than 2 hectares transport the produce by themselves to APMCs.

The APMC markets at Lasalgaon, Pimplagaon and Nashik, inspite of being quite progressive and large markets for onion, do suffer from poor competitiveness, inefficiencies and offer scope for frequent price manipulations. The APMC markets structure of onion is unilaterally dictated by the traders and not the farmers, despite claims to the contrary. While it is much better than the old *"handkerchief"* method of price discovery, the study team found that farmers are mere spectators and deferential to the entire auction mechanism in the APMC with the dominance of licensed traders. These traders collude to determine the purchasing price in a non-transparent fashion, virtually dictating terms to the farmer.

Some of the reasons for the above are as under:

- Poor financial position of farmers- most of the farmers are small and marginal farmers who lack trading expertise and market knowledge and hardly have any holding capacity/ risk bearing capacity.
- Concentration of trading - most of trading is in the hands of commission agents and traders wherein traders buy small lots from market yards and pool the produce for sorting and grading at their packing houses and market different grades to different markets all over India and abroad.

- Information Asymmetry - Farmers generally take reference of the local markets rates, while traders compare rates of all markets, including major national and export markets and then decide where to send their produce of a particular grade. Not many farmers are aware or think that it is possible to get a higher price for their produce by selling to other states or exporting it.
- Oligopoly / Artificial scarcity - Large storage capacities are concentrated with a few big and well established (15-20 years' experience) traders/ wholesalers having well connected networks with market intermediaries in other markets and they can play a role in hoarding for expected high prices.
- Too many middlemen- There are too many middlemen in the markets and not all are necessary. They have thrived because of the inefficiencies of the APMCs. Ideally, the commission agent acts as facilitator between farmers and wholesaler and ensures that the farmers receive their sale price. Many onion traders play multiple roles of commission agents cum wholesalers, and even railway agents.
- The open market auctions somehow did not appear transparent in terms of fair price discovery, and indicated some sort of collusion between traders to keep the prices low. *It took less than 8 seconds for a trade to happen, as observed during the auctions at Lasalgaon and Pimpalgaon APMC mandis.*

- **The GOI has established e-NAM** (electronic National Agricultural Market) to create a national market and price discovery by trading **which is supposed to overcome these problems**. But the platform is yet to be implemented at Nashik APMC. Quick implementation of e-NAM in the onion markets will enable better realization for farmers. Lasalgaon Agricultural Produce Market Committee (APMC) – the largest wholesale market for onions in Asia – is all set to be part of the World Bank-implemented Maharashtra Agricultural Competitiveness Project (MACP). The APMC will receive funds to the tune of ₹ 1 crore as part of the project to bring the entire auction process online. It is the first APMC in Nashik district to receive 100% funding for the project. Under e-NAM, market committees receive 50% funds for moving onto the online process. *According to Shri Jaydutt Holkar, chairman of Lasalgaon APMC, the market committee has purchased some 15 tablets for the e-auction and the bids will commence on a trial basis shortly. They have made arrangements for auction hall where traders can make bids on the computers as well. Large screens have been put at yards, which shall display market prices of commodities of various APMCs in the country.*

5.5 Export of Onions

India is a net exporter of onion, even though it has sometimes imported miniscule amount of onions to tide over the temporary demand-supply mismatches. As discussed in Chapter III, the Government Department of Commerce, Ministry of Commerce & Industry regulates export of onion under Foreign Trade through NAFED by using the mechanism of "Minimum Export Price (MEP)", below which no exports can take place. The MEP is increased, decreased or lifted by Government from time to time to ensure stability in domestic prices. The GoI has also created a Price Stabilisation Fund (PSF) with corpus of Rs.500 Crores which is utilised to procure onion through its nodal agencies.(Source: Lok sabha Questions)

MEP's impact

Onion exports rose substantially after the removal of MEP by the Central Government in December 2015 which made Indian onion very competitive in the exports market beating traditional competitors like Pakistan and Egypt and even China. Following the rise in wholesale prices in domestic markets, an MEP of $850 a tonne was imposed on November 23, 2017, which led to prices dropping by almost 50% in just a month from ₹ 3,550 per quintal on January 5, 2018 to ₹ 1,450 a quintal on February 2, 2018. Subsequently, when MEP was totally removed on February 2, 2018, it led to wholesale onion prices at Lasalgaon, the country's largest wholesale market, shooting up by 46% to ₹ 2,075 per quintal on the first day of trading, on the assumption that supply would shrink following higher exports, fetching good prices for farmers.

The traders felt that that Government's export policy on onion has been unpredictable and any sudden ban or increase in MEP on export of onion not only deprives them from earning higher margin but also causes loss of their credibility in the export markets as they fail to deliver their commitments, thereby adversely affecting India's reputation as a reliable onion supplier and trading partner. Another thing that the traders hinted at was about some big wholesalers taking advantage of lower onion price in domestic market due to high MEP to make money by managing to sell at prices below MEP.

5.6 Absence of a robust production forecasting, and price forecasting mechanism

The **Mahalanobis National Crop Forecast Centre (MNCFC)** at New Delhi in the Agriculture Ministry was established in 2012 to operationalize the use of space and geospatial technology for better agricultural forecasting and drought assessment. Under the **Mission of Integrated Horticulture Development (MIDH)**, the Department of Agriculture has initiated the **project CHAMAN** for assessment and development of Horticulture through Remote Sensing & geo-informatics. The project is being implemented by MNCFC in collaboration with ISRO Centres, 12 state horticulture departments, NHRDF Nashik, IMD, ICAR Centre and State Remote Sensing Centres. It envisages use of satellite remote sensing data for area and production estimation of 7 horticultural crops including Onion.

There are efforts underway by private players to carry out crop wise surveys to document planting intentions of farmers across major states for the Kharif season.

5.7 Bank finance / Credit Flow for Agriculture

5.7.1 **Nashik district Credit flow:**

Nashik district has a good banking network with 541 branches of Commercial Banks, 212 branches of Nashik DCCB, 10 branches of Maharashtra Gramin Bank and 1038 Primary Agriculture Credit Societies (PACS). The CD ratio in the district is 74%, but the **credit flow to agriculture (both crop loans and term loans) over the last five years has remained virtually stagnant between ₹ 3400 crore and ₹ 3700 crore.** The agricultural loans disbursed by the banks in Nashik district during the last five years are detailed below:

(In ₹ Crore)

Particulars	2012-13	2013-14	2014-15	2015-16	2016-17
Crop loan	2354.1	2159.1	1886.1	2464.2	2802.9
Agri term loan	1005.1	1252.1	972.7	1077.2	933.5
Total agri credit	3359.2	3411.3	2858.8	3544.5	3736.4

(Source: NABARD PLP 2018)

The credit potential for agriculture as reflected in the Annual Credit Plan (ACP) for Nashik has not been achieved by the banks for the last 3 years *(80% target achieved under Crop loans and 58% target achieved under Term loans for a total of 73% achievement in 2016-17)*. NABARD in its PLP 2018-19 has projected credit demand of ₹ 580 crore for onion crop alone for Nashik district. Though short term credit to agriculture is on the rise for the past 5 years, the long term loans in the district is showing a negative trend. Banks are predominantly focusing on crop loans (KCC) only.

Onion is one of the major crops cultivated in the district and it accounts for 16.19% of potential for the crop loan for 2017-18, as per the district's PLP prepared by NABARD. However, banks do not maintain any record of credit flow to onion in the region. The crop get subsumed with other vegetables. Banks need to maintain disaggregated database on credit flow to onion which is the major crop of the district. This is significant as information flows from agricultural value chains to financial markets reduce real and perceived risks of agricultural finance.

5.7.2 Inadequate crop loan / dipping scale of finance

A perusal of ACP targets and achievements under agricultural lending by various agencies for the year 2016-17 in Nashik revealed that, 56% of crop loan (Rs 1577.75 crore) was disbursed by DCCBs, 43% of crop loan (Rs 1221.4 crore) was disbursed by commercial banks and 0.13% of crop loan (Rs 3.72 crore) was disbursed by RRBs (NABARD PLP 2018-19). From the data, it is evident that DCCBs are the main purveyors of credit to farmers.

The scale of finance for onion crop computed by DCCB (under District Level Technical Committee (DLTC) of which DCCB is the Convener) is at ₹ 25000 / acre for the year 2018-19.

Sl No	Year	Scale of finance for onion
1	2017-18	Rs 30000
2	2018-19	Rs 25000 (16.6% reduction)

The farmers felt that the scale of finance at ₹ 25000/- per acre was inadequate considering the escalation of labour costs in the region (As mentioned by the farmers, onion planting alone require ₹ 8000/ acre). DLTC could re-examine the scale of finance to appropriately reflect the ground level scenario.

5.7.3 Absence of Agri Value Chain Finance (AVCF) in Onion

The concept of agri value chain finance for the onion crop in Nashik is practically non-existent. The response from most of the banks about participation in onion agri value chain was negative. None of the banks visited, was engaged in value chain finance for onion. Farmers are given regular crop loans under KCC, and loans for building storage structures. Even the private sector banks which are known to originate more term loans to agriculture were yet to finance through the value chain methodology. Though the banks understand the structure of the value chain, they are not aware of the relationships and drivers of the value chain. Bankers do finance input suppliers, farmers, traders, processors among other players, but as separate entities, without viewing them as a part of any value chain.

5.7.4 Absence of warehouse receipt financing

As per RBI guidelines, loans to farmers up to ₹ 50 lakh against pledge/hypothecation of agricultural produce (including warehouse receipts) for a period not exceeding 12 months will qualify under priority sector loans to agriculture. Loans for construction of storage facilities (warehouses, market yards, godowns and silos) including cold storage units/ cold storage chains

designed to store agriculture produce/products, irrespective of their location will also qualify for loans under agriculture infrastructure.

In addition, to discourage distress sale and to encourage them to store their produce in warehouses, the benefit of interest subvention will be available to small and marginal farmers having Kisan Credit Card for a further period of upto six months post the harvest of the crop at the same rate as available to crop loan against negotiable warehouse receipts issued by warehouses accredited with Warehousing Development Regulatory Authority (WDRA).

It is observed that banks are hesitant to extend finance for storage of onions due to perishable nature of onions, huge storage loss and wide price fluctuations. Moreover, to avail the interest subvention scheme warehouses need to be accredited with Warehousing Development Regulatory Authority (WDRA). The absence of accredited warehouses is another factor which discourages banks from warehouse receipt financing for onions. Banks may design alternate pledge financing products with adequate safety margins for farmers to avail loan against the stored onion goods in traditional kanda chawls/ ware houses to discourage distress sale and encourage storage of onion produce.

Chapter 6

Recommendations

Based on our interaction with various stakeholders and perusal of data, the following recommendations are derived. The Onion Value Chain has evolved over a period in varying strengths across the country. There are certain weak links, which if reinforced, can help in improved productivity, better realisation for the growers and price stability. The fragmented supply chain, lack of adequate storage, perishable nature of onion, high marketing margins, and dominance of few traders, are some of the significant challenges in the value chain that need to be overcome. A few recommendations in this regard are listed below:

1. Onion production related recommendations

1.1 Providing high quality seeds and improving seed replacement ratio:

- As the selection of good quality seed almost doubles the value of the output, this is a critical link which may be addressed by the stakeholders in the value chain. Government agencies, commercial nurseries and private players need to step up their efforts to produce and distribute good quality, high yielding and disease resistant varieties of hybrid seeds to the farmers.
- This needs to be accompanied by creating awareness on the usage of quality seed and the benefits of proper seed replacement among the farmers.
- There is space for private players in seed production and banks may find an opportunity to finance seed production on a big scale.

1.2 Improving Production Forecasting

- A better system for forecasting total onion production should be put in place, at least in major onion producing areas, like the Nashik belt. Use of Geographic Information Systems (GIS) should be used for intensive crop planning, crop mapping, yield estimation, and increasing production efficiently.
- The **National Crop Forecast Centre (NCFC)** at New Delhi in the Agriculture Ministry was established in 2012 to operationalize the use of space and geospatial technology for better agricultural forecasting and drought assessment. Its **project CHAMAN** for assessment

and development of Horticulture through satellite Remote Sensing & geo-informatics **is for 7 horticultural crops but a greater focus can be given for Onion.**

1.3 Enhancing, diversifying and staggering cultivation

- Institutes like State Agricultural Universities, ICAR Institutes, CSIR, NHRDF etc. may redirect their projects to focus on increasing the productivity and undertake coordinated efforts to transfer the knowledge on field to bridge the productivity gap.
- Area under onion in Kharif season (early kharif, kharif and late kharif) needs to be expanded across the country (like in Orissa) so that quality onions are available for domestic and export on regular basis.
- Contract farming for red, white and yellow onions can be explored for export and processing purposes.
- Proper staggered planting of onions using suitable varieties can address the supply gap during the slack period. Concentration of onion cultivation in six major states needs to be diluted by promoting onion cultivation in other states like Uttar Pradesh and Punjab.
- All stakeholders of onion need to ensure that primary wastage / spoilage is minimised by careful handling at all levels during the postharvest operations such as storage, transportation and marketing.

1.4 Use of new technology

Encourage farmers to use the micro irrigation, new farm technologies, food irradiation (KRUSHAK in Lasalgaon) etc.

2. Storage related recommendations

Enhancing of proper storage infrastructure can go a long way in fortifying the onion value chain in the country.

- Farmers need to be supported by way of credit and extension services for developing scientific storage facilities (well ventilated and raised) for enhancing storage period.
- Additional public sector storage facilities may be planned to store Rabi onion. Adequate storage facilities to store Rabi onion production can be planned in all major onion growing talukas to reduce the private sector control over prices and onion trade.
- Government agencies may earmark additional funds for onion storage.

3. Processing related recommendations

- There are only 2 onion processing units in Nashik district which appears inadequate for the district's onion production capacity. More such units need to be set up. Banks may scout for such projects which will encourage farmers to cultivate other types of onion (white onion) in the region, to harness the export potential.
- Private sector may set up processing units for manufacturing onion paste and dehydrated products. However, they must integrate backwards with the farmers to ensure regular supply of raw materials at reasonable cost for sustained operations.

4. Credit related recommendations

4.1 Adequate credit facility/ scale of finance

- Commercial banks need to reach out to more small and marginal farmers for both adequate crop loan and term loan to augment asset creation and improve productivity.
- While the general cost of cultivation is increasing, the scale of finance adopted by banks for onion is ostensibly coming down. DLTC and banks may ensure realistic assessment of credit needs and enable access to institutional credit.
- Banks may fund FPOs to construct storage godowns to maximize the scale.

4.2 Warehouse receipt finance / pledge loans

To discourage distress sale by farmers and to encourage them to store their onion produce in warehouses, banks need to come out with specific products to enable farmers to avail loan against the stored onion goods. Since, the benefit of interest subvention is also available for such loans, banks need to actively finance against warehouse receipts for onion.

4.3 Information flow

There is lot of potential for bank finance in Nashik district for fruits and vegetables, especially onion. Banks are not maintaining data on loans disbursed for onion. As it is a predominant crop in the district, banks may start maintaining separate data on loans disbursed for onion cultivation / storage.

- NHRDF is conducting Crop Area Calculation Model using ground level survey and satellite images, which calculates area under cultivation for onion. Banks can take advantage of this exercise for lending to onion cultivation.

4.4 Agri Value Chain financing by banks

Banks need to adopt an **integrated approach** for financing agri-value chain. Onion VCF needs financing of economic activities in the

- upstream (research and development, certified seeds, high yielding varieties, better agronomic practices and farming systems),
- midstream (grading, sorting, processing,), and
- downstream (packaging, food safety, traceability, branding, targeted markets) segments of the value chain

  For instance, banks may finance commercial nurseries, input suppliers and farmers with a tripartite agreement among the stakeholders to route all transactions through the bank.

4.5 Other areas

- Banks could extensively finance for drip /sprinkler irrigation and mulching which enhances the productivity and profit margins of farmers.
- Banks could finance both crop loans and term loans to the farmers supplying their produce to the processing units with a tripartite agreement among the stakeholders.
- Banks could finance seed production for farmers' cooperatives/ seed nurseries.
- Banks could promote the concept of custom hiring centres (CHC) by extending finance. Such CHCs provide the agri equipment on rent for pre-production and post-production activities like sorting, grading, plastic crates, transport vehicles etc.
- Banks could extend finance for FPOs by availing the credit guarantee facility from SFAC.
- Banks could finance Agri Clinics and Agri business Centers (ACABC) and also farmers who are availing the services from these ACABC in an integrated approach.

5 Marketing related recommendations

5.1 Market structure

- Since APMCs seem to be largely dominated by trader lobbies, APMCs need to be further reformed and strengthened.
- Free entry of new commission agents and traders including private companies may be encouraged to eliminate oligopoly.
- Market intermediaries engaging in unfair practices like low price bidding/ collusion/ hoarding etc., may be penalized / banned from transacting in mandis.

5.2 Marketing channels

- Farmer Producer Companies and their direct involvement in marketing should be promoted to reduce multiple layers/ intermediaries in the market.
- Alternate market channels like tie-up with agri-retailers in the corporate sector should be explored to reduce the market layers and the price mark ups. Direct sales of farmers to retail chains may be promoted.
- NAFED may be mandated to procure onions directly from farmers. Market intervention should be at an appropriate time.

5.3 Market Infrastructure

- Improve marketing infrastructure- The market yards may be equipped with state of the art storage facilities and other infrastructural facilities for grading/ sorting etc. so that farmers / traders may store their produce after paying appropriate rent. Encouraging more purchase by retailers like Reliance fresh, More etc. could ensure fair and remunerative price to farmers and infuse competition.
- Faster implementation of e-NAM project.
- Convergence between Agricultural department and APMCs in price forecasting on the basis of area cultivated and health of the standing crops.
- Traders could better use modern market intelligence systems to direct supplies to those markets where there is a genuine deficit.
- A centralised and credible market information system based on arrivals and prices in wholesale and retail markets needs to be put in place. Currently this information is available but with different agencies, and sometimes with different data. This should

include recording, disseminating and analyzing price data for onion for key markets in the country for better price transmissions in the value chain.

5.4 Market Pricing

- The marketing cost, margin and price spread analysis revealed a very high total marketing margin- due to long chains and too many middlemen in the supply chain of onion. It is suggested to reduce actors involved in the market, by promoting direct sales of farmers produce to wholesaler and more particularly linking small farmers produce to retail chains.
- The analysis of retail mark up in some markets revealed that, retailers are taking undue advantage of rise in the price. This practice may be curbed by increasing competition by allowing more number of private players and investment in retailing
- As part of market reforms, MSP under Price Support Scheme (PSS) for onions can help in discovering the right prices for producers as well as consumers.

6. Export policy related recommendations

- The tremendous increase in area and production of onion is in part due to the rising exports in the current decade. However, the spurt in exports should not lead to price rise. Hence, an appropriate export policy including transparency in fixing Minimum Export Price should be in place. This will not only bring a balance in the price discovery of onion but safeguard India's reputation as a reliable supplier and trade partner.
- APEDA or any other Government agency may explore the export potential in European Union and USA, in order to improve the unit price realisation by responding to the onion traits desired by consumers in these markets.
- More attention can be paid to export of processed onions (besides fresh onions) which has a huge export demand
- Contract farming can be adopted for export purposes.
- Suitable infrastructure, for instance ventilated storage godowns at shipyards may be enhanced for preserving quality.
- Quality assurance and branding need greater focus to enhance export competitiveness.

7. Government policy related recommendations

- Contract farming and suitable land lease laws will allow farmers to share the risks associated with the farming and allow them access to cheaper credit and farm inputs.

- Govt. of India is implementing several horticulture development programmes like National Mission on Micro Irrigation (NMMI), Mission of Integrated Horticulture Development (MIDH) etc. Several key drivers envisaged in the value chain like micro irrigation, commercial nursery production, post-harvest management, polyhouse cultivation of vegetables, etc., qualify for incentives/subsidies extended under the above programmes. **Co-ordination with the line departments concerned for ensuring convergence of resources including credit linkage wherever feasible, should be an integral component of the pilot project to increase awareness among potential beneficiaries and ensuring successful delivery.**

Annexure1.

LASALGAON--MONTH WISE MARKET ARRIVALS AND PRICES FOR ONION

Market	Month Name	Year	Arrival (q)	Price Minimum (Rs/q)	Price Maximum (Rs/q)	Modal Price (Rs/q)
LASALGAON(MS)	January	2017	718808	218	740	615
LASALGAON(MS)	February	2017	611965	135	684	483
LASALGAON(MS)	March	2017	380985	294	620	503
LASALGAON(MS)	April	2017	185545	350	647	573
LASALGAON(MS)	May	2017	463320	235	632	447
LASALGAON(MS)	June	2017	310645	246	676	551
LASALGAON(MS)	July	2017	357590	305	899	763
LASALGAON(MS)	August	2017	363130	639	2182	1900
LASALGAON(MS)	September	2017	277045	630	1802	1542
LASALGAON(MS)	October	2017	252898	908	2604	2289
LASALGAON(MS)	November	2017	272149	1099	3600	2936
LASALGAON(MS)	December	2017	504271	1128	3356	2873
LASALGAON(MS)	January	2018	404177	1360	3164	2862
LASALGAON(MS)	February	2018	370891	840	1837	1616
		Total	5473419	599 (Avg.)	1675 (Avg.)	1425 (Avg.)

Source: NHRDF

PIMPALGAON-MONTH WISE MARKET ARRIVALS AND PRICES FOR ONION

Market	Month Name	Year	Arrival (q)	Price Minimum (Rs/q)	Price Maximum (Rs/q)	Modal Price (Rs/q)
PIMPALGAON(MS)	January	2017	559366	265	747	594
PIMPALGAON(MS)	February	2017	522633	260	670	479
PIMPALGAON(MS)	March	2017	272306	250	637	525
PIMPALGAON(MS)	April	2017	528996	269	795	550
PIMPALGAON(MS)	May	2017	829306	152	847	431
PIMPALGAON(MS)	June	2017	390863	137	714	534
PIMPALGAON(MS)	July	2017	578753	269	948	757
PIMPALGAON(MS)	August	2017	420988	580	2308	1905
PIMPALGAON(MS)	September	2017	357980	579	1894	1444
PIMPALGAON(MS)	October	2017	284042	846	2730	2262
PIMPALGAON(MS)	November	2017	409886	716	3739	2930
PIMPALGAON(MS)	December	2017	549611	1112	3297	2691
PIMPALGAON(MS)	January	2018	383075	859	3187	2786
PIMPALGAON(MS)	February	2018	414546	671	1867	1574
		Total	6502351	498 (Avg.)	1741(Avg)	1390(Avg)

Source: NHRDF

Annexure 2:- Onion Exports

Total Export of Onion from India

Year	Source	Quantity(MT)	Value(Rs. Lakhs)	PUV(Rs/MT)
2017-2018	DGCIS	1922710.63	360100.40	18728.70
2016-2017	DGCIS	3492718.25	465172.64	13318.30
2015-2016	DGCIS	1788127.02	322742.96	18049.20
2014-2015	DGCIS	1086071.85	200994.53	18506.50
2013-2014	NAFED	1358193.00	287713.03	21183.50
2012-2013	NAFED	1822760.00	229490.94	12590.20
2011-2012	NAFED	1552904.00	214142.93	13789.80
2010-2011	NAFED	1340772.00	215905.56	16103.00

Source: NHRDF

DESTINATION WISE EXPORT OF CROP ONION

Year	Destination	Source	Quantity (MT)	Value (Rs. Lakhs)	PUV (Rs/MT)
2013-14	**BANGLADESH**	**NAFED**	**490207**	**106634**	**21752.8**
2013-14	**MALAYSIA**	**NAFED**	**226172**	**69883.38**	**30898.3**
2013-14	**U.A.E**	**NAFED**	**152812**	**31402.92**	**20550**
2013-14	**SRILANKA**	**NAFED**	**140245**	**34242.09**	**24415.9**
2013-14	**PAKISTAN**	**NAFED**	**74194**	**9697.93**	**13071**
2013-14	**INDONESIA**	**NAFED**	**67447**	**23129.54**	**34292.9**
2013-14	**NEPAL**	**NAFED**	**28083**	**5588.79**	**19901**
2013-14	**OMAN**	**NAFED**	**26025**	**5328.41**	**20474.2**
2013-14	**SINGAPORE**	**NAFED**	**23389**	**7013.25**	**29985.3**
2013-14	**KUWAIT**	**NAFED**	**22423**	**4965.31**	**22143.8**
2013-14	**DOHA/QATAR**	**NAFED**	**21178**	**4599.79**	**21719.7**
2013-14	**DAMMAM**	**NAFED**	**15801**	**3366.15**	**21303.4**
2013-14	**VIETNAM**	**NAFED**	**15165**	**5786.77**	**38158.7**
2013-14	**BAHRAIN**	**NAFED**	**12636**	**1975.12**	**15630.9**
2013-14	**THAILAND**	**NAFED**	**10776**	**3184.33**	**29550.2**
2013-14	**OTHERS**	**NAFED**	**8190**	**2736.12**	**33408.1**
2013-14	MALDIVES	NAFED	7192	2853.18	39671.6
2013-14	MAURITIUS	NAFED	6756	2538.62	37575.8
2013-14	HONGKONG	NAFED	2446	732.52	29947.7
2013-14	GREECE	NAFED	2200	321.24	14601.8
2013-14	UNITED KINGDOM	NAFED	1867	657.86	35236.2
2013-14	ITALY	NAFED	1689	530.05	31382.5
2013-14	BRUNEI	NAFED	1531	605.01	39517.3
2013-14	RUSSIA	NAFED	871	283.05	32497.1
2013-14	SEYCHELLES	NAFED	806	282.91	35100.5
2013-14	RE-UNION	NAFED	759	280.76	36990.8
2013-14	FRANCE	NAFED	194	45.95	23685.6
2013-14	NORWAY	NAFED	111	49.53	44621.6
2013-14	GERMANY	NAFED	76	58.64	77157.9
		Total	1361241	328773.2	24152.5

Annexure 3: Cost of Production of Onion during Kharif 2014

₹/ha

S. No.	Operations	Gujarat	Maharashtra	Andhra Pradesh	Rajasthan (Bulblet)	Rajasthan (seedling)	Haryana	Karnataka	Madhya Pradesh	Tamilnadu (A. Rose)	Tamilnadu (CO-ON)	Punjab
1	Land Rent for six month	15000	12000	18000	20000	20000	25000	15000	16500	16500	16500	25000
2	Seed Cost	16000	12000	15000	50000	15000	15000	7500	12000	45000	11500	15000
3	Nursery raising/Broadcasting	4860	5000	6250	0	5400	3700	800	3000	0	3250	2400
4	Land Preparation	10750	12200	12500	7000	7200	7650	9500	8000	10300	10300	4050
5	Transplanting	12475	17250	8750	14400	10400	10000	0	12000	8650	8650	10000
6	Irrigation	22500	9540	7500	4500	3000	2500	0	2400	2500	2500	2500
7	Manures & Fertilizers	29160	26054	10425	14728	14800	12866	13729	17415	19020	19007	8540
8	Weeding & Hoeing	10880	12000	9000	7600	8500	13225	11250	6000	16300	21800	10000
9	Plant Protection	3050	8500	9550	7000	6000	3200	9800	7412	7620	7570	4740
10	Harvesting, curring, sorting, grading & packing	16875	22750	20000	23450	21300	16250	6000	19500	15500	15500	10000
11	Transportation	17500	6000	6250	9000	9000	7000	5000	5000	8000	9040	4000
12	Supervisory charges	5000	4000	7000	3500	3500	3000	2500	2000	5000	5000	6000
13	Overhead charges	2000	1000	1500	3000	3300	3000	2000	2500	2000	2000	1000
14	Total (Rs)	166050	148294	131725	164178	127400	122391	83079.2	113727	156390	132617	103230
15	Bank interest on item no. 1 to 13	8303	7415	9221	9851	7644	6120	4154	4549	9383	7957	5162
16	Total Cost (Rs)	174353	155709	140946	174029	135044	128511	87233	118276	165773	140574	108392
17	Average Yield (q)	250	215	260	185	200	200	150	200	150	150	230
18	Cost per quintel (Rs)	697	724	542	941	675	643	582	591	1105	937	471

Source NHRDF- Annual Report 2014-15

Annexure 4: Cost of Production of Onion during Rabi 2014

₹/ha

S. No.	Operations	Maharashtra	Gujarat	Madhya Pradesh	Rajasthan	Andhra Pradesh	Haryana	Uttar Pradesh	Karnataka	Punjab
1	Land Rent for six month	12000	15000	16500	20000	22000	25000	17000	15000	25000
2	Seed Cost	14400	18000	14400	10000	15000	23000	18000	14400	18000
3	Nursery raising/Broadcasting	6100	4710	3000	3500	6250	4000	3500	0	2720
4	Land Preparation	15200	10750	8000	7000	12500	10000	13750	9500	4050
5	Transplanting/ Planting	17250	12475	12000	9400	8000	10000	0	8300	10000
6	Irrigation	13600	22500	9600	7050	10000	3000	18000	8400	8000
7	Manures & Fertilizers	30018	27410	17415	12310	10425	12866	25079	13729	8540
8	Weeding & Hoeing	12000	10880	1750	7500	9000	13225	24045	13500	10000
9	Plant Protection	14660	7725	7412	6000	9550	2500	6070	13800	2620
10	Harvesting, curring, sorting, grading & packing	21000	16875	21000	20700	22000	15000	27750	9000	10000
11	Transportation	15000	19500	6000	9000	3250	8000	4608	6000	4000
12	Supervisory charges	4000	5000	4000	3500	7000	3000	2500	3000	6000
13	Overhead charges	-	2000	2500	3300	1500	3000	1250	2000	1000
14	Total (Rs)	175228	172825	123577	119260	136475	132591	161552	116629	109930
15	Bank interest on item no. 1 to 13	8761	8641	6179	7156	8189	6630	11309	5831	5497
16	Total Cost (Rs)	183989	181466	129756	126416	144664	139221	172861	122460	115427
17	Average Yield (q)	275	325	250	250	300	250	250	175	250
18	Cost per quintel (Rs)	669	558	519	506	482	557	691	700	462

Source: NHRDF Annual Report 2014-15

Annexure 5 : Onion varieties developed by NHRDF

Climate

The onion is cool season crop, tolerant to frost in the young stage but less sensitive to heat. It is well 0 0 adapted to a temperature range of 13-25 C. A temperature range of 15-21 C before bulbing is 0 required for its good vegetative growth whereas a temperature of 20-25 C is considered ideal for bulb development. Very low temperatures in the beginning favours physiological disorder called bolting. Sudden rise in temperature favours early maturity of the crop in rabi and results in small size of bulbs. At least 10 hours light with favorable temperature is essential for growth, development and bulbing. Onion thrives well in places, which receive an average rainfall of 750-1000 mm during monsoon.

Soil

Onions can be grown on all types of soil such as sandy loam, silt loam and heavy clay soils. However, deep friable, highly fertile sandy loam to clay soil rich in humus is considered as ideal. Sandy soil needs frequent irrigation and favours early maturity. Whereas heavy soils restrict the development of bulbs and the crop matures late as compared to light soils. A pH range between 5.8-6.5 is considered as optimum. Good drainage is essential as water-logging results in total failure of the crop.

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