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ONION VALUE CHAIN IN INDIA: THE CISS-F FRAMEWORK ANALYSIS

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ABSTRACT

This study examines the value chain of onion in India, one of the country's key horticultural crops. Despite being a leading global producer, India faces challenges such as price volatility, post-harvest losses and inefficient value chains which limit farmer profitability and market efficiency. Using the CISS-F framework (competitiveness, inclusiveness, sustainability, scalability and access to finance) the research analyses the efficiency of India's onion value chain. It is observed that onion production in India increased from 3.5 million tonnes in 1991-92 to 26.83 million tonnes in 2020-21, area under cultivation also increased from 0.32 to 1.64 million hectares during this period, demonstrating remarkable scalability. However, growth primarily resulted from area expansion rather than yield improvements. Maharashtra remains the dominant producer while Madhya Pradesh has emerged as a significant contributor. In terms of inclusiveness, the participation of marginal farmers increased to 45.11 per cent in 2015-16 from 43.12 per cent in 2010-11 in onion cultivation. The study highlights the potential of contract farming models such as Jain Irrigation Systems Ltd., in improving farmer outcomes, although challenges remain in scaling these models for smaller farmers. In terms of financial sustainability, it is observed that the prices received by onion farmers are often less than the cost of cultivation, making it financially unsustainable for them. Regarding competitiveness, India is a major exporter of fresh and dehydrated onions with Bangladesh being the largest importer of Indian onions. However, frequent trade policy changes, such as export bans and minimum export prices, negatively impact India's position in the global market. Access to finance presents a challenge with small and marginal farmers relying heavily on informal credit sources. Government schemes provide subsidies for storage infrastructure and offer support for cold chains and irrigation systems but many farmers struggle to access these benefits effectively. The findings offer valuable insights for policymaking, emphasizing the need for interventions to enhance competitiveness, inclusiveness, sustainability and scalability while improving access to finance across the value chain.

Key words : Access to finance, Competitiveness, Inclusiveness, Scalability, Sustainability, Value chain.

Introduction

Agricultural Value Chain

A 'value chain' in agriculture identifies the set of actors and activities that bring a basic agricultural product from production in the field to final consumption, where at each stage value is added to the product.

A value chain can be a vertical linking or a network between various independent business organizations and can involve processing, packaging, storage, transport and distribution (FAO, 2010).

Structure of Value Chain

Porter's book "Competitive Advantage: Creating and Sustaining Superior Performance" provides a generic value chain model that includes both primary and secondary activities. The value chain's primary activities are closely related to the development or manufacturing of goods, services or products. In order to gain comparative or competitive advantages over the others, the secondary activities help each actor in each value chain's product transition process become more effective and efficient. Five generic categories make up the main activity in the traditional value chain concept and each

class is further subdivided into a number of distinct actions.

Primary activities in agricultural value chains can be divided into the following categories: (a) Inbound logistics: a group of pre-production and production supplementary activities, such as receiving inputs like seeds, fertilizer, various types of machinery, labor, etc., and the specific, time-bound production-related activities carried out in the field to produce high-quality products. It is the phase where raw material inventories are created and the producer-supplier relationship is managed. (b) Operations: This includes the tasks necessary to convert inputs and services into products that have been enhanced in value. At this point, the raw materials are turned into a finished good that is prepared for sale or marketing. Operational activities are intended to add value or utility to products in terms of time, space or form. Matching, sorting, branding, processing and other functions may generate form utility, while operations such as storage and warehousing may add time utility to the products. (c) Outbound Logistics: It is generally comprised of output delivery activities such as collecting finished products, sorting them according to quality and need parameters, scheduling orders and finally physically distributing the products to end-users or consumers. (d) Marketing and Sales: These are the activities that lead the products to final consumers - the goal is to provide a means for consumers to obtain the products for their intended use. This primary activity serves as an exact tailored integration link between the producer and the consumers, much like a conductor in each subgroup of a symphony orchestra. It aligns customer expectations with product production activities via proper monitoring, advertising and feedback mechanisms. (e) Service: Reaching the consumer does not mark the end of a product's value chain. It undergoes numerous transformations before being consumed in its final form. Non-agricultural goods require installation, after-sales services, repairs and so on. Similarly, agricultural commodities must be prepared for final consumption or end-use through a variety of activities and services. Every primary activity is essential to the value chain's competitive advantage. The secondary or supporting activities include four generic components: a) Procurement: It refers to the purchase or acquisition of inputs and services used in the agricultural value chain. It may also include the use of specific technologies such as direct seeding or the selection of a specific variety of vegetable seeds. (b) Technology Development: Technologies are essential components of all processes, including agriculture. Fertilizers, chemicals, improved crop seed development, land preparation, sowing, intercultural operations, harvesting, primary and secondary processing, marketing, transportation, final consumable product preparation and customer service procedures all require technological inputs at some point. Through research and development, a variety of technologies are created and improved for a variety of activities aimed at improving the product and optimizing the process for a higher margin and greater customer satisfaction. (c) Human Resource Management: It includes activities such as selection, recruitment, hiring, personnel development, reward and training for the value chain of a commodity or firm. It supports all stages and occurs at various levels along the value chain. (d) Infrastructure: This can include physical assets like a road, car, cold storage, machinery, etc., or intangibles like plans for future growth and development, financing, quality management, government support initiatives, management policies and strategies, information management, accounting, legal formalities, etc (Kumar and Rajeev, 2016).

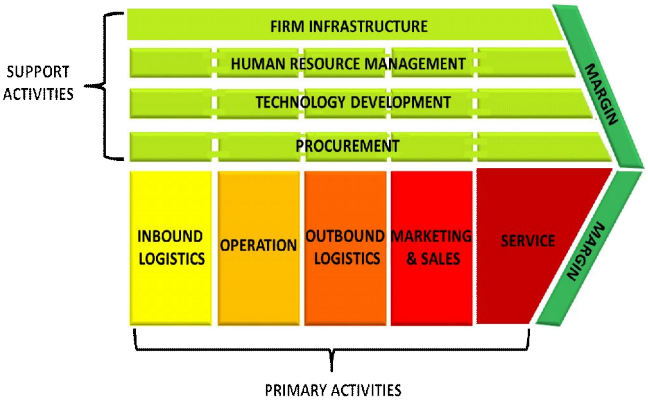

Fig. 1 : Structure of Value Chain.

Stockholder and Player in Value Chain

A stakeholder is a person or group who is involved in a defined process or is influenced by the actions or inertia of others in that process. As a result, there are numerous stakeholders involved in the agricultural value chain, which includes the production, transformation and transfer of farm products to consumers. Farmers, processors, distributors, retailers, input suppliers, finance providers and consumers all participate in the agricultural value chain. Farmers grow and harvest crops, while processors convert them into products like packaged goods or animal feed. Distributors and retailers then sell the products to customers. Each player in the agricultural value chain plays an important role in getting food and other agricultural products from farm to consumer. They are either directly or indirectly connected by networks of activities (Dubey *et al*., 2020).

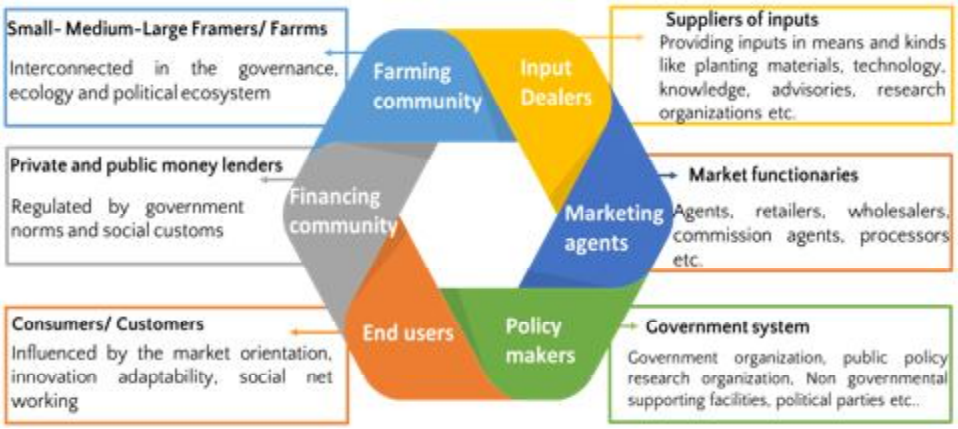

Fig. 2 : Stockholders and players in value chain.

Onion

Onions are one of the most widely cultivated, produced and consumed vegetables in India. Their production has increased dramatically over the years, with India now the world's second-largest producer of onions after China.

According to recent data, the production of onions in 2020–21 was 26.83 MMT. However, this is not good news for vegetable farmers. Overproduction has led to distress sales, crop burning and roadside disposal. The current market situation raises the question of why, despite record levels of production, we have not been able to compensate our farmers adequately. The answer lies in the horticultural crop market in India, which is characterized by value chain fragmentation, price volatility, quality and quantity losses and low levels of processing. The prevalence of these issues has weakened India's position in the global horticulture trade, resulting in low returns for farmers.

Unlike cereals and dairy, which have well-developed procurement and marketing systems, vegetables lack a strong value chain. The reasons include the crop's perishable nature, regional and seasonal concentration and a lack of storage facilities. As a result, it is critical to make the vegetable value chain more demand-driven so that farmers do not face the problem of oversupply.

Agricultural Value Chain Development (CISSF Framework)

Technology, institutions and markets work together to help agricultural value chains become more competitive, inclusive, sustainable and scalable, as well as improve access to finance (Fig. 3). Technology has been instrumental in streamlining value chains, increasing efficiency and allowing farmers to participate. Institutions that focused on aggregating marginal and small farmers, providing them with greater bargaining power, inducing economies of scale and establishing market linkages were critical to the successful transformation of agricultural value chains. Examples include dairy cooperatives, co-operative unions in the grape industry and the integrator model in poultry. Institutions play a critical role in improving governance and accountability while also addressing equity concerns in high-value agriculture.

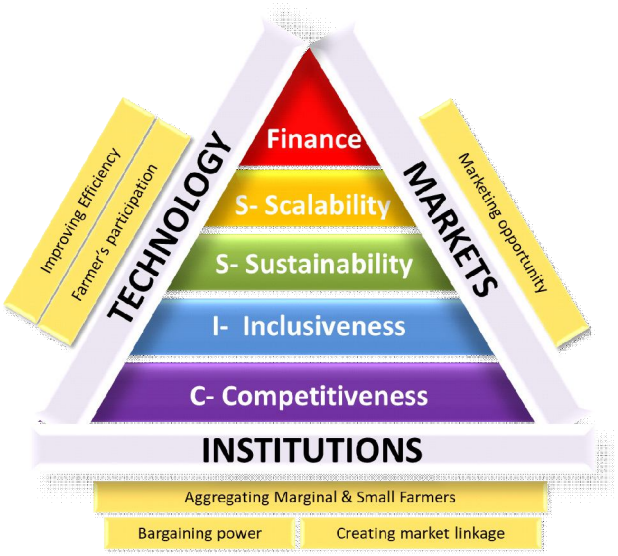

Fig. 3 : CISS-F Framework.

Commodities such as tomato, onion, potato and pulses, which are marketed primarily through traditional market channels despite their high volumes and value, are more price volatile than grains. Farmers have repeatedly suffered from price drops while benefiting little from price increases in the wholesale or retail markets. Much of this can be explained by farmers' limited marketing opportunities and unwillingness to take marketing risks. The role of technology, institutions and markets, as well as their critical interplay, have been examined in greater depth when assessing value chains in the CISS-F framework.

For strengthening CISS-F of the agricultural value chain, it is essential that technology, institutions and markets to work together. It is difficult to isolate the effects of these factors on the value chain. As the value chain matures, the relative importance of these factors shifts, but each remains relevant to the value chain's development. For example, without the establishment of co-operatives or FPOs, it is difficult to determine whether

the dairy and grape sectors could have used technology for inclusive market access. Without the Bombay milk market and the export market for grapes, institutions and technology would not have been as successful (Gulati *et al*., 2022).

Methodology

This study was based on secondary data analysis and findings from a study conducted by Gulati *et al.* (2022), who developed the CISS-F framework. The CISS-F framework comprises the following components:

Competitiveness: Measured in terms of international competitiveness using Nominal Protection Coefficient (NPC) and domestic competitiveness using farmer's share in the consumer rupee.

Inclusiveness: Analysed in terms of participation of small and marginal farmers in production.

Sustainability: Assessed in terms of financial (profitability) and environmental sustainability of the value chains.

Scalability: Measured in terms of area expansion and productivity gains, expansion of exports and value addition and its replicability across states.

Access to Finance: Studying the financing mechanisms available to the value chain participants, the gaps and potential of innovative financing methods.

Data Sources and Collection

Secondary data included information on onion area, production, yield (1960 to 2020), export (2000-01 to 2020-21), costs of cultivation, wholesale and retail prices (2009-10 to 2019-20) and farmers participation in onion farming (2010-11 and 2015-16), which were collected from various government sources including Directorate of Economics and Statistics (DES), Department of Agriculture, Cooperation & Farmers Welfare (DoAC&FW), Agricultural and Processed Food Products Export Development Authority (APEDA), Department of Consumer Affairs, Agmarknet and FAOSTAT. For aspects of the CISS-F framework this study includes findings from the previous research conducted by Gulati *et al.* (2022). This includes data on inclusiveness in contract farming, competitiveness of the onion value chain and access to finance for various stakeholders in the value chain.

Data analysis

The following analyses were conducted using secondary data:

1. Scalability: Calculated compound annual growth rates (CAGR) for area, production and yield of onions over six decades. Analysed changing constituents of major onion-producing states in terms of acreage and production over a 10-year period.
2. Inclusiveness: Examined the participation of different farmer groups in onion cultivation using agricultural census data.
3. Sustainability: Evaluated the financial sustainability of onion cultivation by comparing the cost of cultivation with wholesale and retail prices. Analysed water requirements for onion cultivation in comparison with other crops.

Compound annual growth rate

The compound growth rates of area, production, productivity and exports were estimated using the following exponential model.

$$Y = a\ b^{t}U_{t} \quad (1)$$

Where,

Y = Area, Production, Yield, Export quantity, Export value

a = Intercept

b = Regression co-efficient

t = Time variable

U = Error term

The compound growth rate was obtained from the logarithmic form of the exponential equation as below

$$\text{Log } y = \text{Log } a + t \text{ Log } b \quad (2)$$

The value of log b in equation (2) was computed using the formula

$$Log\ b = \frac{\left(\Sigma t\ Log\ Y - \left(\Sigma t.\ \Sigma Log\ Y/N\right)\right)}{\Sigma t^{2} - \left(\frac{\Sigma t^{2}}{N}\right)} \quad (3)$$

Where, N = Number of years.

Then, the per cent compound growth rate (g) was calculated by using the relationship

$$g = \{\text{antilog of (logb) } -1\} \times 100 \quad (4)$$

Where, g = Compound growth rate per annum in per cent.

Student 't' test was used to determine the significance of the growth rates obtained for which the following formulation was employed,

$$t = \text{Log } b/\text{SE (Log b)} \quad (5)$$

The calculated 't' values, from equation (5), were compared with the table 't' values and the significance was tested for 1 and 5 per cent probability levels.

Results and Discussion

Scalability

Scalability in area and production: onion

India's onion production saw a significant increase, rising from 3.5 million tonnes in 1991-92 to 26.83 million tonnes in 2020-21. Similarly, the area under onion cultivation also expanded, growing from 0.32 million hectares to 1.64 million hectares in 2020-21 (Fig. 4). There has been a decline in onion acreage every second or third year. This shows how onion cultivation is risky for farmers and their profitability volatile (DES, DoAC&FW, 2022a).

CAGR of area, production and yield of onion

Compound annual growth rates (CAGR) were calculated using the 'LOGEST' function of MS Excel for area, production and yield for onions over six decades starting in the 1960s. The CAGR of area, yield and production of onion for overall time period were found to be 3.17 per cent, 2.05 per and 5.029 per cent respectively, which were statistically significant at 1 per cent. It is clear from Table 1 that most of the growth in production has come from expansion in the area under cultivation and not growth in yield. The factors that have driven Onion production were the launch of the Integrated Development of Vegetables by Ministry of Agriculture, technology developed for micro irrigation systems, availability of quality seeds in adequate quantity and technology dissemination among farmers. Area expansion and production of onions in non-traditional areas and in different seasons increased overall availability throughout the year (FAOSTAT, 2022b).

Scalability in acreage: onion

Changing constituents of major onion producing states in terms of acreage over a 10-year period are shown in Fig. 5. Madhya Pradesh emerged as an important state with an area under cultivation for onions in the year 2020-21. Rajasthan maintained its share of five per cent in area under cultivation of onion. Maharashtra increased its share to 43 per cent in the year 2020-21 compared to 41 per cent in 2010-11 and it remain the largest state in terms of area under onion cultivation while Gujarat, Bihar and Andhra Pradesh reduce its share in terms of area compared to the year 2010-11 (DoAC&FW, 2021a and DoAC&FW, 2022c).

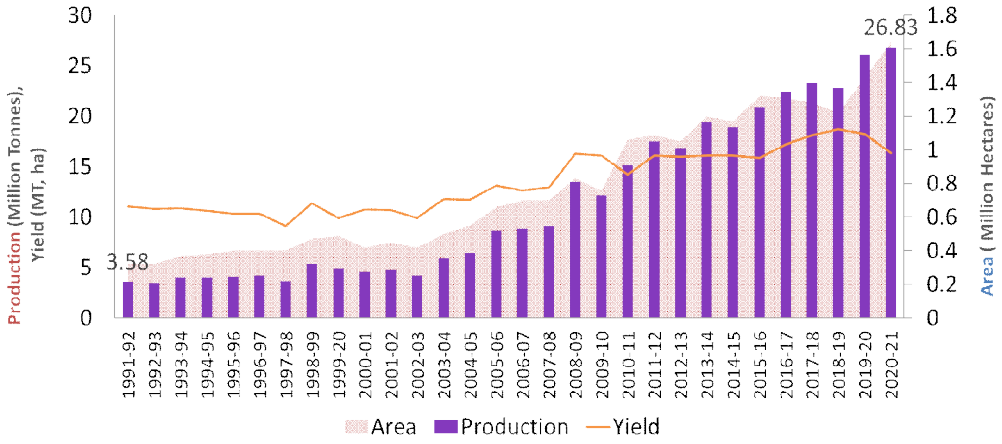

Fig. 4 : Onion area, production and yield – All India.

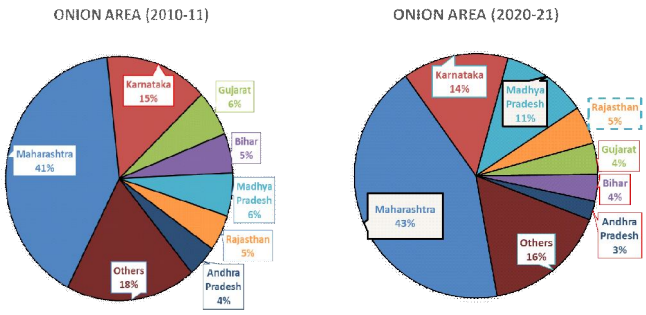

Fig. 5 : Scalability in Onion acreage.

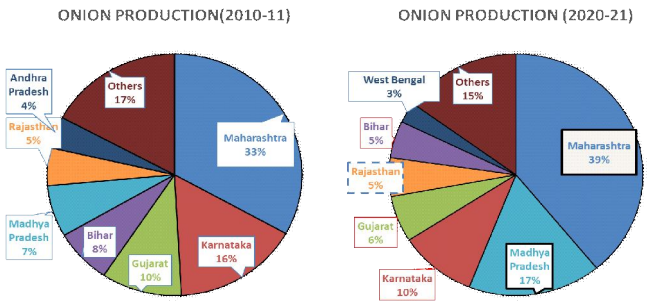

Fig. 6 : Scalability in Onion production.

Scalability in production: onion

Changing constituents of major onion producing states in terms of production over a 10-year period are shown in Fig. 6. Maharashtra remained the largest producer of onion. Madhya Pradesh has emerged as the second largest onion producing state in 2020-21. Followed by

Table 1 : Compound annual growth rates of area, yield and production of onion.

Decade	Onion CAGR (%)		
	Area	Yield	Production
1960	4.12**	1.02**	5.18**
1970	3.78**	-0.61**	3.15**
1980	2.49**	-0.07**	2.43**
1990	4.33**	-0.84**	3.45**
2000	8.8**	5.46**	14.74**
2010	2.56**	1.99**	4.6**
All	3.17**	2.05**	5.29**

Note: * and ** indicate significance at 5 % and 1% levels, respectively.

Inclusiveness

Inclusiveness in production: onion

Table 2 shows that in India, out of total onion growing farmers 45.11 per cent farmer were marginal farmer and 25.29 per cent farmers were small farmers in the year 2015-16. Also, as per agriculture census data, the share of marginal farmers in onion cultivation has increased from 43.12 per cent in 2010-11 to 45.11 per cent in the year 2015-16. Also, the share of semi medium and medium sized farmers has increased from 18.65 per cent and 9.32 per cent in the year 2010-11 to 18.76 per cent and 9.4 per cent in 2015-16, respectively (DoAC&FW, 2022g).

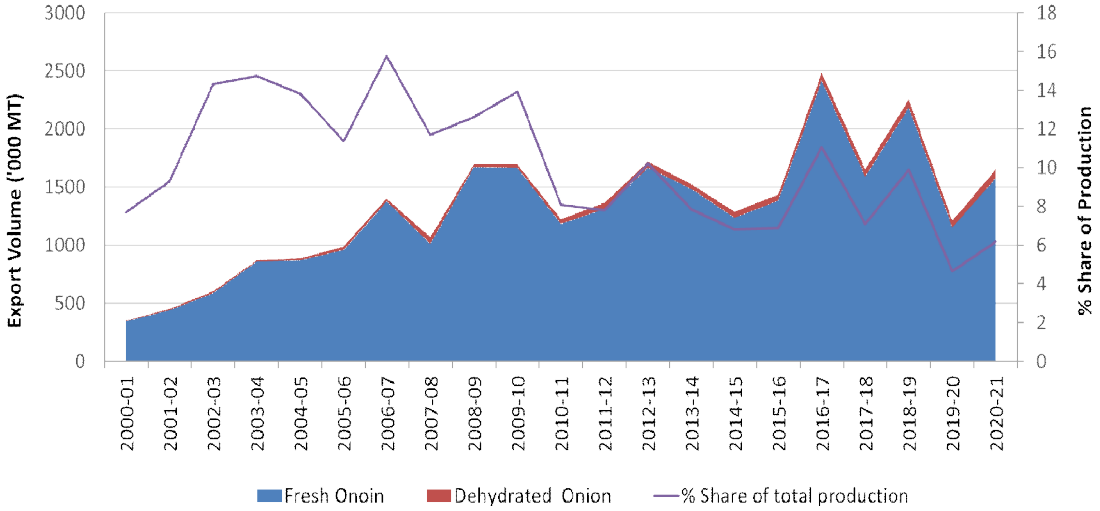

Fig. 7 : Scalability in Onion exports.

Karnataka and Gujarat. Rajasthan maintained its share of onion production over the period (DoAC&FW, 2021b and DoAC&FW, 2022d).

Scalability of exports: onion

Onions account for more than 50 per cent of the total fruits and vegetables' export. However, despite a rising trend in onion production in the country, onion exports have not increased at the same pace (Fig. 7). This was because of the trade-distorting policies of the Indian government, ranging from bans on exports to imposing minimum export prices, adversely affecting overall onion exports from the country. India exported around 6 per cent of total onion production and never exported more than 16 per cent of total onion production. Indian trade policy instruments like export bans or the imposition of MEPs were used for correcting short term inflationary conditions and it affected India's image as a reliable exporter (DoC, GoI, 2022e and DoAC&FW, 2022f).

Inclusiveness in contract farming – Jain Irrigation Systems Ltd (JISL)

Jain Irrigation Systems Ltd. (JISL) has signed a contract with farmers in and around Jalgaon, one of Maharashtra's major white onion growing regions, to process their onions. The company offers farmers a high-yielding variety of white onion seeds at subsidized rates. The company also meets the technological needs of farmers, such as drip irrigation systems. Farmers also benefit from the company's extension services, which are designed to ensure that the produce meets specific quality requirements. According to an FAO case study, JISL's services to contract farmers help to mitigate the various risks that onion growers face. The study compared farmers in the traditional value chain to those working with JISL on a variety of parameters and concluded that contract farmers in JISL benefit from higher margins due to increased productivity and lower price risk due to the minimum guaranteed price. Because of these benefits,

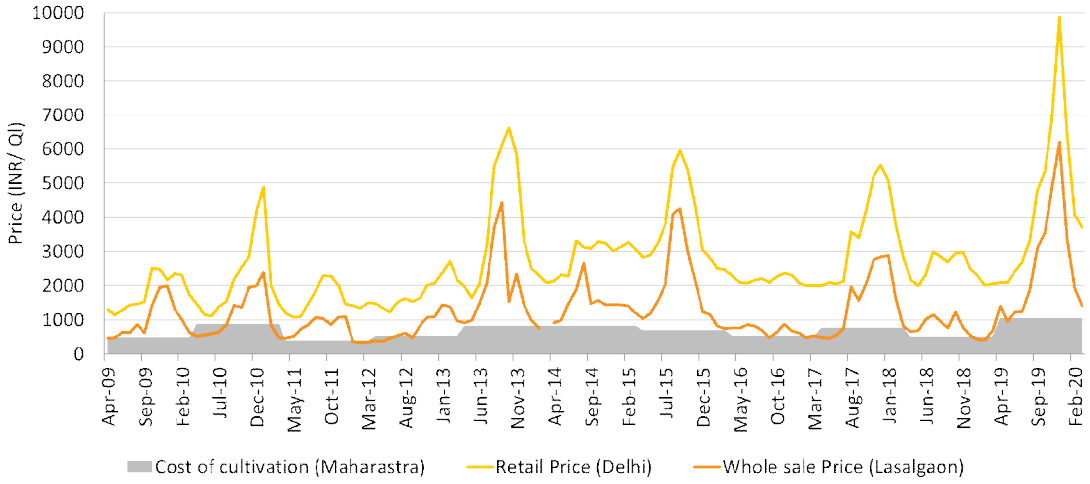

Fig. 8 : Onion: Cost of cultivation, wholesale and retail price.

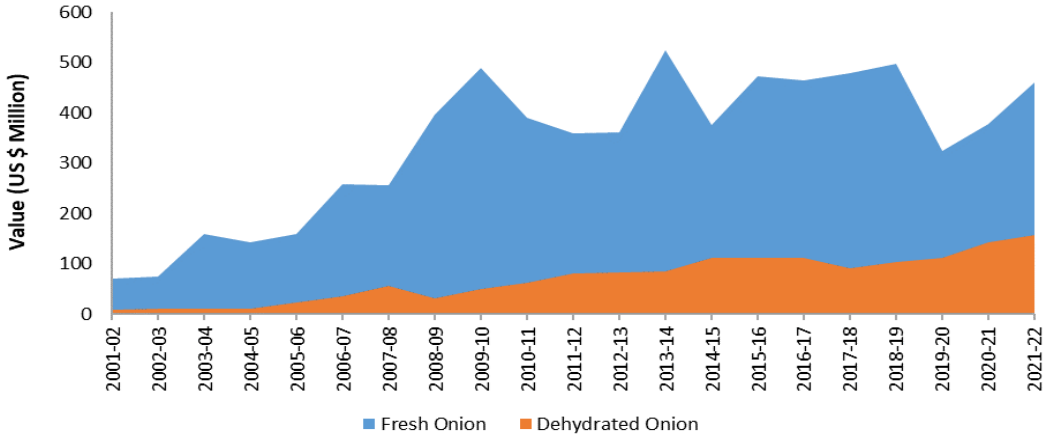

Fig. 9 : Exports of Onion from India.

small and marginal farmers are encouraged to join the supply chain. JISL collaborates with farmers at both ends of the value chain, providing them with inputs such as fertilizers, seeds, micro irrigation systems and extension services before purchasing their raw produce for processing.

Although, contract farming provides numerous benefits, such as access to technology, credit, marketing channels and information at low transaction costs, large and medium farmers are preferred over small farmers, who have greater access to capital and risk-taking capability. Large farmers are better able to adopt technology. Some contract farming requirements make participation difficult for small and marginal farmers; however, these obstacles can be overcome by organizing them into collectives such as FPOs (FAO, 2015).

Sustainability

Financial sustainability: onion

While there has been a dramatic increase in the production of horticultural crops in India, market inefficiency and a lack of well-integrated value chains are key impediments to farmers benefitting from these record levels of production. Recent market conditions have served as a reminder that a bounty monsoon and a bumper crop are not synonymous with increased farm incomes. Newspaper reports have been highlighting the pitiable condition of tomato, onion and potato farmers who have been forced to resort to distress sales or even dump the crop on the roads because the price offered was way lower than the cost of cultivation.

A look at the average wholesale and retail prices of onions along with the corresponding cost of production reveals significant insights. The cost of cultivation of Maharashtra is taken while the whole sale price of Lasalgaon is taken as it is a major market of onion in India. Data shows that farmers are perpetually subject to the vagaries of the “boom and bust cycle” (Fig. 8). When the price received by a farmer is less than the cost of cultivation, farming of a particular crop becomes financially unsustainable for them (Anonymous, 2021c; Anonymous, 2022h; Anonymous, 2022i).

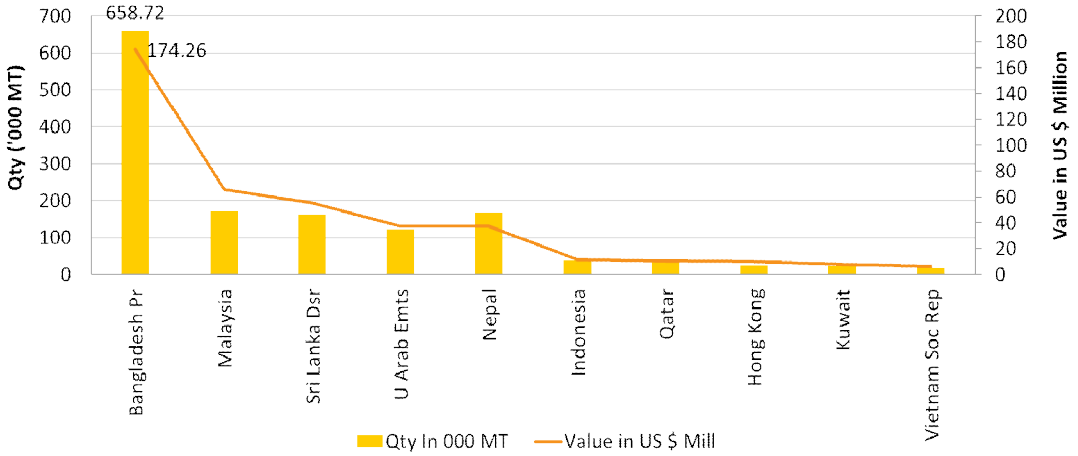

Fig. 10 : Major export destinations for Indian onion (2021–22).

Table 2. Share of different farmer groups- onion

S. no.	Size Class (HA)	2010-11	2015-16
		% of total	% of total
1	Below 0.5	22.95	22.49
2	0.5 1.0	20.17	22.62
	Marginal	43.12	45.11
3	1.0 2.0	27.31	25.29
	Small	27.31	25.29
4	2.0 3.0	12.73	12.19
5	3.0 4.0	5.92	6.57
	Semi medium	18.65	18.76
6	4.0 5.0	3.63	3.9
7	5.0 7.5	4.04	3.88
8	7.5 10.0	1.64	1.62
	Medium	9.32	9.4
9	10.0 20.0	1.4	1.22
10	20.0 & above Large	0.22 1.61	0.21 1.43
11	All classes	100	100

Water requirement for onion

Onions require less water than cereals and sugarcane (Table 3). Drip irrigation or sprinklers can significantly reduce water usage in areas where it is both necessary and viable. Sprinklers are widely used for tomato cultivation, particularly in Andhra Pradesh and Karnataka, but they are rarely used for onion (except in Maharashtra) or potato cultivation. Traditional cultivation practices, including flood irrigation are unsustainable and should be replaced with micro irrigation systems. Contract farmers working with private companies such as McCain, PepsiCo and Jain Irrigation have increased productivity by implementing micro irrigation systems. The fields of every farmer that collaborates with McCain are equipped with sprinkler or drip irrigation systems. In addition to helping traditional farmers, microirrigation will save a significant amount of water.

Another significant issue is the "virtual trade of water," which refers to the import and export of hidden water in the form of commodities. India is a net exporter of water, with food grains accounting for the majority of its exports. Rice, cotton, sugar and soybeans are India's main exports and all are water-intensive crops. China, on the other hand, is a net importer of water because it imports water-intensive soybeans, cotton, meat and cereals while exporting fruits, vegetables and processed foods. Promoting the cultivation of water-efficient vegetables will help to promote sustainable water use in Indian agriculture (DOGR, ICAR, 2022j).

Competitiveness

Exports of onions from India

In the early years, the value of fresh onion exports showed a steady increase, starting at US$ 70.73 million in 2001-02 and reaching a peak of US$ 524.98 million in 2013-14 (Fig. 9). However, after this peak, there was a noticeable decline to US$ 324.2 million in 2019-20 and reaching US$ 460.56 million in 2021-22 while the export value of dehydrated onions exhibited significant growth over the same period. Starting at US$ 8.32 million in 2001-02, it steadily increased, peaking at US$ 158.44 million in 2021-22 (APEDA, 2022k).

Major export destinations for Indian onion

Onions from India have a huge global demand because of their high pungency and year-round availability. India exported 1.53 million tonnes of fresh

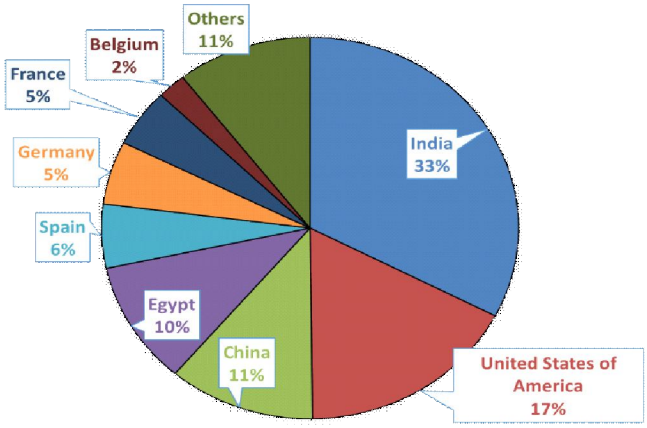

Fig. 11 : Share in global dehydrated onion exports (2021).

Table 3 : Water requirement and number of irrigations for onion.

Water requirement of different crops		Number of times irrigation required for onion and potato	
Crop	**Water requirement (mm)**	**Season**	**Onion**
Rice	900-1300		DOGR
Wheat	300-400	*Kharif*	5-8
Maize	450-650	Late *Kharif*	10-12
Sugarcane	1800-2400	Rabi	12-15
Cotton	650-900		
Potato	500-700	Season	Potato
Onion	350-550	Rabi	8
Tomato	600-800		

onions in 2021–22. Bangladesh is the largest importer of Indian onion with 658.72 thousand tonnes valued at 174.26 US$ million followed by Malaysia, Sri Lanka, United Arab Emirates and Nepal in the year 2021-22 (Fig. 10). However, the trade policy in India is haphazard and makes India's exports very volatile. With frequent imposition of minimum export prices (MEP) or complete export bans, India is losing its credibility in the global onion export market. This gap in exports from India encourages other nations like Pakistan to increase its exports. The Netherlands, despite not being a major producer, has emerged as a top exporter on the back of their efficient storage and packaging solutions. The Rose variety of Krishnapuram in Karnataka is premium quality and attracts a higher price than the medium sized onions from Maharashtra. While India is able to export much of its onions to its neighbours and Gulf countries, exports to European countries are at a nascent stage (APEDA, 2022l).

India's share in global dehydrated onion exports

India is among the largest exporters in the world in the year 2021 with 33 per cent share followed by the USA (17%), China (11%), Egypt (10 %) and Spain (6%) (Fig. 11). These top four countries account for around 60% of the world's total dried/dehydrated onion export. Dried onion or dehydrated onion (ITC HS Code: 7122000 Onions, Dried, Whole/Cut/Sliced/Broken/In Powder but Not Further Prepared) is in the form of dried flakes, slices, granules or powder. India has the largest hub of dehydration units for onions in the world. These products are generally exported to Europe, Russia, Africa and the Middle East countries (Trademap.org, 2021d).

NPC for onion

Gulati *et al.* (2022) found that nominal protection coefficients calculated for onions are consistently less than one. It indicates export competitiveness of onions from India (Fig. 12).

Trade policies for onions in India

Due to fluctuations in domestic prices and market arrivals of onions, the Indian government resorts to measures aimed at reducing prices to safeguard the interests of consumers. Hence, Indian trade policy for onion is very unstable. It can range from a complete ban on exports or increasing the minimum export price (MEP) to freeing exports of onions and reducing import taxes. For example, onion exports were prohibited from December 2010 to February 2011 and then briefly again in September 2011. MEP has been imposed on onions several times, ranging from USD 0 to USD 1150 per MT for the normal variety of onion (Fig. 13). Since December 2015, onion exports were free. MEP was again imposed on November 23, 2017, at USD 850 per MT. In the first week of February 2018, MEP was removed as onion prices started coming down. This frequent imposition and removal of MEP on onions hampers the credibility of India as an onion exporter as high MEP discourages domestic exporting firms from selling their produce overseas. Importing nations resort to buying onions from elsewhere like Pakistan. The imposition of MEP not only destroys India's credibility as an exporter, it also deprives farmers of higher prices for their produce. A date wise timeline of the imposition of MEP on onions has been shown in Figure 13. The red line shows the MEP imposed on the premium Rose and Krishnapuram varieties of onions from Bangalore, which was always higher than the common variety of onion, before April 2012. Since August 2013, a common MEP has been imposed on all varieties of onion when there is a shortage of onion in the domestic market (DGFT, 2022m).

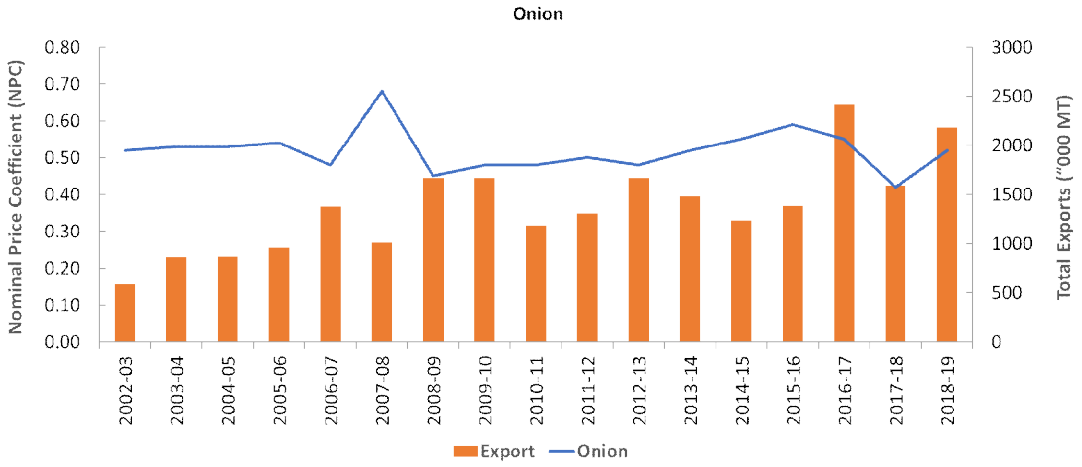

Fig. 12 : NPC and export volume- Onion.

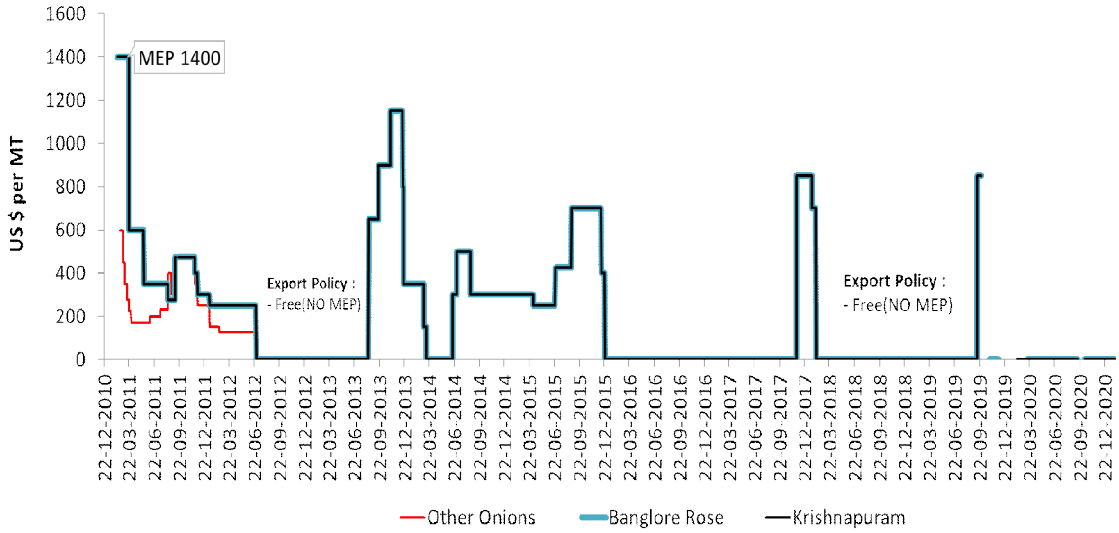

Fig. 13 : Timeline for MEP and other trade policies for onions in India.

Onion value chain: cost and margins

The farmer's share of the consumer rupee is 29.1 percent, while retailers' share is 30.6 percent (Table 4). The share of traders and semi-wholesalers is 24.1% and 16.3%, respectively. During a glut, farmers frequently struggle to cover their production costs. The table also shows the markups along the onion value chain from major producing regions to Delhi (Gulati *et al.*, 2022).

Access to Finance

Access to finance – financing for farmers

Field visits by Gulati *et al*. (2022) to Kolar revealed that 80 percent of small and marginal farmers obtain credit from the unorganized sector, which includes commission agents, friends, relatives and their own sources. Large farmers and traders are important credit sources for small and marginal farmers. This is because of the mutual trust and understanding that has grown over time. Additionally, obtaining credit for them is quicker and simpler than applying for bank loans, which involve a lot of paperwork. Large farmers borrow only 30 to 35 per cent of the total cost of production. Of this, 60 to 70 per cent is borrowed from banks, less than 30 per cent from relatives and none from commission agents.

In terms of farmer schemes, the government provides a 90% subsidy for drip irrigation, which costs INR 25,000 per acre. However, the effective subsidy is only 70%; the 20 per cent goes to middlemen. Farmers also get support in production technologies such as precision farming, pest management and drip irrigation.

There is also a crop loan of INR 30,000 per acre for onion production. This is the minimum amount; if instalments are paid on a regular basis, the amount will increase over time. An interest rate of 7 per cent is charged for crop loan up to INR 3 lakhs with a 2 per cent rebate for regular repayment. Following the initial INR 3 lakh crop loan, farmers receive a cash credit loan at an interest rate of 10-11 per cent from nationalized banks and 12 per cent from private banks.

Table 4 : Costs and margins of onion value chain from producing regions to Delhi.

No.	Stakeholder	Cost and margin (INR/Quintal)	Share in consumer rupee (%)	Mark up (%)
1	Price received by farmer	701	29.1	29.1
2	Total trader's cost	417	17.3	24.1
3	Trader's margin (4-2-1)	164	6.8	
4	Delhi wholesale price	1282		
5	Semi wholesaler total cost	265	11.0	16.3
6	Semi wholesaler margin (10%)	128	5.3	
7	Price to retailer	1674		
8	Retailer cost	150	6.2	30.6
9	Retailer margin	587	24.4	
10	Price paid by consumers	2412	100.0	

Access to finance – financing for Infrastructure

DOGR and NHRDF have developed different kinds of low cost, improved storage structures using bamboo, asbestos and other materials. While some structures are three sides open, some are open on all sides with ventilation provided at the bottom through a raised platform. Scientists at DOGR and NHRDF claim that these structures are able to reduce post-harvest losses to 15–20% as compared to the 40–50% when onions are stored in traditional structures. For the construction of these storage structures, the government provides a subsidy of 25 per cent to farmers under the RKVY (Rashtriya Krishi Vikas Yojana) scheme (Anonymous, 2014).

While existing cold storages are concentrated in a few states and (80-90%) of available cold storages are used for potatoes, there is a dire need for cold storages in India. The Ministry of Food Processing Industry is building a National Cold Chain Grid in the country to connect major agricultural producing hubs to cold storage and processing industries. The Cold Chain and Value Addition Infrastructure scheme of MoFPI provides financial support to the tune of INR 10 crores for setting up such facilities (MoFPI GoI, 2022n).

Access to finance – financing for processors

The emergence of Mahuva as a dehydration hub can be attributed to the Gujarat Government's favourable policy regime. This includes subsidies to dehydration units. The Gujarat Government provides subsidies to cover 25 per cent of the project cost up to INR 500 lakhs to set up such industries under the scheme of cold chain, food irradiation processing plant and pack house. Another scheme for Agro and food processing unit provides 25 per cent of the project cost up to Rs. 50 lakhs under the scheme of capital investment subsidy (Anonymous, 2016a).

The Government of India's SAMPADA (Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters) Yojana, which provides subsidy for setting up food processing units is another scheme that has boosted the food processing sector. It is an ongoing scheme for the food processing sector and has been renamed to Pradhan Mantri Kisan SAMPADA Yojana14 with an allocation of INR 6000 crore for the period 2016–20. This scheme of the Ministry of Food Processing Industries (MoFPI) provides a subsidy of 35 per cent of the project cost up to INR 5 crores to set up food processing units. The scheme also covers the setting up of the mega food parks, integrated cold chain and value addition infrastructure, the creation and expansion of food processing and preservation capacities, infrastructure for ago-processing clusters, the development of backward and forward linkages, food safety and quality assurance infrastructure and human resources and institutions.

Another scheme is production linked incentives scheme for food processing industry (MoFPI GoI, 2016b).

Conclusion

The analysis of the onion value chain in India through the CISS-F framework reveals both significant progress and persistent challenges. The onion sector has demonstrated remarkable scalability with production increasing from 3.5 million tonnes in 1991-92 to 26.83 million tonnes in 2020-21. This growth has been primarily driven by area expansion rather than yield improvements, indicating potential for further productivity enhancements. In terms of inclusiveness, the participation of marginal farmers in onion cultivation has increased, reaching 45.11 per cent in 2015-16. Contract farming models, such as those implemented by Jain Irrigation Systems Ltd., show promise in improving farmer outcomes, although challenges remain in scaling these models for smaller farmers. The sustainability of onion cultivation faces challenges, particularly in terms of financial viability for farmers. The study reveals that farmers are often subject to price volatility with prices frequently falling below the cost of cultivation. However, onions are relatively less water-intensive compared to cereals and sugarcane, presenting an opportunity for more sustainable water use in agriculture. India has maintained its position as a leading global exporter of onions, demonstrating competitiveness

in the international market. However, frequent changes in trade policies, such as export bans and minimum export prices, negatively impact India's reliability as an exporter and farmers' incomes. Access to finance remains a significant challenge, particularly for small and marginal farmers who often rely on informal credit sources. While government schemes provide subsidies for storage infrastructure and support for cold chains and irrigation systems, many farmers struggle to access these benefits effectively.

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