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Value chain analysis of the food processing sector in Andhra Pradesh and Odisha

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APICOL	Agricultural Promotion and Investment Corporation of Odisha Limited
AP	Andhra Pradesh
EU	European Union
FPOs	Farmer Producer Organizations
FDI	Foreign Direct Investment
GVA	Gross Value Added
ILO	International Labour Organization
MPEDA	Marine Products Export Development Authority
MSA	Market Systems Analysis
MSMEs	Micro, Small And Medium Enterprises
MoFPI	Ministry of Food Processing and Industries
NIFPHATT	National Institute of Fisheries Post Harvest Technology and Training
PL	Post Larvae
PMFME	Pradhan Mantri Formalization of Micro Food Processing Enterprises'
PMKSY	Pradhan Mantri Kisan Sampada Yojana
PHT	Pre-harvest Test
PHTC	Pre-Harvest Test Certificates
PSEI	Promoting Sustainable Enterprises in India
RTC	Ready-to-Cook
RTE	Ready-to-Eat
R&D	Research and Development
SC	Scheduled Caste
ST	Scheduled Tribe

Executive summary

▶ Executive summary

Background

The Promoting Sustainable Enterprises in India (PSEI) project, led by the International Labour Organization (ILO), and supported by the Korea International Cooperation Agency (KOICA), enables micro, small and medium enterprises (MSMEs) in the ready-made garments and food processing sectors to integrate more effectively into national and global supply chains with the aim of supporting inclusive economic growth and creating more, and higher-quality, jobs.

With these objectives, this study analyses two food processing market systems in Andhra Pradesh (AP) and Odisha, fruit pulp and fisheries, with a specific focus on mapping the challenges and opportunities in these sectors to drive state-level economic growth. The findings of this report can be used by the governments of AP and Odisha, as well as development partners, to inform sector policies and strategies and programme design. As is reflected in the study, there are significant opportunities in both sectors and states to enhance competitiveness, strengthen links with buyers, improve MSME performance, and support inclusive and job-rich growth.

Sector snapshot

Food processing is a large and rapidly growing sector in India, currently worth US$ 31.2 billion,[1] with an average annual growth rate of 11 per cent between 2011 and 2019. It is a major source of employment with 7.1 million active workers in registered and unregistered processing units, representing 14 per cent of all industrial employment in India (Ministry of Food Processing and Industries (MoFPI) 2022). It has the potential to support economic transformation as a high-productivity, export-oriented sector. There has also been significant growth in inward investment, with foreign direct investment (FDI) increasing from US$ 516 million in 2015 to US$ 905 million in 2020.

To help ensure a sufficient depth of analysis across these two states, this study focuses on two food processing subsectors with the highest potential:

- **Fruit pulp, specifically mango**: India is an internationally competitive fruit pulp exporter; mango is a major fruit grown in both AP and Odisha, and the land under cultivation is only increasing. AP is the largest producer of fruits in India with a production of 18 million metric tonnes in 2021/22 with agriculture and allied sectors contributing 40 per cent of AP's gross value added (GVA). Odisha's fruit production was 2.4 million metric tonnes in 2017/18, with agriculture and allied sectors contributing 19.9 per cent to the state's GVA.
- There has been sustained growth in domestic and international demand for processed fruit products, particularly pulp, which offers new market opportunities for processors. Fruit processing is labour-intensive, employing a high proportion of women, and growth in the sector is likely to translate into the creation of direct and indirect jobs.
- **Shrimp aquaculture**: Inland aquaculture is growing rapidly in India (an increase of 267 per cent from 2001–2020) versus stagnant growth in marine fisheries. Shrimp is the most popular seafood globally, and frozen shrimp is both the largest and fastest-growing fisheries export in India. Ninety-one per cent of the fish products in India are sold in an unprocessed state, representing a major market opportunity for growth in the processing sector. Inland fisheries employ more than four times the workers as marine fisheries, including a substantially higher proportion of women.

1 All US dollar values have been at the following conversion rate: 1 Indian rupee = US$ 0.013

The state of AP had over 71,900 ha under cultivation during 2020/21 and produced 634,672 metric tonnes of shrimp in 2020/21. Odisha had over 10,600 ha under cultivation and produced 43,677 metric tonnes of shrimp over the same period.

MSMEs dominate the food processing sector across the world. India has more than 63 million MSMEs, over 99 per cent of which are microenterprises, accounting for 30 per cent of India's gross domestic product and up to 45 per cent of its exports. Collectively, more than 111 million workers are employed by these enterprises. In AP, there are an estimated 3.39 million MSMEs and an estimated 1.98 million in Odisha (Ministry of MSME (MoMSME) 2021).

Developing the food processing sector is a strategic priority for the Government of India. Key initiatives include developing a major sector upgrade scheme called the Pradhan Mantri Kisan Sampada Yojana (PMKSY); positioning food processing as a key pillar in the 'Make in India' campaign; and relaxing FDI restrictions in the sector to allow 100 per cent foreign ownership. At the state level, both AP and Odisha have ambitious agendas for the growth of the food processing sector, including plans to increase the area under cultivation, enhance market linkages, and strengthen marketing and distribution.

▶ Impact of COVID-19

The coronavirus disease (COVID-19) had a substantial impact on the food processing sectors in AP and Odisha. National-level lockdowns limited the supply of labour to processing units, severely constraining production. The slowdown in international trade also reduced aggregate demand, leading to a surplus of products and lower margins, resulting in many MSMEs exiting the sector. The lasting impacts of the pandemic include an increased focus on food hygiene and packaging. For example, there is now an increased demand for aseptic containers over cans, carrying a cost implication for processors.

Binding constraints

To understand the constraints and opportunities in the sector, the PSEI project commissioned a market systems analysis (MSA), a study that takes a holistic view of the food processing sector to consider the value chain – from producer to retailer to end consumer – and the supporting functions and rules determining the performance (and inclusiveness) of the sector.

There are sufficient similarities between the binding constraints in the fruit pulp and shrimp aquaculture subsectors to enable a parallel analysis whilst recognizing that some details vary by subsector and location. The binding constraints are summarized in figure 1.

Skills

There are significant gaps in processors' knowledge and technical skills at both the worker and managerial level, which inhibits their ability to work efficiently and move up the value chain.

- In the fruit pulp value chain:
  - Fruit farmers lack awareness of the harvesting requirements for supplying to the pulp industry, often leading to spoilage or damage to the fruit and microbial contamination causing high wastage.
  - Farmers lack of awareness of modern farming practices, such as ultra-high density plantation (UHDP) which can increase the yield per hectare, leading to further low yields.

▶ **Figure 1. Market systems analysis framework**

Source: Authors' analysis

- In the shrimp value chain:
  - Processors' skills in AP and Odisha are dedicated to secondary processing for the US and European Union (EU) markets due to the predictability and scale of these markets. This focus comes at the cost of building tertiary processing skills and secondary market segmentation for other high-value Asian markets.

Infrastructure

- The unreliability and high cost of power lowers margins for MSMEs compared to established players. MSMEs have tighter margins due to lower volumes, rendering them less competitive in a market focused on operational efficiency.

Research and development and product innovation

- In the fruit pulp value chain, the new varieties of mango produced locally are not being tested and explored for pulpability as processors are unwilling to bear these costs due to uncertainties in consumer perception and lower demand for new blends of fruit pulp.
- In the shrimp value chain, there is a perception that the risks of developing new, tertiary ready-to-cook (RTC) and ready-to-eat (RTE) products are higher than the potential rewards. As a result, there has been limited investment in the research and development of market-segmented tertiary RTC and RTE products. Instead, the sector focus is on volume and operational efficiency, leading to an unmet demand for tertiary processed products catering to specific markets.

Quality control and certification

- Challenges in the value chain result in products of variable quality being sold in both the domestic and international markets. As a producer, this impacts India's reputation and access to certain markets such as those in east Asia. Value chain challenges include delays in certification infrastructure and the non-acceptance of Indian certifications in some markets.

Access to financial services

- Food processing has high capital expenditure and working capital needs; however, banks see MSME processors as being risky propositions for loans and facilities for working capital finance. Thus, MSMEs have limited alternatives to banks, obstructing the development of entrepreneurship in the value chain, and this is a key limitation of these processors moving up the value chain.

Marketing

- Fruit pulp MSMEs do not have a strong brand presence to compete against trusted, well-established corporations which are market leaders.

Access to government schemes

- Accessing existing government schemes, such as the Mega Food Park (MFP) Scheme and the Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME) Scheme, is challenging for MSMEs due to the amount of effort and time involved in making scheme submissions and waiting for funding or approval. Thus, MSMEs face large delays in receiving financial aid from these schemes, which increases their time to repay loans, scale up and become profitable.
- The MFP Scheme was intended to create linkages through geographic proximity. However, renting space in MFPs was highlighted as too expensive for MSMEs to access.

Contracting

- In the shrimp value chain, input suppliers depend on building trust over formal contractual relationships. Most MSMEs have not had the time to build trust or touch points, and this compares unfavourably with larger, more established players due to their vertical service integration and the time they have spent building relationships.

Opportunities

In response to the binding constraints outlined in this chapter, five intervention areas were identified. Within each intervention area, quick-win interventions are marked with an ⚡ icon. These interventions are detailed here.

Improving access to quality raw materials

- **Objective:** Strengthen the quality and consistency of raw materials supplied to MSME processors.
- **Impact:** A more reliable raw material supply would help MSME processors function at a higher capacity, resulting in better commercial performance at the firm level and the ability to compete more effectively with larger domestic processors and international competitors. Higher processing throughput would also increase employment opportunities in both sectors, particularly for women.
- **Interventions:**
  - Enhance backward linkages between farmers and processors through quality linked bonuses, profit sharing or shared ownership. Backward linkages should be fostered through a farmer and processor forum.
  - Build a skills development function focused on improving raw material consistency at harvest and on promoting the best practice use of chemicals and antibiotics.
  - Investigate new varieties of crops and evaluate the resilience of current crops and species to climate change.

Increasing value addition at the processing stage

- **Objective:** Build processors' knowledge and capacities to increase the share of value-added products.
- **Impact:** Knowledge of processing requirements and market demand for value-added products can enable risk-averse MSMEs to develop tertiary products. Coupled with reliable business from such markets can ensure that processors willing to grow can move up the value chain or develop market niches.
- **Interventions:**
  - Enhance the capacity of secondary and tertiary processors to develop market-segmented secondary and tertiary (RTE and RTC) products.
  - Enhance the awareness and capacity of processors to understand and develop new products for different palates and facilitate linkages between importers from high-value markets and processors considering developing tertiary products.

Strengthening access to domestic and international markets

- **Objective:** Improve the perceptions and systems that limit MSMEs' access to high-value markets.
- **Impact:** Systemic changes in the current functioning of the shrimp value chain will result in faster processing speeds, whereas improving the perception and brand recognition of MSMEs in the fruit pulp value chain will make them competitive in both the domestic and international markets.
- **Interventions:**
  - Explore ways to speed up sample testing for high-value markets, such as South Korea, and increase the number of testing facilities with accreditation to these markets.
  - Strengthen the brand recognition of processed food in India.

Improving access to affordable finance

- **Objective:** Increase MSMEs' access to finance and improve the efficiency of processing loans.
- **Impact:** MSMEs will have more capital to invest in lowering the cost of production and building market niches. Indian businesses may see a rise in more entrepreneurial ventures, leading to a dynamic and competitive environment.
- **Interventions:**
  - Facilitate access to working capital products for MSMEs.
  - Support local banks in enhancing the speed at which MSME loans are processed and work with MSMEs to ensure high-quality loan applications.

Building a supportive private public dialogue

- **Objective:** Increase dialogue between the government and processors to enable a constructive and healthy environment.
- **Impact:** Processors increase their engagement with regulators and policymakers, build trust in local government with the aim of ensuring that policy is developed in line with key MSMEs constraints.
- **Interventions:**
  - Streamline approvals for government-mandated schemes for MSMEs in the food processing sector and for those directly relevant to food processors in AP and Odisha.
  - Strengthen processor advocacy between the private sector and the central and state governments.

1 Introduction

▶ 1. Introduction

1.1 Background

The International Labour Organization (ILO), supported by the Korea International Cooperation Agency (KOICA), is leading the Promoting Sustainable Enterprises in India (PSEI) project in Andhra Pradesh (AP) and Odisha. The PSEI project supports micro, small and medium enterprises (MSMEs) in the garments and food processing sectors to help them integrate more effectively into national and global supply chains, with the ultimate aim of supporting inclusive economic growth and creating more and better-quality jobs.

With these objectives in mind, this study focuses on two high-potential food processing subsectors: fruit pulp and fisheries (particularly shrimp aquaculture). The research aims to:

1. identify the binding constraints limiting the competitiveness of food processing MSMEs using a market systems analysis (MSA). This holistic approach analyses both the core value chain and the supporting functions and rules that drive value chain performance.
2. develop an "upgradation strategy" to address constraints and realize opportunities in the short term (six months), the medium term (one to three years), and the long term (three to five years).

Together, the MSA and upgradation strategy will provide a blueprint to help increase the competitiveness of food processing in AP and Odisha, leading to enhanced linkages with domestic and international buyers, improved MSME performance, and inclusive, job-rich economic growth.

The study recognizes that the PSEI project is a temporary initiative and that lasting change will be driven by long-term players in the market system. It, therefore, considers how the roles of key market actors need to change to support a more competitive food processing sector.

1.2 Study parameters

To ensure a sufficient depth of analysis across the two focal states, the entry point for the MSA was two high-potential food processing subsectors: fruit pulp (particularly mango) and shrimp aquaculture. Although other products are also being considered, these value chains are at the core of the analysis. This selection was based on the following considerations.

▶ Table 1. Justification for the subsectoral value chain selection

Fruit pulp with a focus on mango	Shrimp aquaculture
• There has been sustained growth in domestic and international demand for processed fruit products, particularly pulp. • India is an internationally competitive fruit pulp exporter. • Mango is the dominant fruit grown in both AP and Odisha, with increasing land under cultivation. The investment and capacity in mango processing can be applied to other pulpable fruit. • Fruit processing is labour-intensive and employs a high proportion of workers. Growth in the fruit processing sector is likely to create both direct and indirect jobs.	• In contrast to marine fisheries, where production is declining, production from inland aquaculture is growing rapidly (267% increase from 2001 to 2020). • Frozen shrimp is both the largest and fastest-growing fisheries export in India. • Inland fisheries employ more than four times as many people as marine fisheries, including a substantially higher proportion of women. • 91% of fish products are sold unprocessed, representing a major market opportunity to grow the processing sector.

1.3 Methodology

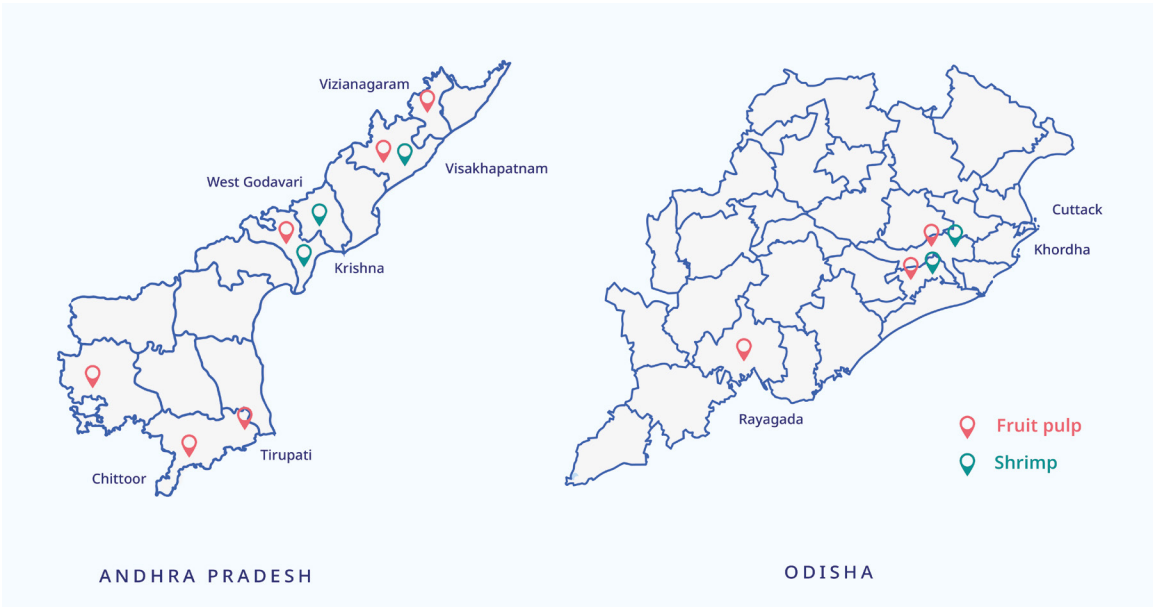
The research was carried out in two phases.

Phase 1: Desk research: The available literature was gathered to provide a framework for the primary data collection process, including existing value chain analyses in Odisha and AP, relevant initiatives, legislation and regulations, sector data and market trends.

Phase 2: Field research: A total of 40 interviews were conducted with individuals involved in the fisheries and fruit pulp value chains in AP and Odisha during the research process. The interviews were semi-structured and were conducted with government officials, employers' associations, sector advisors, unions, training institutions, research institutions, business owners, employees, and workers. These in-depth interviews provided a detailed understanding of the sector from a variety of perspectives and interests.

The interviews were conducted remotely and in-person and covered the location as seen in figure 2.

▶ **Figure 2. Districts in AP and Odisha where value chain participants were interviewed**



Source: Authors' analysis

A detailed list of the stakeholder organizations interviewed is included in Annex A. All interviews were conducted under the assumption that the interviewee would maintain their anonymity.

This research is based on the methods outlined in two ILO reports, *Value Chain Development for Decent Work* (ILO 2021) and the *Operational Guide for the M4P Approach* (Springfield Centre 2014). The results were validated through triangulation between the secondary and primary research and between respondents. The results were also validated by relevant stakeholders who attended validation workshops in August and October 2022. The key findings of the study were presented at these workshops and feedback on binding constraints and interventions areas have been incorporated into this study.

1.4 Report structure

The structure of the report is:

- **Chapter 1** provides an overview of the background of the report, its methodology and structure.
- **Chapter 2** provides an overview of the food processing value chain with a focus on shrimp aquaculture and fruit pulp, including historical trends, analysis of national and international markets, areas of potential growth, employment dynamics, and an overview of the target group.
- **Chapter 3** analyses the fruit pulp and shrimp market systems in AP and Odisha with a focus on identifying the binding constraints in key supporting functions and rules. The constraints are

summarized at the end of the section and are prioritized according to **feasibility** (including timeframe, political economy, budget and market readiness) and **impact potential** in terms of both breadth (scale of outreach) and depth (magnitude of change).

- **Chapter 4** builds on the key constraints identified in the previous chapter to suggest potential areas for project intervention. This entails an assessment of the key actors involved in the market system with their relevant incentives and capacities for change, and suggested intervention activities.

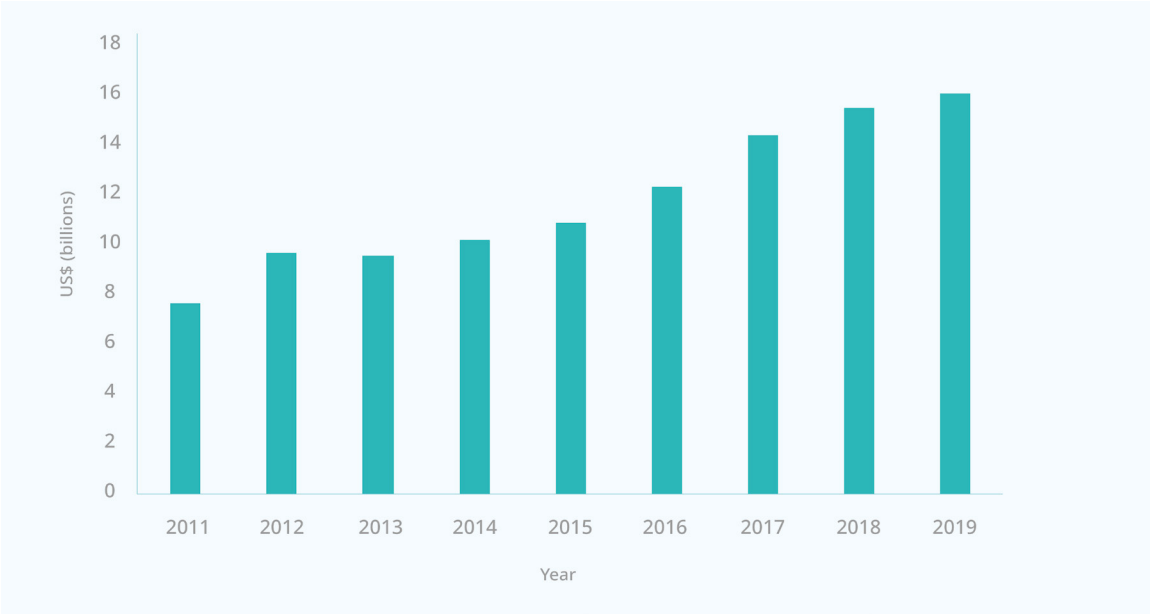
2 The Indian food processing sector: A snapshot

▶ 2. The Indian food processing sector: A snapshot

2.1 Size and growth

Food processing is a large and rapidly growing sector in India. The market is currently worth US$ 31.2 billion, representing 1.8 per cent of the gross value added (GVA) across India (Ministry of Food Processing and Industries (MoFPI) 2022), and it grew at an annual rate of over 11 per cent between 2011 and 2019 versus 4.2 per cent in agriculture (see figure 3). At this rate of growth, the market is expected to reach a value of US$470 billion by 2025 (Invest India 2022).

▶ **Figure 3. Year-on-year GVA from the formal food processing sector, 2011–19**



Source: MoFPI (2022)

The growth in this sector has been driven by multiple factors including:

1. Food processing is a strategic priority for the Government of India as evidenced in the development of several government initiatives and policies focused on this sector such as:
   - The MoFPI has announced flagship schemes to upgrade the sector such as the Pradhan Mantri Kisan Sampada Yojana (PMKSY)[2] and the Pradhan Mantri Formalization of Micro Food Processing Enterprises (PMFME) Scheme. These schemes aim to boost the growth of the food processing sector, reduce wastage, enhance the export of processed foods, strengthen existing micro food processing units, integrate these units into an organized supply chain, and increase access to finance.
   - The 'Make in India' initiative lists food processing as a key pillar for growth.
   - Foreign direct investment (FDI) restrictions have been relaxed, allowing 100 per cent foreign ownership in the sector.

2 The PMKSY Scheme has consolidated several initiatives, including mega food parks, food safety, cold chain, quality assurance infrastructure, infrastructure for agro-processing clusters, integrated value addition infrastructure, and the creation of backward and forward linkages under a single umbrella scheme.

2. The FDI in the sector has increased from US$515.9 million in 2015 to US$904.7 million in 2020. At the state level, the FDI in AP in 2021 was $178 million (MoCI 2022), of which US$0.03 million (MoFPI 2021) was in food processing industries for the year 2021. For Odisha, the FDI data for food processing is unavailable.
3. There is an abundance of raw materials for the food processing sector, with India ranking second in the global output of fruits and showing rapid growth in the production of raw inputs for fisheries such as shrimp.
4. The increasing demand for processed food products is driven by changing lifestyles and growing incomes.

The food processing sector presents several opportunities for inclusive growth by, for example, increasing in-country value additions, improving crop diversification, improving farmer incomes, supporting the inclusion of disadvantaged communities, and increasing export earnings. There are also potential benefits in terms of addressing food security, food inflation and nutritional outcomes.

2.2. Role of MSMEs

Food processing has the potential to play a key role in India's ongoing economic transformation,[3] both as a potentially higher-productivity sector and as one with significant export potential.

A key aspect to consider when discussing productivity is the dominance of MSMEs in food processing. India has more than 63 million MSMEs, which provide 30 per cent of India's GDP and 40–45 per cent of exports (Ministry of MSME (MoMSME) 2021), collectively employing more than 111 million workers. In AP and Odisha alone, there are over 5.3 million MSMEs, of which over 99 per cent are microenterprises.

▶ Table 2. State-wise distribution of MSMEs, 2020

State	Micro (million)	Small (million)	Medium (million)	Total MSMEs (million)
AP	3.40	0.01	0.00	3.39
Odisha	2.00	0.04	0.00	1.98

Source: MoMSME (2021)

There is a high level of informality, with MoFPI data from 2021 suggesting the number of unregistered food processing units operating in AP and Odisha are 26 and 80 times higher than the number of registered units.

▶Table 3. Formal and informal food processors in AP and Odisha

Name of State	Number of formal food processors manufacturing food and beverages (Annual Survey of Industries 2018–19)	Number of informal food processors manufacturing food and beverages (73rd Round Survey of NSSO 2015–16)
AP	5 653	154 330
Odisha	1 188	77 781
All India	40 579	2 459 929

Source: MoFPI (2022)

3 The movement of labour and other resources from lower-to-higher productivity sectors and from lower-to-higher productivity activities within the same sector. This was highlighted in the Lewis Model, which illustrated the impact of transitioning from agriculture to industry to be higher capital accumulation leading to higher economic growth.

2.3. Fruit pulp sector

India is the second-largest producer of fruits and vegetables in the world, producing 311.7 million metric tons in 2017/18 (IIFPT 2022). AP is the largest producer of fruits in India, with a production of 14 million metric tonnes in 2017/18 and with agriculture and allied sectors contributing 40 per cent of AP's GVA. Odisha's fruit production was 2.4 million metric tonnes in 2017/18 (Horticulture Statistics Division 2018), with agriculture and allied sectors contributing 19.9 per cent to the state's GVA. Given the dominance of mango in both states (see table 4), this study uses mango as the entry point for analysis but considers other pulpable fruit varieties common to both states, such as papaya, guava and pineapple, as well. The pulp and export potential of these products is outlined in table 5.

▶ Table 4. Fruit production in AP and Odisha (2017/18)

	Andhra Pradesh			Odisha		
Fruit Types	Area under cultivation (000' ha)	Production (000' MT)	% of total national production	Area under cultivation (000' ha)	Production (000' MT)	% of total national production
Mango	363.0	4373.61	20.04	199.08	805.77	3.69
Papaya	18.0	1687.82	28.18	3.05	70.29	1.17
Guava	9.53	229.78	5.67	14.27	105.04	2.59
Pineapple	4.52	71.33	4.18	0.97	11.53	0.68

Note: MT stands for metric tonnes.
Source: Horticulture Statistics Division (2018)

▶ Table 5. Pulp and export potential by fruit type in AP and Odisha

Fruit type	Pulp and export potential
Mango	High pulp potential for Totapuri, Alphonso and Kesar varieties High export potential for both fresh fruit and fruit pulp
Banana	Low pulp potential as most varieties are grown for raw consumption High export potential as fresh fruit
Papaya	High ratio of harvest to area, high pulp potential High export potential as secondary products, for example, jams, jellies, etc.
Lime/Lemon	Pulp directly sells directly into the market as juice concentrates
Guava	High pulp potential for white guava and pink guava High export potential for both fresh fruit and pulp
Pomegranate	Pulp directly sells directly into the market as juice concentrates High demand in domestic but not export market
Pineapple	High ratio of harvest to area, high pulp potential for queen variety Low export potential due to low volume of production and smaller size of fruit than required by international buyers

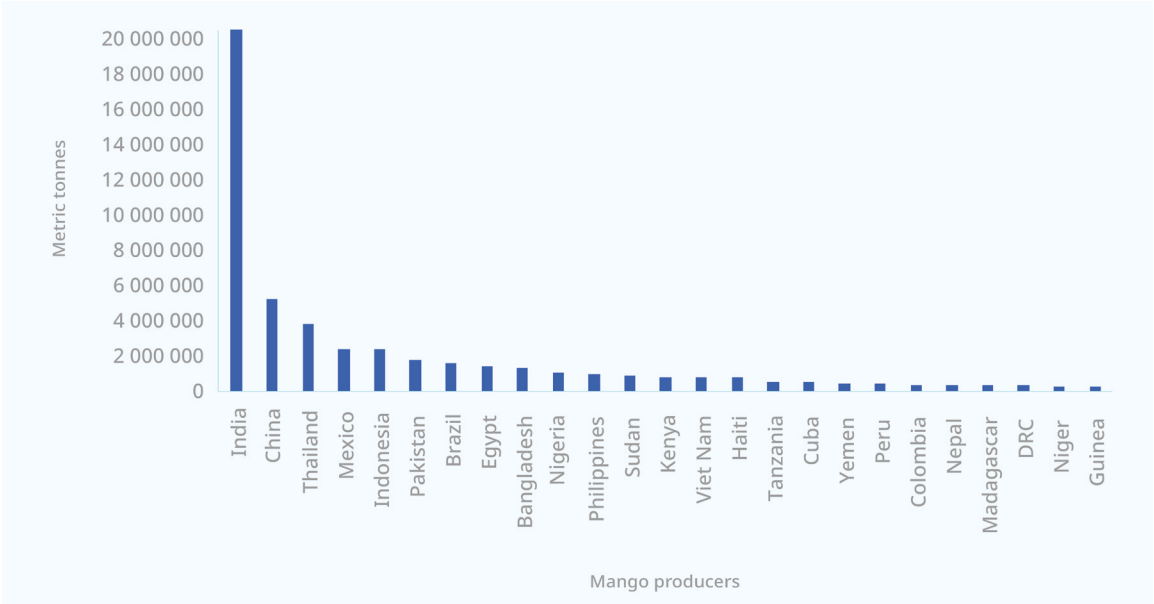
Source: Authors' analysis

2.3.1. Mango subsector

India is the largest global producer of mango, ahead of its nearest rival, China, by a wide margin, with a total area of 2.2 million ha under cultivation in 2015/16, a production of 19.5 million metric tonnes, and an average productivity of 9.7 tonnes per ha (Precision Farming Development Centre (PFDC) 2020).

At the state level, mango is the dominant fruit produced in AP and Odisha. The average mango productivity in AP is 12 tonnes per ha, higher than the national average of 9.6 tonnes per ha. In Odisha, it varies from 4.0 to 6.3 tonnes per ha (PFDC 2020).

▶ Figure 4. Twenty-five largest mango-producing nations in the world, 2018



Source: IHS (2022)

Mangoes come in different varieties, each with its specific and unique characteristics. The market-dominant and most expensive variety, Alphonso, is extensively grown in Maharashtra and Gujarat. The commercial mango varieties grown in AP are Banganpally, Suvarnarekha, Neelam and Totapuri. The varieties considered suitable for export are Imam Pasand, Banganpally, Suvarnarekha and Alphonso. The pulpable varieties grown in AP are Totapuri, Alphonso and Kesar. Farms in AP tend to be more commercially oriented, focusing on growing pulpable mango varieties (Totapuri), whereas production in Odisha is on a smaller scale, laying greater emphasis on tabletop varieties, which are eaten without processing. Eighty-five per cent of the mango crop grown in Odisha is Amrapali, a tabletop variety. The state is now exploring the pulpability of this variety.

▶ Table 6. National exports of tabletop varieties in India for 2020 and 2021 by value (US$ million)

National export of mango products	2020	2021	Growth in per cent	Main uses
Alphonso	6.08	10.12	66.4	Commercial, export, pulping
Banganapally	1.46	3.02	106.8	Commercial, export, tabletop
Chausa	0.05	0.05	0.0	Tabletop
Dasheri	0.09	0.11	22.2	Commercial, pulping
Langda	0.08	0.16	100.0	Tabletop
Kesar	2.92	6.93	137.3	Commercial, export, pulping
Totapuri	0.07	0.17	142.9	Commercial, export, pulping
Mallika	0.03	0.09	200.0	Commercial
Other	25.49	23.55	-7.6	NA
Mango slices and dried	4.52	7.66	69.5	Commercial, export
Mango pulp	96.43	124.01	28.6	Commercial, export

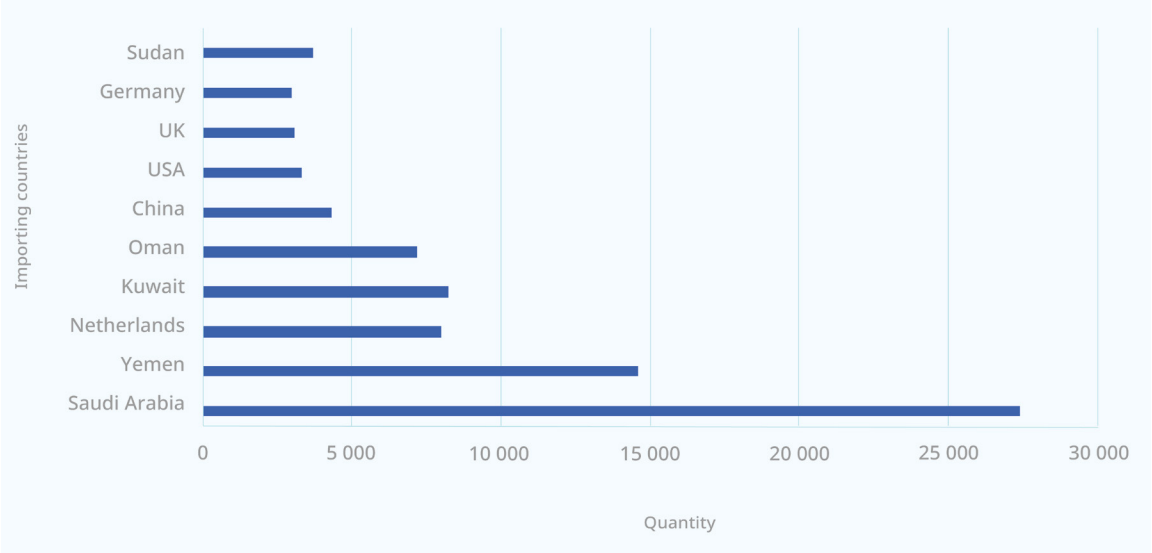
Note: State-level exports are available by fruit types, but not by specific varieties.
Source: Directorate General of Commercial Intelligence and Statistics (n.d.)

Of all the mangoes produced in Andhra Pradesh, 16 per cent are processed into pulp, puree or fruit concentrates (FAO 2017). These primary processed products may be subject to further processing as ingredients in juices, ice creams, yogurts, desserts, bakery items, confectionaries or candies. The remaining 84 per cent is sold as fresh fruit. Pulp accounts for around 80 per cent of processed mango products. Its long shelf life, of up to two years, and the flexibility to use it in a variety of secondary processed products have helped drive demand.

Exports

During 2020/21, India exported fruits and vegetables worth US$1.34 billion, of which fruits comprised US$675 million (APEDA 2022), with fresh mangoes accounting for a share of US$36 million and mango pulp worth US$96 million. Approximately 54 per cent of the fruit pulp produced in AP is exported, and exports have increased in both value and quantity and unit value from 2019 to 2020.

▶ Figure 5. Export volumes for India's mango pulp by country, 2020 (metric tonnes)



Source: APEDA (2020/21)

In 2020/21, India exported 98,369 MT of mango pulp at a value of US$96 million, with the top three export destinations being Saudi Arabia, Yemen and Kuwait. East and Southeast Asia accounted for a lower share of exports, with the top destinations being Malaysia (1,026 MT) and Taiwan (732 MT). To date, there has been limited engagement with South Korea and Japan for mango pulp. In addition, India has competition in Asian export markets from Cambodia, the Philippines and Thailand, which have longstanding export relationships with key buyers in importing countries.

Market opportunities

There is scope for both AP and Odisha to expand their export earnings, due in part to their coastal locations that provide easy access to international markets. An earlier harvest than competitor states (such as Uttar Pradesh and West Bengal) results in mangoes from AP and Odisha being the only mangoes available for early season pulping.

▶ **Table 7. Seasonal cycle of mango varieties**

	March	April	May	June	July	August
Sindhoora						
Banganpalli						
Alphonso						
Ratnagiri Alphonso						
Badami						
Himsagar						
Dussheri						
Langra						
Chausa						

Source: Authors' analysis

The growth markets for fruit pulp include countries in the Middle East, such as Oman, Sudan and Qatar. The exports of mango pulp to the EU, UK and the USA decreased during the coronavirus disease (COVID-19) pandemic; however, this is likely a consequence of a general slowdown in global trade. These markets have substantially higher unit prices per tonne of fruit pulp as compared to Middle Eastern and East African markets. New opportunities to access these higher-value markets have recently expanded to include the use of mango pulp for sweetness and acidity in balancing orange juice. The addition of mango pulp to orange juice began because of increasing global orange prices, resulting in substitutions and increased demand for mango pulp (Agriexchange 2019).

Product opportunities

Higher value mango products

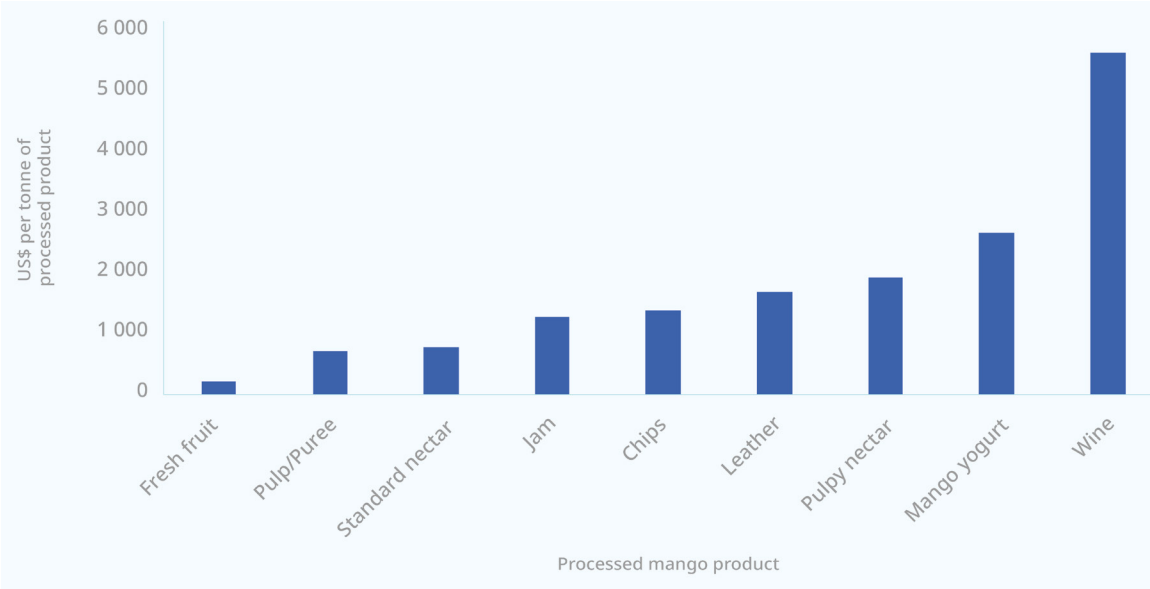
Mango puree, the production of which requires only the capacity to pulp and pasteurize, is a common product for many small-scale processors. However, it has the lowest returns of all processed fruit products. As highlighted in figure 7, the net profit on pulp from 1 MT of mango fruit is US$700 globally (MDPI 2021). Some large manufacturers have commented that exporting fruit pulp was becoming less commercially viable due to the erosion of margins. As a result, some processors in AP have focused on either new processing techniques, such as flaking or cutting into pieces (this has a higher price than pulp and an easier cold chain requirement), or on secondary processing, for example candying or drying.

The most lucrative processed product from mango is wine, with a net profit of US$5,500 per tonne of mango fruit. However, processing mango wine requires a more sophisticated system to produce the quantity and quality required by lead buyers across the globe.

Drying (dehydrating) mango fruit into products like chips and leather does not require sophisticated equipment or facilities, requiring only minimal capital expenditure, thereby having the potential to employ marginalized communities in this sector. According to an MDPI report (2021), mango chips and leather can fetch a net profit of US$1,300 and US$1,600 for mango chips and mango leather respectively.

The pickles market was seen to be highly competitive with significant barriers to entry for MSMEs, and the transition into secondary and tertiary production of fruit juices was seen as challenging in the face of major brands such as Frooti and Maaza, which have parent companies with vast economies of scale and scope. Mango jelly was considered a potential new product for the local market.

▶ Figure 6. Value of mango fruit through processing



Source: Owino and Ambuko (2021)

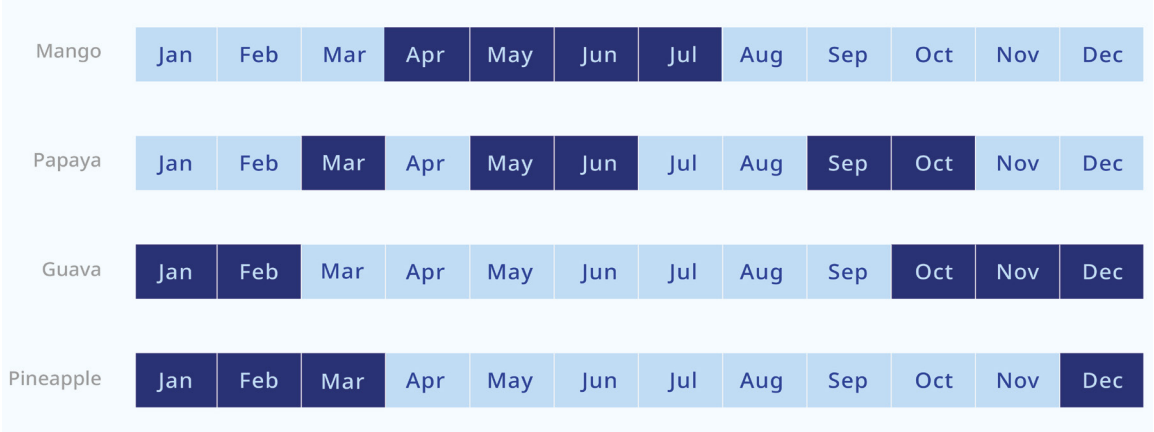
Expanding processing of other fruits

In order make the production cycles for mango, which is available for a few months of the year (as highlighted in figure 8), more economical by ensuring that there is continuous production from processing facilities, there is an opportunity to expand the processing of other fruit products.

- Large national buyers in India highlighted an increasing demand for pulps, purees and concentrates of pomegranate, lemon and mandarin orange. These products are currently imported but could be produced domestically with sufficient investment in processing capacity.
- There is anecdotal evidence of buyers in the EU approaching producers in Odisha about pineapple juice production. In Odisha, the cultivation of the Queen pineapple variety represents a substantial opportunity for pulp processing. The production of this variety is too small to be exported internationally as a tabletop product, but expanding into pulping is an option for producers. There is also a demand for litchi fruit juice for the domestic and international market, which the state has the potential to cultivate.
- Lead buyers in AP highlighted the additional demand for tomato pulp, guava pulp, papaya pulp and titbits, and processed mango products like dried mango, raw mango flakes and cut slices.

Other pulping opportunities include research and development (R&D) into alternative blends of mango, with other varieties replacing Alphonso, which does not grow as easily in the two focus states. Experiments are currently also underway to use the Amrapali mango in Odisha as a replacement for Alphonso, which does not grow in the state.

▶Figure 7. Fruit pulp production cycle by month



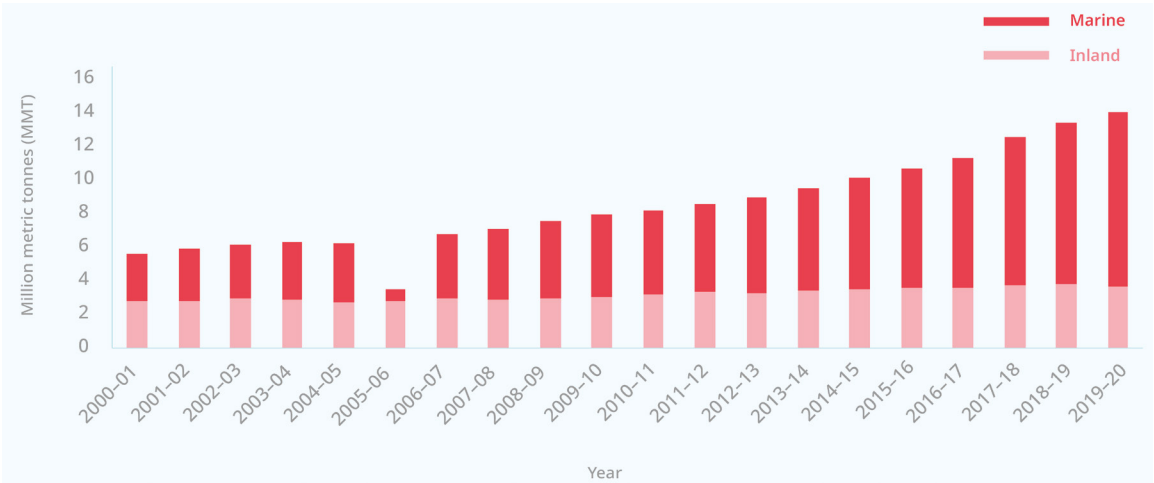
Source: Authors' analysis based on stakeholder interviews conducted in AP and Odisha.

2.4. Fisheries and shrimp sector

The fish production in India in 2019/20 was 14.2 million tonnes, comprising 3.7 million tonnes from marine fisheries and 10.4 million tonnes from inland sources. The fisheries sector contributed US$27 billion to the Indian economy (by GVA) between 2018 and 2019, approximately 1.24 per cent of the total (Department of Fisheries 2020).

Figure 8 illustrates the stagnation in production from marine fisheries and the growth of the inland fisheries sector, which increased 267 per cent from 2001–2020, while marine fisheries production only increased by 32.6 per cent.

▶ Figure 8. Fish production in India



Source: Department of Fisheries (2020)

Shrimp is a major inland fisheries product (table 7), and the Indian shrimp market reached a valuation of US$6.5 billion in 2021. It is forecasted to grow at a compounded annual growth rate of 11.8 per cent with a 2027 market value forecasted at US$12.7 billion (Research and Markets 2022).

▶ Table 8. Preserved and processed commodities by state 2019/20 (thousand tonnes)

States	Shrimp and frozen prawn	Frozen Tuna	Frozen marine fish	Dried, unsalted fish	Dried and salted or smoked fish	Frozen Whole Cooked Lobster	Dried prawn/ shrimp	Frozen cuttlefish fillets
Andhra Pradesh	335	1	5	0	0	0	0	1
Odisha	65	0	1	0	0	0	0	0
Gujarat	6	0	132	220	136	0	0	0
Karnataka	64	3	32	8	19	0	1	0
Kerala	64	0	60	13	52	0	1	0
Maharashtra	0	0	104	10	4	21	4	6
Tamil Nadu	80	11	47	0	0	0	0	4
West Bengal	77	0	5	4	0	0	0	5

Source: Department of Fisheries (2020)

Shrimp production focuses on three species: tiger shrimp, *L. vannamei,* and scampi. As illustrated in figure 10, the proportion of *L. vannamei* has risen from 3 per cent of the shrimp production in 2011 to over 95.8 per cent in 2021. The shift to *L. vannamei* from black tiger shrimp was a result of the issues of the diseases affecting black tiger shrimp and the disease resistance of the *L. vannamei*. Additionally, due to the low productivity of black tiger shrimp farms (2.0 and 1.6 tonnes per ha per year reported in AP and Odisha respectively), farmers are choosing to cultivate *L. vannamei* instead of black tiger shrimp.

▶ Figure 9. Shrimp production in India by species, 2010–2021 (metric tonnes)

Source: The Marine Products Export Development Authority (MPEDA) (2021)

Shrimp has been the largest growth area in the Indian fisheries sector with a total of over 59,700 ha, spread across 12 states in India, under production (Coastal Aquaculture Authority 2018). The domestic production of shrimp in India is dominated by AP, Odisha, West Bengal, Tamil Nadu and Gujarat, with AP accounting for almost 76 per cent of the total production.

In 2020/21, AP had over 71,900 ha under cultivation for *L. vannamei* and produced 634,672 MT of shrimp in this period. Odisha had over 10,600 ha under cultivation and produced 43,677 MT in the same period.

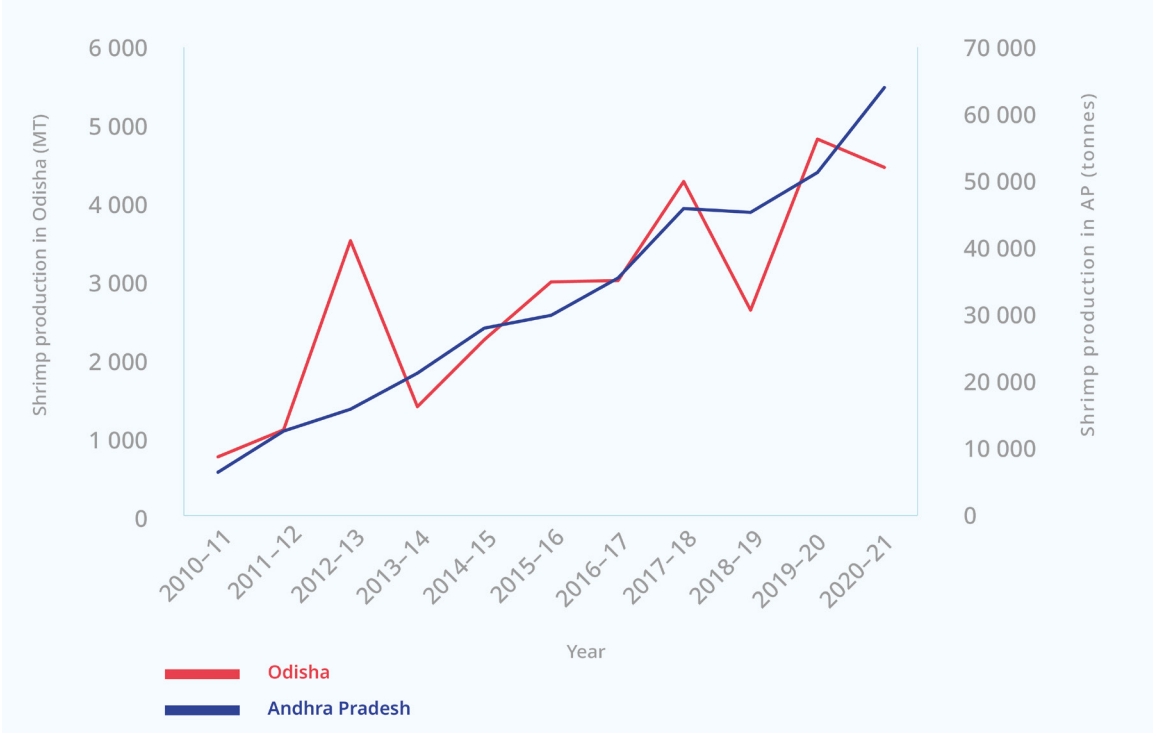
The average yield of shrimp aquaculture is 7.5 tonnes per ha per year across India. AP has the highest yield with 8.8 tonnes per ha per year, a consequence of greater scale and modern practices. Odisha produces 4.1 metric tonnes of *L. vannamei* per ha per year (MPEDA 2022).

▶ Table 9. Snapshot of the shrimp sector in AP and Odisha, 2022

States	Farms	Pre-processing plants	Processing plants	Manufacturer exporters	Merchant exporters
AP	19 894	105	99	74	69
Odisha	10 034	32	34	21	19

Note: Some of the export data may overlap as many actors have multiple roles in the value chain. Farm data has been compiled from Coastal Aquaculture Authority (2018).
Source: MPEDA export directory (2022)

▶ Figure 10. Trends in shrimp production in AP and Odisha, 2011–2020



Source: MPEDA (2022)

Exports

Shrimp is the most popular seafood consumed across the world. The global market was valued at US$62.8 billion in 2021 and is set to grow to US$84.2 billion by 2027 (IMARC Group 2022). Most shrimp produces in AP and Odisha is targeted at export markets, with only an estimated 1 per cent being sold for domestic consumption.[4]

▶ Domestic shrimp consumption

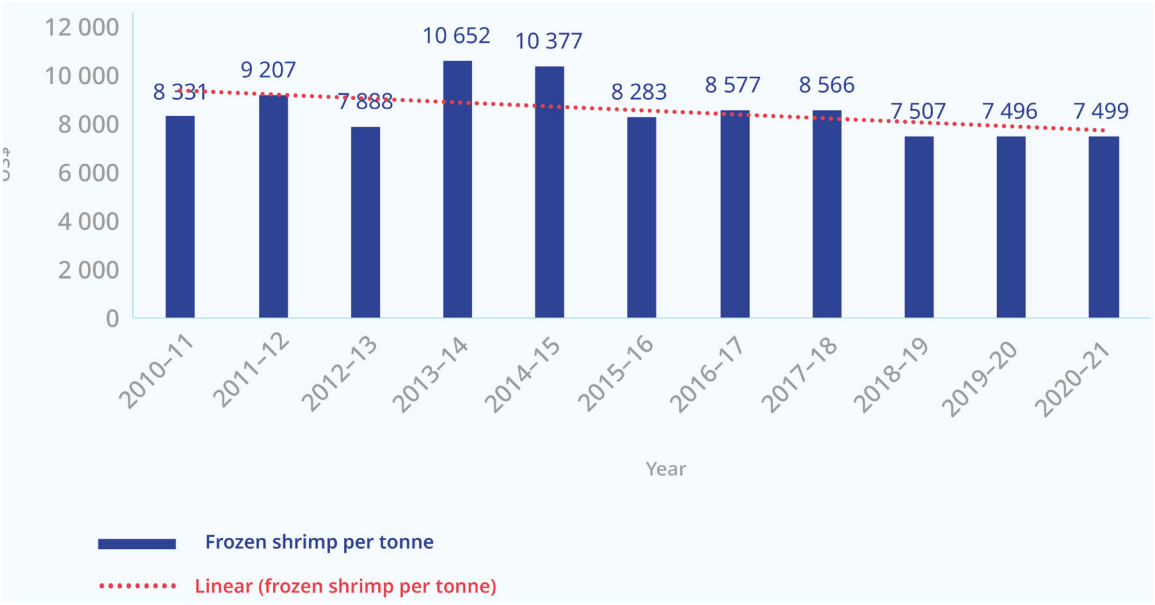
The shrimp market in India is regionally segmented due to geographically distinct food habits and high transportation and logistics costs. The high price of shrimp renders the product unaffordable to most people in India. Processors said that the export market was easier to supply to than the domestic market because of the single point of wholesale contact in a foreign country, as opposed to managing 30–40 retailers, and the ability to use of letters of credit that guarantee income. Due to the large administrative and cashflow burden, the historic lack of demand and shrinking profit margins, processors are deterred from expanding into the domestic market.

At the national level, Indian shrimp exports are worth US$5.1 billion. The global market for shrimp has grown by 2 per cent in value and 5 per cent in volume from 2017 to 2020. The value and volume of Indian shrimp exports grew by 1 per cent and 3 per cent respectively over this period, with an average unit value of US$7,626 per tonne. The growth in demand in this time was predominately from Saudi Arabia, Kuwait and China. The average export distance for Indian shrimp was over 9,000 kilometres.

Frozen shrimp accounts for 74.4 per cent of the total export value and 51.4 per cent of the total quantity with a trend towards value added products at the national level. As figure 11 highlights, driven by international competition, the export price of frozen shrimp at the national level has decreased over time. This has led to a greater focus on operating efficiency through economies of scale and volume over quality. Some analyses have suggested that perceptions among international buyers are that Indian processing is of an inferior quality (Kar and Tripathy 2020). This was confirmed by several processors who reported that countries like China and Vietnam are better at tertiary value added products, and they re-export Indian processed shrimp after tertiary processing on their soil. However, the demand for shrimp is elastic in the international market. If the price of shrimp increases over a certain threshold, then consumers will substitute it with chicken or plant-based food sources.

4 This estimate is based on interviewee responses.

▶ **Figure 11. Export price of frozen shrimp, 2011–2020 (US$ per tonne)**



Source: MPEDA (2022)

Market opportunities

The shrimp market can be divided into different geographies, with East Asia as a whole accounting for the highest per capita consumption. Growing incomes in East Asian countries may result in consumer preferences switching to higher-value seafood including higher-quality shrimp.

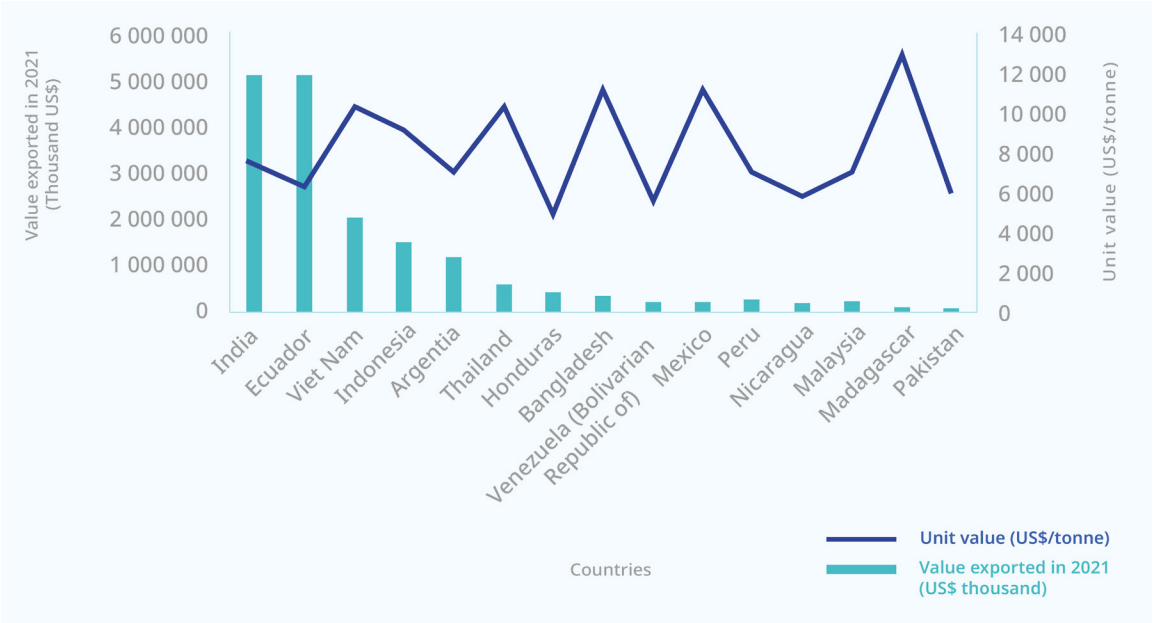
New market opportunities for shrimp from AP and Odisha might include expanding value-added products to Japan, Korea and Thailand through a greater understanding of consumer preferences in those markets, such as:

- South Korea requires smaller shrimp than the current large sizes produced in India. This in part is due to the growth of the meal kit market in Korea, with home meal replacements growing during COVID-19.
- In the Japanese market, quality is valued over cost, with stringent packaging, food safety and no antibiotics requirements in place.
- Similarly, the Chinese market also operates under stringent food safety requirements. Their 'zero COVID' policy causes added challenges for Indian exporters.

There may also be scope for increased exports to the EU and US markets. These markets require exporters to have rigorous certification and are challenging for new players to enter due to the time, cost and complexity of gaining the required licences to become an approved supplier. The anti-dumping duty applicable in the US also limits pricing advantages in these markets.

Ecuador is a major competitor for India, selling their shrimp 5–10 per cent cheaper with processing costs being a third lower. Ecuador also has geographical advantages in accessing the US market with a lower transit time of 15 days as compared to 30–35 days from India. This proximity also translates to higher freight costs and greater risks for the buyer due to price and demand fluctuations during transit. In AP, there is an additional expense of a 1 per cent agricultural market cess for the exporter.

▶ Figure 12. Shrimp export values and unit values of India compared to key competitors, 2021



Source: International Trade Centre Trade Statistics (n.d.)

The growth of demand in the domestic market may also present some opportunities. Historically, India has had a high proportion of vegetarians. However, the proportion of those eating meat is increasing. With increasing incomes and a greater demand for ready-to-eat (RTE) and ready-to-cook (RTC) products, this could be a growing market. This gap could also be filled through direct e-commerce orders via various platforms.

Product opportunities

To date, there has been limited R&D and investment in RTE and RTC production capabilities across Indian processors (MSME and large processors), but this may present an opportunity over the medium term.

Developing new RTE and RTC products relies on a proper understanding of consumer preferences in target markets. Currently, India's value-added battered and breaded shrimp offerings are made to a standardized recipe that does not factor in the taste preferences of different markets. Japan, Korea, China and Europe all have differing preferences for spices and local ingredients. As a result, frozen raw shrimp from India is exported to a third country, such as China, where that country further processes the shrimp into RTC and RTE products and then exports on to other countries. Consequently, India loses out on potential value additions.

A joint venture between Indian and Vietnamese companies is one model that can be used to build competency in local palates. Instead of secondary processing taking place in Vietnam for the Vietnamese market, a Vietnamese-Indian venture can be formed to produce shrimp products tailored to the Vietnamese market's needs.

Organizations engaged in researching how to shift from low- to high-value products commented on the opportunity to use what is currently considered processing waste to build new products, such as pickles, cutlets and wafers. The Indian shrimp market may also be able to build more affordable product ranges for the African market by processing broken or damaged shrimp into sausages with other ingredients like soy.

Finally, shrimp is an important source of chitin and chitosan, polymers used in industrial processes to make various products including edible films, thickeners and stabilizers. Currently, these are treated as

waste and disregarded by processors. However, with the connection of the sector to new industries, there may be an opportunity to commercialize and productize these by-products as well. The development of the whey protein market (originally a waste by-product) is an example of waste becoming a product in its own right in the dairy industry.

2.5. Trends in consumer demand

The macro trends described in table 10 influence the way consumers make food decisions in both the domestic and global markets.

▶ Table 10. Trends influencing demand for processed foods

Trends influencing food demand	Impact on shrimp and fruit pulp subsectors
Increasingly health and hygiene conscious consumers	• There is a premium for products with a greater nutritional value and fewer additives, including the reduced use of chemicals during production and processing. • This trend will be intensified through product labelling at a global and national level, which is likely to provide transparency on the nutritional quality of different foods. • Shrimp is regarded as healthy food due to its nutritional properties, including iodine, protein, vitamin B12 and calcium, leading to rising demand for frozen shrimp food globally. • Mangoes are believed to protect against heart disease, cancer and cholesterol and can provide up to 40% of the daily fibre requirement (Kalaiarasi et al 2020). • Increased consumer awareness is leading to greater demand for hygienic, packaged products. • Countries like the United Arab Emirates (UAE) and Saudi Arabia have increased their fruit-based imports due to measures taken by their governments to create awareness about healthy eating habits (Agriexchange 2019). • The US juice industry has been making increasing use of mango pulp in orange juice blends for the sweetness to balance the acidity of oranges. As a result, consumers are also developing a taste for mango flavours.
Concerns around environmental sustainability	• Consumers are becoming increasingly aware of farming methods, especially in aquaculture, and of the negative consequences these can have on both humans and the environment if not practised responsibly. • In high-value markets, consumer preferences are shifting towards organic production.
Requirement for reduced time for cooking due to women working and people having higher disposable incomes	• Consumers are shifting towards pre-cooked frozen foods to balance working schedules effectively. Also, as consumers place greater emphasis on good nutrition, there is a greater focus on the health qualities of different products.
Product traceability	• Consumers increasingly want to know where their food is coming from and the ultimate source and supply chain.
Growth in e-commerce platforms	• The growth of e-commerce platforms for processed foods in India and globally can link producers directly to the consumer.

Source: Authors' analysis

2.6. Policy and regulatory environment

The Government of India's National Food Processing Policy aims to expand India's processing capacity, particularly in perishables, from 10 per cent in 2020 to 25 per cent in 2025 by increasing investment in supply chain infrastructure. As detailed in tables 11 and 12, several schemes have been developed to support this goal.

Both AP and Odisha have created ambitious policy environments to encourage the growth of the food processing sector. The horticulture sector's five-year plan (2015) proposed a quantum increase in the area under horticulture cultivation and production of fruits. The plan also aimed to improve forward and backward linkages of production, marketing and distribution. The Government of Odisha (GoO) has set an ambitious target of increasing the area under horticulture to 2 million ha by 2019/20.

The food processing sector was opened to 100 per cent FDI in 2016 under the automatic route. Further in 2017, 100 per cent FDI under the government route for retail trading, including through e-commerce, is permitted with respect to food products manufactured and/or produced in India.

The Government of India has introduced an investor-friendly portal called Nivesh Bandhu, which integrates central and state government initiatives and policies for all stakeholders operating in the food processing sector.

▶ Table 11. National-level initiatives

Policy/Initiative	Detail
Pradhan Mantri Kisan Sampada Yojana (PMKSY)	The PMKSY aims at creating modern infrastructure with efficient supply chain management from the farm gate to retail outlets to bolster the growth of the food processing sector in the country. It aims to provide better returns to farmers, create employment opportunities in rural areas, reduce wastage of agricultural produce, increase processing, and enhance the export of processed foods. The PMKSY encompasses an awareness campaign and supports antibiotic-free production, pond development, and sea bass and crab culture.
Pradhan Mantri Matsya Sampada Yojana (PMMSY)	The PMMSY is designed to address critical gaps in the fisheries value chain from fish production, productivity and quality to technology, post-harvest infrastructure and marketing. It aims to modernize and strengthen the value chain, enhance traceability and establish a robust fisheries management framework while ensuring the socioeconomic welfare of fishers and fish farmers.
Production Linked Incentive Scheme for Food Processing Industries (PLISFPI) Scheme	This scheme aims to support the creation of global food manufacturing champions in India commensurate with the country's natural resource endowments. It also works to support Indian food product brands in the international markets with an outlay of 10,900 crore Indian rupees (approximately US$1.4 billion). To qualify for the scheme in the processed fruits and vegetable segment requires minimum sales of 250 crore rupees (US$~30.4M) with an investment of 50 crore rupees (US$~6.08M). The qualification for the marine segment comprises minimum sales of 600 crore rupees (US$~73M) with an investment of 75 crore rupees (US$~9.1M).
Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME) Scheme	This scheme aims to provide financial, technical and business support to existing micro food processing enterprises seeking to upgrade their skills and capabilities.
Rashtriya Krishi Vikas Yojana (RKVY)	The main objective of this scheme is to increase processing, reduce wastage and add value to enhance the income of farmers as well as increase exports, resulting in the overall development of the food processing sector. The scheme envisages extending financial assistance to Indian states to establish new food processing units in the country.
Fisheries and Aquaculture Infrastructure Development Fund (FIDF)	The FIDF envisages the creation of infrastructure facilities for fisheries in both the marine and inland sectors and augmenting fish production to achieve the target of 15 million tonnes set under the Blue Revolution by 2020. The FIDF also aims to achieve a sustainable growth of 8–9 per cent in a move to boost the country's fish production to the level of about 20 million tonnes by 2022/23.
Mega Food Park Scheme (a MoFPI initiative)	This scheme aims at providing a mechanism to link agricultural production to the market by bringing farmers, processors and retailers together to maximize value additions, minimize wastage, increase farmers' incomes, and create employment opportunities, particularly in the rural sector. The scheme is based on the "cluster" approach, and it envisages the creation of state-of-the-art support infrastructure to set up modern food processing units in industrial plots provided in mega food parks with a well-established supply chain.
Agriculture Export Promotion Scheme by the Agricultural and Processed Food Products Export Development Authority (APEDA)	This is a financial assistance scheme (FAS) run by the APEDA to promote exports. It aims to facilitate the export of agri-products by understanding the challenges faced by agri-exporters and providing financial assistance in three areas: development of export infrastructure, quality development and market development.

Policy/Initiative	Detail
Food Processing Fund (FPF) of the National Bank for Agriculture and Rural Development (NABARD)	The central government has allocated a special fund of 2,000 crore rupees (~US$256 million) to NABARD for the FPF scheme to provide direct term loans at affordable interest rates to designated food parks and to food processing units in these parks. The objective is to provide an impetus to the development of the food processing sector using a cluster approach, reduce wastage of agricultural produce and create employment opportunities, especially in rural areas.
Scheme of Fund for Regeneration of Traditional Industries (SFURTI) by the MoMSME	The SFURTI scheme aims to support MSMEs by providing development infrastructure through two components: • via SFURTI and • the Micro and Small Enterprises Cluster Development Programme (MSECDP).

▶Table 12. State-level policies and initiatives

Policy/Initiative	State	Detail
Andhra Pradesh Food Processing (APFP) Policy, 2020–25	Andhra Pradesh	The APFP Policy 2020–25 aims to: • promote innovations and R&D for focus crops and ensure continuous technology upgradation by promoting new tech transfer to enterprises; • support appropriate crop planning to ensure a regular supply of raw material to the food processing industry; • produce quality produce by encouraging good agricultural practices; • support farmer producer organizations (FPOs)/co-operatives to create common infrastructure along the value chain, ensure backward and forward linkages, and proper branding and marketing; • enhance marketing strategies by tie-ups with existing dominant players in the food industry; • establish agro-processing clusters closer to potential production areas; • encourage the transition from the unorganized sector to the formal sector via enhanced compliance with food quality and safety standards; • impart entrepreneurship skill development training to the youth by establishing incubation centres in the food processing sector; • establish backward linkages with Rythu Bharosa Kendras5/primary processing centres for the supply of raw materials needed for the industry; and • establish market linkages with commodity online platforms.
YSR Rythu Bharosa Scheme	Andhra Pradesh	This is a prestigious government flagship scheme designed to ensure farmers' welfare, provide financial assistance to farmers, and make farming a remunerative profession. The initiatives under the scheme are: • a credit of 13,500 rupees (US$173) in farmers' bank accounts each year for welfare • a government-paid premium for crop insurance • interest-free loans to farmers • free borewells for farmers • nine hours of free electricity for agricultural use • electricity to be available at 1.5 rupees (US$0.019) per unit for aquafarmers • a price stabilization fund of 3000 crore rupees (US$380 million) to be established with guaranteed minimum support price • a road tax waiver to be provided to agriculture tractors • the YSR Insurance Scheme to provide 7 lakh rupees (US$9,000) to the families of farmers who die of any cause
Odisha Food Processing Policy, 2016	Odisha	This policy aims to increase the flow of investments in the sector across the value chain from farm to market, increase shelf life and reduce the wastage of farm produce.

5 These are seed to sale service centres set up by the Government of AP.

Policy/Initiative	State	Detail
Odisha Industrial Policy Resolution, 2015	Odisha	The Industrial Policy Resolution, 2015, was formulated to create a supportive environment through an enabling policy and regulatory framework to drive sustainable industrial growth in the state. The policy focuses on providing quality industrial infrastructure, creating a large land bank, providing financial assistance to the private sector to develop industrial infrastructure and sustainable environmental protection.
Agricultural Promotion and Investment Corporation of Odisha Limited (APICOL)	Odisha	The APICOL aims to strengthen the rural economy by providing financial support for the promotion and development of agro-based and food processing industries. The APICOL provides a subsidy to agro-processing and food-processing units in Odisha.
Krushak Assistance for Livelihood and Income Augmentation (KALIA) Scheme	Odisha	The KALIA scheme makes payments to farmers to encourage cultivation and associated activities. It supports cultivators, small farmers and landless agricultural labourers and will benefit 92% of the cultivators in the state of Odisha, who can avail of the scheme benefits through the direct benefit transfer (DBT) mode.
Electricity subsidy	Andhra Pradesh	The subsidies provided by the state on power are: • Micro and small enterprises pay 1 rupee (US$0.013) per unit for five years. • FPOs pay 1.25 rupees (US$0.016) per unit for 5 years. • BC/minority communities pay 1.25 rupees (US$0.016) per unit for five years. • Scheduled caste (SC)/Scheduled tribe (ST) entrepreneurs pay 1.5 rupees (US$0.019) per unit for five years.
Electricity subsidy	Odisha	The subsidies provided by the state on power are: • Electricity tariff reimbursement ranging from 0.25–1.25 rupees per unit for a period of five years, depending on investment and employment generated provided there is a minimum investment of 50 crore rupees and a minimum of 75 people are employed • Electricity duty exemption for five years up to a contract demand of 5 megavolt-amperes (MVA)
Capital subsidy	Andhra Pradesh	The capital subsidies received by various users in the state include: • micro and small enterprises: 15% up to 20 lakh rupees (US$25,657) • FPOs: 35% up to 50 lakh rupees (US$64,144) • BC/minority communities: 35% up to 50 rupees (US$64,144) • SC/ST entrepreneurs: 45% limited to 1 crore rupees (US$128,287) for both women and men • 25% land conversion charges up to 10 lakh rupees (US$12,829) to be subsidized for micro and small enterprises (MSEs), FPOs, BC/minority communities (women) and SC/ST entrepreneurs • 50% rebate in land cost up to 20 lakh rupees (US$25,657) for FPOs, BC/minority communities (women) and SC/ST entrepreneurs
Capital subsidy	Odisha	• The capital subsidies received by various stakeholders within the food processing value chain in the state include: • Capital investment subsidy: This will be provided to set up cold chains, value addition and preservation infrastructure for non-horticultural produce and primary processing centres/collection centres for both horticultural and non-horticultural produce. Thirty-five per cent up to 5 crore rupees (US$641,437) for cold chain, value addition and preservation infrastructure for non-horticultural produce or primary processing centres/collection centres for all produce. • Assistance to entrepreneurs: Industrial units will be encouraged to file patents for their research and the state will aid entrepreneurs with patent and intellectual property rights provisions by providing 50% of the expenditure up to a maximum of 5 lakh rupees (US$6,414). • Assistance for MFPs: Up to 20% of the project cost, capped at 15 crore rupees (US$1,924,311) will be provided to a special purpose vehicle (SPV) or as equity participation.

<table>
<tr><th>Policy/Initiative</th><th>State</th><th>Detail</th></tr>
<tr><td></td><td></td><td>Assistance for human resource development:
• One-time grant of 50% of the cost, up to 1 crore rupees (US$128,287) to any university/institute to offer courses in food processing
• Three lakh rupees (US$3,849) per entrepreneurship skill development programme (ESDP) to be awarded to government industrial training institutes (ITIs)/polytechnics to conduct a 30-day certification program on food processing</td></tr>
<tr><td>Interest subsidy</td><td>Andhra Pradesh</td><td>The subsidies provided by the state on interest are:
• Micro and small enterprises: 3% for five years
• FPOs: 3% for five years
• BC/minority communities (women): 3% for five years
• SC/ST entrepreneurs: Up to 9% over and above the primary 3% for five years</td></tr>
<tr><td>Interest subsidy</td><td>Odisha</td><td>Not applicable</td></tr>
<tr><td>Value added tax (VAT)/central sales tax (CST)/state goods and services tax (SGST) exemption or reimbursement</td><td>Andhra Pradesh</td><td>The tax exemptions provided by the state are:
• 100% reimbursement of stamp duty and transfer duty for the purchase of land for MSEs, FPOs, BC/minority communities (women) and SC/ST entrepreneurs
• SGST reimbursement
• Micro and small enterprises: Reimbursement of 100% net SGST for five years
• For entrepreneurs from the BC/minority communities, (women) and SC/ST and FPOs who are sole proprietors:
• MSEs: 100% SGST reimbursement
• Medium enterprises, large and mega industries:
<table>
<tr><th>Employment generated</th><th>SGST reimbursement</th></tr>
<tr><td><1000</td><td>50%</td></tr>
<tr><td>1000 to 2000</td><td>75%</td></tr>
<tr><td>2000+</td><td>100%</td></tr>
<tr><td>Large enterprises</td><td>50%</td></tr>
<tr><td>Medium enterprises</td><td>75%</td></tr>
</table></td></tr>
<tr><td>VAT/ CST/SGST exemption or reimbursement</td><td>Odisha</td><td>The tax exemptions provided by the state are:
• No stamp duty needs to be paid for land allotted by the government to Odisha Industrial Infrastructure Development Corporation (IDCO). However, a stamp duty of 5% will need to be paid for the transfer of land/a shed by the government and IDCO to industrial units. This will also be applicable to private land acquired by IDCO, which will subsequently be allotted to industrial units.</td></tr>
<tr><td>Employment generation</td><td>Andhra Pradesh</td><td>For medium enterprises, large and mega industries, the exemptions are:
<table>
<tr><th>Employment generated</th><th>SGST reimbursement</th></tr>
<tr><td><1000</td><td>50%</td></tr>
<tr><td>1000 to 2000</td><td>75%</td></tr>
<tr><td>2000+</td><td>100%</td></tr>
</table></td></tr>
<tr><td>Freight/transport subsidy</td><td>Andhra Pradesh and Odisha</td><td>• Not applicable</td></tr>
</table>

Policy/Initiative	State	Detail
Others	Andhra Pradesh	• Quality certification/patent registration for SC/ST entrepreneurs: 100% of the cost incurred, limited to 3 lakh rupees (US$3,849) • Seed capital assistance: SC/ST entrepreneurs are eligible for 25% of machinery cost for micro units • Other common initiatives: 16.2% of the plots allocated to SC entrepreneurs and 6% of the plots allocated to ST entrepreneurs in industrial parks • Grant-in-aid at the rate of 35% of the eligible project cost, up to 10 crore rupees (US$1,282,874), will be provided for the development of food processing clusters • Formalization of micro food processing units at 35% of the eligible project cost with a maximum ceiling of 10 lakh rupees (US$12,829) per unit to individual micro food processing units as credit-linked capital subsidy. • Brand building and marketing support of 50%, up to 10 lakh rupees (US$12,829) • Support for common infrastructure of 35%, up to 10 lakh rupees (US$12,829) • Seed capital assistance of 40,000 rupees (US$513) per SHG member for working capital, at 35% of the eligible project cost with a maximum ceiling of 10 lakh rupees (US$12,829) for FPOs.
Others	Odisha	**Quality certification** • The state government has put the improvement of the quality of industrial units on a high priority, and these units will be given assistance in obtaining quality certifications from the Bureau of Indian Standards (BIS) and other internationally recognized institutions. The government will bear 50% of the expenditure, up to a maximum of 2 lakh rupees (US$2,566). **Patent registration** • Industrial units will be encouraged to file patents for research, and the state will aid entrepreneurs with patent and intellectual property right provisions, and the government will bear 50% of the expenditure, up to a maximum of 5 lakh rupees (US$6,414).

2.7. Employment

The food processing sector is a major source of employment in India, with 7.1 million active workers across registered and unregistered processing units. This represents 14 per cent of all industrial employment in India, and women make up 11.2 per cent of workers in registered food processing units (MoFPI 2022). However, there is a higher proportion in the two focus subsectors. Skilled labour shortages were reported in Odisha. Larger companies sourcing shrimp include the Ananda Group, Falcon, Nekkanti and Jagdeesh. The supply chain flows from lead buyers to foreign importers are commercially sensitive and therefore, challenging to map. For fruit pulp, the large companies in India sourcing from AP and Odisha include Parle Agro, Dabur, PepsiCo and Coca-Cola. Unemployment in the two states is below the national average of 7.1 per cent, with AP at 4.4 per cent and Odisha at 2.6 per cent respectively (Centre for Monitoring Indian Economy 2022).

Only 13.9 per cent of the workforce (15–59 years) in India received either formal or non-formal vocational training in 2019/20 (National Sample Survey Organisation 2020). Only 8.9 per cent of MSME workers are considered skilled (World Bank 2017). There is also a large gender skills gap – only 9 per cent of the female workforce received technical and vocational education and training (TVET) against 18.8 per cent of the male workforce (National Sample Survey Organisation 2020).

▶ **Figure 13. Trends in the number of registered units and employment in India**

Source: MOFPI (2022)

2.7.1. Employment in the fruit pulp subsector

Processing activities in the fruit pulp subsector are typically conducted in two or three shifts ranging from 7–14 hours in length, and there are no days off during the peak season. A fruit processor typically employs 50 to 200 people, and employment is highly seasonal and based on material availability.

Employment is gendered with technical work being dominated by men and quality checks being conducted by women. The workforce in fruit processors comprises approximately 75 per cent female and 25 per cent male employees. The men conduct the grading, while the women are engaged in washing, sorting, cutting, pulping and packing.

Men are paid more than women; they receive 180–400 rupees (US$2–5) per day, while women are paid 80–130 rupees (US$1–1.7) per day. Wages differ from region to region based on the market price of the end products, and processors said that this difference was a result of the physical nature of the labour. In recent years, some processors have started paying a rate per kilogram processed while others paid a daily rate. The highest-paid role is quality checking.

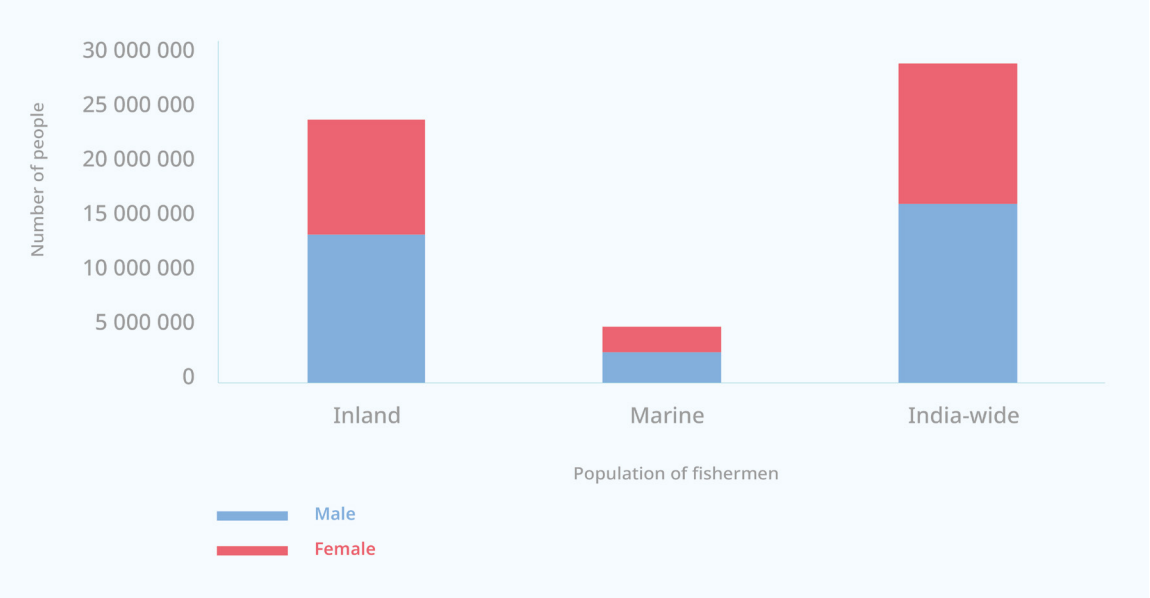
Employment is predominately local; however, there were examples of workers coming from neighbouring states, such as Bihar, Karnataka and Tamil Nadu, predominately to work for larger-scale processors. The maximum working age the processors noted was around 40 years due to the physical demands of the role.

Workers do not require any previous certifications and are trained on the job. Processors operated a ratio of managers to workers of between 1:4 and 1:10.

2.7.2. Employment in the fisheries and shrimp subsector

The fisheries sector employs over 2.5 million people in India, with most workers engaged in inland fisheries (see figure 14). Shrimp aquaculture is labour-intensive and makes up a substantial proportion of inland fisheries employment. For example, a medium-size de-heading factory typically employs 250 people, while an individual production line requires approximately 20 people to take the raw product through processing and packaging if it remains raw and 23 people if cooking is required.

▶ Figure 14. Number of people working in inland and marine fisheries and processors by gender



Source: Department of Fisheries (2020)

Shrimp processors estimated that 15–30 per cent of their workforce were men, while 70–80 per cent were women. Shrimp processors have gendered roles, with women generally responsible for peeling and de-heading the raw shrimp. Other roles in the processing plant include cutting the shrimp for ease of peeling, conducting manual grading, and placing the shrimps on belts for individual quick freezing and packaging. A warehouse team is then responsible for loading and packing the seafood in a cold storage, ready for export.

Payment is made on an output basis, with workers engaged six days per week for six to seven hours per day. Lunch, snacks and conveyance to and from work are typically provided by the processing unit. Workers typically earn 60–100 rupees (US$0.77–1.15) per kilogram of shrimp processed, and a worker processes 30 kilograms per hour on average. This equates to wages of between 10,000–16,000 rupees (US$128 and US$205) per month. An additional 150 rupees (US$1.92) per day is paid if a worker takes the night shift. Trade union representatives have noted that there are no fixed working hours even when there are defined shifts. The usual workday is from 6 a.m. to 3 p.m., while overtime is compensated for with tea, snacks and a payment of 50 rupees ($0.63 USD). Trade union representatives have also noted that overtime arrangements are not always well understood, and thus many factories do not have proper time recording practices or human resource systems at the workplace.

Experts in the processing sector have highlighted that historically, workers in both focus states came to the processing units from other parts of India. However, the proportion of local labour has been increasing and is currently 50:50 migrant to local workers. In AP, intra-state migrant workers mostly come from the Srikakulam district to work in Visakhapatnam, while inter-state migrants generally come from Odisha, Assam and Kerela. Trade union representatives have suggested that labour mostly comes from lower-income households. Workers often come from nearby villages or districts in search of work and join these factories on a contractual basis. In many cases, labour is required to be present at any given time depending on the demand from the processing units.

Most workers are hired via contractors rather than being directly employed by the processing unit. Interviewees reported that enterprises preferred this system as they were not required to manage insurance, Employees' Provident Fund and Employees' State Insurance Corporation contributions, and labour law compliance. They were also able to source labour and manage contracting through a single point of contact.

People who have worked in the sector previously become agents who source manpower from local villages for the factories. These agents will eventually become supervisors who can lead a team of 15–20 workers. Supervisors get paid 1,000 rupees (USD 12.51/worker) as a lumpsum or in instalments. However, a trade union representative stated that a lack of formal documentation and the absence of labour cards means that many labours do not qualify for the social security benefits offered by the labour department. Representatives also commented that many owners have good relations with local politicians, resulting in fewer and less stringent labour inspections.

Employers also said that workers in the processing units had developed the skills for rapid processing since the industry had begun to grow in both Odisha and AP. However, others noted that there was usually high worker attrition, with workers rarely staying at the same factory for more than one year. Employers mentioned that greater skills were required for value added products, such as battered or breaded shrimp and RTE product lines.

Trade union representatives suggested that the working conditions on the shop floor were sometimes poor with even the basic facilities missing. For example, toilets for women in some units were reported to be unusable due to unhygienic conditions. Limited spaces for rest in certain factories was another issue they faced. Processing must be done while standing in very low temperatures, and trade union representatives suggested that the long working hours coupled with the cold sometimes resulted in discomfort and nerve- and bone-related health disorders in the long term.

These decent work deficits may increasingly impact the sector's ability to access high-value markets. This is especially apparent with the EU, which has adopted a proposal for Corporate Sustainability Due Diligence Directive (CSDD). This proposal aims to foster sustainable and responsible corporate behaviour throughout global value chains. Companies will be required to identify and prevent the adverse impacts of their activities on human rights and the exploitation of workers among other measures in high-risk sectors like fishing.

3 The market system: A snapshot

▶ 3. The market system: A snapshot

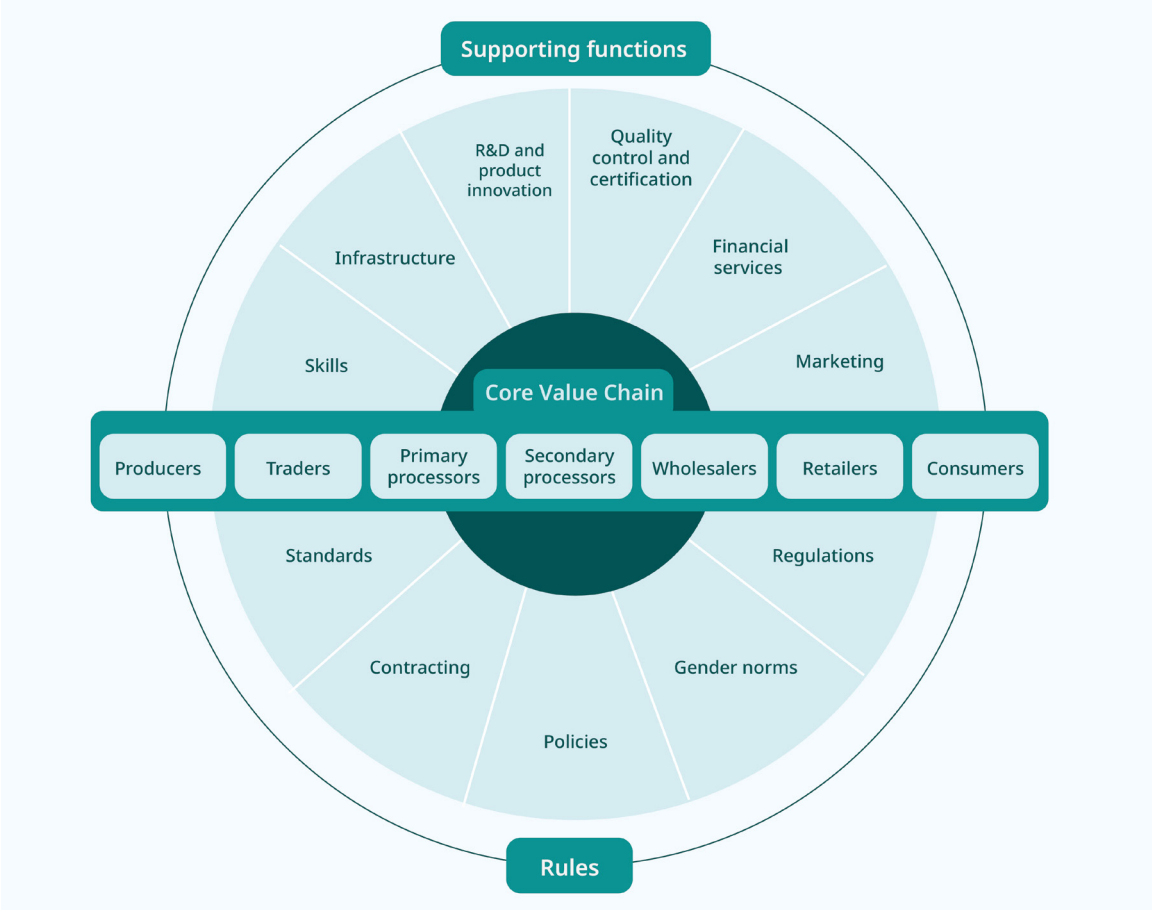
3.1. Introduction

The market system is the overall picture of how a sector operates. It includes the supply-demand transactions in the core value chain – from producer to retailer to end consumer – and the "supporting functions" and "rules" that shape how businesses and employees work in this chain. The market system, therefore, has a broader scope than traditional value chain analysis because different actors in the value chain do not operate in a vacuum: their commercial success is influenced directly by the context in which they operate.

As the project has examined two value chains – fruit pulp and shrimp – this analysis will draw out the commonalities and differences between the value chain to generate inventions across the wider food processing sector in the focus two states.

Figure 15 shows an illustrative market system for the food processing sector across the two states, which strongly influences and constraints market performance.

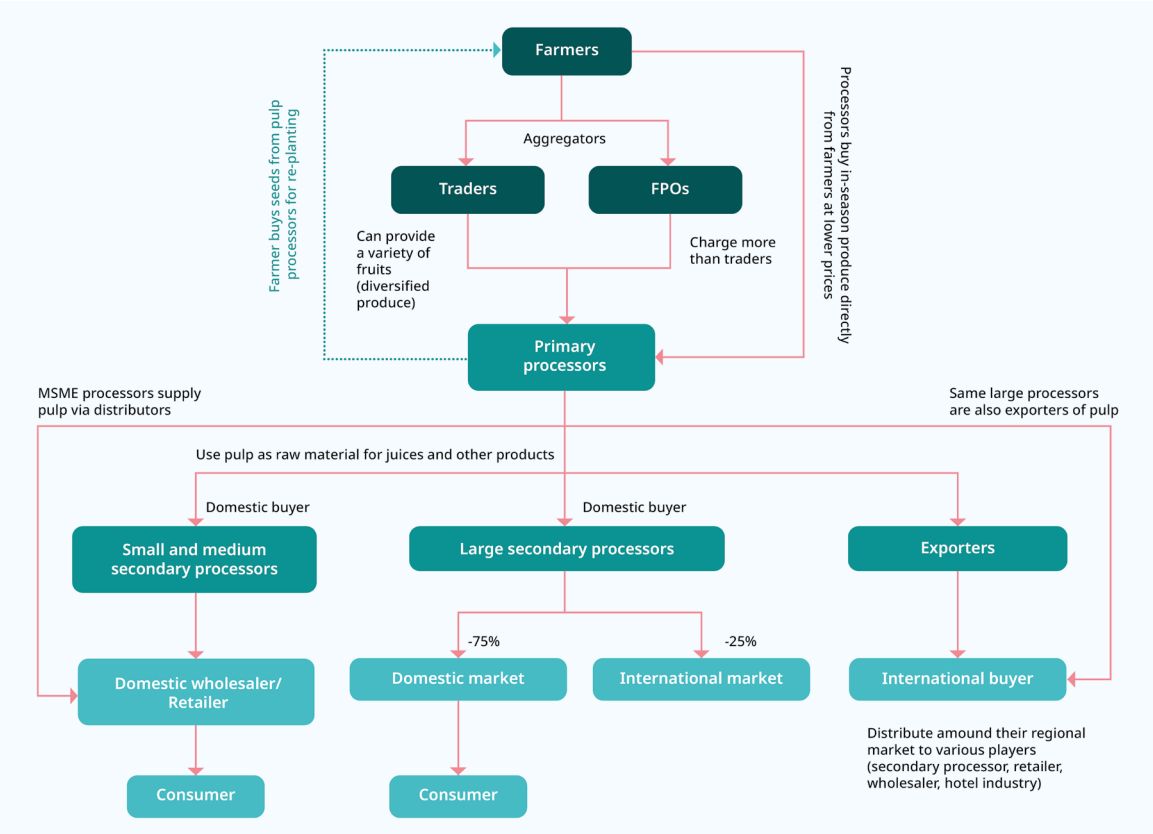
▶ **Figure 15. The food processor market system in AP and Odisha**



Source: Authors' analysis

3.2. Fruit pulp core market and value chain

▶ **Figure 16. Value chain for fruit pulp processing**



3.2.1. Farmers/Producers

The main fruit-growing districts in AP are Chittoor, Ananthapuram, Kadapa, Kurnool, Prakasam and Tirupati in the south and Vizianagaram and Srikakulam in the north. In Odisha, fruits are mostly grown in the Mayurbhanj, Koraput, Rayagada, Kalahandi, Kandhamal, Dhenkanal, Ganjam, Cuttack and Khorda districts. These areas are typically located inland, with production hubs often being built near farming areas.

There is a short window to harvest fruit in the two focal states. Mangoes are harvested from April to July and as a result, timely processing is critical in ensuring that produce can be used through the year.

Greater efforts from the central and state governments to enhance backward linkages have given horticulture farmers in both states direct access to the market and its players. The processing sector is less developed in Odisha, but farmers in AP are motivated to supply to fruit processing industries for the following reasons.

High demand in every season

- Most pulp processors procure large quantities of fruits; they usually buy a minimum of between 100 and 200 kilograms of fruit from a single farmer.

Farmers receive instant cash payments

- Processors provide farmers plastic crates to enable careful handling of the produce to avoid post-harvest losses and cover the cost of transportation.

- If the buyer is a large company, they also provide farming inputs, like pesticides and fertilizers, to maintain produce quality.

Farmers set the price of the fruits

- For seasonal fruits like mango, supply is limited and fluctuating in nature, which increases the market demand and leads to price volatility. In this case, the farmer has the power to set a profitable market price while having access to multiple stakeholders of the supply chain.

Aggregators

Processors require bulk quantities of fresh fruits for pulping and rely on aggregators in case of low supply of fruits in the market. The aggregation of fruits is done either by traders or local FPOs.

Traders

The price of fruits procured via traders is similar to the price of fruits procured directly from a farmer. However, a processor prefers to buy raw material from a trader for two main reasons:

- to ensure they receive sufficient quantities of produce in case of a low supply of fruits during the off-season
- to procure more than one variety of fruit from the local markets and process them into a diverse range of value-added products

FPOs

Under the Companies Act, 2013, a minimum of five farmers are required to register an FPO, and there is no maximum number of farmers that can be a part of this collective. The price of fruits per kilogram is slightly higher at an FPO than the market price as they aim to provide farmers competitive prices and charge a commission. For example, if the market price of 1 kilogram of fruit is 10 rupees (US$0.13), the price of the same via an FPO would be 11 rupees (US$0.14) per kilogram. From this additional rupee (US$0.013), .50 paise (US$0.0064) is charged as commission and .50 paise (US$0.0064) goes into a farmer savings account. Currently, the FPOs in AP and Odisha are selling their produce to private companies and retail stores in the domestic market and are not involved in export sales.

3.2.2. Processors

There are a total of 56 fruit pulp processors in AP. Of these, 45 are associated with the Chittoor Food Processors Association in the Chittoor district, from which 30 are still functioning and some are temporarily closed. There is no data available on the number of processors in Odisha.

Primary processors make secondary products like fruit pulp and puree, while secondary processors use the pulp to make tertiary products like juices, ice cream, candies, desserts and other confectionery items. However, the role of processors within the fruit pulp value chain in India is not well-defined and varies based on the scale of the operation.

Large-scale companies can conduct all operations, such as secondary processing, testing, packaging marketing, distribution and exporting, in-house. On the other hand, MSME processors focus only on primary and/or secondary processing and sell these products to downstream players for marketing and sale.

There is also a geographical distinction observed in this sector. The southern districts of AP have a relatively well-established market for fruit pulp processors because raw materials are easily available and multiple stakeholders have a presence in the region. There is no record of the number of large-scale companies in each state; however, in the case of Chittoor, there are six large companies.[6] In comparison,

6 "Large" is defined by the Chittoor Food Processor Association as those units with more than a 10–16 crore rupee investment. However, this is not defined as large as per the MoMSME, which defines a company as large if the annual turnover is more than 250 crore rupees.

Odisha's fruit pulp industry is in a relatively nascent stage, and secondary processors often must rely on sourcing pulp from neighbouring states.

The presence of many processors in the southern districts of AP has enabled them to form an association, which supports advocacy and sector-level dialogue including buyer and seller meetups, dispute resolution and assistance in price regulation. However, there are only a handful of fruit pulp processors in the northern districts of AP, making it difficult to reach the critical mass to organize. Similarly, Odisha has no industry association for fruit pulp processors due to the limited number of firms.

Even if there are no competitive barriers for MSMEs in the northern regions of AP and Odisha to enter the fruit pulp sector, entrepreneurs are unwilling to enter this industry in the absence of a robust market system consisting of local material suppliers and guaranteed buyers. In contrast, processors in the north AP region believe that the presence of more processors would be beneficial in attracting more exporters as well as domestic and international buyers to source from these areas and meet volume requirements.

Another major distinction between the fruit pulp industries in both states is that it is easier to find processors of pulp in AP as most of them have an up-to-date online presence, whereas the information on Odisha fruit pulp processors is outdated and many do not have an online presence to sell their products.

Primary processors

Most MSME processors buy fresh produce directly from local farmers to reduce transport costs and middleman fees. Transport costs vary based on fuel prices and distance. On average, it cost 30,000 rupees (US$385) per truck carrying a maximum capacity of 20 MT. Even if there are lower than usual yields, the processor must bear the full cost of transportation even if the truck is only partially filled.

Due to the perishable nature of the fruits, processors need to take extra care to avoid post-harvest losses and maintain safety. To support this, they often provide farmers with plastic crates to minimize the damage to produce. The presence of even a single rotten fruit can spoil the entire consignment.

There are two ways of packing fruit pulp: canning and aseptic packaging. MSME pulp processors prefer canning as it is cheaper than the aseptic method, has more durable material for transportation, and results in a longer shelf life. However, international buyers prefer pulp in aseptic packaging as it helps maintain product safety and quality at export standards. This trend has intensified following the COVID-19 pandemic.

Fruit pulp processors prefer to set up their production facilities within industrial estates as the land is cheaper than that provided within MFPs or other non-agricultural areas. A minimum of two to three acres of land is needed to set up a medium-scale fruit pulp processing plant.

The land, buildings and machinery costs account for 97 per cent of the total fixed investment across all categories of firms. All the essential machinery for pulping is available in India. For high-end machinery, some large processors buy equipment from the Italian market due to its high-quality output. Overall, it requires an investment of a minimum of 16 lakh rupees (US$20,000), up to 16 crore rupees (US$2 million), to set up a fruit pulp processing unit.

Secondary processors

Presently, the domestic market for fruit-based tertiary products is dominated by large-scale private companies like Dabur, Parle Agro, Coca-Cola and PepsiCo. MSME secondary processors thus have little scope to enter the market and establish their brands due to limitations in the size of their business. They are also unable to compete and sell in the export market due to lower brand recognition.

Odisha has more secondary processors and few to no primary processors due to the unavailability of pulpable fruit varieties in the state. These processors must source fruit pulp from neighbouring states like AP, Tamil Nadu, Bihar and Maharashtra, which further increases the cost of production.

Some secondary processors in Odisha make their fruit pulp using locally available fruits such as pineapple. For mango pulp, they rely on raw materials from neighbouring states. Hence, processors and institutes are now exploring methods to use local tabletop varieties, like the Amrapali mango, for pulp production. About 50 per cent of the pulp required can be extracted from an Amrapali mango, whereas a Totapuri gives 60 per cent pulp. Since Amrapali gives 10 per cent less pulp, it has been considered unfeasible for pulp production in Odisha. However, one processor argues that this difference in percentage yield is equivalent to the additional cost of transportation incurred in buying mango pulp from other states, making Amrapali an equally profitable option for pulping.

3.2.3. Lead buyers/distributors/exporters

MSME processors in the focal two states lack marketing skills and rely on distributors for domestic sales and exporters for overseas sales. This is due to MSMEs' capacity and their capability related to marketing. Often, large processors act as distributors and exporters for MSMEs in AP and Odisha. Distributors and exporters provide MSME processors with the forward linkages essential for business growth in exchange for a commission usually set at 25 per cent of the product cost.

Large processors (such as Parle Agro, Dabur, Coca-Cola and PepsiCo) mentioned in section 3.2.3 can process, conduct quality assessment, package, market, distribute and sell tertiary products directly into domestic and export markets. For juice, approximately 75 per cent of the product is sold within Indian markets and 25 per cent is sold overseas.

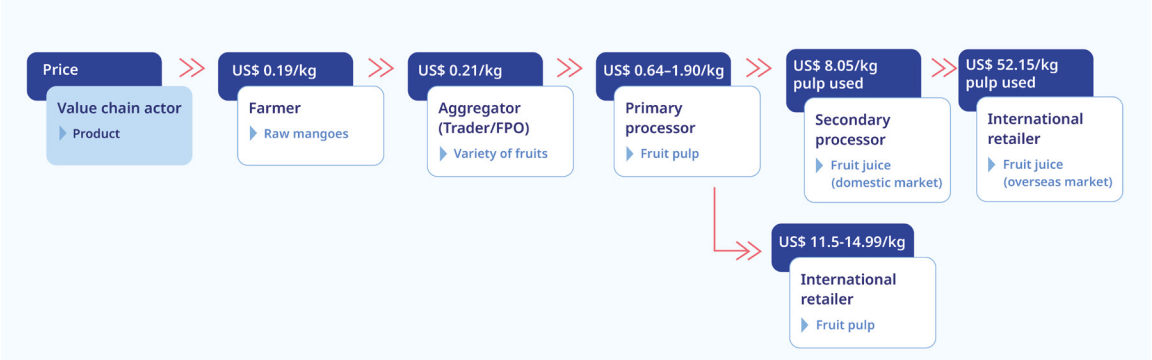
The minimum quantity required for export is 500 tonnes, which can only be fulfilled by at least four medium-scale processors. However, the northern districts of AP and the entire state of Odisha are not able to meet this volume requirement as there are very few fruit pulp processors in the region, leading to challenges in attracting exporters and buyers to their region. On the other hand, lead buyers typically source 100,000 metric tonnes of pulp per year from the southern districts of AP.

Lead buyers also look for certifications from trusted institutions such as the Food Safety and Standards Authority of India (FSSAI) and International Organization for Standardization (ISO), which are mandatory for food processors. Product specifications, including pulp density, acidity, no added sugar and related parameters, are also important considerations. To date, there have been little to no concern (except for some incidences of contamination due to ineffective packaging) regarding the product quality of the fruit pulp exported overseas. However, if processors in northern AP and Odisha aim to sell fruit-based tertiary products in the international market, they first need to establish a thriving fruit pulp processing industry within the district/state before tackling overseas sales.

3.2.4. Pricing

Figure 17 illustrates the pricing of fruit and its pulp at various stages of the supply chain and where value is added by actors.

▶ **Figure 17. Pricing of fruit pulp at each stage of the value chain**



Source: Authors' analysis

Farmers set the price of fruits based on season, yield and availability. Mango has the most variable market prices due to the its short harvesting season and the high demand in both the domestic and export markets through the year. The prices of other fruits like banana, guava and papaya are comparatively stable. When the supply fluctuates and the demand is constant, farmers usually increase the price per kilogram, and the processor must bear this cost.

Processors receive a purchase order from a potential buyer or exporter in which the buyer decides the price of pulp based on the price per carton. This gives the processor limited freedom in achieving high profit margins as prices are non-negotiable both upstream and downstream.

If the deal is completed, the processor manufactures and packages the order. However, there is no liability for the buyer to collect the agreed upon quantity (as stated in the purchase order) as it is an estimated market requirement. Lead buyers sometimes take advantage of this norm and do not buy full stock in times of high production (as lower prices are available elsewhere).

3.3. The shrimp core market and value chain

3.3.1. Producers

Producers are the backbone of the shrimp aquaculture industry. They consist of hatcheries, which grow post-larvae shrimp to provide strong and healthy juveniles for farmers, who in turn, produce competitive and uniform-sized shrimp for end markets. Other players, such as aggregators, labs and feed providers, facilitate this process as discussed in this section.

Hatcheries

The shrimp value chain starts with the feedstock for the shrimp farmers: post-larvae (PL) shrimp. The PL stage of the shrimp is booked by the farmers a month in advance of the receipt of these shrimps from hatcheries authorized by the Central Aquaculture Authority. Around 200,000 PL shrimp can be used in a one-acre pond. Farmers book the seed in advance from the hatchery or pay a premium (~0.1 INR (US$ 0.0013)/PL shrimp) if they buy it on the spot. Hatcheries may also provide logistics and delivery if the farmer does not have trucking capacity.

Aggregators

Small farmers may also go through agents to procure their PL shrimp from hatcheries. Agents aggregate demand from small farmers, get the feedstock tested for viruses and parasites, procure it in bulk and deliver it to the farmer's pond. For these services, the hatcheries pay INR 0.1-0.2 (~US$ 0.0013-0.0026) per PL shrimp to the agents.

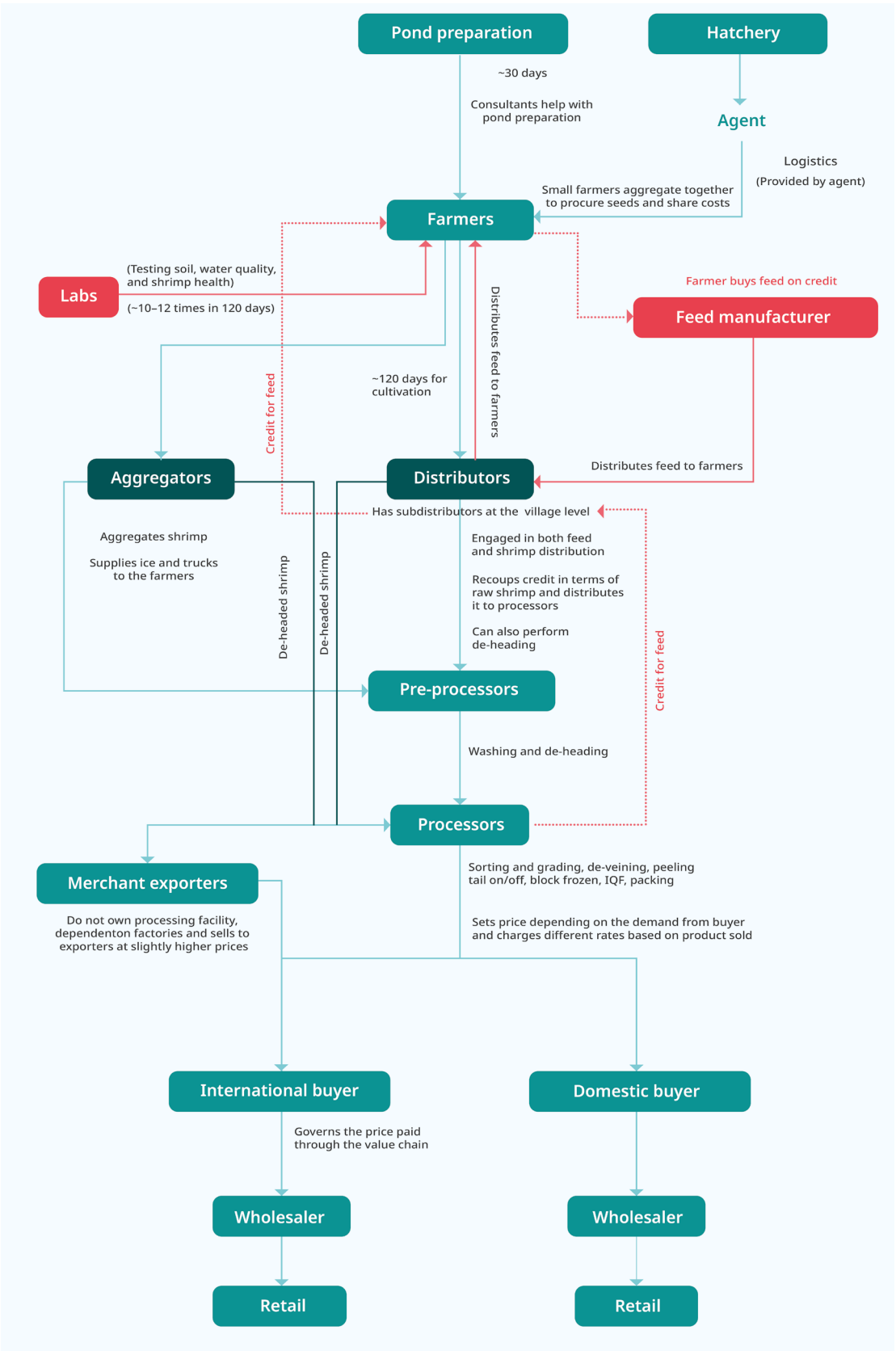
Farmers

Farmers play a central role in the shrimp processing value chain. They must plan at least one month of a crop cycle to procure the PL shrimp, prepare the soil, conduct water testing and arrange for feed before farming can begin. Consultants may provide technical expertise for each step; for example, civil engineers can assist in pond construction and labs can help with testing and analysis.

The farming of one cycle of shrimp takes around 120 days, during which they must regularly monitor the health of the shrimp and water parameters like dissolved oxygen and pH balance. In one year, it is possible to execute three cycles of shrimp farming. Shrimp farming does not follow a crop pattern, but farmers plan cycles to coincide with the high-demand Christmas period.

Farm sizes vary based on several factors, but a typical farm is a small- or medium-scale unit and has around three acres of land for shrimp farming. In Bhimavaram, a major aquaculture hub in AP, 60 per cent of the farmers are small scale with between 2–5 acres of land; 20 per cent are medium scale with 10–20 acres of land; and 10 per cent are large scale with farm sizes in the range of 20–60 acres. The final 10 per cent consists of corporate farmers with farms as large as 200–300 acres. Processors from Bhimavaram reported that most farmers generally do not want to get into the hassle of processing and exporting.

▶ Figure 18. Shrimp processing flow



Small- and medium-scale farmers depend on credit to purchase feed from either distributors or processors. Processors often use the revenue from feedstocks (a by-product of their processing) to subsidize the price of the shrimp they buy, gather market intelligence and control which sizes of shrimp are grown. Around 80 per cent of large farmers sell directly to processors, while the remaining 20 per cent sell to distributors. The greatest threat to farmers is disease which can result in mass death. If the disease is identified in the ponds, farmers typically harvest early, receiving less money for their crop but avoiding total losses. Extreme weather events, such as cyclones in Odisha, have been responsible for causing damage to assets, but they were perceived as a risk of doing business and not necessarily as an impact of climate change. Farmers perform a pre-harvest check, get ice and crates ready, harvest the shrimp, dip it in sodium metabisulphite and pack it in ice.

Some differences exist between farmers in Odisha and AP. Farmers in Odisha are considered less export-oriented, which limits the volumes and quality of supply for Odisha processors. Processors in Odisha said that raw materials were not as easily available to them as they were in AP. There are fewer hatcheries in Odisha, and the entire value chain is affected by this supply shortage. This was corroborated by the local government who reported that the shrimp sector in Odisha is currently in a nascent stage with high growth potential.

3.3.2. Distributors and exclusive suppliers

Distributors have a dual role in the value chain. They purchase shrimp feed from manufacturers in bulk and supply it to farmers on credit. They maintain a steady supply of feed to respective villages via subdistributors over the whole period of the crop cycle. When the shrimp is harvested after ~120 days, the same subdistributors become the first point of sale. The distributors take the shrimp in part or fully from the credit owed for the shrimp feed.

These distributors aggregate shrimp from farmers and, in turn, give it to processors. As distributors are so intertwined in the trading activity, there tends to be a significant level of trust involved in transactions. The subdistributors are also locals, which helps build trust. The processors' reliance on distributors increases the further their factory is from the farms.

The role of these distributors, however, was disputed by processors. Some felt they were necessary to the supply chain as they become a single point of contact for purchase. They also felt that there wasn't a significant cost difference when it came to procuring from farmers or distributors. Distributors also have better (for instance, longer) payment terms whereas farmers preferred faster payment.

Since distributors supply feed to the farmers, they also have intelligence on the condition of the ponds under cultivation. Thus, distributors also ensure the quality for shrimp to processors. Distributors also have a developed logistical fleet (small and large trucks to cater to custom orders) to supply of shrimp and feed; thus, processors do not have to waste time sending vehicles to multiple farms and risk product deterioration.

On the other hand, some processors argued that adding a step between the farmer and processor removed the margin from the process and increased the time to get the perishable product to the factory. Some also felt that distributors were an unnecessary middleman responsible for price gouging and misinformation. For example, at the beginning of the pandemic, just before India's national lockdown in March 2020, the distributors misinformed the farmers about the prices quoted by the processors and profited amidst the chaos. In some cases, processors have avoided distributors and built relationships with farmers directly to ensure the quality of their products. This divisiveness is also reflected in processors' procurement channels, as on average, processors buy both from distributors and farmers. Besides the dual roles that distributors generally play, some have even begun expansion into de-heading shrimp and selling it to the processors at a margin.

Aggregators differ from distributors in that they do not give farmers credit for feed and are not involved in feed distribution during the cultivation phase. Aggregators also focus on identifying exclusive supply to pre-processors and processors. They source the ice and trucks for the farmers and aggregate bulk quantities for processors at a margin. The processors pay them between 2–3 rupees per kilogram

(US$0.026–0.038) for aggregation services. If processors want ice and trucks as well, then they pay 8–10 per kilogram (US$0.10–0.13).

3.3.3. Pre-processors

Pre-processors specialize in shrimp head removal. Over the past decade, processors have started to outsource de-heading the shrimp to other players, and this is now being done either by exclusive de-heading centres or increasingly by aggregators. Usually, processors must pay between 3–5 rupees per kilogram (US$0.038–0.064) to de-head the shrimp, with the process paid on a contract basis per kilogram of headless shrimp. As with all processing in the value chain, the minimum price is fixed by the MPEDA. Processors can choose to pay extra to secure greater volumes of de-headed shrimp.

Harvested shrimp needs to be de-headed as quickly as possible to prevent the product from decay. Even when the shrimp is transported on ice to a de-heading centre, it is subject to decay. Usually, it takes five to six hours for shrimp to spoil. As such, the efficiency of the de-heading centre is crucial for processing. The raw shrimp is washed, drained and de-headed by the pre-processor before sending it to the company's processing factory.

The further a factory is from a farm, the greater is its reliance on de-heading centres as shrimp needs to be harvested quickly. In situations where there are many factories far from farms, de-heading centres may be overburdened, creating a bottleneck, increasing the risk of spoilage and leading to further losses. This was especially true for Odisha since many new MSME factories are far from farms, resulting in higher raw material losses. One shrimp processor recalled how they suffered significant losses because of the bottleneck created at the de-heading centre during a high-demand period.

3.3.4. Processors

As the shrimp industry is export-oriented, most processors also export their products. There are two types of processors in AP and Odisha:

- **Manufacturer exporter**: These operate processing facilities and export their processed products.
- **Merchant exporter:** These do not have manufacturing infrastructure and rely on manufacturer exporters.

Overall, according to the MPEDA registry, there are 74 manufacturer exporters and 69 merchant exporters in AP, while Odisha has 21 manufacturer exporters and 19 merchant exporters.

Manufacturer exporters

Most manufacturer exporters are legacy players who have been in the shrimp processing and export business for many decades. They have been crucial to the growth of the Indian aquaculture sector and continue to shape its future. Most of these businesses are family-owned, private enterprises. Manufacturer exporters have enough capital to acquire their own manufacturing infrastructure, logistics fleets, farmlands and shrimp feed factory units. They have access to all markets, with exports revenues running into millions of dollars.

Manufacturer exporters remain competitive by relying on volume business. The scale at which they operate allows them to control the markets effectively by giving farmers credit for shrimp feed, monitoring their ponds, controlling what they grow and harvesting shrimp accordingly. Many small processors feel that this vertical integration allows large players to undercut the market, leading to monopolies.

Many manufacturer exporters outsource de-heading activities to smaller players or distributors if their facility is far from the farms. Most manufacturer exporters in AP and Odisha are operating under their full capacity, driven by both unpredictable global demand (exacerbated by COVID-19) and challenges in sourcing raw products.

Merchant exporters

Merchant exporters are new players who do not have enough capital to set up manufacturing facilities and use the existing infrastructure of another business. According to the MPEDA, if a manufacturer exporter is operating under their full capacity, they can lease out their processing infrastructure to two other merchant exporters. This allows small business to funnel capital into operating expenditures and start exporting.

Merchant exporters pay a monthly rent for the infrastructure and labour at the processing facility. However, the amount of shrimp they can process is fixed as per their contract, leading to business being capped at a certain volume. Hence, they cannot commit to higher orders even if they find a lucrative and willing buyer. They can only process larger orders in the unique scenario in which the manufacturer exporter and the other merchant exporters using the same facility do not have orders to process. Merchant exporters also have greater reliance on de-heading centres than manufacturer exporters and have reported facing losses due to the inefficiency of the de-heading centre.

Merchant exporters also must rely on large farmers to avoid managing many small farmers. They must also pay extra for their shrimp as the relationship and trust between the processor and farmer factor into the costs. As transactions grow and timely payments are made, the farmer will settle for lower prices in return for guaranteed orders. They also rely less on traders and work directly with farmers to build this trust and ensure that the quality of the product is superior and uniform as they feel that this gives them a competitive edge.

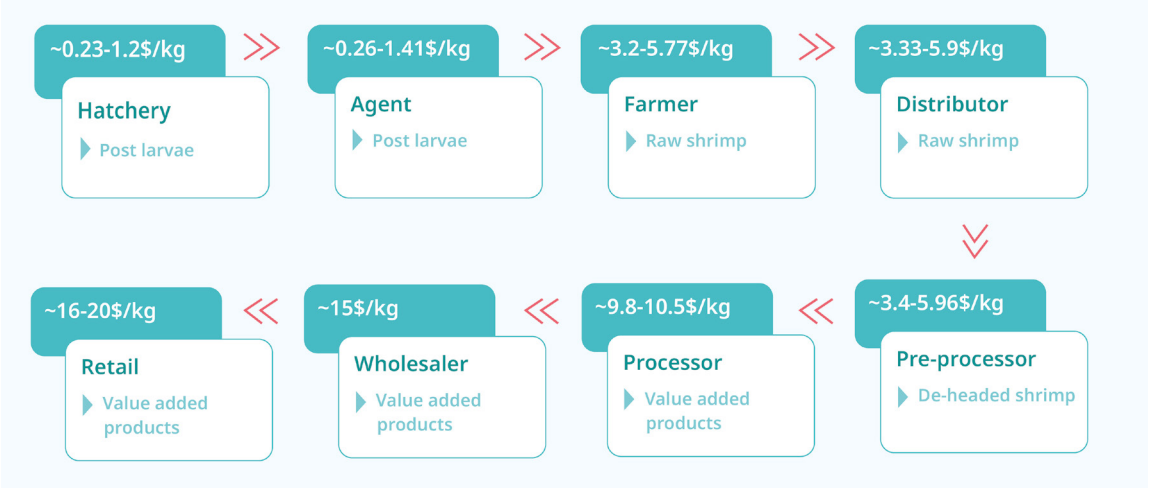
Merchant exporters also use the licenses of other manufacturers. Therefore, access to markets is dependent on the licenses of the overarching facility. If an issue arises with the overarching facility and a specific market, as is the case with some of the interviewees and the US, then the merchant exporter cannot access the market. In addition, most processors also stated that the market is oversaturated and controlled by large players who can act like a syndicate and can decrease the price due to their volumes of business.

In Odisha, merchant exporters reported that supply does not meet demand, especially at critical demand points. This means that the export potential is capped by weak backward linkages which negatively impacts processors and exporters.

3.3.5. Pricing

Figure 19 illustrates the pricing of shrimp at various stages in the supply chain and where value is added by actors

▶ Figure 19. Pricing in the shrimp value chain



Source: Authors' analysis

Shrimp pricing is dictated by international buyers and trickles down to farmers. Exporters assess the demand and secure the required size from farmers to fulfil their orders. Large companies are vertically integrated and can thus assert control over the entire supply chain. However, MSMEs cannot do the same.

The true price of shrimp is hard to determine because of the distributors' role in the value chain. Since they give the farmers credit to purchase feed, farmers often sell the shrimp to them at a lower price than the market average. Distributors aggregate the product for processors and take a margin from them as well. Therefore, it is difficult for most MSMEs to obtain the right price.

Farmers also demand to be paid immediately, and MSMEs cannot afford to spend their capital on infrastructure as the shrimp business demands higher working capital. Therefore, MSMEs must rent a manufacturer exporters infrastructure and use their capital on operations. This system also pushes the merchant exporters' products to have higher pricing, impairing their ability to be competitive.

Pricing is also influenced by the supply side because of volatility caused by an unsteady supply of raw materials. The increased cost of inputs for the farmers coupled with the reduction in subsidies can result in a farmer's unwillingness to plan their next crop. This can have a ripple effect as there is less shrimp to go around to meet the market demand.

Long-term agreements with farmers are generally avoided as the price fluctuates and lead buyers do not want to miss out on the potential arbitrage opportunities. Groups on WhatsApp are used to communicate the changing prices in the market. Farmers may also lose their crops if the size of shrimp on their farms does not suit the buyer. In such cases, farmers choose to harvest shrimp early when they are smaller. COVID-19 has also had a huge impact on the price of shipping as many exporters reported paying six times what they normally pay.

3.4. Supporting functions

3.4.1. Skills

Fruit pulp

Fruit farmers lack awareness of the harvesting requirements in supplying to the pulp industry, often leading to fruit spoilage/damage and microbial contamination which causes high wastage.

Pulp processors in northern AP and Odisha find it challenging to obtain the desired quality and quantity of fruits from local farmers due to gaps in farmers' awareness of safe harvesting and collection/packaging practices. Processors emphasize the safe and organized collection of fruits from the orchards to maintain their quality after harvesting as they are highly perishable and delicate. There is also a chance of damage to the skin of fruits which can cause the spread of microbial contamination within the entire batch, resulting large material losses because of mishandling during transportation. The presence of a single damaged fruit can spoil an entire batch of a harvest. Therefore, processors get involved in collection and packaging processes and provide farmers the necessary collection material/equipment. They prefer for the fruit to be collected in plastic crates over wooden boxes as these are disease-resistant, waterproof and ensure the safety of fruits by preventing voiding microbial contamination.

Limited knowledge of modern farming practices leads to yields not meeting their potential.

Another technical knowledge gap observed concerns the farmers' lack of knowledge of modern farming techniques to increase yield. In the mango subsector, high variability in the supply of raw material input is likely to intensify in some areas of Odisha and AP due to the age of the orchards, with many trees being between 30–40 years old. Farmers need to identify new ways of increasing and/or maintaining yields. Large processors like Coca-Cola are now involved in educating farmers about techniques such as the ultra-high density plantation technique for mango cultivation. This helps processors receive consistent supply of mangoes of good quality, which also reduces the associated price volatility.

Shrimp

Due to the predictability and scale of the market, processors' skills in Andhra Pradesh and Odisha are focussed on secondary processing for US and EU markets. This focus comes at the cost of building tertiary processing skills and secondary market segmentation for other high-value Asian markets.

High-value markets, such as South Korea, Japan and China, require the shrimp to be frozen and packaged within four or five hours of harvesting. Processors have commented that de-heading the shrimp sooner was challenging and required skilled labour due to the risk of a greater volume lost through processing within the four-five-hour window. With the current manufacturing practices in India, the head is typically removed after eight hours. This eight-hour approach is acceptable for the EU and US markets but not for the Chinese, Japanese or South Korean.

The reliance on US and EU markets for profit has changed the nature of processing. It has become volume centric instead of becoming quality focused. Catering to higher volumes has resulted in poor labour compliances, including working long hours. This is elaborated in the section on employment in the fisheries and shrimp subsector.

Processors recognize that there is a high level of capacity in de-heading and deveining shrimp in AP and Odisha; however, they lack value-added skills and an understanding of the technology required for further tertiary process. This is currently a barrier for the shrimp industry to develop RTE and RTC products fit for export to higher-value markets. Competitor countries can produce shrimp with a greater presentation, including redder and shinier produce that is more attractive to consumers.

3.4.2. Infrastructure

The unreliability and expense of electricity affects MSME units' margins as compared to established players. MSMEs have tighter margins due to lower volumes, rendering them less competitive in a market focused on operational efficiency.

Lack of consistent power supply was a common complaint from processors and farmers in both sectors. For example, in Andhra Pradesh, farmers and processors have been advised to use 50 per cent grid power and 50 per cent from alternative sources like generators. This leads to a high cost of electricity which reduces margins. One kilowatt hour of power costs 7 rupees (US$0.090); however, the same kilowatt hour from a generator costs 28 rupees (US$0.36) (1litre of diesel produces 3-4 kilowatt hours) at a diesel price of Rs. 100–110 (US$1.28- US$1.41). Therefore, generator use increases the cost of production nearly four times. This has an impact on each stage in the value chain and ultimately on the price at which processed foods can be sold. Intermittent power supply also presents challenges in maintaining the cold chain, with unexpected interruptions in supply resulting in potential losses of raw materials on the production line.

Fruit pulp

For fruit pulp processors, cold storage was seen as an added cost to store products as fruit pulp can be easily stored at ambient room temperature for up to 12 months (aseptic) and 24 months (canned). Cold storage is required to hold surplus fruits/raw materials for a long time if the supply is more than required. However, there is currently no surplus supply in both states.

Shrimp

When asked about cold storage and its issues, processors did not consider it a major issue. One processor commented that steady and consistent supply or raw farmer inputs needed to be solved before cold storage concerns. Since supply is not adequate, cold storage is not yet a barrier.

3.4.3. R&D and product innovation

Fruit pulp

New mango fruit varieties produced locally are not being tested and explored for pulpability as processors are unwilling to bear the expenses because of uncertainties in consumer perception and low demand for the new blend.

The fruit pulp sector is dominated by mango pulp as it is a major raw material for the fruit juice industry. Most of the native mango varieties grown in Odisha are sold as tabletop fruits. One of these, the Amrapali mango, is also sold as tabletop fruit and has a pulp content of up to 50 per cent. With some additional R&D, it can also be used for pulping purposes for the juice industry. However, it is not currently used by processors due to uncertainty in market demand as the consumers have a palate for better known varieties such as Alphonso, Totapuri and Kesar. Consumers all around the world prefer the taste of Alphonso mango as it provides a natural sweetness to the juice. Due to their high pulp content and bright colours, Totapuri and Kesar are also preferred in making mango beverages. The potential of Amrapali can be tapped by promoting more research on its pulpability along with smart marketing strategies to gradually introduce consumers to a new flavour and analyse its impacts.

▶ Climate change

Farmers highlighted the impact that climate change was having on agriculture. They viewed it as both a threat and an opportunity, with an earlier summer season allowing earlier and longer harvest periods for fruit. A changing climate was also seen to open opportunities to plant new fruit varieties. However, climate change also represents a substantial threat, which most farmers are not prepared for. Yields in the competitor state of Uttar Pradesh are estimated to fall by 70 per cent because of climate change. Increased extreme weather and high rainfall was already impacting the quality of AP and Odisha's fruit harvests with a 30 per cent decrease in productivity being predicted by the leading government figures interviewed. An understanding of the changes, preparation to realize opportunities and to ensure resilience is currently lacking amongst farmers.

Shrimp

In the shrimp value chain, there is a perception that the risks of developing new, tertiary RTC and RTE products are higher than the potential rewards. As a result, there has been limited investment in the R&D of market-segmented tertiary products for different RTC and RTE markets. Instead, the sector focus is on volume and operational efficiency, which leads to unmet demand for tertiary processed products segmented to specific markets.

There is a demand to develop secondary products which are specific to the tastes of different geographic markets, including a demand to shift to new value-added products, such as RTE and RTC. This is also an opportunity to use what is currently considered waste to develop new, low-value products.

However, challenges exist in innovating new product lines; for example, the capital investment to produce tertiary product lines would not be covered by additional profits. There is a demand for current products, and thus, building capabilities to produce new product lines is seen as a risky investment. Additionally, processors lack an understanding of international consumer preferences and have limited skills developing new taste blends to service new international customer groups. There is also a perceived lack of demand from buyers due to their sole requests for low-value processed goods, such as headless and peeled shrimp.

Historically, new products in the food processing sector have been developed with additives to increase shelf life. However, in today's health-conscious and properly regulated environment, using additives will likely result in exclusions from certain markets.

3.4.4. Quality control and certification

Challenges in the value chain result in the sale of products of variable quality in the domestic and international market. This impacts India's reputation and access to certain markets. Value chain challenges include delays in certification infrastructure and Indian certification not being accepted by some markets.

MSMEs find it challenging to gain accreditation and the required certifications to supply lead domestic and export markets in a timely fashion. Certification is a prerequisite for food processors while accessing domestic and export markets. Certain markets require approved supplier status, which is gained through repeated high performance and a low rate of rejection, and there is widespread demand for product testing. Some examples of key standards are that at a base level, leading domestic and international buyers require processors to adopt total quality management (TQM) practices, including ISO 9000, ISO 22000, Hazard Analysis and Critical Control Points (HACCP), good manufacturing practices (GMP) and good hygienic practices (GHP) in the future.

Fruit pulp

To manufacture and sell fruit pulp, processors are required to have FSSAI and ISO 9001 compliance for quality management, a water recycling and pollution control licence, and licences for pest control and monitoring, warehouse management, traceability, transportation management, corrective action and preventive action. The importance of these certificates is illustrated in the geographic dominance of processors in Mumbai and Delhi as there are many accredited factories in these regions. Inventory is often held for long periods due to delays from the buyer's end in collecting the entire purchase order placed as they usually order more than what they require to be market ready. This results in capital being tied up in inventory for longer periods.

Shrimp

In shrimp farming, lead buyers in EU and the USA require the Global Aquaculture Alliance Best Aquacultural Practices standard (GAA-BAP certification) to ensure quality and to demonstrate that this farmed seafood is socially and environmentally responsible. Farmers also need to be registered with the Coastal Aquaculture Authority, procure feedstock from registered hatcheries and be audited to supply to high-value players. New entrants also require licenses to export to high-value countries. The Indian government does extend its support in licences for export, but receiving countries often require additional certifications. For example, the US requires processors to be on their list of approved suppliers.

Processors also highlighted that gaining certificates is time-consuming. For example, it can take six to eight months to become certified and be able to export to the EU. In 2019, the EU stopped the approving new factories as their demand had been met, and the Indian government had not dealt with the issue of antibiotic use. Thus, processors cannot grow without approval from these authorities and lists.

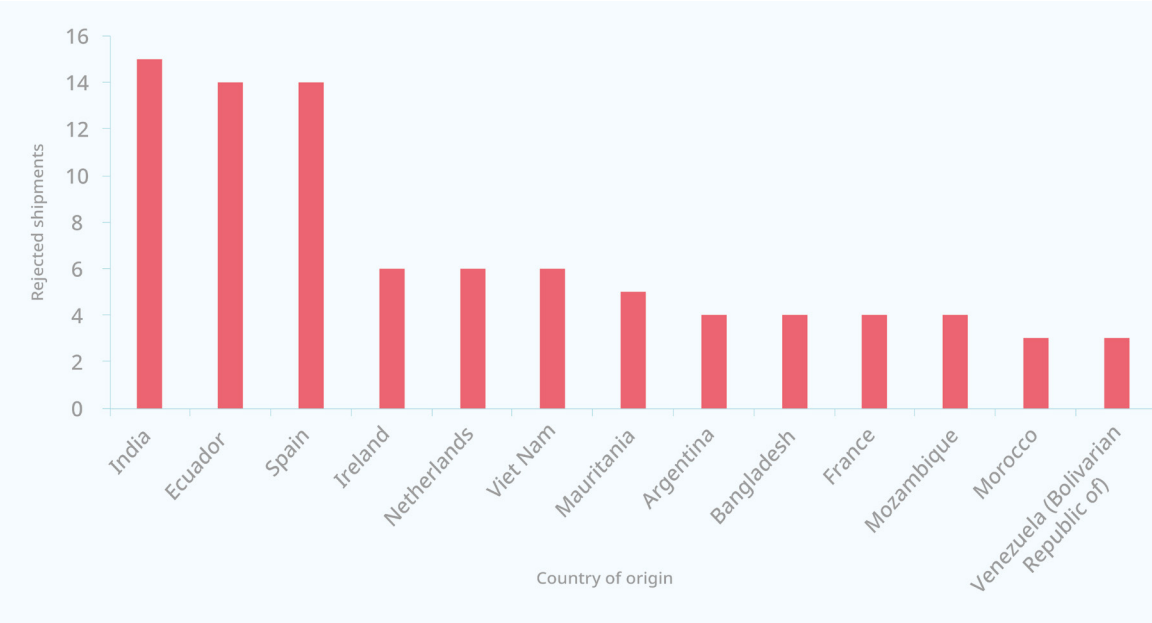
Although there is a great focus on quality and a heavy burden of accreditations and certifications, India has experienced the greatest number of rejections due to non-compliance with the EU market. Processors noted that new EU guidelines have negatively impacted their business and said that collaborative solutions need to be formulated instead of a flat-out ban. Interviewees across the value chain noted that the sector has evolved to focus on volume, not quality, and therefore it cannot access high-value markets and struggles to move up the value chain. This is especially evident in the use of antibiotics and enhancers in shrimp farming.

Interviewees noted that in the shrimp subsector, there was widespread misapplication of antibiotics. Farmers rely on antibiotics to increase the yield of shrimp to meet the market demand, and depending on the antibiotic used, its residue has a withdrawal period ranging from days to weeks. If farmers wait for

the withdrawal period, the antibiotics leave the body of shrimp, avoiding the potential harmful impacts of humans consuming needless antibiotics. However, as shrimp growth cannot be controlled, they might grow larger than the required size and in such a scenario, farmers will harvest the shrimp sooner, leading to antibiotic residue.

This presents a substantial issue for processors because many markets ban the use of antibiotics. The residue is also a cause for the rejection of processed products and carries reputational risks in the international market. The extensive use of antibiotics also increases the likelihood of antibiotic resistance, which is a key risk to India's shrimp sector. Without reducing antibiotic use, India may fall behind its competitors and fail to break into high-value markets, such as Japan, South Korea, Europe and the US.

▶ Figure 20. Number of shipments rejected due to quality of crustaceans entering the EU by country (2017–22)



Source: European Commission (2022)

Further, testing infrastructure is not always up to the standards required by international buyers. For example, one processor quoted that lead buyers in South Korea prefer the testing to be done in Chennai instead of Vizag, and this increases the time by roughly one to two weeks. Such perceptions hamper the efficiency of product deliveries. In the case of the US, the time taken to reach the destination is almost two to three times more than that from countries like Ecuador, therefore, any additional time taken up by verification delays the deliveries (table 13).

▶ Table 13. Time taken for shrimp to reach the USA market from India

Activity	Time taken
Processing, lab verification and transport to the port	20 days
Document verification, container checks	3–10 days
Container health check (spot checked)	14–28 days
Transit time	30–35 days
Clearance	10–15 days
Transport to buyer's warehouse	1–10 days

Source: Authors' analysis

3.4.5. Access to financial services

Food processing has high capital expenditure and working capital needs; however, banks see MSME processors as high-risk propositions for debt or working capital finance loans. MSMEs have limited alternatives to the banks, obstructing the development of entrepreneurship in the value chain, and this is a key limitation for an MSME processor moving up the value chain.

The overall credit gap for MSMEs in India is estimated to be 20–25 trillion rupees (US$271–339 billion), and 91 per cent of the demand for credit comes from MSMEs (Asian Development Bank (ADB) 2021). Access to finance was reported to be a major constraint by processors in the value chain and the wider MSME ecosystem in Odisha (Malepati et al 2022). The nature of the food processing sector, with perishable products that decrease in value the longer they sit on shelves and a large amount of working capital tied up in inventory, makes finance an even more pressing issue for its MSMEs.

Gaining finance for working capital and capital expenditure is challenging due to collateral requirements and high interest. New MSMEs looking to start operations require upwards of 30–40 crore rupees (US$4–5 million) to invest in the infrastructure required by the export market in shrimp processing. In fruit pulp processing, a minimum of 1.5–2 crore rupees (US$200,000- US$260,000) are required. Processors can access capital subsidies from the state government that only cover 25 per cent of the total project cost. This barrier to entry restricts the growth of productive, formalized MSMEs in both states. Women business owners face a higher rejection rate for finance than their male counterparts – 31 per cent against 19 per cent – and receive only 5 per cent of the total MSME lending from private sector banks (IFC 2018).

Processors reported that the approval for a loan often hinges on the aptitude of the bank manager. If the bank manager perceives a lot of risks or does not share the vision for the MSME's growth, they will most likely choose the safer options and fund large, established corporations instead. Industry associations also reported that many banks do not offer certain government schemes, thus limiting access to them.

MSMEs reported that they mainly rely on state banks for their loans with a few preferring private banks. Without success in obtaining a bank loan, many MSMEs seek finance through informal or family channels, where interest rates can be double the standard formal rates (Omidyar Network and Boston Consulting Group 2018). Banks, on the other hand, admitted that they have strict requirements on collateral, including an unwillingness to accept agricultural land for the same.

Processors in AP reported that they must pay 1 per cent agricultural market cess to the government even though the banks do not consider shrimp an agricultural product. Further, MSMEs reported that it could take up to 1.5 years to get a loan processed, and poor accounting practices also hinder loan approvals. To secure the volume and quantity required by processors, some have resorted to actively financing farmers. However, non-traditional funding sources, such as venture capital, non-banking financial companies, angel investors and initial public offering (IPOs), are very limited in AP and Odisha (Venkatesh and Muthiah 2012).

The shrimp aquaculture industry requires significant working capital, which is often unavailable to newly established MSMEs. Even for established players, it takes more than three months for payments to be realized after a shipment is processed. Thus, MSMEs often start as merchant exporters and try to build up the capital needed to acquire their infrastructure.

3.4.6. Marketing

Fruit pulp MSMEs do not have a strong brand presence to compete against trusted, well-established and market-dominant corporations.

Section 3.4.4, dealing with certification, highlighted the importance of gaining accreditations to access domestic and international lead buyers. However, there are some additional factors that limit market access, particularly the challenges that MSMEs face while looking to build new trading relationships. Fruit pulp producers in AP and Odisha have substantial difficulties in accessing domestic lead buyers or international markets. Processors highlighted low brand recognition for pulpers with an especially low digital presence in Odisha. International brand recognition was flagged as an important concern for Indian food processors because of the Indian beverage market's reputation linked to past malpractice, including mislabelling and dumping of substandard products.

3.5. Rules

Overlapping legislation, high tariffs in higher-value markets and revised taxes hamper MSME growth in both domestic and export markets.

Processors commented on the challenges posed by the implementation of the Goods and Services Tax (GST), which arise from the large administrative burden it places on already stretched resources, the requirement to spend on auditors and the harsh penalties for non-compliance. Delays in GST reimbursements present cash flow challenges for MSMEs operating with limited cash buffers. The research suggested that high GST compliance was increasing informal activity.

Key sector stakeholders have demonstrated a preference for industry peers to oversee the sector rather than have government oversight. Industry actors such as Seafood Exporters Association of India (SEAI) and All India Food Processors Association (AIFPA) and their local chapters were seen as authorities on regulation, and they managed and monitored the relationships between farmers, traders and processors. They provided support in resolving disputes around the quality of produce and acted as conveners and mediators. The SEAI performs a critical function in the effectiveness of the market. Aquaculture is governed by the Coastal Aquaculture Authority, with whom all hatcheries and farmers are registered. The Authority ensures that regulations are implemented, and unregistered units are either destroyed or have their electricity disconnected. They also set standards for seed, feed, growth supplements and chemicals used, and provide training on antibiotic-free farming.

Additionally, tariff barriers limit the markets that Indian MSMEs can access and can hold back value-added in-country. For example, processors highlighted that although Egypt represented a potentially large market, the high duties imposed by Egypt made exporting to that market uncompetitive. They said that their shrimp was then first sold into the UAE and then re-sold into Egypt.

3.5.1. Access to government schemes

MSMEs face long delays in receiving financial aid from schemes, which increases the time they take to repay loans, scale up and become profitable.

Although many favourable schemes and initiatives have been developed by the government at the central and state level, some processors commented that accessing the schemes was challenging due to huge effort and time involved in making the submission and waiting for the funding or approval to come through.

Processors reported that the approval for a scheme often hinges on the aptitude of the bank manager. If the bank manager perceives a lot of risks or does not share the vision for MSME growth, they will most likely choose safer options and fund large, established corporations instead. Industry associations also reported that many banks do not offer certain schemes launched by the government, thus limiting access to them.

Large and small players also noted that the subsidies are notoriously difficult to access regardless of business size. In many cases, the subsidies were reportedly sanctioned by the government but never released to the applicants. However, government officials said that they were aware of these issues and were looking to respond. Many rejections due to incomplete applications were also highlighted.

MFPs were seen to have significant challenges due to the high rents required by the sites, limiting their usage and network and geographic proximity effects. Special purpose vehicles are unable to attract processors to MFPs as there is no financial incentive for them to set up units there. Processors must rental land inside an MFP, which is often very expensive. Since they cannot own land inside the MFP, they cannot use this land as collateral to for bank loans, which acts as a further disincentive. Renters are unable to select their project management consultants, which adds to the inflexibility of the MFP model. Being a central government initiative, MFPs often lack support and coordination from the state government.

The scheme design is unattractive to multinational investors from countries such as Japan, Korea, the US, Australia and the EU, who are now willing to invest in food processing clusters in India but cannot invest in a grant-based scheme in a developing country like India as they cannot take a grant from a developing

country (MoFPI 2015). India's MFP model is also restrictive in nature in comparison to the joint venture models of China, Thailand and Viet Nam.

The MFP Scheme, intended to bring value chain stakeholders together in close proximity, is inaccessible to MSMEs due to high rents.

The Mega Food Parks Scheme initiated by the central government is aimed at resolving the challenge of supplier-processor concentration by bringing all essential stakeholders in close proximity to each other to fulfil the market's supply and demand. However, fruit pulp processors prefer to be located closer to market players, especially farmers, as the fresh fruits required for pulping are perishable and prone to microbial contamination. However, high rents within MFPs discourage MSME processors to setup up a facility in an MFP campus.

3.5.2. Contracting

Input suppliers depend on trust over formal contractual relationships, and MSMEs have not had the time to build trust or touchpoints due to the vertical service integration of larger, more established players.

Shrimp

The lack of formalized procurement generates challenges to achieving a predictable and consistent supply of quality raw food inputs. A typical food processor needs to run at full capacity for 250–300 days per year to break even. There is currently a significant shortage of raw materials, and there is limited time to make alternative sourcing arrangements given the perishability of shrimp. This results in processors often accepting substandard raw products. Product sourcing is especially challenging for MSME processors due to the heavy reliance on trust in the market and the requirement for immediate payments to farmers, neither of which smaller/new entrants may have the capacity for. Larger processors can engage directly with the small proportion of large farmers who can standardize production and contract to generate an annual supply.

▶ Inconsistent supply

Shrimp processors in both states noted that the raw materials from the farmers might sometimes only contain 60 per cent of the requested grade. Naturally, shrimp cannot be grown to a uniform size because of reasons which are out of the farmers' control, such as genetics, behaviour and growth rates of shrimp.

This has a negative effect on processors as they must procure more raw materials to compensate for the irregular sizes and risk having antibiotic residue in them. This drives the cost of production higher and increases waste if a suitable buyer is not found. A knock-on effect of this is that it takes a longer time for processors to repay loans, and they lose global competitiveness due to higher cost of production.

There are limited incentives on the part of the farmer to improve quality. In situations where a delivery has failed to meet quality standards, the fast turnaround times for shrimp mean that farmer and processor do not have time to renegotiate or to resell if quality requirements are not met. One result of this dynamic is that farmers have limited incentive to improve quality as they know their raw materials will have a market even when quality is dubious.

3.6. Summary of binding constraints

Table 14 aggregates and describes the constraints that, if relieved, would produce the largest gains in inclusive and sustainable growth in the fruit pulp and aquaculture subsectors.

▶ **Table 14. Summary of binding constraints**

Constraints	Underlying causes	Impact on market
	Core market	
Core value chain	The supply of raw/fresh produce does not meet demand from processors leading to high wastage.	Processing bottlenecks result in raw material losses and quality losses due to the time spent from harvest to processing.
	Smaller processors are dependent on ad hoc supply from the market and cannot lock in quality or volume.	The prolonged time between harvest and processing decreases the quality and, therefore, the price of the product.
	The relationship between the farmer and processor is dependent on trust, often built over generations.	Farmers have pricing power.
		New entrants and MSMEs cannot source from high-quality high-volume farmers or pay a higher price until trust is developed.
	There is a limited supply of fruit from Odisha.	Processors cannot reject low-quality raw materials.
	Large processors and distributors use the supply of feed to gather intelligence on the quality of a farmer's product and the timing of harvest.	Larger players and distributors can identify the highest quality raw shrimp and plan for processing.
	Factories further away from farmers must rely on de-heading centres.	Overburdened de-heading centres lead to higher raw material loses.
Market structure	Larger processors are increasingly vertically integrated.	MSMEs are unable to compete on price with larger players.
	Larger players can subsidize secondary product margins through margins on other inputs.	
	The throughput of larger processors allows them to achieve economies of scale.	
	Processing capacity is in excess of supply of raw product.	
	Supporting functions	
Skills	Farmers lack awareness of harvesting requirements essential for pulp processors.	There are lower yields of fruits suitable for supplying to the pulp industry.
	Farmers lack education on modern farming practices.	
	There is mishandling of fresh fruits during collection/packaging and transportation.	Mishandling increases material costs and the chance of wastage due to microbial contamination.
	Limited skills in tertiary processing leads to the perception of lower quality for RTE and RTC products in international markets.	Processors do not generate higher prices from greater value addition.

Constraints	Underlying causes	Impact on market
Infrastructure	The electricity supply is inconsistent.	Secondary power is more expensive, raising costs. Time without power leads to increased wastage due to breaks in the cold chain and the perishability of the raw and processed products.
	The costs involved in setting up a manufacturing unit are extremely high.	An increased reliance on rent-based manufacturing is driving up costs.
R&D and product innovation	Locally produced mango fruit varieties are not being tested and explored for their pulping potential to make tertiary products as processors perceive risk.	The level of innovation in the pulp processing sector is stunted.
	There is a well-set, pre-existing consumer palate and preferences for market-dominant varieties.	There is an unexplored market demand for products made using local varieties.
	Processors perceive a risk in developing new RTC & RTE products.	Processors cannot penetrate new markets with segmented product offerings.
Quality control and certification	The lead times for MSMEs to gain accreditation and certification to access certain markets is very long.	MSMEs take longer to generate profits.
	There is misapplication of antibiotics in shrimp farming.	The rate of rejection of the end products from the high-value market is high.
Access to financial services	MSME processors experience high interest rates, collateral requirements and lengthy approvals times for loans.	Processors unable to achieve economies of scale or work with export markets with long payment terms.
	There are few working capital products to support long payment terms.	
	There is a lack of non-traditional funding (Angel investments, venture capital, IPOs, private equity).	
	Banks view MSMEs as a risk.	
	There is low brand recognition of fruit pulp from AP and Odisha.	
	The geographic concentration of fruit pulp processors in Odisha and northern AP is low.	This leads to an obstruction of entrepreneurship.
Marketing	The geographic concentration of fruit pulp processors in Odisha and northern AP is low.	The perception of these products as low-quality limits high-value demand.
	There is an existence of overlapping regulations.	This leads to limited export interest.
	Rules and regulations	
Regulatory environment	There are high tariff barriers for some high volume and value export markets.	This limits compliance and increases the time burden.
	MSMEs face tremendous delays in receiving financial aid from government schemes.	There is increased informal activity in the food processing sector.
	MSMEs experience high administrative burden to comply with GST requirements.	Value addition occurs in the third country to service some export markets.

Constraints	Underlying causes	Impact on market
Access to government schemes	MSMEs face tremendous delays in receiving financial aid from government schemes. The Mega Food Park Scheme is inaccessible to pulp processing MSMEs due to high rents at these parks.	The chances of business failure increase.
		The time taken to repay loans and scale up increases. All essential stakeholders are not located in close proximity to each other, adding to higher cost and susceptibility to transport-related material losses.
Contracting	Farmers depend on trust over formal contractual relationships.	MSMEs often lack access to quality raw materials and accept variable-quality raw materials.

COVID-19 has exacerbated many of these binding constraints. More detail of its impact on the subsectors are included below.

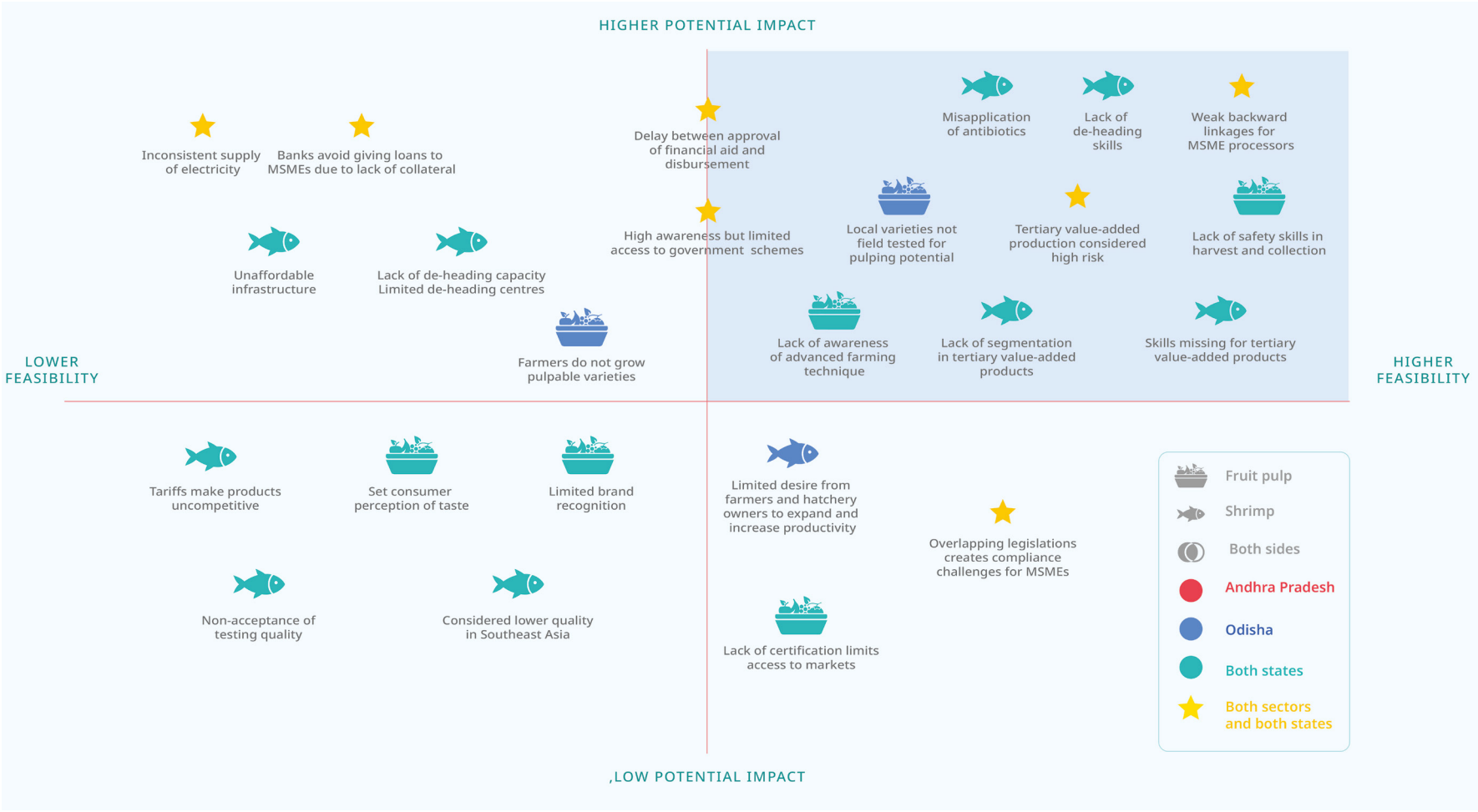
▶ The impact of COVID-19 on the food processing value chain

COVID-19 had a substantial impact on the food processing sectors in AP and Odisha. The immediate COVID-19 response, in the form of national lockdowns, limited the supply of labour in processing units, constraining the production of raw materials. At the same time, the slowdown in international trade and lockdowns in countries buying processed foods reduced demand. This led to a surplus of products dropping prices and cutting profit margins for the industry. This forced many processors to cut production and capacity and many processors left the market. The pandemic also resulted in early harvests by farmers to pre-empt lockdowns and the closing up of international trade. Increased freight costs also had an impact on processing businesses. An assessment of the COVID-19 lockdown conducted by the Central Institute of Brackishwater Aquaculture (Kumaran et al. 2021) shows that the Indian shrimp aquaculture sector may have incurred an economic loss of US$1.5 billion during the year 2020–21.

COVID-19 has also had lasting impacts on food processing, changing access to markets and production practices. An increased focus on food hygiene and packaging has increased the importance of aseptic containers over cans, which has increased costs processors. China, an important market, banned Indian products, initially due to COVID-19 in packaging and later expanding to the whole aquaculture value chain. This gradually increasing restriction in the face of Chinese attempts to contain COVID-19 has limited the markets India is able to sell shrimp to.

In order to develop a prioritization of interventions, two factors were examined: the impact that resolving binding constraints could have on the effective functioning of the subsectors and the feasibility of addressing the bindings constraints within a limited time period and with limited funds. The results of this analysis are presented in figure 21, which is codified by both subsector and state.

▶ Figure 21. Assessment of the impact and feasibility of responding to value chain constraints



Source: Authors' analysis

4 Opportunities

▶ 4. Opportunities

A market system approach seeks to identify, address and remove the system-level constraints inhibiting the growth of more inclusive markets. Market systems are complex with multiple factors, many of which are often outside the PSEI project's control, determining the success or failure of an intervention. These factors include market forces which affect the demand for products, the capacity and motivation of partner and implementing organizations to engage in interventions and shifts in global pricing and tariffs which may impact profit margins.

In this context, detailed long-term planning is often of limited use. Instead, market systems development is based on a "learning by doing" approach to delivery involving the structured testing of various pilot projects with a clear focus on adapting activities in response to real-world results. Once the pilots are tested and have been demonstrated to be effective in incomes for MSMEs in the food processing sector, the PSEI project could then see how these approaches can be scaled up to have greater impact.

Sustainability and scalability will be a central focus, ensuring that businesses and intervention models can be scaled up and replicated by market actors to further increase the long-term impacts.

4.1. Key market actors

To ensure sustainability in interventions, it is recommended that the PSEI project implement interventions with existing market actors leading them. To support partners with the right incentives and abilities to take initiatives forward, table 15 summarizes perceived organizational, motivational, and human and financial resources capacities to drive change in such initiatives. Motivation refers to perceived organizational motivation[7] to drive change in the sector.

▶ Table 15. Key food processor actors

Organization	Relevant information	Motivation	Capacity
MoFPI	• Acts as a catalyst to attract investment from abroad and within India • Provides support in the creation of infrastructure, capacity, upgradation and policy • Works towards the introduction of modern technology in the food processing industries • Encourages R&D in food processing for product and process development • Promotes export of processed food products	High	High
AIFPA	• Promotes encourages and supports Indian food processing industries in raising technical standards, product quality and safety to match global standards • Provides access to newer technologies, critical process plants and machinery, modern packaging machines, efficient logistics and enabling marketing infrastructure • Conducts workshops and training programmes to acquaint processors with good manufacturing practices, good hygienic practices and hazard analysis, critical control points and other new technological developments • Conducts and promotes market research/market studies in India and abroad on processed food products	High	High

7 This was gauged by the research team through secondary desk research, semi-structured interviews and field research and informed and calibrated through reference to other ILO VCAs.

Organization	Relevant information	Motivation	Capacity
Food Industry Capacity and Skills Initiative (FICSI)	• A not-for-profit organization under the Ministry of Skill Development and Entrepreneurship • Creates occupational standards and qualification packs, develops training materials and tools • Conducts train-the-trainer programmes, conducts skill gap studies, assesses, and certifies trainees on curriculum aligned to National Skills Qualification Framework	Medium	High
APICOL	• Implements the Pradhan Mantri Krushi Udyoga Yojana and the Agriculture Entrepreneurship Promotion Scheme of the Government of Odisha • Acts as the state nodal agency for the PMFME Scheme, Agriculture Export Policy and the APEDA • Primary objective to promote commercial agri enterprises in the state in the agriculture, horticulture, animal resources development, agri exports, food processing and fisheries sectors Activities include: • Counselling entrepreneurs of appropriate agri/food enterprises on the right technology, scheme benefits and process, sources of further information, vendors for different components, successful enterprises for reference and financers at the start of a project to ensure a higher success rate • Providing training on various aspects and subsector knowledge • Conducting seminars and workshops connecting entrepreneurs with government officials, bankers and technology solution providers • Hosting exhibitions • Providing customized detailed project reports to entrepreneurs at the nominal charge of 0.2% of the project cost + GST	High	High

Table 16 highlights the key actors in the shrimp value chain, their roles, objectives and authority and maps them against their capacity and motivation to influence the value chain in meaningful ways.

▶ Table 16. Key actors in the shrimp value chain

Organization	Relevant information	Motivation	Capacity
MPEDA	• Responsible for sustainable development of the fisheries sector • Fixes standards and specifications of products for export • Oversees regulation of export • Implements the National Residue Control Programme and pre-harvest tests to address food safety issues (rejection of seafood consignments sourced from farms due to the presence of antibiotic residue) in farmed produce • Issues pre-harvest test certificates based on screening • Developed the SHAPHARI certification programme, a market-based tool for hatcheries/farmers to adopt good aquaculture practices and produce good quality antibiotic-free shrimp products • Assists schemes under “Processing Infrastructure and Value Addition”, an initiative of MPEDA, which aims to transform India into a hub for reprocessing and value addition	High	High

Organization	Relevant information	Motivation	Capacity
	• Provides financial assistance of 5 crore rupees per establishment (US$ 641,437) to acquire processing/ manufacturing facilities to make specific value-added products (breaded, battered and RTE products) • Conducts training programmes on product value addition and facilitates stakeholders to venture into product value additions to create expertise and increase export of value-added products by creating awareness of technology and innovation used by countries such as Viet Nam and Thailand along with upskilling of the workforce • Operates 12 ELISA screening labs in the country to test farmed shrimp to ensure antibiotic-free residue in shrimp for export • Organizes the participation of Indian manufacturers and exporters at domestic seafood fairs and buyer seller forums • Markets marine products outside India, and builds brand promotion and product awareness of Indian shrimp • Promotes geographical information system mapping of farms and hatcheries for traceability of shrimp		
Rajiv Gandhi Centre for Aquaculture (RGCA)	• Conducts R&D activities in the areas of export-oriented aquaculture • Has developed a brood stock multiplication centre in Vishakhapatnam, Andhra Pradesh • Supplies domestically raised SPF *L. vannamei* brooders at a cheaper rate than the imported brooders • Offers training and consulting on *L. vannamei* hatchery construction and operation • Has supplied nearly 2.1 million units of feedstock to 326 beneficiaries	High	High
National Centre for Sustainable Aquaculture (NaCSA)	• Enables aquaculture farmers to adopt sustainable and environment-friendly farming practices to produce quality and safe aquatic products • Organizes small and marginal farmers into clusters. It has 612 societies in AP consisting of 13,982 farmers, and 31 societies in Odisha consisting of 1,051 farmers • Trains farmer societies to follow a cluster approach, allowing for sharing of resources, costs and infrastructure with the same production system and involving the same species • Provides technical support and educates societies on better management practices for safe and sustainable shrimp farming • Promotes the scientific management of ponds and farms to improve aquaculture sustainability through a participatory approach • Facilitates improved service provision to small-scale aquaculture farmers • Connects farmers to markets to receive better prices for good quality products • Facilitates interaction among stakeholders by promoting better management practices to improve aquaculture productivity and profits • Establishes Aqua One Centres, which are labs near farmers for technical assistance and disease-free shrimp production	High	High
Coastal Aquaculture Authority	• Advises state governments on aquaculture-related infrastructure • Fixes standards for the seed, feed, growth supplements and chemicals used for the maintenance of waterbodies and reared organisms	High	High

Organization	Relevant information	Motivation	Capacity
	• Constitutes various technical committees, subcommittees and working groups for the preparation of technical manuals such as acts, rules and guidelines for regulation • Collects and disseminates scientific and socio-economic information related to coastal aquaculture • Makes suitable recommendations to the central government for amending the guidelines regularly		
SEAI	• Promotes the interest of companies in the seafood business • Develops the international trade of seafood items from India • Helps actors in the value chain and oversees smooth functioning • Represents MSMEs by aggregating common industry problems	High	Medium
Central Institute for Brackish-water Aquaculture	• Serves as the nodal agency for R&D into brackish water aquaculture in the country • Involved in capacity enhancement and technology transfer • Working towards a national flagship programme on the selective breeding of Indian white shrimp P. indicus, a native alternative to *L. vannamei* in a public private partnership mode • Develops a nutritious, sustainable and cost-effective fish meal to lower input costs for shrimp feed • Works on multiple new fish species to reduce the reliance of the entire shrimp industry on one species (*L. vannamei*) • Works towards increasing the yield, growth rates and survival of shrimp in India • Assesses damage to shrimp aquaculture due to natural disasters and climate change	High	Medium
NIFPHATT	• Develops value-added products from all varieties of fish • Trains actors on value-added products, post-harvest technology, and quality control • Conducts test marketing and popularization of value-added products of all fish varieties	Medium	Low

Table 17 highlights the key actors in the fruit pulp value chain, their roles, objectives and authority and maps them against their capacity and motivation to influence the value chain in meaningful ways.

▶ Table 17. Key actors in the fruit pulp value chain

Organization	Relevant information	Motivation	Capacity
APEDA	• Supports the development of fruit processing industries for export by providing financial assistance or undertaking surveys and feasibility studies, participation in enquiry capital through joint ventures and other reliefs and subsidy schemes • Registers persons as exporters of products on the payment of fees • Fixes standards and specifications for processed food products for exports • Conducts an inspection of processing plants, storage premises and other areas where products are kept or handled for ensuring the quality of products • Improves packaging of export products using appropriate and internationally accepted methods of packaging (aseptic and canning) • Improves marketing of products outside India	High	High

Organization	Relevant information	Motivation	Capacity
	• Promotes export-oriented production and development of products • Collects statistics from the owners of factories or establishments engaged in the production, processing, packaging, marketing or export of the scheduled products • Provides training in various aspects of the industries connected with scheduled products		
Department of Horticulture, Visakhapatnam	• Focuses on increasing the production and productivity of various horticultural crops coupled with value chain development and marketing linkages to help the farming community for the realization of remunerative prices • Extends technical services and guidance to farmers in the implementation of new technologies and new crops • Increases production and productivity by bringing additional area through diversification of traditional crops to market-driven horticulture crops like fruits and high-value vegetables, spices, plantation crops and flowers • Improves productivity through the adoption of the best package of practices as per case relevance, for example, usage of high yielding/hybrid quality planting material, rejuvenation of old orchards, modern farming techniques, etc.	High	High
Directorate of Horticulture, Odisha	• Increases production of suitable fruits in the state thus enhancing the economic status of farmers, promoting export-oriented agro-based industries through the provision of subsidies on the supply of quality planting materials, training, and development of market infrastructure. The National Horticulture Mission Scheme envisages financial assistance from the Government of India and the Odisha state govebment at a ratio of 85:15 basis • Strengthens the School of Horticulture under the National Horticulture Mission programme (20 lakh rupees • Provides an input subsidy of 0.01 lakh rupees • Increases the area and production of mango, citrus, banana and cashew plantation in compact patches over an area of 550 ha with the financial assistance of 55.50 lakh rupees	High	High
National Agricultural Market (eNAM)	• A pan-India electronic trading portal which networks existing APMC mandis to create a unified national market for agricultural commodities Benefits from eNAM for a seller/farmer: • Transparency in trade through better price discovery • Access to more markets and buyers • Real-time information on prices and arrival in nearby mandis • Quick payments, enabling farmers to build a healthy financial profile Benefits from e-NAM for buyers/traders: • Extended reach to other mandis, hence greater access to more sellers • Access to larger and integrated markets – access to real-time information on arrival, quality, and price of commodities • Ease of doing business through a mobile application • Access to online banking and payments	High	High
Indian Council of Agricultural Research – Central Institute of Post-Harvest Engineering and Technology (ICAR – CIPHET)	• Undertakes basic, applied, and adaptive engineering and technology research in the post-production sector of the produce of plant origin, livestock and aquaculture produce including agricultural and environmental control, quality and safety • Acts as a national institute for research, education/teaching and training in post-harvest engineering and technology • Acts as a national repository of information on processes, equipment, products and technologies in post-harvest engineering and technology	High/Medium	High

Organization	Relevant information	Motivation	Capacity
	• Transfers technology and provides advisory and consultancy services and promote entrepreneurship • Develops and strengthens linkages with the private and public sectors in the mandated areas		
Odisha Agro Industries Corporation (OAIC)	• A government company with equity participation from the central government and the state government of Odisha • Engages in executing different schemes, and programmes of different departments of the state like Agriculture, Water Resources, Forest and Environment, Rural Development, Industries, Scheduled Tribes, Scheduled Caste Development, Panchayati Raj, Fisheries and Animal Resources Development • Creates and develops irrigation sources for providing irrigation facilities to non-irrigated agricultural land in the state • Provides equipment and system to farmers for optimal utilization of available water for irrigation • Supplying and installing electric and diesel pump sets • Supplying and installing sprinkler irrigation and drip irrigation system • Sale of tractor, power tiller and power reapers, improved agri-implements, P.P. equipment, storage bins. • Hiring of bulldozers and air compressors • Manufacturing and marketing bio-fertilizers, compound feed for cattle, poultry, duck and deer • Sale of chemical fertilizer, P.P chemicals, gypsum, and other agro-inputs	High/Medium	Medium
Andhra Food Processing Society (APFPS)	• Established by the Government of AP in 2012 to act as a nodal agency for the development of the food processing sector in the state. The APFPS aims to: - Enhance and stabilize the income level of farmers - Integrate the food processing infrastructure from farm to market - Make food processing an all-season activity - Undertake capacity building and promotional activities - Provide quality check facility - Provide marketing assistance to producers - Reduce agricultural waste - Enhance the competitiveness of the food processing industry in both domestic and international markets - Make the food processing sector attractive for both domestic and foreign investors	High	Medium
Chittoor Food Processors Association	• Works closely with the following stakeholders: district administrator, Department of Horticulture, Department of Industries, Agriculture Advisory Board of Andhra Pradesh • Conducts seminars and workshops for processors and entrepreneurs • Assists in resolving problems faced by the processors such as power cuts, price fluctuations, and labour/workforce-related issues	High	Low
ICAR	• ICAR is an autonomous organization under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India • One of the largest national agricultural systems with 111 ICAR institutes and 71 agricultural universities spread across India • Apex body for coordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in India • The institute conducts studies focused on nutritive quality and nutraceutical traits of fruits and vegetables • Conducts research on post-harvest and value addition in horticulture crops • Developed modified atmosphere packaging for long storage and transportation of fruits and vegetables.	Medium	Low

4.2. Potential areas of intervention

The intervention areas discussed in this section have been identified alongside potential implementing partners to serve as a starting point for the PSEI project. It should be noted that some of these interventions may not be feasible due to variations in buy-ins from key stakeholders. There also needs to be flexibility for leading implementing partners to deliver interventions in the way they feel is most relevant to the context and in line with their core interests. Some interventions will be relatively quick to implement with more limited impact, while others may take several years to come to fruition with resulting higher impacts.

4.2.1. Prioritized interventions

Table 18 provides a prioritized list of interventions related to the key constraints in the food processing subsectors in the two states of study: access to raw materials, increasing the value addition in the processing and accessing government schemes.

▶ **Table 18. Priority interventions**

Intervention area	Intervention	Sector	State
Access to raw materials	Enhance backward linkages Build skill development functions in the production of raw materials	Both	Both
Increasing value addition at the processing stage	Enhance secondary and tertiary processing in MSMEs Enhance awareness of market segmentation and facilitate linkages in high-value markets	Both	Both
Access to government schemes	Improve accountability and speed of approvals for government schemes	Both	Both

Intervention area 1: Improving access to quality raw materials

Objective: Strengthen the quality and consistency of raw materials supplied to MSME processors

Impact: A more reliable raw material supply would help MSME processors run at higher capacity, resulting in better commercial performance at the firm level and giving them the ability to compete more effectively with both larger domestic processors and in the international market. Higher processing throughput would also increase employment opportunities, particularly for women in both sectors.

Interventions:

1. Enhance the backward linkages between farmer and processor through quality linked bonus, profit sharing or shared ownership to facilitate a partnership between MSME processors and producers via a processing forum

 ✓  ✓ *AP* ✓ *Odisha* ✓

Encourage building partnerships between specific farmers and buyers. Partnerships could be strengthened for MSMEs through a sharing of risk and reward between farmers and processors. An initial pilot project could select a small number of farmers and processors who are in relative proximity. Farmers could be incentivized to provide consistently high-quality produce in a timely manner to farmers through a bonus mechanism taken from the profit at the end of each harvest cycle if the produce can be sold in a high-quality market. By adjusting the financial remuneration to include an additional bonus

element based on quality and end markets, a partnership could be fostered. The intervention could work through the MPEDA and APEDA, who are already involved in setting minimum pricing.

An alternative method of increasing the partnership between farmers and processors is to encourage profit sharing between the two actors. This would ensure a symbiotic relationship between farmers and processors through an alignment in sharing of risk and reward. This mechanism would allow MSMEs access to elements of vertical integration which benefits larger players in the sector. The NaCSA currently has a similar project for farmers, with the potential for NaCSA to facilitate with SEAI. Online portals such as eNAM have the scope to promote transparent trade with price regulation that would result in increased partnership between processors and farmers/traders/co-operatives.

A third method to further enhance the backward linkages would be to explore the potential for shared ownership of farming facilities by MSMEs. Motivated processors could be identified through associations and farmers considering investment could be referred to clusters of processing MSMEs. The arrangement would involve co-financing in return for consistent and high-quality supply to processors. APFPS and NaCSA could be engaged to build on their current work with MSMEs in this area.

In a supply market that depends on trust and long-term relationships, forums for farmers and processors to meet face-to-face in relaxed settings provides a platform for the exchange of ideas, and concerns and the development of trust between key parties. This forum could also be a means to communicate market trends and demands which will influence how raw materials are grown. For the fruit pulp subsector, co-operatives such as FPOs, local food processor associations, such as the Chittoor Food Processors Association, and central associations, like AIFPA, can provide a platform for dialogue between the two stakeholders. For shrimp, it is suggested that SEAI can lead the intervention and MPEDA can facilitate it.

2. Build a skills development function focused on improving raw material consistency at harvest and best practice use of chemicals and antibiotics


AP ✓ *Odisha* ✓

Having identified that lack of standardization in the quality and sizing of products results in high wastage, a key factor in decreasing profits of MSMEs, a targeted education campaign with farmers to improve consistency could be developed. The same campaign could also be used to highlight the best practice use of chemicals and antibiotics and highlight the risks of misuse in profitability for farmers.

This could focus on two methods to achieve this:

- provide technical capacity to local farmer associations through a train-the-trainer approach as a value addition to association memberships like the NaCSA and SEAI for shrimp and local FPOs and the Department of Horticulture for fruit farmers.
- Enhance and promote the use of existing technological platforms such as eNAM and FAARMS to receive online technical training via their mobile phones. This would involve building video content on best practice farming from sector experts for dissemination. The results of the training could be recorded via the FAARMS application through quality and yield data collection.

Through such a targeted intervention in fruit and shrimp farming, valuable data on the influences on production may be collected to identify targeted capacity development modules through these platforms. If the intervention is successful during a pilot, online training modules could be developed and delivered via online platforms, such as FAARMS, as a fee-paying service that provides advice on broader good farming practices.

3. Investigate new varieties and evaluate the resilience of current crops to climate change


AP ✓ *Odisha* ✓

Review the varieties of fruit and species of shrimp discussed in this research and assess their resilience to a warming climate with more extreme weather. This was highlighted by fruit farmers as a current constraint to higher yields and a large future threat. The intervention should engage with national

agencies such as Central Institute for Brackish-water Aquaculture and National Innovations in Climate Resilient Agriculture (NICRA) project of the Indian Council of Agricultural Research (ICAR) as well as with state agencies such as the Department of Fisheries and Department of Horticulture to identify varieties and species of shrimp and fruits which are adaptable to a warming climate and extreme weather events. This research may yield opportunities for farmers to replace old orchards with declining productivity with species and varieties that are suitable for a rapidly changing climate. The research may also yield new opportunities to grow favoured varieties of fruit.

Intervention area 2: Increasing value addition at the processing stage

Objective: Build the knowledge and capacities of processors to increase the share of value-added products

Impact: Knowledge of processing requirements and demand for value-added products can steer risk-averse MSMEs to increase tertiary processing. Greater skills in tertiary production can help ensure that willing processors move up the value chain.

Interventions

1. Enhance the capacity of secondary and tertiary processing methods for MSME processors

 ✓  ✓ *AP* ✓ *Odisha* ✓

Increasing demand for RTE and RTC products highlights a substantial market opportunity for shrimp. Currently, shrimp processors lack the skills to develop high-quality RTE and RTC products. To address this, tertiary processing sector experts could be engaged by processor and exporter associations to conduct a series of seminars on RTE and RTC processing. These seminars should include an overview of the cost benefits of investing in RTE and RTC equipment, advice on sourcing equipment, the skills required and an overview of the potential markets for RTE and RTC products, as well as highlighting the competition. The SEAI, AIFPA and FICSI could arrange training for members as part of their membership services or offer it at a small cost. This should first be piloted in more advanced sections of the shrimp and processed mango value chain before being rolled out in other less advanced contexts.

2. Enhance awareness and capacity of processors to understand and develop new products for different palates and facilitate linkages between importers from high-value markets and processors considering developing tertiary production.

 ✓  ✓ *AP* ✓ *Odisha* ✓

The lack of market segmentation and the understanding of different palates across geographies limits the shift of processors up the value chain in the shrimp subsector. Market research could be conducted into the differing palates of high-value global shrimp markets based on consumption. In the initial phases of a pilot, the research into the taste and texture of different markets could be conducted by the National Institute of Fisheries Post Harvest Technology and Training (NIFPHATT). This market research could be communicated to processors interested in expanding to tertiary production through industry associations with existing channels to processors such as SEAI. NIFPHATT could also support processors in developing new spice blends, initially for breaded and battered shrimp for specific markets to be sold in trial batches. This could build on the recent NIFPHATT work developing a new recipe for shrimp – IQF butterfly shrimp coated in garlic-flavoured coconut crumbs.

In the fruit pulp value chain, there is very little understanding of the consumption patterns of other kinds of fruit pulp outside mango pulp. Market intelligence reports by APEDA Agriexchange are available online and are updated on a weekly basis. These can assist fruit pulp processors to understand market trends and the consumption patterns of fruit-based products across different countries. APEDA could be approached to understand the different market segments of fruit pulp.

Success in linking tertiary processors to target markets, such as Japan and South Korea, with Indian shrimp processors has been demonstrated with Vietnamese joint ventures. These ventures have allowed the onshoring of tertiary product development for the Vietnamese market in India. The intervention could be implemented through associations such as the SEAI, AIFPA and ILO to identify a small group of shrimp and fruit pulp MSME processors who are interested in expanding the marketing of their tertiary products (for shrimp: breaded and battered shrimp, RTE and RTC products; for fruit pulp: fruit juice, beverages, squashes, jams, jellies and other RTE products).

The intervention could work with MPEDA, APEDA and Invest India to identify international buyers in South Korea and Japan who conduct tertiary processing of Indian shrimp and fruit-based beverages in their countries. Invest India could package an opportunity to work with Indian processors to produce the quality and taste required by these markets in India at a lower cost. Forward linkages could then be fostered between Indian exporters and target market importers and processors on this basis.

Intervention area 3: Strengthening access to domestic and international markets

Objective: Improve perceptions and systems which limit access to high-value markets

Impact: Systemic changes in the current functioning of the shrimp value chain will result in faster processing speeds, whereas improving the perception and brand recognition of MSMEs in the fruit pulp value chain will make them competitive in the domestic and international markets.

Interventions

1. Explore the means to speed up sample testing for high-value markets, such as South Korea, and increase the number of testing facilities with accreditation to these markets


AP ✓ *Odisha* ✓

Slow sample testing speeds increases the overall time required to fulfil a shipment. This leads to higher working capital requirements and poses financial risks. To respond to this risk and the length of time that capital must be tied up in inventory while samples are processed, it is suggested there is engagement to increase the number of accredited testing facilities near export hubs and maintain stringent inspection to adhere to the export country's standards by NaCSA and CAA .

2. Strengthen the brand recognition of processed food in India


AP ✓ *Odisha* ✓

This intervention is intended to strengthen the perception of fruit pulp products from AP and Odisha in the domestic market and to neutralize any negative associations with quality and food safety. Engagement with Invest India to develop a communication campaign to emphasize the quality of processed foods in the country and reduce the current negative perceptions associated with MSME food products could be conducted. The recognition of better quality prodocts and food safety in the domestic market will further aid in international brand recognition in high-value markets.

Intervention area 4: Improving access to affordable finance

Objective: To increase access to finance and improve the efficiency of processing loans

Impact: MSMEs will regain trust in the financial system, and Indian businesses may see a rise in more entrepreneurial ventures leading to a dynamic and competitive environment.

Interventions

1. Facilitate access to working capital products for MSMEs

  *AP* ✓ *Odisha* ✓

This will need to entail a feasibility assessment by local banks in building products such as invoice financing and debt facilities to smooth MSME cash flows. Local banks in regions of the high processing activity, such as the Small Industries Development Bank of India (SIDBI) and state financial co-operations such as Andhra Pradesh State Financial Corporation (APSFC) and Odisha State Financial Corporation (OSFC), could be approached to understand the feasibility of developing new working capital products. The first business case for the banks will need to be built to demonstrate the financial opportunities for these products and to outline the risks. The intervention could work with industry associations to identify MSMEs with cash flow challenges to pilot new working capital products and the systems to manage them. The project could work with banks to build up accessible and relevant systems via mobile applications to manage the working capital debt and repayments. Once the management systems have been built, the products could be rolled out to other MSMEs.

2. Support local banks to enhance the speed of processing of MSME loans and work with MSMEs to ensure high-quality applications

  *AP* ✓ *Odisha* ✓

Both the quality of loan applications and the processing time taken by banks were identified as areas of binding constraint in accessing finance. Increasing the efficiency of the system will decrease the time taken to receive loans and supporting applicants to submit high quality applications will result in faster decisions and higher success rates. PSEI could work with industry associations, such as the SEAI and AIFPA, or a bank that has a large number of application rejections to first understand rejections and the process of application review. The project could also work with APICOL who helps in generating detailed project reports (DPR) for guaranteed loans. The project could then conduct seminars through industry associations to communicate common areas in which applications are below the threshold standard. An industry association could provide a review service for a small fee for applications before they are submitted to the banks. The project could also work with a technology provider to provide an e-portal on the state of application review so that processors are updated on progress.

Intervention area 5: Building a supportive private-public dialogue

Objective: Increase dialogue between the state and central government and the processors to enable a constructive and healthy environment

Impact: Processors will gain faith in the local government, and MSMEs will be able to utilize relevant schemes

Interventions

1. Improve accountability and streamline approvals of government-mandated schemes for MSMEs in the food processing sector and those directly relevant to food processors in AP and Odisha

  *AP* ✓ *Odisha* ✓

This could be facilitated at both the central level, through MoFPI, and at the state level through industry associations such as the Andhra Pradesh Chamber of Commerce and Industry Federation and banks themselves. First, a review of the bottlenecks and underlying causes for non-approval and lengthy approval times should be conducted. This information should be presented to the administrators of government schemes and the project could work with government bodies implementing the government schemes at the state and central levels to speed up processing times.

2. Strengthen processor advocacy between the private sector and state governments

 ✓  ✓ *AP* ✓ *Odisha* ✓

Processors felt that government agencies were not supportive of the sector and that new policies would have a limited impact on the sector. In some instances, trust in the government by the industry was lacking.

Challenges around overlapping regulation and limited engagement in growing the sector were also highlighted. To strengthen enterprises' voice with the state government, it is suggested that associations for the two sectors could undergo advocacy training. This intervention would strengthen the dialogue between public and private players. In Odisha, the voice of the pulp industry is underrepresented due to the small scale. This intervention could contribute to raising this voice in policymaking in the processing sector. Industry associations like AIFPA could work with the Regional Directorate of Horticulture and SEAI could interact with the Department of Fisheries.

In addition, the development of a tripartite dialogue forum and private sector engagement strategy from the central and state governments would be useful for achieving greater centre-state coordination and coordination between departments concerning engagement with the private sector.

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Appendix

Appendix A. Interviewees

Name of Organization	Sector
Government agencies	
Andhra Pradesh Food Processing Society (APFPS)	Both sectors
AP Chamber of Commerce and Industry Federation	Both sectors
Directorate of Fisheries, Odisha	Fisheries
Directorate of Horticulture (Khurda, Odisha)	Fruit pulp
Research institutes	
National Institute of Fisheries Post Harvest Technology and Training (NIFPHATT)	Fisheries
Financial agencies	
UBI SME Lending, Vizag District Branch	Both sectors
Export Credit Guarantee Corporation of India (ECGC, Vizag)	Both sectors
Agricultural Promotion and Investment Corporation of Odisha Limited (APICOL)	Both sectors
Collective associations	
Chittoor Fruit Processors Association	Fruit pulp
Seafood Exporter Association of India	Fisheries
West Godavari Mega Food Park	Fisheries
Farmer Producer Organization FPO (Ananthapuram, AP)	Fruit pulp
Aabahana Fruit Processing Cluster, (Bhubaneswar, Odisha)	Fruit pulp
Processors, Exporters	
Lito Marine Pvt. Ltd.	Fisheries
Jagdish Marine	Fisheries
Vasista Marine	Fisheries
Ananda Group	Fisheries
Kura Exports	Fisheries
Teekay Marine	Fisheries
Micro Aqua Lab	Fisheries
Nursery owner	Fisheries
Shrimp farmers	Fisheries
Flamingo	Fisheries
Suvera Foods	Fruit pulp
Sree Sanniddhi Foods	Fruit pulp
Global Farm Fresh	Fruit pulp
Sashi Agro Foods	Fruit pulp
SAS Agro Foods	Fruit pulp
Agri-link Foods Pvt. Ltd.	Fruit pulp
Prime Agro Food Processing	Fruit pulp
Hayath Foods	Fruit pulp
Dabur	Fruit pulp

Appendix B. List of importing markets for crustaceans from India

Country	Global imported quantity (tons) 2021	Growth in imports in 2017–21 (%)	Indian supply to import (%)	Effectively applied tariffs8 on Indian shrimp (%)
United States of America	692 443	23	43	0.00
China	534 542	6	23	2.83
Japan	146 827	-13	28	0.00
France	112 642	10	9	4.81
Italy	78 182	34	10	4.81
Russian Federation	61 977	105	23	3.67
Korea, Republic of	61 428	15	3	10.00
Netherlands	57 551	49	28	4.81
Viet Nam	51 766	-23	79	10.29
Chile	48 656	108	0	5.87
United Kingdom	46 148	2	33	4.81
Taipei, Chinese	42 111	24	1	20.00
Canada	41 177	3	37	0.00
Belgium	37 745	-23	324	4.81
Germany	35 020	-5	11	4.81
United Arab Emirates	30 153	-13	67	0.00
Hong Kong, China	28 947	-17	8	0.00
Portugal	28 662	8	15	4.81
Thailand	25 752	81	5	11.43
Malaysia	20 183	35	11	0.00
Australia	17 259	13	0	0.00
Egypt	15 130	102	0	20.00
Guatemala	13 582	104	10	12.50
Singapore	13 365	28	16	0.00
Greece	12 100	72	153	4.81
Colombia	11 051	62	0	16.00

Source: International Trade Centre Statistics (2022)

8 Effectively applied tariff is the lowest duty that a country might apply to a specific imported product from a specific origin country

Appendix C. Regulation to Export Shrimp to the EU

Regulation (EC) No 470/2009 lays down the procedure for setting maximum residue levels (MRLs) for residues of pharmacologically active substances in food of animal origin, such as antibiotics. See the complete list of substances and their MRLs in the Annex to Regulation (EU) No 37/2010.

Regulation (EC) No 396/2005 establishes European Union MRLs for pesticides. They are laid down in various regulations and a publicly available database is maintained by the European Union.

Regulation (EC) No 1881/2006 lays down MRLs for certain environmental contaminants such as heavy metals, including mercury.

Some other substances classified as "feed additives" in the European Union (coccidiostats and histomonostats) may also leave residues in food derived from animals reared on feed containing them. See the European Union Register of Feed Additives.

Contact details

ILO DWT for South Asia and Country Office for India
Core 4B, 3rd Floor, India Habitat Centre
Lodhi Road, New Delhi – 110003, India

T: +91 11 4750 9200
E: delhi@ilo.org