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Abstract

India is one of the world's largest producers of many agricultural commodities, yet it captures only a small share of global processed-food exports. This paper asks whether export-oriented food processing can provide a missing link between agricultural abundance, structural transformation, and better rural employment. Combining cross-country evidence on trade and productivity with Indian factory data, commodity-level comparisons, and case studies, it shows that processed food is a global market comparable in scale to apparel and has historically supported early industrialization. India nevertheless underperforms sharply: it holds about 14 percent of global arable land but less than 2 percent of processed-food exports, implying an annual export gap of roughly $50–110 billion. This underperformance reflects weak productivity growth in both cultivation and processing, unusually small formal plants, high energy costs, fragmented farm supply, inadequate quality-control systems, and unstable trade policy. Yet India's success in shrimp, frozen French fries, and table grapes shows that firms and producer organizations can build competitive clusters by coordinating technology, inputs, standards, and procurement. The paper argues for policies that target the entire farm-to-export chain—linking processors, production bases, finance, infrastructure, affordable power, traceability, and stable market access—while ensuring that farmers share in the gains.

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* 555 Pennsylvania Ave NW, Office 558Z, Washington, D.C. 20001, USA. Email: shoumitroc@jhu.com. I have benefited greatly from many years of conversations with Devesh Kapur, Mekhala Krishnamurthy, and Arvind Subramanian. Their generosity with their time and insights has shaped my thinking in ways that extend well beyond this paper. I am also grateful to Sayantan Bera, Harish Damodaran, Avinash Kishore, and Devesh Roy for helpful conversations on the issues examined here. All errors are my own.

1. Introduction

India has some of the world's most fertile land, high agro-biodiversity, and large production volumes across many commodities. However, its agricultural strength has not translated into a comparable position in global processed-food exports. Figure 1 documents this paradox. India is the world's largest producer of dry beans and the second-largest producer of wheat, tomatoes, green peas. Yet its share of global processed-food exports using these as inputs is small. For example, India produces about 14 percent of the world's wheat, but has only about 2.5 percent of the global export market for products such as flour, pasta, and couscous. It produces 27.4 percent of the world's dry beans, but has only about 0.5 percent of the export market for frozen and canned beans.

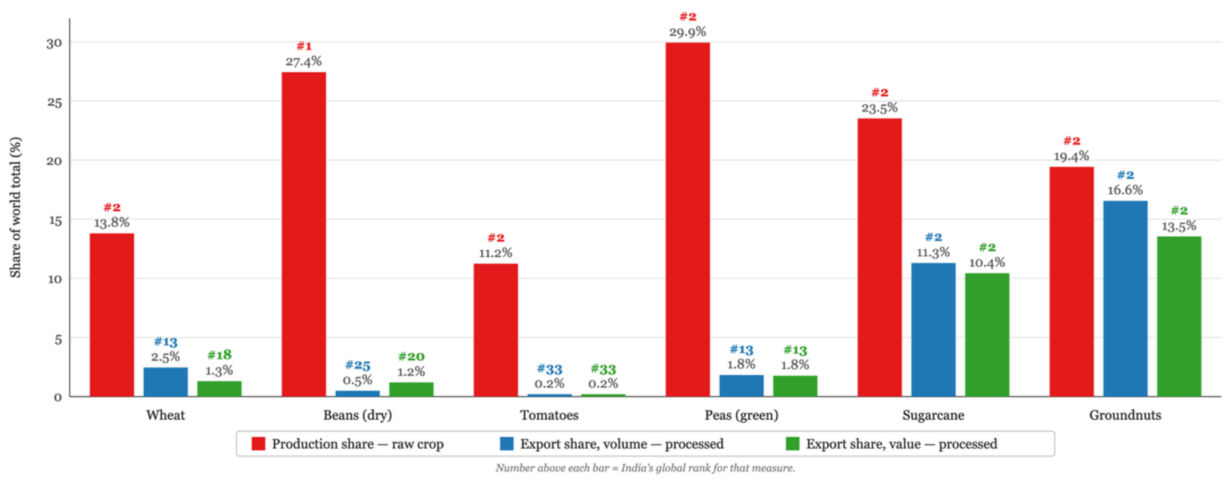


Figure 1: Production of Commodities vs Exports of Processed Products

This gap matters because India's central development problem remains the shortage of well-paying non-farm jobs. India has long underperformed in manufacturing, and its economy has not created enough good jobs for workers leaving or supplementing agriculture. The limits of agricultural incomes are visible in the NSSO Situation Assessment Survey of Agricultural Households for 2018–19. There were 5.8 crore households owning less than two acres (~0.8 hectares) of land. On average, these households earned about Rs 80,000 per year from all farm and non-farm sources combined. With roughly two working adults per household, this amounted to about Rs 40,000 per working adult per year. Only around 30-40 percent of this income came from farming, making it not only low but also risky and lumpy over the year.

The job crisis is especially acute in some of India's poorest states. About half of these 5.8 crore smallholder households are located in Uttar Pradesh, Bihar, Jharkhand, and West Bengal. Their average annual household income was even lower, at about Rs 36,000 per working adult. Women in these households were often not wage earners, and households that depended primarily on agricultural labour earned in a similar range once all sources of income are combined. These are also some of the most fertile regions of the country. The puzzle is therefore not the absence of agricultural potential, but the inability to convert that potential into higher and more stable incomes.

The difficult implication is that farming alone cannot raise these households to dignified income levels. Even if farm income were to double, annual earnings for a working adult in the poorest smallholder households would still remain very low. This is the problem of scale. Farmers in the United States or Europe do not earn high incomes only because prices or yields are high; they also cultivate much larger areas of land (Lagakos, Gollin, and Waugh 2014). For Indian smallholders, especially those cultivating less than two acres, the route to higher income must therefore involve non-farm work, higher-value agricultural linkages, or both.

In this paper, I argue that export-oriented food processing should be considered as a serious pathway for jobs and growth, especially in the Gangetic belt. The usual development discussion focuses on low-skill manufacturing sectors such as garments, or on low-skill services in urban or peri-urban clusters. These pathways remain important. But food processing has they key advantage of being able to connect non-farm employment with India's agricultural base.

Food processing can affect rural incomes through four channels. First, it creates factory jobs. In 2018–19, the average worker in a formal Indian food-processing factory earned about Rs 1,40,000 per year, roughly four times the average annual income per working adult in smallholder agricultural households in Uttar Pradesh, Bihar, Jharkhand, and West Bengal. Second, processing creates jobs in related activities such as logistics, warehousing, testing, packaging, and cold-chain services. Third, it can raise farm incomes through stronger backward linkages. Tomato farmers in Nashik are estimated to earn about Rs 75,000 per hectare (Gaikwad et al 2020). Potato farmers supplying French-fry processors in Gujarat earn between Rs 2.5 lakh and Rs 3 lakh per hectare (Bera 2025, Damodaran 2025, and Patel et al. 2025). Shrimp farmers producing export-quality shrimp can earn up to Rs 8 lakh per hectare (Narkis et al. 2021). While these incomes are volatile because farmers face yield risk and global price risk, but they indicate the gains that are possible when agriculture is connected to higher-value processing. Fourth, because many processing activities can take place close to production regions, the sector can create rural non-farm jobs and reduce pressure on very small landholdings. Over time, this can also support land consolidation and higher incomes for those who remain in cultivation.

The argument is not that India lacks food processing. Flour mills, rice mills, sugar mills, edible-oil units, and many other facilities are all part of the processing economy. But a large share of this activity remains informal, small-scale, low-productivity, and unable to generate the kind of formal jobs India needs. India is also a significant exporter of some agricultural and processed products, including rice, sugar, and groundnuts. Even there, it often performs below potential. Consider sugar. India is the second-largest producer of sugarcane and one of the largest exporters of processed sugar. But Brazil converts cane into sugar more efficiently, which helps explain why its export market share is larger relative to its production share. USDA estimates suggest that Brazil's factories have a conversion efficiency of about 14 percent, compared with about 8–9 percent for Indian factories.

The same pattern appears in groundnuts. More than 90 percent of processed-groundnut exports from China and the United States are concentrated in higher-value products such as peanut butter and roasted nuts. India, by contrast, exports mainly crude groundnut oil. As a result, India's export market share in high-value processed-groundnut products is only about 8 percent, compared with 16.6 percent across all processed-groundnut products.

The scope of the opportunity depends on exports. High-value food processing can grow on domestic demand, but domestic demand alone is unlikely to be enough for large-scale job creation. As Chatterjee and Subramanian (2023) argue, India's effective domestic market is much smaller than aggregate GDP suggests because most households have limited purchasing power and richer households spend a smaller share of income on food. Indeed, rising urban incomes have created demand for niche processed products such as khapli atta, gourmet cheeses, chocolates, and foxnuts. But these markets remain too small to drive the sector at the scale India needs. For food processing to become a major source of growth and employment, it must become export-oriented and processing itself has to be done within formal manufacturing.

The paper examines this opportunity and the constraints to realizing it. The remainder of the paper is organized as follows. Section 2 discusses the features of food processing that make it attractive from a development perspective. Section 3 lays out various analytical definitions used in the paper. Section 4 documents global trade patterns in food. Section 5 examines the state of food processing in India. Section 6 discusses policy implications, especially in comparison to China. Section 7 concludes.

2. Why food processing matters

Discussions of low-skill manufacturing-led development usually begin with garments and textiles. This is understandable. Apparel has historically absorbed large numbers of workers, required limited skills, and helped countries move from agriculture into export-oriented manufacturing. Bangladesh is the canonical recent example. But this focus can make the development role of food processing appear smaller than it has been. For many countries, especially those with a large agricultural base, food processing has also been an important part of early industrialization.

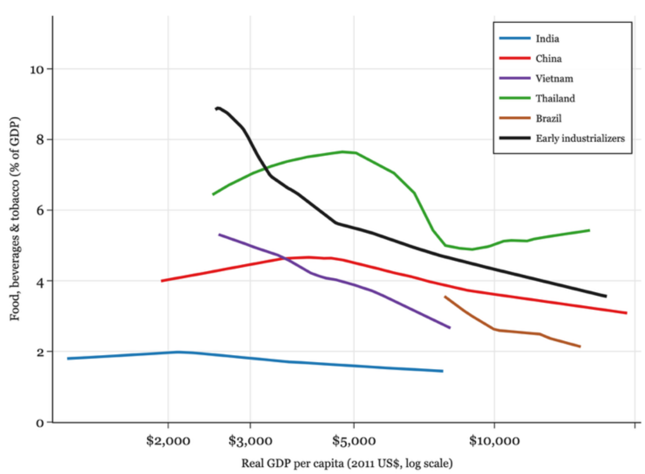


Figure 2a

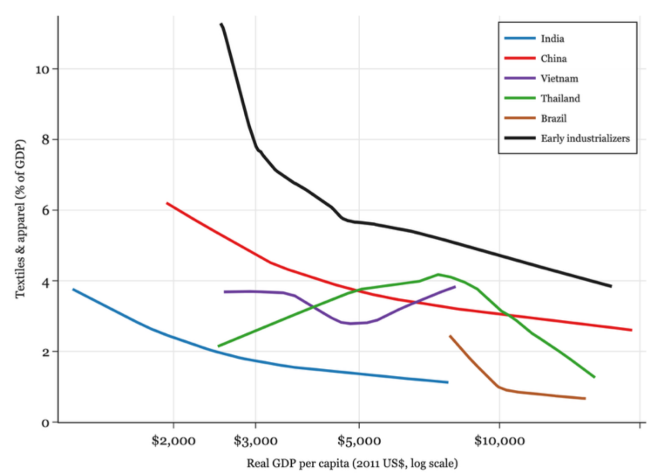


Figure 2b

Figure 2 shows this clearly. Panel A plots the share of food and beverages in GDP against real GDP per capita, measured in PPP international dollars. Panel B does the same for apparel and textiles. The figure shows that at early stages of development, food and beverages often mattered as much as apparel and textiles. When countries were in the \$2,000–\$3,000 per capita range, food processing typically accounted for 4–7 percent of

GDP. This pattern is visible not only among early industrializers such as the United States, France, Spain, and Italy, but also in more recent growth experiences such as China, Brazil, and Vietnam.

India stands out in this comparison. Despite its large and diverse agricultural base, food processing has accounted for only about 2 percent of GDP since the 1960s. This is very low, both relative to India's own agricultural potential and relative to the experience of other countries at similar stages of development.

A second reason to take food processing seriously is labor-productivity convergence. Rodrik (2013) argued that manufacturing can serve as a development escalator because productivity in manufacturing tends to grow faster in poorer countries than in richer ones. Countries that start with low levels of productivity can therefore catch up to the frontier while creating jobs. This logic depends on the rate of convergence: whether countries with low initial levels of productivity can grow faster relative to countries with higher levels of productivity.

I update the data and estimate convergence rates across manufacturing subsectors between 2005 and 2020. Figure 3 reports the rate of convergence in labor productivity, with 95 percent confidence intervals. Food and beverages is among the low-skill, labor-intensive sectors with one of the highest convergence rates. This suggests that the sector is not only relevant because of domestic demand or agricultural linkages. It also has the potential to support productivity growth and catch-up.

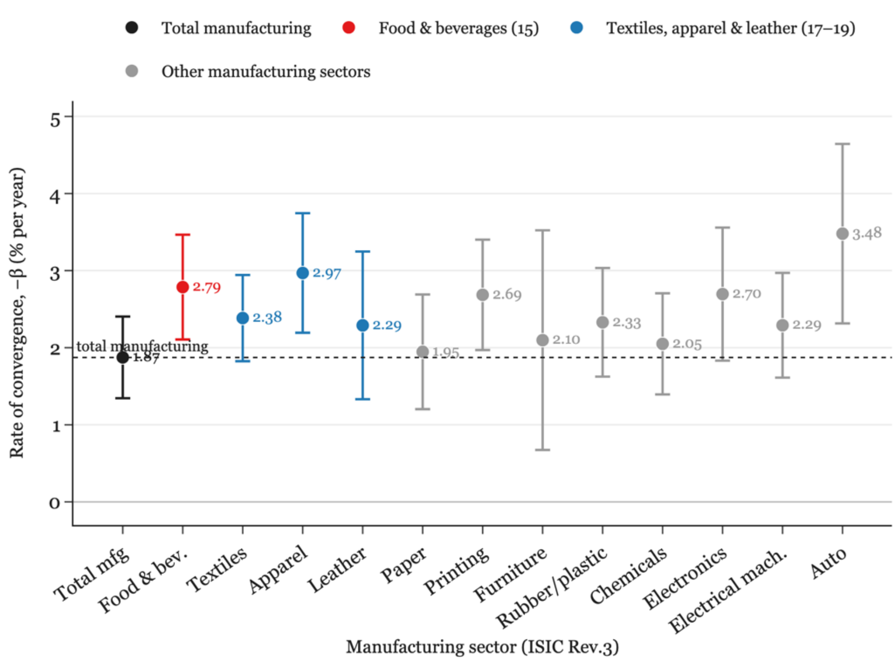
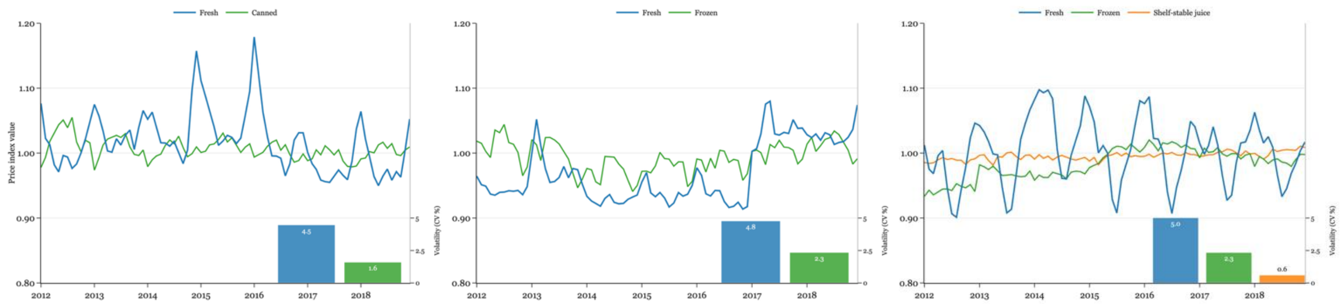


Figure 3: Cross-Country Convergence in Labor Productivity

A third feature of food processing is its role in managing climate and price volatility. On one hand climate variability make agriculture risky, but on the other creates opportunities for processed food. Fruits and vegetables are highly exposed to weather shocks, and yield volatility quickly translates into price volatility. Even in the United States, where logistics, cold storage, and supply chains are relatively advanced, fresh produce prices fluctuate substantially, as Figure 4 shows. One reason is that many fresh commodities cannot be stored for long in raw form. Tomatoes, for example, have a short shelf life; canned tomatoes and tomato paste can be stored and transported over much longer periods.



(a) Tomatoes (b) Green Vegetables (c) Fruits

Figure 4: Daily Price Volatility of Raw vs Processed Produce in the US, 2012-2018

Processing therefore changes the economics of perishability. It extends shelf life, reduces waste in periods of abundant supply, and helps smooth consumption across seasons and regions. Figure 4 shows that processed fruits and vegetables exhibit much lower price volatility than their raw counterparts. Food processing is not a solution to climate change, but it is an important adaptation margin. This is especially relevant for India, where weak logistics and limited cold storage make price volatility even more severe, as Figure 5 shows.

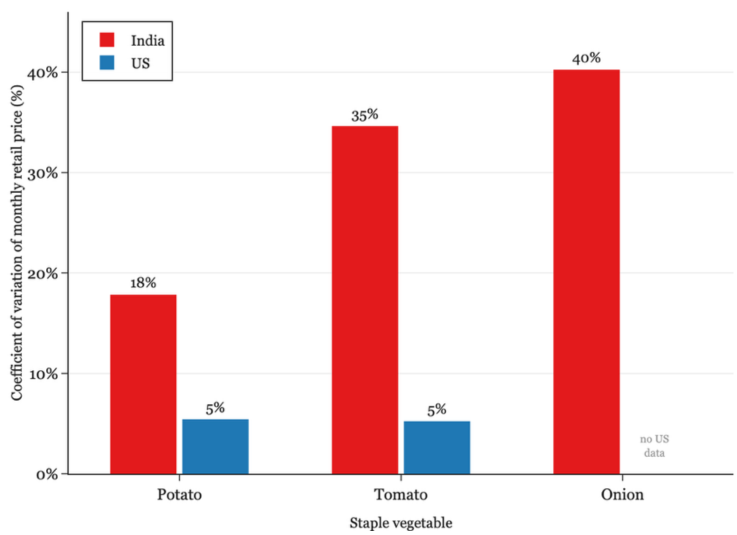


Figure 5: Price Volatility in Monthly Retail Prices India vs USA: 2015-2018

A fourth feature is employment. Figure 6 reports the wage bill as a share of value added across industries in India in the formal sector. Food processing is more capital-intensive than apparel, and this should be acknowledged. It usually requires more machinery than garment production and this is true across countries. But lower labor intensity than apparel does not mean the sector cannot create jobs.

The relevant question is whether food processing can generate formal, low-skill manufacturing employment at scale. Figure 6 suggests that food processing sits between apparel and electronics in labor intensity. This is an important comparison. Electronics is less labor-intensive than garments, yet large electronics plants in India, such as Foxconn's Tamil Nadu facility, show that sectors outside apparel can still generate significant factory employment.

Food processing also offers reasonably good wages, definitely better than the risky, lumpy, and low incomes from agriculture (figure 1). Figure 7 shows that formal jobs in the sector can pay up to ₹1.4 lakh per year, broadly comparable to wages in formal garment factories. The net pay would be slightly larger once we add social security and other benefits. Some subsectors, including sugar, infant foods, dairy, and animal feed, pay even more. The sector therefore combines several features that matter for development: a historical role in early industrialization, evidence of productivity convergence, resilience to agricultural and climate shocks, and the ability to create formal low-skill jobs.

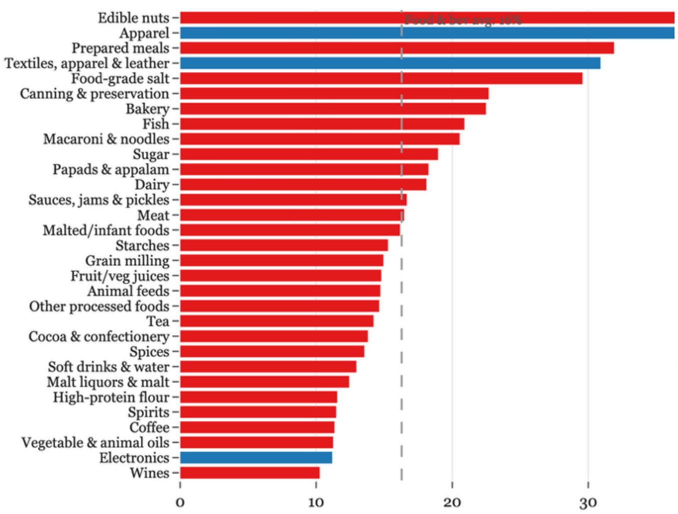


Figure 6: Wage bill as a share of Value Added (%) 2015-16 to 2019-20

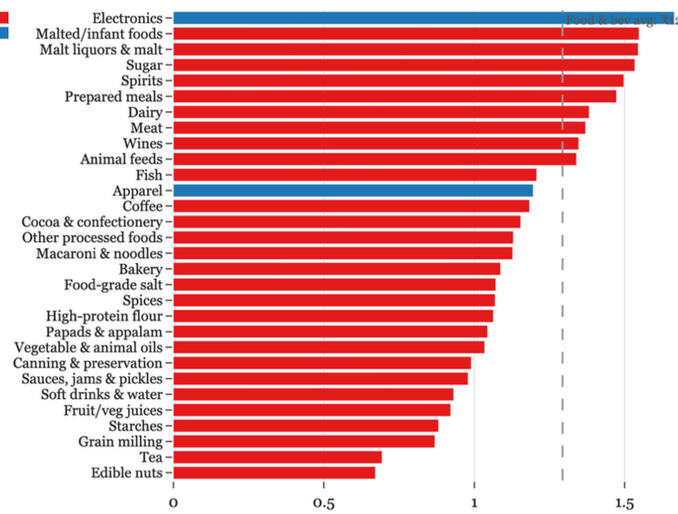


Figure 7: Annual Average Wage (Rs. Lakhs) 2015-16 to 2019-20

3. Data and Definitions

I broadly follow the UN Trade and Development classification of agricultural products into raw, minimally processed, and processed products, with a few exceptions. Minimally processed products include items such as shelled lentils, frozen uncooked vegetables, and vegetable oils that have undergone limited processing but are not yet fit for human consumption. More substantially transformed products—including canned beans, tomato paste, frozen French fries, and fruit juices—are classified as processed foods.

I exclude tea and coffee throughout because a substantial share of their value added arises from blending, branding, packaging, and marketing rather than from processing alone. Depending on the purpose of the analysis, I either treat meat, poultry, eggs, and seafood as separate categories or include them among processed products.

When estimating potential processed-food exports, I use the broadest definition of processed food, including meat, dairy products, and related items, while excluding only tea and coffee. In examining export composition, however, I do not count minimally processed products as processed foods. Most such activities occur at the lower end of the value chain and often produce intermediate goods that are not yet ready for final consumption. The main qualitative conclusions are not sensitive to this definitional choice, and the relevant classification will be stated clearly in the text.

In this paper, I am concerned with export-oriented food processing and therefore restrict my attention to formal food processing plants from the Annual Survey of Industries since they are the ones that can achieve the scale necessary for exports.

Data. For the analysis in this paper, I draw on a wide range of trade, agricultural, industrial, macroeconomic, price, and household-survey data. The trade patterns are built from the CEPII BACI database, which reconciles UN Comtrade mirror flows into exporter-by-importer trade at the six-digit Harmonized System level — using the HS-1992 vintage for the long run (1995–2024) and the HS-2017 and HS-2022 vintages for recent product detail — complemented by the OECD Trade in Value Added (TiVA) database for the domestic and foreign value-added content of gross exports. As stated above, to separate raw commodities from processed food, HS six-digit codes are mapped to processing stages and food categories using UNCTAD's Classification of Food Products. Physical output, land, and jobs come from the FAO's FAOSTAT collection — the Crops and Livestock Production, Land Use, and Agrifood-Systems Employment datasets — and, for seafood, the FAO's Global Fishery and Aquaculture Production and fisheries-commodities trade databases (FishStat).

For development context and the sectoral comparisons, I use real GDP per capita from the Maddison Project Database 2023; sectoral value-added shares from the World Bank's World Development Indicators; long-run historical national accounts from the Groningen Growth and Development Centre (its GGDC Historical National Accounts, Economic Transformation, and 10-Sector databases), supplemented for France by Dormois (2006) and for Italy by Banca d'Italia historical series; population from the UN World Population Prospects (2024 revision); and the World Bank's official income classification.

The labor productivity convergence analysis draws on UNIDO's INDSTAT database for cross-country manufacturing value added, employment, and productivity. I supplement it with the India KLEMS, EU KLEMS, and the China KLEMS productivity databases. Retail-price volatility uses the USDA Economic Research Service's Food-at-Home Monthly Area Prices and the Indian Ministry of Consumer Affairs' daily retail prices of essential commodities. The India-focused sections rely on unit-level micro-data from MoSPI — the NSS 77th-round Situation Assessment Survey of Agricultural Households, the Periodic Labour Force Survey (PLFS) for 2018-19, and the Annual Survey of Industries (ASI) from 2015-16 to 2019-20. District-level crop Area–Production–Yield and Agriculture Census data from the Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare. Illustrative farm-level benchmarks and the country case studies additionally draw on published farm-economics studies and evidence from the World Bank, USDA Foreign Agricultural Service, FAO, ILO, and ICCO.

4. Global Market Size and Patterns of Trade

The global export market for processed food is comparable in size to apparel. Table 1 reports the details. Excluding tea and coffee, and excluding likely re-exports from hubs such as Dubai, Rotterdam, Singapore, and Hong Kong, global processed-food exports averaged about $1.2 trillion per year between 2021 and 2024. If the sample is restricted to plant-based products and excludes high-value commodities such as tea, coffee, cocoa and spices, the market was still about $700 billion per year. By comparison, global apparel exports averaged $489 billion per year over the same period, while the combined market for textiles, apparel, and footwear was about $1 trillion. Processed food is therefore not a niche opportunity. It is a market of the same order of magnitude as the sectors that usually dominate discussions of low-skill export-led industrialization.

Table 1: Global Export Market Share (%), 2021-2024 average.

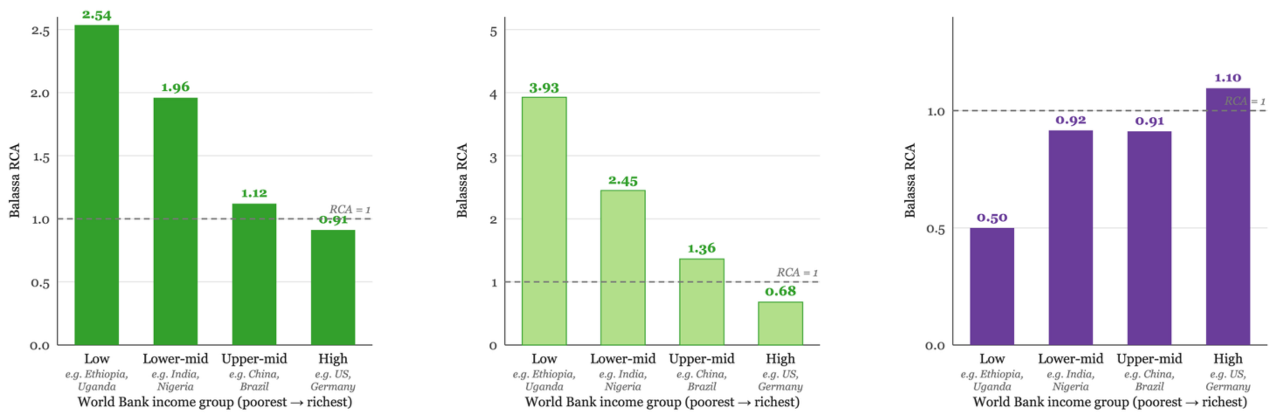
	Global Exports $Bn/yr	India	China	EU	US	Low and Low-middle Income	Upper Middle Income	High-Income
Raw Produce	406	4.0	3.1	19.6	15.9	9.4	39.1	51.4
Processed (ex. Tea and Coffee only)	1229	2.3	4.1	34.8	7.1	7.7	31.7	60.3
Processed, plant based (ex. Animal, tea, coffee, cocoa, spices)	714	1.8	4.1	34.6	6.6	7.0	36.8	55.9
Processed, plant based (ex. Animal, tea, coffee, cocoa, spices, minimal processed)	523	1.9	4.0	40.8	6.2	4.7	33.2	61.7
Arable Land Share (%)		11.1	7.9	7.0	11.0	34.9	31.6	33.5
Apparel, Textile, Leather, Footwear	1019	4.3	31.8	22.4	2.5	17.6	51.1	30.4
Apparel	489	3.7	28.6	22.5	0.9	25.0	48.4	26.4

4.1 Rich country dominance

Table 1 shows that countries at different income levels have similar shares of the world's arable land, but very different positions in food trade. Low- and lower-middle-income countries, upper-middle-income countries, and high-income countries each account for roughly 30–35 percent of global arable land. Yet upper-middle-income and high-income countries dominate exports of both raw and processed food. High-income countries alone account for 55–60 percent of the processed-food export market. Part of this reflects lower agricultural productivity in poorer countries and part of it reflects the underdevelopment of their food-processing sectors. As I discuss in Section 5, these two constraints may be closely related.

I start with the composition of exports. The analysis focuses on plant-based food products, excluding meat, seafood, dairy, spices, tea, coffee, and cocoa. I measure specialization using revealed comparative advantage, or RCA, following Balassa (1965). RCA is the share of a product group in a country's export basket divided by that product group's share in world exports. An RCA above one means that the product group is more important in a country's exports than it is in world trade on average. RCA therefore captures specialization, not scale. A small country can have a high RCA in a product while still accounting for only a small share of global exports.

Figure 8 shows average RCA for raw food, minimally processed food, and processed food between 2017 and 2024, by country income group. The pattern is expected but important. Poorer agricultural countries have a revealed comparative advantage in raw produce, such as vegetables or rice, and in minimally processed goods, such as dried and shelled chickpeas, beans, lentils, nuts, and crude vegetable oils not fit for human consumption. High-income countries, by contrast, have a revealed comparative advantage in more processed products, including preserved fruits and vegetables, tomato paste, canned beans, jams, jellies, and fruit juices.



(a) Raw Produce (b) Minimally Processed (c) Processed Products

Figure 8: Revealed Comparitive Advantage 2017-2024

Notes: All panels exclude Meat, Dairy, Tea, Coffee, Cocoa, and Spices

This pattern is not only visible relative to a country's full non-oil merchandise export basket. It also appears within food exports themselves. Figure 9a plots the processed-food share of total plant-based food exports by country income group. Processed food accounts for only 13 percent of plant-based food exports among low-income countries. The share rises to 28 percent for lower-middle-income countries, 41 percent for upper-middle-income countries, and 55 percent for high-income countries. As countries become richer, their food-export baskets become more processed.

While Figures 8 and 9a describe the composition of exports, Figure 9b shows country-level market shares. It plots each country's share of global processed-food exports against its share of global raw-produce exports. Countries above the 45-degree line have a larger share of the processed-food export market than of the raw-produce export market. Most countries above this line are upper-middle-income or high-income countries. Some, such as Indonesia, may owe this position to particular products such as palm oil. Many European countries, by contrast, export a more diversified set of processed foods. India sits well below the 45-degree line. It has more than 3.5 percent of the global raw-produce export market, but only 1.6 percent of the global processed-food export market. If meat, poultry, eggs, and dairy are included, the gap becomes larger because these segments are even more concentrated among high-income countries.

In both panels of Figure 9, I classify "minimally processed" items together with raw produce. Reclassifying them as processed products does not materially alter the position of any large country in Figure 9b, either qualitatively or quantitatively, because minimally processed products account for only a small share of the global market. For example, India's share of processed exports rises only from 1.6 percent to 1.7 percent and China's from 4.0 percent to 4.2 percent.

The reclassification has a larger effect on Figure 9a. It raises the processed-product share to approximately 50 percent for the lower-income country groups and 66 percent for the higher-income groups. This reflects the importance of lower-value, semi-finished agricultural products in the exports of many African countries.

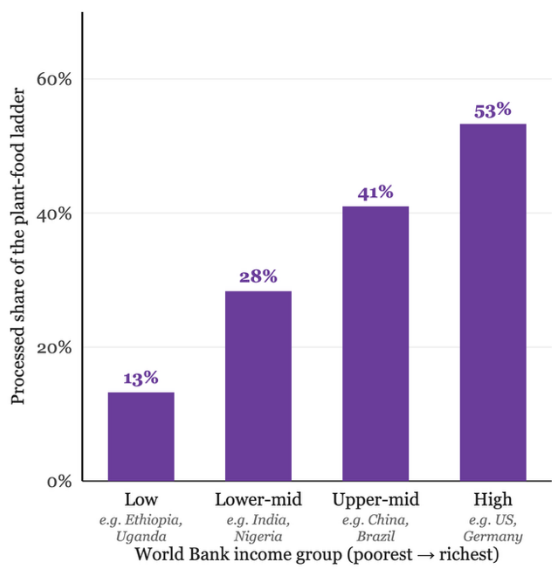


Figure 9a: Processed-food Intensity, 2017-24

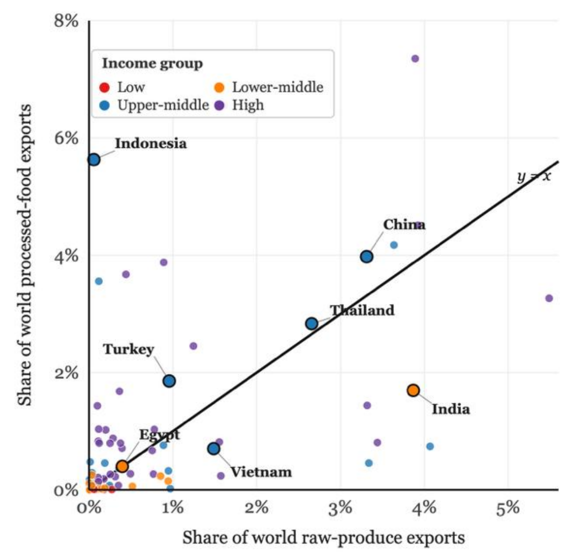


Figure 9b: Raw vs Processed Exports GMS, 2017-24

Notes: Figures 9a and 9b consider plant-based products except high-value commodities tea, coffee, cocoa, and spices. Meat, dairy, poultry and eggs are excluded. In these figures, raw produce includes minimally processed products. Figure 9b omits two outliers--the United States and Brazil. Both have a global higher share in exports of raw + minimally processed products, the United States exports 16.4% of the world's raw-produce and 6.6% of processed-food products, Brazil's shares are 3.7% and 13.5% respectively.

There are exceptions, and they are instructive. Low- and lower-middle-income countries have a revealed comparative advantage in seafood, tea, coffee, cocoa, and spices. Seafood exports among non-high-income countries are driven by China, Vietnam, Ecuador, Chile, and India; together, these countries account for about 30 percent of the global seafood export market. In several of these countries, seafood processing has also been an important source of jobs. Tea, coffee, and cocoa are more complicated. In these sectors, production is concentrated in low- and middle-income countries, but a large share of value addition takes place in high-income countries.

Tea illustrates the distinction between processing and value addition. Most tea processing takes place in the countries that produce tea. But much of the higher value comes from blending, packaging, and branding. As a result, although low- and middle-income countries produce nearly all the world's tea, high-income countries account for 11 percent of tea exports by quantity and about a quarter by value. Coffee shows the pattern more starkly. Green coffee is produced and exported almost entirely by low- and middle-income countries, but high-income countries account for more than 90 percent of global roasted-coffee exports.

4.2 Processing without production

Processed-food exports usually build on domestic agricultural production. Many leading exporters of processed products are also major producers of the underlying raw commodity. Italy, the world's largest exporter of processed tomatoes, produced around 6 million tonnes of tomatoes per year between 2021 and 2024. The United States, a leading exporter of processed potatoes and soybean products, is also a major producer of both commodities, producing about 30 percent of the world's soybeans and about 5 percent of the world's potatoes and groundnuts. The same is true for olive oil: Spain, Italy, Greece, and Portugal are all large olive producers and leading olive-oil exporters. China also fits this pattern. Between 2021 and 2024, it produced about 34 percent of the world's tomatoes, 34 percent of groundnuts, and 50 percent of apples, and held roughly 20 percent of global exports of processed products based on these commodities.

But domestic production is not always necessary for processing. This is especially true for high-income countries. The standard examples are cocoa and coffee (Abhoushady, Roy, and Zaki 2022). Germany and Belgium are among the world's largest exporters of chocolate without producing cocoa. Switzerland was the world's largest exporter of roasted coffee between 2017 and 2024, with a global market share of 22 percent, despite producing no coffee beans. Nespresso's coffee pods are manufactured only in Switzerland. This pattern however extends to a much wider range of products: countries can become major processed-food exporters without producing the raw input, or by relying heavily on imports to supplement domestic production.

Table 2 provides an un-exhaustive list. Japan has about 20 percent of the global export market for sesame oil despite producing virtually no sesame seeds. Canada has about 4 percent of the global peanut-butter export market despite producing no groundnuts. The United Kingdom is a major exporter of canned beans despite being fully dependent on imported beans. These examples show that agricultural production is an advantage, but not a strict precondition.

Even countries that produce the relevant raw commodity often rely on imports to expand processing capacity and smooth production shocks. Italy is a major producer of both tomatoes and wheat, but it imports substantial amounts of both to support its processed tomato and pasta industries. In 2022, when drought reduced domestic tomato production by about 10 percent, Italy imported nearly 18,000 metric tonnes of tomatoes from the United States (Bettini 2023). France similarly relies on imports for its jam, marmalade, and mustard industry. The broader lesson is that reliable imports are a key for development of the processed-food industry.

Table 2: Processing with imports

Exporter	Product	World share	Raw input	Status
Switzerland	Roasted coffee	22%, rank 1	Coffee, green	Not produced domestically
Germany	Chocolate & cocoa preparations	17%, rank 1	Cocoa beans	Not produced domestically
Netherlands	Cocoa butter, fat & oil	27%, rank 1	Cocoa beans	Not produced domestically
Canada	Peanut butter & prepared groundnuts	4%, rank 8	Groundnuts	Not produced domestically
Italy	Pasta (uncooked)	44%, rank 1	Wheat	Produced but insufficient
UK	Packaged tea (<=3kg)	5%, rank 6	Tea leaves	Not produced domestically
Italy	Canned/preserved beans	29%, rank 1	Beans, dry	Produced but insufficient
France	Prepared mustard & mustard flour	26%, rank 1	Mustard seed	Processing scale > supply
Netherlands	Orange juice	9%, rank 2	Oranges	Not produced domestically
France	Citrus jam & marmalade	17%, rank 1	Oranges & citrus	Produced but insufficient
UK	Canned/preserved beans	4%, rank 4	Beans, dry	Not produced domestically
Poland	Prepared/preserved salmon	19%, rank 2	Salmon	Imports the raw fish
Spain	Prepared/preserved squid, octopus	11%, rank 3	Cephalopods	Imports the raw fish
Poland	Prepared/preserved herring	31%, rank 1	Herring	Imports the raw fish
Italy	Canned/prepared tuna	3%, rank 10	Tuna	Imports the raw fish
Germany	Prepared fish n.e.c., shark fin, minced	10%, rank 2	Whitefish	Imports the raw fish
Japan	Sesame oil	19%, rank 1	Sesame seed	Not produced domestically
Germany	Prepared/roasted nuts & seeds (excl. groundnuts) & mixtures	9%, rank 4	Tree nuts	Produced but insufficient
Ireland	Tea/mate extracts, essences & concentrates	16%, rank 1	Tea leaves	Not produced domestically
Netherlands	Refined coconut oil	16%, rank 3	Copra / coconuts	Not produced domestically
United Kingdom	Breakfast cereals (swelled/roasted; cornflakes)	10%, rank 3	Maize	Not produced domestically
Belgium	Prepared potatoes (frozen)	23%, rank 1	Potatoes	Processing scale > supply

4.3 China and Other LMIC successes

Rich countries dominate processed-food trade, but several low- and middle-income countries have built globally competitive industries in particular products. Vietnam, Thailand, and Ecuador have gained substantial market shares in shrimp and prawns, while Ecuador is also a major exporter of canned tuna. Brazil accounts for about half of global orange-juice exports. Vietnam provides the clearest example of processing based on imported inputs: it has been the largest exporter of cashew kernels since 2006, now accounting for more than 80 percent of the world market, using raw nuts imported from Africa and Cambodia. Indonesia used higher export taxes on raw palm oil and cocoa beans to encourage domestic processing; refined products now account for more than 90 percent of its palm exports, while cocoa grinding expanded sharply after the 2010 export tax. The Philippines retains roughly half of the global coconut-oil market, and Côte d'Ivoire and Ghana have increased domestic cocoa processing. However, these successes are often concentrated in a few commodities, and some remain at the lower end of processing.

China is the most important LMIC success story. Unlike countries whose processing exports are concentrated in resource-based products such as cocoa or palm oil, China has built a diversified industry across several product groups. It is the world's largest exporter of processed vegetables[1], with about 15 percent of the frozen-vegetable market, and holds 10–13 percent of global exports of processed tomatoes and beans. It accounts for at least 32 percent of processed chilli exports and is also the leading exporter of apple juice and concentrate. China is similarly the largest exporter of processed fish, with about 10 percent of the global market. Fish fillets provide a particularly interesting example of processing without production: China imports raw fish from Europe and elsewhere, processes it domestically, and re-exports about 75 percent of those imports (Asche et al. 2022). China's success is also deeper than its gross export shares suggest. According to the OECD Trade in Value Added database, in 2022, it accounted for only 4–6 percent of global food and beverage exports, but about 13 percent of the value added embodied in those exports. This suggests that China retains a much larger share of each export dollar because many of the inputs used in processing—including packaging, cans, and machinery—are also produced domestically.

5. State of Food Processing in India

This section assesses India's performance in food processing relative to its economic and agricultural endowments. It then examines four possible explanations for the sector's underperformance: weak productivity growth, the small scale of firms, high energy costs, and fragmented agricultural production. The final two subsections discuss India's emerging export successes and the continuing paradox of India supplying raw materials to processors abroad.

5.1 Underperformance or Opportunity?

A simple way to assess export performance is to compare a country's share of world exports with its share of the relevant endowments. For low-skill, labor-intensive manufacturing, labor is the natural benchmark. For food processing, arable land is also relevant because production of the raw material requires land. Figure 10a plots each country's share of global arable land against its share of processed-food exports. The broad pattern is similar if land is replaced by total labor or employment in agri-food systems. For comparison, Figure 10b presents an analogous chart for textiles and apparel, following Chatterjee and Subramanian (2023).

[1] https://www.ers.usda.gov/amber-waves/2006/april/data-feature

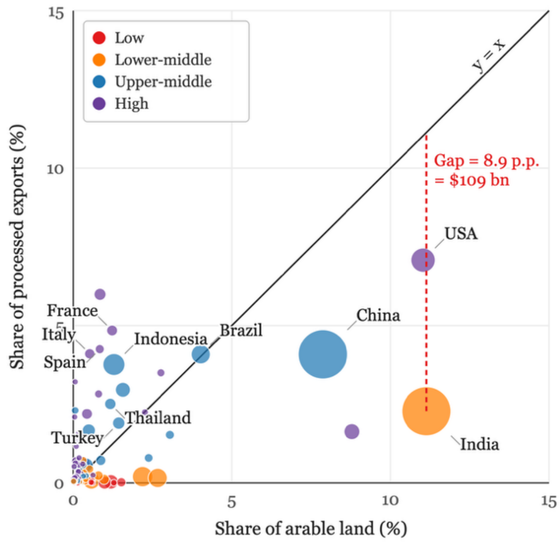


Figure 10a: Processed-food Export Share vs Arable Land Share, 2021-24

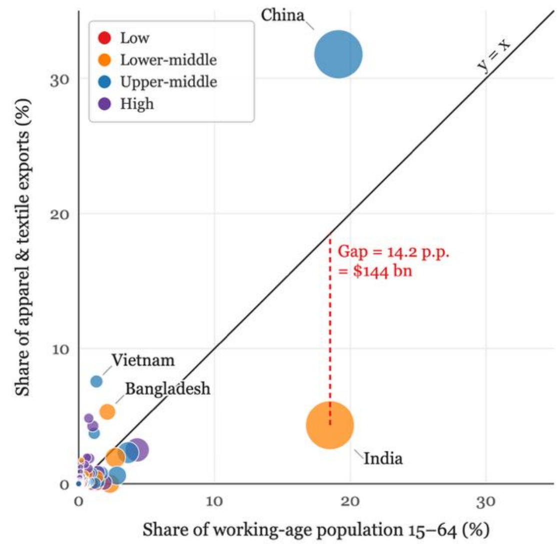


Figure 10b: Apparel & Textiles Export Share vs Labor Endowment Share, 2017-24

Notes: Definition of processed foods in Fig 10a corresponds to row 2, of table 1. It only excludes tea and coffee.

Countries that export more processed food than their land endowment would predict are overwhelmingly upper-middle-income or high-income countries. China performs better than India, although it also lies below the 45-degree line: it has about 10 percent of the world's arable land but only 4 percent of processed-food exports. India has 14.4 percent of global arable land but only 1.9 percent of processed-food exports. Most European countries, by contrast, have a larger share of processed-food exports than of global arable land. Compared to India's land endowment, its "missing" processed food exports are approximately $110 billion dollars a year. It is about $50 billion dollars a year if we exclude the minimally processed market. Closing even half this gap, can create millions of jobs in the agri-food systems economy.

The comparison with textiles and apparel makes India's position more striking. China, Bangladesh, and Vietnam partly compensate for their underperformance in food processing through their success in textiles and apparel. India underperforms in both. Its large labor force and agricultural base have not translated into a commensurate share of either export market.

Figure 10 can be read in two ways. One interpretation is that processed food is a difficult export sector in which even China has not performed particularly well relative to its land endowment. The alternative interpretation, which this paper advances, is that the sector offers considerable room for growth. China has not come to dominate processed-food exports to the same extent as it has apparel, leaving more space for lower-middle-income countries. China's own experience also provides useful lessons on how some of the sector's main constraints can be addressed.

India's underperformance has two components. The first is low agricultural productivity. Crop yields remain well below the global frontier, which means that India uses a large amount of land without obtaining its full productive benefit. This is also a source of opportunity: unlike China, which is already close to the frontier for many crops, India has considerable scope to raise yields.

The second component is the limited capacity to convert agricultural produce into competitive processed products. These two constraints are often treated as separate problems, but they are closely related. A productive agricultural sector provides processors with reliable volumes and consistent quality. At the same time, globally competitive processing firms can introduce better seeds, production technologies, extension services, and procurement systems that raise farm productivity. Progress on one side can therefore support progress on the other. I return to this interaction in Section 6.

5.2 Reasons behind underperformance

Productivity Growth

India has experienced very little aggregate productivity growth in food processing over the past two decades. Figure 11 plots real labor productivity in food processing and in textiles and apparel relative to the global productivity frontier for India and China. I define the frontier in each year as the 90th percentile of productivity among European countries, Japan, the United Kingdom, and the United States.

Both India and China were far from the frontier in 1995, but their subsequent trajectories were very different. In food and beverages, China's productivity rose from about 5 percent of the global frontier in 1995 to 33 percent in 2019. India's relative productivity remained broadly stagnant. The sector has therefore shown little of the convergence that might have been expected given its initially low productivity.

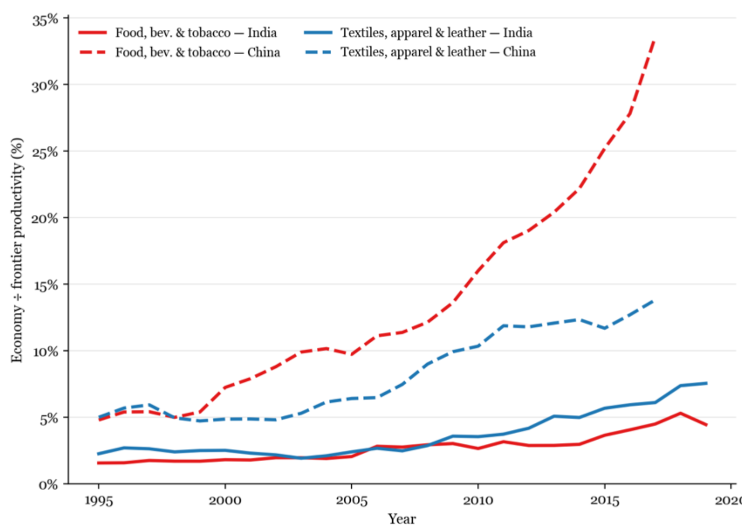


Figure 11: Real Labor Productivity Growth relative to the world frontier

This limited productivity growth is also reflected in employment and the composition of the industry. Between 2000–01 and 2022–23, employment in food processing grew by only about 0.5 percent per year. Within formal food processing, grain milling and sugar processing—both strongly shaped by agricultural policy—account for 26 percent of value added and 28 percent of employment. Grain mills alone constitute 46 percent of all formal food-processing factories. Dairy accounts for another 10 percent of employment and value added. Tea and fish processing, which are among India's more export-oriented segments, account for 7.5 percent and 5 percent of formal food-processing employment respectively. Most other segments remain small.

Achieving Scale

The sector's low productivity is closely related to its small scale. The 2024–25 Annual Report of the Ministry of Food Processing Industries reports about 23 lakh workers in formal food processing, compared with approximately 47 lakh workers in informal enterprises. India has about 24.5 lakh informal food-processing establishments but only around 43,000 formal factories. The bigger reality however is that even within the formal sector, most factories are small.

Figure 12 compares the size distribution of formal food-and-beverage factories with that of textile, apparel, and leather factories. India's truncated firm-size distribution and its consequences for aggregate productivity are well established (Hsieh and Klenow 2013). The problem is particularly severe in food processing. Between 2015–16 and 2019–20, the median apparel factory employed 46 workers, while the median factory across textiles, apparel, and leather employed 32. These numbers are already small by global standards. However, the median food-processing factory employed only 13–14 workers.

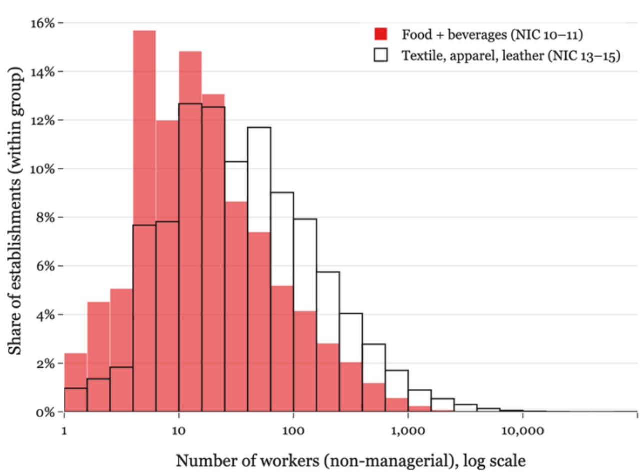


Figure 12: Formal factory size-distribution, 2015-19

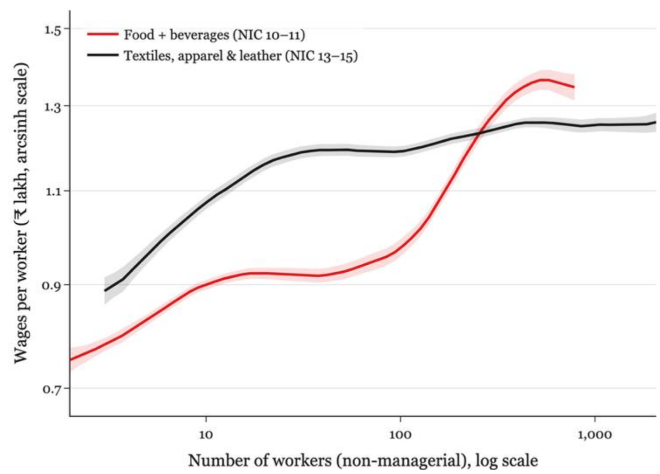


Figure 13: Wages vs Factory Size, 2015-19

Notes: Figure 13 residualizes wages off 3-digit industry and year fixed effects. Means are added back to retain level differences.

Small enterprises remain an important source of employment, particularly in rural areas. But scale matters for three reasons. Larger factories tend to be more productive and are therefore better placed to compete internationally. They can also meet the volume requirements of large buyers and absorb the fixed costs of complying with food-safety and phytosanitary standards. Most importantly, larger formal factories generally provide higher and more stable wages, along with better working conditions and benefits.

Figure 13 shows the relationship between factory size and wages within the formal sector, after accounting for differences in industry composition and inflation. A food-processing plant with around 250 workers pays approximately ₹1 lakh per worker per year, while a factory with five workers pays roughly 25 percent less. Among factories employing more than 200 workers, there is little difference between wages in food processing and apparel. The employment and policy question is therefore not only how many enterprises the sector creates, but whether those enterprises can grow large enough to provide productive and stable jobs. This is something Chinese policy making was incessantly obsessed with in the 1990s and early 2000s as I discuss in section 6.

Energy Intensity

High energy costs are especially damaging for food processing because the sector is considerably more energy-intensive than apparel or electronics. Figure 14 reports energy expenditure as a share of value added across manufacturing industries in India. For food processing, the average is about 22 percent—more than twice the corresponding share in apparel or electronics.

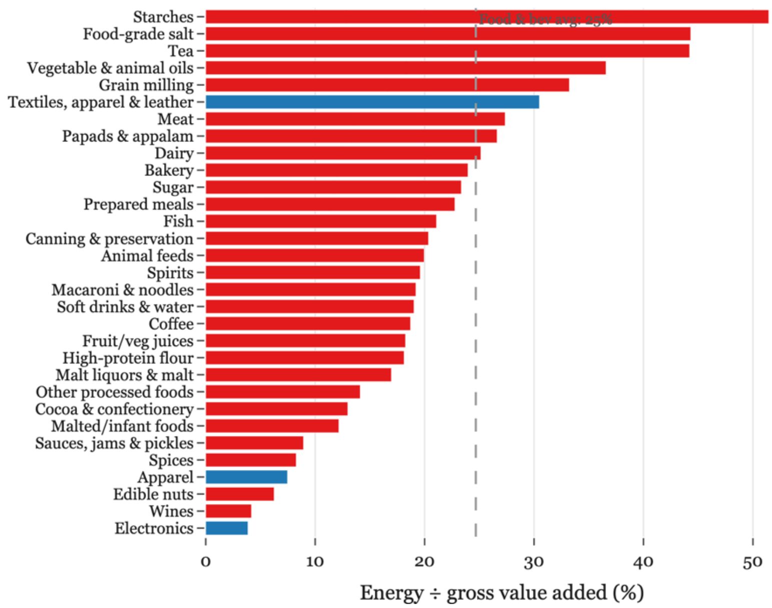


Figure 14: Energy as a share of Value Added for the Industry, 2015-19

This matters because industrial electricity tariffs subsidize agricultural and residential consumption. Kapur and Subramanian (2025) estimate that the resulting burden is equivalent to a tax of around 100 percent on industrial power. Since food processors spend a larger share of value added on energy, the same tariff distortion imposes a much larger cost on them than on most other low-skill manufacturing industries. Small and medium-sized processors are at a further disadvantage because the capital cost of captive or off-grid power generation is often too high for them.

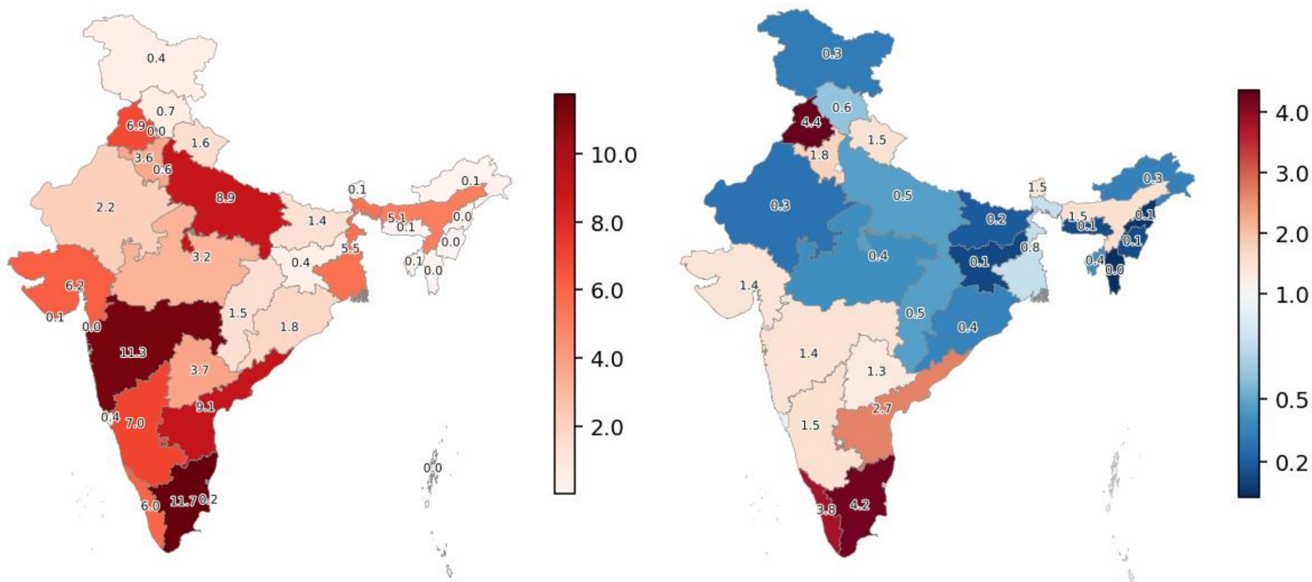
The dairy industry illustrates the problem. Pasteurization and milk-powder production require substantial heating, while milk must also be cooled and stored at low temperatures. Private dairies often find coal, firewood, or biomass cheaper than grid electricity for the heating stage. In 2024–25, Hatsun Agro, one of India's largest private dairies, reported in its annual reports of 2024 and 2025 using 25.1 million kilograms of coal, 35 million kilograms of firewood, and 7.9 million kilograms of briquettes.

Cooling requirements add another structural cost, especially given India's climate. India's average ambient temperature is around 25 degrees Celsius, roughly 10 degrees warmer than New Zealand's. Indian dairy processors must therefore use more energy to cool and store the same quantity of milk. This weakens their competitiveness relative to producers in New Zealand and Europe. Similar constraints apply to frozen vegetables and other products that require uninterrupted refrigeration.

Farm sizes

India's food-processing industry is also poorly aligned with the geography of agricultural employment. Figure 15a shows that formal food-processing employment is concentrated in the western and southern states. Gujarat, Maharashtra, Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, and Kerala together account for nearly 55 percent of India's formal employment in the sector.

The divergence becomes larger when food-processing employment is compared with the number of agricultural households in each state. Figure 15b normalizes each state's share of food-processing employment by its share of agricultural households. Uttar Pradesh, Bihar, Jharkhand, and West Bengal have a much smaller share of processing employment than their agricultural populations would suggest. Punjab and Haryana seemingly perform better on this measure, although much of their employment is in grain milling supported by the public procurement system. Figure 16 further establishes this point for specific industries.



(a) Share of National Formal Food Processing Employment (%), 2015-19

(b) Share of National Food Processing Employment relative to share of agricultural households

Figure 15: Geography of Food Processing Employment

Bihar provides a useful example of the disconnect between agricultural production and processing. The state grows a diverse range of crops and is a major producer of litchis, makhana, maize, and vegetables. Harish Damodaran documented a maize boom in Bihar in 2015,[2] when parts of the state began supplying the global animal-feed market at yields approaching those of the American Midwest. Gulab Bagh in Purnia is also one

[2] https://indianexpress.com/article/india/india-others/bihar-an-unlikely-corn-revolution/

of India's largest agricultural mandis. Yet Bihar has developed neither a significant tomato-processing industry nor a large starch-processing industry.

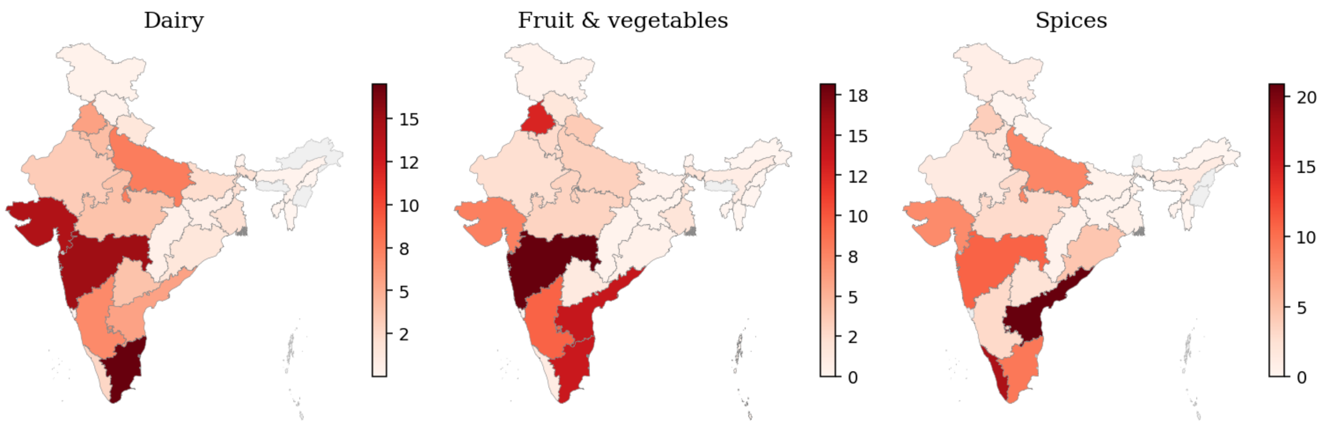


Figure 16: Geography of food processing employment in various commodities (National Shares %)

Farm fragmentation is one reason for this outcome. Figure 17 maps the location of holdings of four acres or more. India's fertile and water-rich Gangetic plains have relatively few such holdings and a very large number of small farms. Fragmentation makes specialized commercial agriculture more difficult. Small farmers must manage both income risk and household food requirements, and are therefore less likely to devote most of their land to a volatile crop such as tomatoes. Even a somewhat larger farmer in Bihar may cultivate paddy on the main plot and grow tomatoes only on a smaller area (Chatterjee et al. 2020, Damodaran and Agarwal 2021). This limits the volume of a single crop that can be sourced from any one farm.

Fragmentation also raises the cost of aggregation. A processor may need to coordinate with hundreds of farmers to obtain the volume that a single large farm could supply elsewhere. Existing intermediaries are often effective at moving produce quickly from places such as Purnia to the Azadpur market in Delhi. But efficient movement through spot markets is not the same as a reliable supply chain for processing. Factories require a steady flow of crops of consistent quality and suitable varieties. Volatile volumes and uneven quality make it difficult to operate a large plant at high capacity. For this reason, Chinese food processing shifted from purchasing in spot markets to dedicated production bases after their products pesticide residue cases in Japan in early 2000s (Yamada and Sui 2013).

Bihar's maize experience reinforces this point. The initial expansion was concentrated in areas with relatively larger farms. Since 2014–15, growth in India's maize export volumes and global market share appears to have plateaued and while bihar continues to supply maize for animal feed processed elsewhere, including in East Asia, but little feed-processing capacity has emerged within the state.

To be sure, farm size is not the only explanation for this pattern. Infrastructure, availability of ports, electricity, law and order, access to finance, and the business environment also influence where firms invest. But fragmentation is an important part of the explanation because it affects both the reliability of raw-material supply and the cost of coordinating farmers with processors.

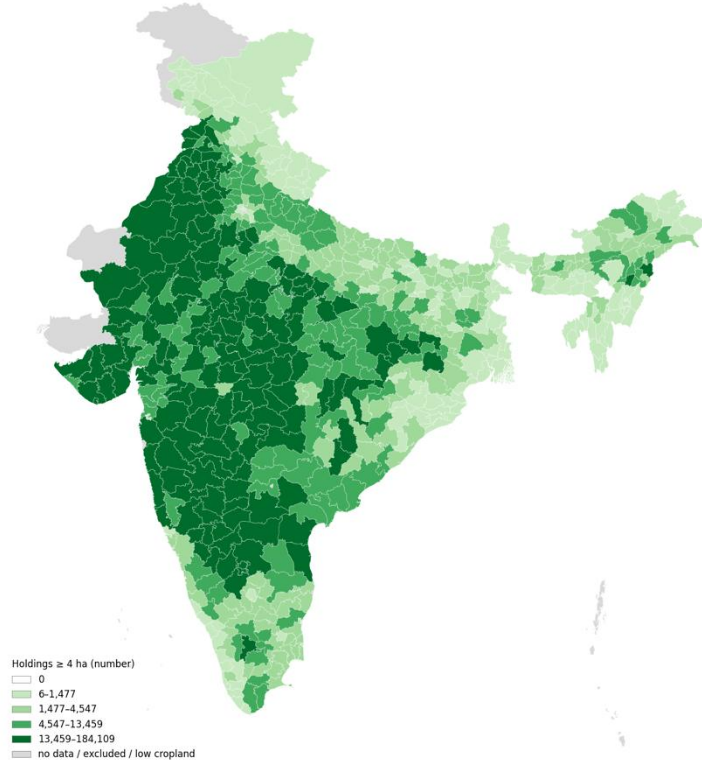


Figure 17: Geography of Large Farms (>4 hectares)

5.3 Pockets of success

India has nevertheless built globally competitive export clusters in shrimp, frozen French fries, and table grapes. Between 2010 and 2024, India's share of global shrimp exports increased from about 7 percent to 20 percent. Its share of frozen French-fry exports rose from almost zero to approximately 2 percent, while its share of grape exports increased from 1 percent to 4 percent. The achievements in French fries and grapes are particularly notable because production is concentrated in only a handful of districts around Gujarat and Nashik.

It is important to note that private investment and innovation played a central role in each case. In shrimp, the adoption of specific-pathogen-free *Litopenaeus vannamei* broodstock supported rapid improvements in output and export competitiveness. In potatoes, McCain Foods developed processing-grade varieties through a specialized high-altitude seed programme in Lahaul-Spiti. In Nashik, Sahyadri Farms, a farmer-producer company, invested in processing, marketing, and new grape varieties. In 2022, Sahyadri purchased the exclusive Indian rights to grow Grapa's patented Arra table-grape varieties for ₹35 crore. The first commercial batch reportedly sold for ₹250 per kilogram at a Nashik farm auction in 2024.[3]

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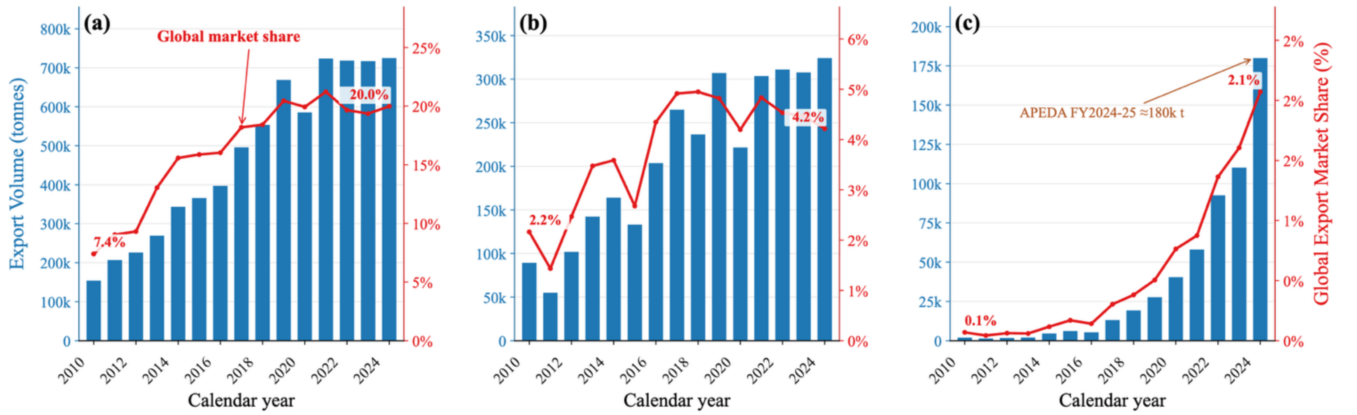
[3] https://www.livemint.com/industry/how-grapes-from-nashik-conquered-the-world-table-grape-farmers-export-market-wine-maharashtra-11734253762634.html



(a) Shrimps (b) Table Grapes (c) Frozen French Fries

Figure 18: India's recent exports successes of agricultural products

These cases show how firms and producer organizations can solve problems that extend beyond the factory. They introduced specialized inputs, improved production practices, coordinated quality standards, and connected farmers to export markets. Their contribution was not simply to purchase an existing agricultural surplus, but to help create the kind of agricultural production required for processing and exports.

One common feature across these success stories is farm scale. Available accounts suggest that successful farms in these clusters generally cultivate between 5 and 15 acres. Larger holdings allow farmers to specialize, invest in technology, and meet buyers' requirements for volume and consistency. However, as I discuss in section 6, these stories also suggest that successful participation can be brought about by different forms of aggregation, contracting, or producer organization that reproduce some of the advantages of larger farms.

5.4 Paradoxes: India as an input supplier

While these success stories are encouraging, India's role as a supplier of raw materials to processors abroad reveals structural weaknesses. India is the world's largest producer of dried chillies, producing approximately 2 million tonnes, or around half of global output each year. Between 2022 and 2024, India supplied more than half of global dried-chilli imports, while China accounted for about 21 percent. India exported approximately $1 billion of dried chillies, of which around $400 million went to China. China used most part of this imported material to produce and export higher-value processed chilli products.

A similar pattern is emerging in rice. Vietnam has recently been importing more than half a million tonnes of rice from India each year for use in its rice-noodle industry (Nguyen 2025). India supplies the agricultural input, while processing and much of the downstream value addition take place in Vietnam. There is nothing inherently undesirable about exporting agricultural commodities. Raw-material exports can support farmers and generate foreign exchange. The concern is that India often captures only the first stage of the value chain. To the extent that agricultural production is supported by subsidized electricity, fertilizer, credit, or output prices, some of that public support may ultimately benefit processors in other countries. The broader challenge is therefore not to restrict raw exports, which actually yields undesirable results, but to create the conditions under which more of the downstream processing can take place in India.

6. Discussion

6.1 The policy problem

This paper does not offer a detailed policy blueprint. The constraints differ across products, and workable interventions require a deeper understanding of specific technologies, supply chains, and markets. Its narrower purpose is to establish two points. First, food processing can become an important source of rural jobs and growth, but there are few low-hanging fruits. Second, success requires solving a common set of problems—scale, finance, raw-material supply, energy, standards, and policy stability—across the entire value chain.

The relevant starting point is the entrepreneur considering a large export-oriented processing plant. Such a plant needs land and long-term finance. It needs reliable and competitively priced power. It needs a steady supply of raw material of consistent quality. It needs that other enterprises do not export adulterated products or those with high chemical residues such that it hurts India's reputation. It also needs testing and traceability systems, access to ports, and confidence that export policy will not change after the investment has been made.

These constraints must be addressed together. A processing park without an organized production base will operate below capacity. A production base without a credible processor will not induce farmers to invest in specialized crops. Export incentives will achieve little if shipments repeatedly fail quality tests or if exports can be restricted at short notice. The relevant unit of policy is therefore not the farm or the factory in isolation, but the chain connecting the farm to the factory and the factory to the export market.

6.2 What China did differently

China's experience is useful because it treated these constraints as parts of the same problem. Its rise in processed-food exports was not driven by a single subsidy or programme. The central government set broad objectives—build large processing firms, connect them to farmers, improve agricultural productivity, and expand exports—but left provinces and local governments considerable flexibility over implementation. Credit could support working capital, land development, infrastructure, or farmers. Production bases could be organized through contracts, cooperatives, leasing arrangements, or state farms. National direction was therefore combined with local experimentation.

At the centre of this system were the so-called "dragon-head enterprises." These were leading agribusinesses expected to coordinate production, processing, and marketing. Public support was not meant to be available to all firms. The policy makers were obsessed about large firms: eligible enterprises were expected to meet thresholds for substantial scale (e.g. sales of over 100 million yuan in 2000 equivalent to 15 million USD today) and financial health, add substantial value to agricultural inputs, maintain close links with production bases, reach a large number of farmers, invest in technology, and demonstrate a strong market position. Firms that did not initially meet the scale thresholds could qualify later by showing technological capability, export success, or the ability to develop new industries.

The underlying policy view was that agricultural productivity, farmer incomes, and processor growth were mutually reinforcing. The development of the agro industry was critical for improving the welfare of farmers. And therefore, the industry was not seen farming for economic purposes like tax incentives.

The multi-ministerial opinion on supporting Dragon Head Enterprises in the year 2000 stated, "It can not only extend the agricultural industry chain, improve the added value of primary agricultural products, and increase farmers' income, but also contribute to the development of agricultural specialization, socialization and commercialization, and improve the overall efficiency of agriculture…. In the strategic adjustment of agricultural and rural economic structure, leading enterprises bear the heavy responsibility of developing markets, technological innovation, guiding and organizing base production and farmer operation… Unlike other industrial and commercial enterprises, the rise and fall of leading industrialized enterprises not only affects the development of the enterprise itself, but also affects the increase of agricultural efficiency, the increase of farmers' income and the stability of rural areas. Therefore, supporting leading enterprises means supporting agriculture and farmers."

Large processors were expected to provide seeds, technical advice, production standards, procurement contracts, and access to markets. Their growth could raise the demand for higher-quality agricultural output, while a more productive farm sector could provide the volumes and consistency required by processors. Supporting a capable processing enterprise was therefore seen as one way of supporting agriculture rather than as an alternative to it.

The state used several instruments to support this model. State-owned banks provided credit for raw-material purchases, capital investment, and production-base development. Local governments provided land, infrastructure, industrial parks, energy connections, and logistics. Parts of agricultural processing received favourable tax treatment. Foreign and domestic private investment were encouraged, particularly when they brought technology or access to overseas markets. Support was accompanied by public rosters, eligibility criteria, periodic evaluation, and the possibility of losing official recognition.

Production bases were the main mechanism for organizing the supply of raw material. Firms did not generally own the underlying farmland. They acquired operational control through production contracts, leasing, subcontracting, entrusted management, or the provision of technical services. Local governments often combined these arrangements with agricultural parks, standardized production zones, or export-registration systems. The institutional form varied across regions, but the objective was consistent: to provide processors with reliable volumes of crops meeting specified standards.

Quality control became central to this model after Japanese authorities rejected Chinese spinach shipments in 2002 because of excessive pesticide residues. Export processors were subsequently required to source vegetables from registered production bases. After Japan introduced more stringent residue limits in 2006, exporters faced additional inspection by both government and private testing agencies before shipment. Many processors moved away from anonymous spot-market procurement towards contracts, registered farms, and directly managed production. Because a failure by one exporter could raise compliance costs for the entire industry, quality was treated as a collective rather than purely firm-level problem. This was even more important because such a policy shift meant that necessarily in the initial years sourcing did not happen from small farms.

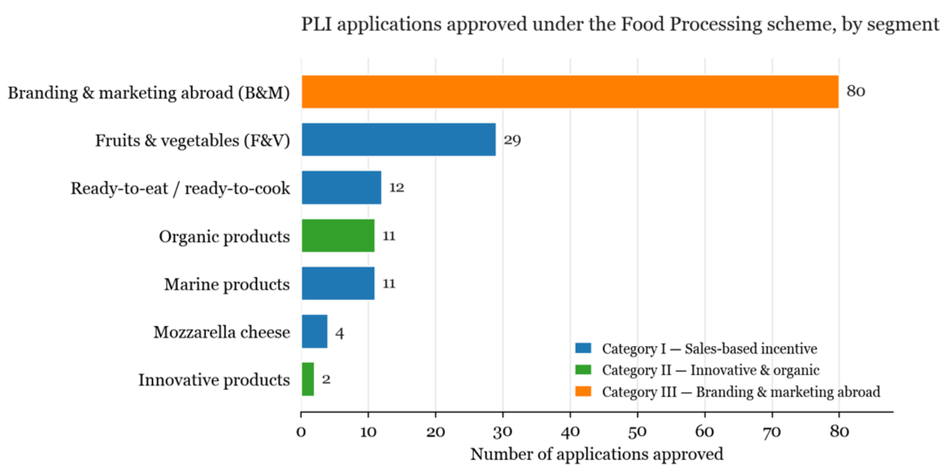
The lesson from China is institutional, not that India should reproduce its policies exactly. China's land system, financial system, and local state capacity are different. What is relevant is the way policy combined a lead firm, a production base, local infrastructure, finance, and quality control around a particular product and place.

6.3 Where India's approach falls short

India's policy regime is much more fragmented. The central government supports food parks, cold chains, farmer organizations, branding, marketing, processing equipment, and exports through separate schemes. States and local governments often play a limited coordinating role. Some policies are also too rigid. For example, there is little flexibility in how funds from priority sector lending can be used. The result is that individual components may be financed without anyone being responsible for making the full chain work. A food park can be built without an adequate raw-material base, while farmers can be supported to produce a crop without a processor committed to buying it.

Current support to firms also does not consistently target the constraints identified in this paper. Figure 19 shows that a substantial share of assistance approved under the production-linked incentive scheme has gone towards advertising and marketing. Branding may be useful, but it does not by itself solve the problems of plant scale, technology, power costs, raw-material supply, or quality control. Support would be more effective if it were linked to measurable investments in processing capacity, production-base development, exports, and farmer

participation.



Source: PLIS-FPI approvals list, Ministry of Food Processing Industries (literature/pli.pdf, p.4–5). 149 applications approved across 119 companies; 20 applications are common to Categories I and III, so segment counts sum to the 149 approved applications, not to distinct companies.

Figure 19: PLI Applications for Food Processing by Category

Agricultural policy is similarly poorly connected to downstream demand. India spends heavily on input subsidies, procurement, and price support, but this support is concentrated in particular crops and regions. It does not necessarily produce the varieties, quality, or volumes required by competitive processors. At the same time, processing firms face expensive power, costly credit, and uncertainty over the availability of raw material.

The problem is therefore not simply that farmers receive support and firms do not. It is that support on the farm and factory sides is designed separately and not in-coordination.

Unpredictable export policy further weakens the incentive to invest. Export bans and restrictions are generally introduced when domestic prices rise. They reduce prices received by farmers and sharply lower the value of inventories and contracts held by exporters. An onion exporter to the premium East Asian market I interviewed from Maharashtra, for example, reported holding smaller inventories because an export ban could be imposed at any time. This makes commercial sense for the individual firm, but it prevents exporters from building scale, maintaining long-term relationships with buyers, or investing in storage and logistics.

Using export restrictions to force domestic processing is also risky. Indonesia's cocoa experience illustrates the trade-off. Its export tax on cocoa beans expanded domestic grinding, but lower bean prices weakened farmers' incentives to produce cocoa. Processing (or rather grinding) capacity increased even as domestic production began to decline and it is unclear if the policy had a net positive impact on jobs. Where downstream processing is the objective, time-bound support for investment and production is generally preferable to suppressing the price of the raw commodity through export taxes or bans. India's recent push to produce ethanol has done exactly that—i.e. ban exports of sugarcane.

Similarly, banning imports is not the right approach either. Often when global prices fall, in order to protect farmer incomes, India bans imports of raw produce. However, not only from the Chinese fish-fillet export experience, but also from the experience of advanced countries that I have described above, it is clear that imported inputs are a key source of raw material for agro-processing industry. The seasonality in production of agricultural crops means that local production cannot consistently meet the needs of a processing factory that needs to run and pay workers around the year. The shortfall or if factory wants to expand beyond local production has to be met with imported inputs. Banning imports stymies the growth of processing factories, in turn hurting the incomes of the very farmers the policy was trying to protect.

India's approach to quality control is also too reactive. Rejections of soy products, shrimp, chillies, or other agricultural exports affect compliant and non-compliant firms alike. Yet the usual response is to seek government intervention after a problem has emerged.[4] A more effective system would require traceability, registered production sources, pre-shipment testing, and industry-level monitoring before goods leave India. Exporter associations have an important role because quality failures create an externality across firms. A better use of the PLI fund would be providing testing infrastructure and enforce standards on shipments leaving India, but firms and associations must also bear responsibility for protecting the reputation of the industry.

6.4 Organizing the production base

The hardest issue is how to aggregate agricultural production while maintaining quality and protecting farmers. India already has several models, but each works under particular conditions.

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[4] https://www.thehindu.com/news/national/andhra-pradesh/chilli-exporters-seek-spices-board-intervention-over-rejections-china-ban-registration-issues/article71133747.ece#google_vignette

The cooperative model is represented by Sahyadri Farms in Nashik. It allows farmers to retain ownership while pooling production, processing, marketing, and technical services. Its strength is alignment between farmers and the processing organization. Its limitation is that successful cooperatives require substantial managerial capacity, trust, and access to capital.

The contract-farming model has worked in processing-grade potatoes for French fries. Processors provide suitable varieties, technical advice, and an assured buyer, while farmers retain control over cultivation. This model provides greater traceability than spot-market procurement. These two models work best, however, when farms are sufficiently large, contracts can be enforced, and processors can manage the risk of farmers selling to other buyers when spot prices rise.

The intermediary model used in Bihar's corn trade relies on traders and commission agents to aggregate output from many farms. It can move large volumes at relatively low cost and works reasonably well for a storable commodity with less demanding quality requirements. It is less suitable for perishables or processing-grade crops, where factories need predictable deliveries, specific varieties, and detailed information about production practices.

The shrimp and sugarcane sectors use more tightly coordinated procurement systems. Shrimp processors often provide expensive inputs and technical support at the start of the production cycle and require confidence that they will receive the harvest. Sugar mills procure locally because cane must be processed quickly and transport costs are high. These arrangements solve some coordination problems, but they can also give processors substantial market power.

Each model involves a trade-off. Cooperatives preserve farmer control but require strong organization. Contracts give processors greater influence over quality but create enforcement and side-selling risks. Intermediaries can aggregate quickly but provide limited traceability. Tightly coordinated procurement can support investment but may weaken competition for farmers' produce.

A fifth option, drawn from the Chinese experience, is state-facilitated land aggregation or operational leasing. Firms would not purchase agricultural land. Smallholders could voluntarily lease land to a public or collective intermediary for a fixed period, and the assembled parcel could then be leased to a processor or specialist producer. This would give the firm greater control over varieties, cultivation practices, timing, and quality.

Such a model may be politically difficult and would require strong protections for landowners. Lease terms would have to be transparent, participation voluntary, rents indexed appropriately, and the right to recover the land clearly protected. It may nevertheless be worth testing in places where holdings are extremely small, agricultural incomes are low, and reliable supply cannot be created through contracts alone. Tamil Nadu's experience of acquiring or leasing land for industrial development provides a possible institutional precedent, although agricultural land would require much stronger safeguards.

7. Conclusion

India's agricultural abundance has not translated into industrialization. Some of the country's poorest regions are also among its most fertile, yet remain concentrated in low-value agriculture. Food processing offers a way to connect this agricultural base to factories, logistics, and export markets. The India–EU Free Trade Agreement expands the opportunity, but market access alone will not create a competitive industry.

Food processing is difficult because it not only combines the constraints of manufacturing with those of agriculture but also intensifies issues already faced by low-skilled manufacturing firms like greater energy needs. Firms need land, credit, reliable power, logistics, technology, and the ability to meet demanding standards. They must also secure a steady supply of raw materials of consistent quality from fragmented farms. A processing plant without an organized production base will operate below capacity; higher farm output without a processor and a market will generate little downstream value.

Policy debates often reduce these problems to the minimum support price or insufficient public spending on agricultural research. Both matter, but they do not explain the central puzzle. India is already one of the world's largest producers of fruits and vegetables yet captures little of the value created by processing them. Even in rice and wheat, which receive the maximum state support, we don't move up the value chain in terms of exporting those products. The missing link is the capacity to coordinate farmers, introduce suitable varieties and technologies, maintain quality, and process at a scale that is competitive in world markets.

India's fiscal constraints make it unrealistic to rely on public spending alone (Kapur and Subramanian 2025). But the successes in shrimp, frozen French fries, and grapes show that private firms and producer organizations will invest in technology, extension, and supply chains when the market opportunity is credible. The policy challenge is to create those conditions—stable trade policy, affordable power and credit, reliable standards, and institutions that connect processors to farmers—while ensuring that farmers share in the gains.

India already has the agricultural endowment. The task is to turn it into higher productivity, formal jobs, and rising rural incomes. Success should be measured not by the number of schemes or the volume of raw output, but by whether India moves up the value chain and gains share in global processed-food markets.

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