India as a global manufacturing hub for smart protein processing equipment

Key insights and strategic actions to build India's self-reliant smart protein equipment ecosystem



Background

As India's smart protein landscape evolves beyond its formative stages, reducing the high costs of procuring and operating processing equipment, especially for the production of plant-based smart proteins, will be critical to achieving price parity with conventional proteins and positioning the country as a global manufacturing leader. With its abundant natural resources, skilled workforce, and supportive government policies for capital goods manufacturing, India is well-positioned to manufacture equipment such as extruders, separators, and drying systems that are essential to the smart protein sector. To accelerate this progress, the Good Food Institute India (GFI India) and the National Institute of Food Technology, Entrepreneurship and Management, Thanjavur (NIFTEM-T), have partnered to assess India's manufacturing capabilities for extruders, dryers, and separators, and to recommend strategies for cost-effective indigenous production. Perspectives from stakeholders across the smart protein value chain (equipment manufacturers and innovators) and a data-driven approach to understanding India's current capabilities in manufacturing have been considered to:

- identify bottlenecks and challenges that hamper the cost-effective production of this equipment;
- map the industry's requirements, opportunities and collaborations that can promote local manufacturing; and
- provide actionable recommendations for transforming India into a global hub for smart protein processing equipment.

Study approach

The approach adopted in this study is a combination of primary and secondary research, outlined below and illustrated in Figure 1.

- Evaluate India's current manufacturing capabilities for plant protein processing equipment such as extruders, separators, and drying systems:
    - Map India's Original Equipment Manufacturer (OEM) landscape for extruders, dryers, and separators using Harmonised System (HS)-code trade data and secondary sources.
    - Classify more than 150 OEMs by equipment category and manufacturing state to identify major production clusters.
    - Assess fabrication, machining, and assembly capabilities through a mix of primary and secondary research.
    - Review the export participation and certification status of Indian manufacturers, including compliance with International Organisation for Standardisation (ISO) and Conformité Européenne (CE) standards.

    - Summarise India's current strengths in mechanical fabrication for manufacturing advanced food processing equipment.
- Identify gaps in existing capabilities and explore opportunities for indigenous manufacturing of cost-effective extruders, separators, and dryers.
    - Break down the cost structure of extruders, dryers, and separators into component and subsystem levels.
    - Distinguish domestically manufactured components from imported precision sub-systems using trade and industry data.
    - Benchmark the performance of current Indian equipment against global standards, focusing on technical specifications such as torque, g-force, and evaporation rate.
    - Quantify how much of the total equipment value is tied to import-dependent precision components versus localisable fabrication.
- Assess the interest and readiness of global and local equipment manufacturers to enter India's plant-based protein processing sector and identify the key bottlenecks on operational, technological, and policy levels limiting their participation.
- Develop detailed, actionable recommendations for government, industry, and academic stakeholders to foster a favourable manufacturing environment.

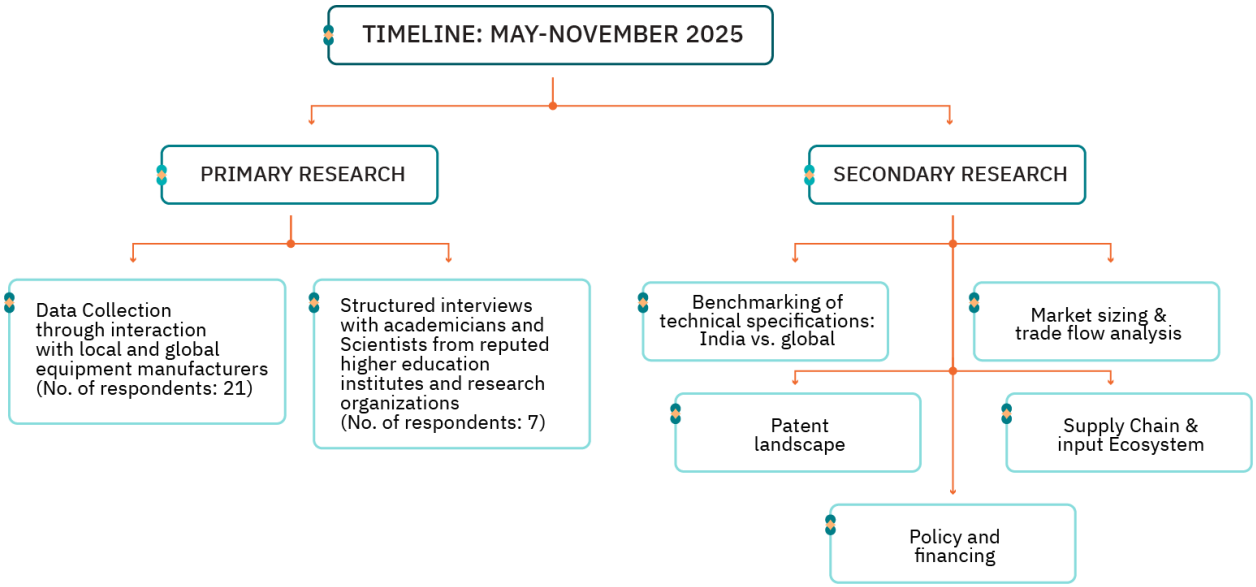

Figure 1. Study approach

In 2023, India imported more than ₹13,000 crore worth of centrifuges and filtration machinery but exported only about ₹7,600 crore, creating a trade deficit of about ₹5,300 crore.

A SWOT analysis of the determinants shaping indigenous manufacturing of smart protein processing equipment

The following key dimensions anchor India's indigenous manufacturing landscape for extruders, separators, and dryers used in plant-based smart protein processing.

- **Manufacturing capacity:** Assesses the market maturity and scalability of India's domestic manufacturing base for extruders, separators, and dryers to meet the growing demand for plant-based protein processing by considering factors such as market size and growth, production volumes, precision engineering skills, and quality control systems.
- **Innovation and technology:** Examines the extent of indigenous R&D, access to advanced design and automation technologies, customisation capabilities, and the ability to integrate global best practices in equipment to improve efficiency, yield, and product quality.
- **Supply chain ecosystem:** Evaluates the availability, resilience, and localisation depth of suppliers for critical components and wear-prone spares.
- **Policy and regulatory environment:** Analyses the impact of government policies, incentives, standards, and compliance requirements on domestic equipment manufacturing, including ease of doing business, import/export regulations, and support for food processing and advanced manufacturing sectors.
- **Market growth and export potential:** Considers domestic demand from the growing plant-based smart protein sector, adoption by large-scale food processors, and the competitiveness of indigenous equipment in international markets, including pricing, performance, certifications, and alignment with global customer requirements.

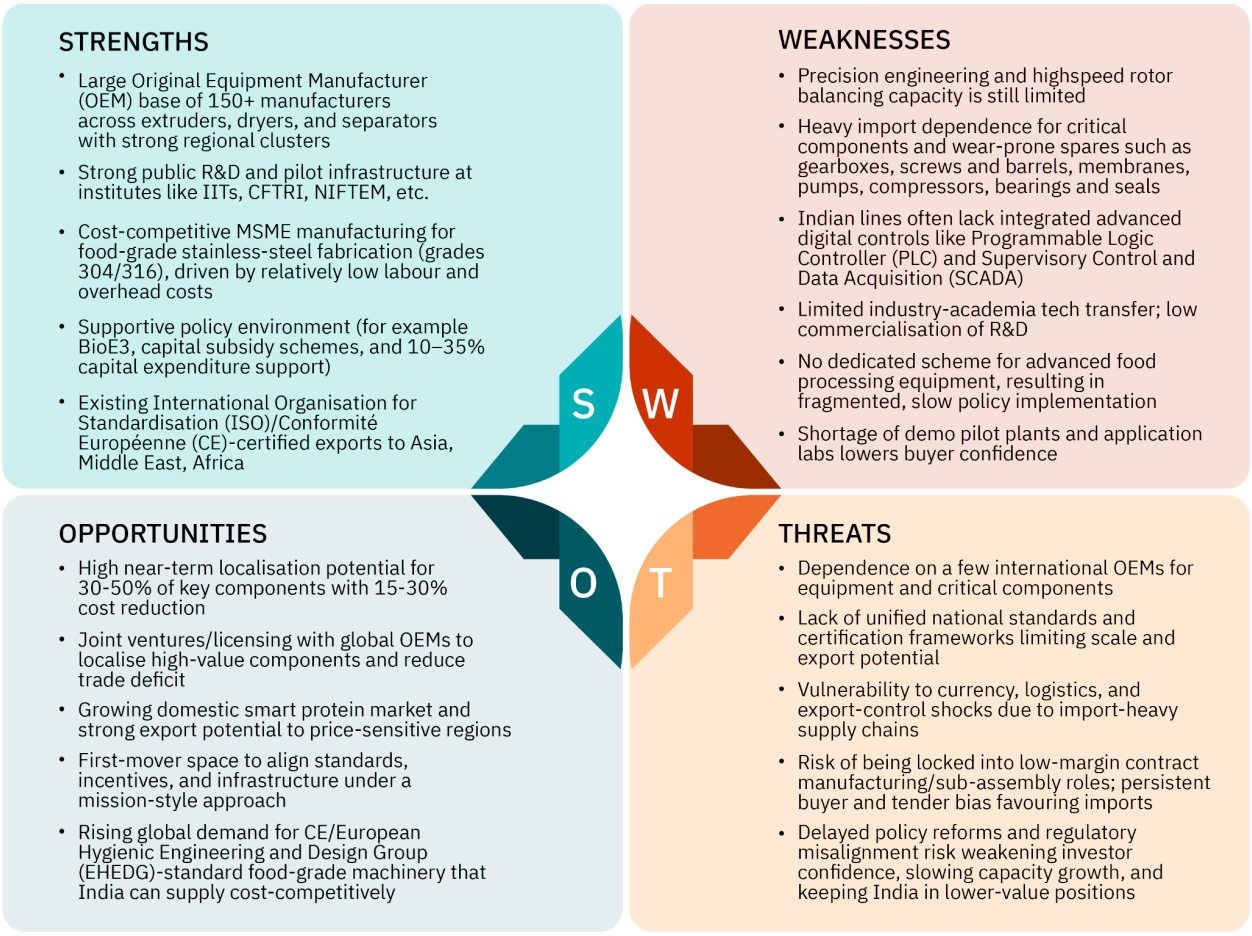

Figure 2: SWOT analysis

Around 75% of India's extruder import value comes from just two countries—China (~40%) and Germany (~35%).

Recommendations for policy stakeholders

1. Attract global OEMs to use India as their manufacturing base

The government should consider launching an Advanced Food Processing Machinery Foreign Direct Investment (FDI) and co-production programme. This would offer tax breaks, faster clearances, and duty benefits to international extruder, dryer, and separator companies that set up manufacturing and R&D centres in India, committing to sourcing a rising share of components locally. The programme could encourage global leaders in high-value parts like gearboxes, advanced controls, membranes, and high-speed rotors to treat India as their hub for Asia, Africa, and the Middle East, ideally through joint ventures with Indian micro, small,

and medium enterprises (MSMEs). This will bring advanced designs, processes, and quality systems into the country, cut import dependence at the top of the value chain, and position India as a serious global base rather than just a buyer of finished equipment.

150+ Original Equipment Manufacturers (OEMs) produce key plant-based protein processing equipment—including extruders, dryers, and separators—with distinct regional clustering: extruder manufacturers are concentrated around Delhi (~38.7%), dryer manufacturers in Maharashtra (43.5%) and Gujarat (26%), and separator manufacturers primarily in Gujarat (28.6%) and Maharashtra (22.9%).

2. Localise high-value components to reduce import dependence

The government must launch targeted Production Linked Incentive-style (PLI) programmes for high-value components like gearboxes and cooling dies for extruders, pumps and compressors for dryers, membranes and high-speed bearings for separators, and PLC (Programmable Logic Controller)/Supervisory Control and Data Acquisition (SCADA) systems across all equipment categories. This is because dependence on imported parts increases cost and delays production timelines. This can be achieved by incentivising precision machining, membrane fabrication, and electronics manufacturing in industrial clusters, enabling a 15–30% reduction in machinery costs and making Indian equipment globally price-competitive.

Indian manufacturers could immediately localise 30–40% of extruder components and 40–50% of dryer components, including housings, heaters, feeders, chambers and ducts, which can reduce overall equipment costs by ~15–30% when paired with locally made control panels, pumps and compressors.

3. Establish unified national standards and certification labs

India must develop clear, unified food-grade machinery standards under the Bureau of Indian Standards (BIS) and Food Safety and Standards Authority of India (FSSAI) and set up accredited testing labs that can certify equipment to CE/EHEDG-equivalent levels. This will replace today's fragmented requirements, shorten validation cycles, improve quality consistency, cut compliance costs, and make it easier for Indian OEMs to qualify for export markets.

4. Create a coordinated Smart Protein Machinery Mission that ties together R&D, clusters, exports, and talent

The government should launch a Smart Protein Machinery Mission that brings the following under one roof:

- national R&D and commercialisation centres, where Indian and global OEMs can co-develop and test equipment;
- a few food processing equipment manufacturing clusters with shared precision workshops, demo lines, and incubation space;
- targeted export support such that Indian-made machines are showcased and financed in key Global South markets; and
- specialised training programmes to build a workforce skilled in advanced food-machinery design, automation, and service.

A single mission under these pillars would replace today's scattered efforts with a coherent growth platform, making it easier for both Indian firms and international manufacturing companies to invest, innovate, and scale.

Recommendations for industry stakeholders

1. Upgrade precision engineering and automation to meet global performance benchmarks

OEMs must invest in systematically upgrading precision machining, balancing, hygienic design, and PLC/SCADA controls to ensure that production lines can reliably perform high-moisture extrusion, gentle drying, and separation processes without constant intervention. Using the R&D and pilot lines available at academic and research institutes, OEMs can co-develop and validate smarter, better-controlled machines that are ready for the standards and certification push.

2. Localise high-value components through focused partnerships, including with global OEMs

Rather than trying to localise everything at once, OEMs should pick a shortlist of high-impact components like screws and barrels, gearboxes, deep-vacuum pumps, membranes, low-temperature compressors, high-speed bearings, and control assemblies. They can build joint roadmaps, including collaborations with international technology leaders who are open to manufacturing in India, as well as long-term co-development agreements with capable domestic suppliers. By aligning with policy support and cluster infrastructure, the industry can

steadily reduce import dependence, shorten downtime, and maintain more value and intellectual property within India.

3. Standardise common parts and build a shared demand platform with MSMEs

Industry associations should lead an effort to standardise common parts across brands, such as flanges, seals, bearings, heater cartridges, sensor interfaces, control panels, and other repeat elements to facilitate sourcing at scale from Indian MSMEs. Large OEMs and processors should run a shared digital platform with government support where they publish their forward demand for spares and critical components and invite qualified MSMEs to supply against those volumes. Standardisation, along with a transparent demand pipeline, will simplify certification and reduce inventory and lead times, making it commercially attractive for local suppliers to invest in higher-precision, food-grade manufacturing.

4. Build proof, service, and export-ready offerings anchored in R&D collaboration

OEMs should develop integrated proof-of-performance and service offerings that make Indian-made lines a low-risk choice for smart protein processors in India and the Global South. This includes establishing demo lines and application labs, in collaboration with leading R&D institutes, to validate performance on plant protein recipes and new product formats, and backing these with robust after-sales service, Annual Maintenance Contracts (AMCs), and local spare-parts stocking. Based on this foundation, OEMs can package export-ready, cost-effective smart protein lines and systematically export them to priority markets in Africa, Southeast Asia, and the Middle East.

Scan the QR code and register to receive the full report upon release

---