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UNLOCKING INDIA'S FOOD PROCESSING REVOLUTION

SHRI CHIRAG PASWAN

Union Minister of
Food Processing Industries

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FROM SOIL TO SHELF, THE RISE OF FOOD PROCESSING

Agriculture has long been defined by the sweat of the brow and the rhythm of the seasons. Now, as we deal with the complexities of the 21st century, the focus of our industry is shifting. It is no longer enough to simply grow more; we must do more with what we grow. This edition is dedicated to the vital bridge between the farmer's field and the consumer's fork: Food Processing.

For too long, "processed food" was a term met with skepticism, associated with additives and the loss of nutritional integrity. Today, we are witnessing a paradigm shift. Modern food processing is the cornerstone of food security, waste reduction, and rural economic empowerment. By transforming perishable raw materials into shelf-stable, nutritious products, we are effectively "extending the harvest," ensuring that the abundance of a peak season can feed a population year-round.

The statistics are a call to action. Globally, nearly one-third of all food produced is lost or wasted, often due to a lack of immediate cold storage or local processing facilities. Investment in value-addition technology isn't just a business strategy; it is a moral imperative. When farmers are able to turn a surplus of tomatoes into high-quality puree or sun-dried delicacies, they are no longer at the mercy of volatile "spot market" prices for raw goods.

The rise of "Clean Label" processing is proving that convenience doesn't have to compromise health. By utilizing high-pressure processing (HPP) and advanced dehydration techniques, we can lock in vitamins and flavours without the need for synthetic preservatives. This technological leap allows the agricultural sector to meet the demands of an increasingly health-conscious public while maintaining the transparency they crave. We are also seeing the emergence of circular processing, where "waste" streams—such as fruit peels or whey—are upcycled into high-value functional ingredients, creating new revenue streams from what was once discarded.

As we look to the future, we find that integration of agriculture and industry is the path toward a sustainable food system. The science of processing is turning primary producers into global entrepreneurs. The farms are only the beginning. The future of food is in the finish.

Rajni Shaleen Chopra

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From the CEO's desk

Unlocking India's Food Processing Potential

India's diverse agricultural landscape, from the rice bowl of the east to the spice gardens of the south, food processing emerges as the vital bridge between farm and future. At Agriculture Today, we celebrate how this sector transforms raw harvests into economic powerhouses, reducing waste and amplifying farmer incomes. Far beyond preservation, food processing is innovation—converting grains, fruits, and vegetables into nutritious, shelf-stable products that reach every corner of the globe. India produces over 300 million tonnes of food grains annually, yet post-harvest losses hover at 20-40% due to inadequate infrastructure. This is a missed opportunity worth billions. Advanced milling for rice and paddy yields premium varieties like basmati and fortified staples, enhancing nutritional profiles. Fruits become pulps, juices, and ready-to-eat snacks via adoption of modern techniques of processing and packaging, while dairy and spices fuel exports. Small and medium enterprises are at the forefront, with clusters in food parks turning millets into health foods and horticulture into organic preserves. Government thrust through schemes like PMFME and Pradhan Mantri Kisan Sampada Yojana provides subsidies for cold chains, machinery, and skill training, aiming for the creation of more and more jobs. Startups leverage tech for IoT-monitored drying and blockchain-traced supply chains, meeting global standards for sustainability. Diversification shines: rice bran oil powers biofuels, sugarcane bagasse yields paper, and cashew processing creates rural employment. Emerging trends like plant-based proteins from pulses and ready-to-cook masalas from regional spices further boost value addition, tapping into vegan and convenience markets worldwide. Precision farming integrations now optimize raw material quality for superior processed outputs. Yet hurdles remain—power shortages, fragmented supply chains, and complex regulations. There is need for expedited government regulatory approvals, expanded mega food parks, and farmer producer organizations to scale operations. Embracing clean-label trends and export compliance will position India as a processing leader. Investments in renewable energy for processing units and AI-driven quality control can bridge gaps effectively. Skill development programs for rural youth in advanced processing technologies will sustain long-term growth. As health-conscious consumers demand convenience without compromise, processed foods blend tradition with modernity—from idli mixes to millet porridges. There is need for stakeholders to invest boldly in processing. Let's convert abundance into atmanirbharta, ensuring every harvest fuels national prosperity.

Haris Khan

INDIA BRAZIL TRADE

BRAZIL MINISTER MR. PAULO TEIXEIR

SPOTLIGHTS MUTUAL GAINS IN AGRI TECH WITH INDIA

Agriculture Today Group CEO Mr. Haris Khan recently engaged in a key interaction with Brazil's Minister of Agrarian Development and Family Farming, Mr. Luiz Paulo Teixeira Ferreira, focusing on India-Brazil agricultural collaboration.

Key Discussion Points

Minister Paulo Teixeira emphasized vast potential in bilateral cooperation, including AI in agriculture, food security, bio-innovation, digital transformation, and climate-resilient farming—aiming to co-create technology-driven models for smallholder farmers and sustainable value chains. He reaffirmed Brazil's commitment to vital tech partnerships with India that shall benefit both nations.

The interaction underscores Agriculture Today Group's role in fostering global agri-dialogue and advance strategic and mutually profitable global ties in agriculture and allied sectors.

Huge Potential of Bilateral Cooperation Between Brazil and India

Minister Paulo Teixeira highlighted the significant potential of bilateral cooperation between Brazil and India in agriculture and allied sectors. He noted that key areas like AI in agriculture, food security, and bio-innovation offer mutual benefits, enabling both nations to co-create the next global model of technology-driven farming.

Minister Paulo Teixeira noted that key areas like AI in agriculture, food security, and bio-innovation offer mutual benefits, enabling both nations to co-create the next global model of technology-driven farming

Minister Paulo Teixeira reaffirmed Brazil's commitment to strengthening these ties through agricultural technology, digital transformation, and climate-resilient farming systems. He emphasized the critical role of technological partnerships in empowering smallholder farmers and building sustainable agri-value chains.

INDIA-US TRADE FRAMEWORK

WHAT IT MEANS FOR INDIAN AGRICULTURE

The recently announced India–United States trade framework has attracted intense attention and divergent interpretations, particularly around its implications for Indian agriculture and farmers. While public debate has largely focused on immediate tariff concessions and political claims of "market opening," the more consequential issues lie in the long-term opportunities for trade, investment, technology cooperation, and institutional alignment between the two countries.

This framework is best understood not as a conventional trade agreement but as a strategic signal of deeper engagement between two major economies navigating global supply chain reconfiguration and geopolitical uncertainty. Historically, agricultural trade between India and the United States has been shaped by a structural asymmetry in protection mechanisms.

India relied heavily on high tariffs, quantitative restrictions, and public procurement systems to safeguard food security and farmer livelihoods, while the United States maintained relatively low tariffs but imposed stringent non-tariff barriers in the form of sanitary and phytosanitary standards, traceability requirements, certification norms, and regulatory controls. As a result, Indian farm exports often faced practical barriers to entry in the US market, even when tariffs were low. The current framework reflects a gradual shift away from headline tariff battles toward trade facilitation, predictability, and cooperation, while leaving the most sensitive issues for future negotiation.

The India–US trade framework reflects cautious liberalisation, strategic alignment, and recognition that future agricultural competitiveness will be driven less by border protection and more by innovation, value addition, and institutional strength

From India's perspective, the most significant long-term opportunity lies in repositioning agriculture from a commodity-centric model to a value-led, market-oriented system. The US is not a volume market for staples such as rice or wheat, but it is a premium destination for processed foods, organics, nutraceuticals, specialty grains, spices, and geographically indicated products. If leveraged strategically, this framework can catalyse investments in food processing, cold chains, quality certification, and branding, enabling Indian farmers to capture higher value rather than compete on volume alone.

Such a transition is essential for raising farm incomes without exposing core crops to destabilising import competition. Equally important is the scope for deeper cooperation in agricultural technology, innovation, and knowledge exchange. India and the US are natural partners in areas such as climate-resilient agriculture, precision farming,

About the **AUTHOR**

The author is the Executive Director of World Agriculture Forum, President of International Agriculture Consulting Group (IACG), and Chairman, Agriculture Today Group.

digital advisory systems, water-use efficiency, soil health management, and post-harvest logistics.

For Indian farmers, long-term competitiveness will depend less on tariff protection and more on access to affordable, adaptable technologies that raise productivity while reducing risk. Institutional collaboration between universities, research centres, startups, and agri-businesses can play a transformative role if aligned with Indian agro-ecological realities.

The framework also creates opportunities for strengthening livestock and allied sectors. Limited tariff reductions on select feed inputs may help reduce costs for poultry, dairy, and aquaculture, i mproving competitiveness and moderating consumer prices. Over time, this could support diversification of rural incomes and expansion of protein production.

However, these gains will materialise only if accompanied by safeguards for domestic feed producers, investments in fodder development, and mechanisms to manage market volatility. Without such balance, cost advantages could translate into uneven outcomes across the value chain. At the same time, the agreement raises critical issues that warrant careful scrutiny.

While tariffs attract the most attention, non-tariff barriers remain the real determinant of market access. US sanitary and regulatory requirements remain largely unchanged, and without progress on mutual recognition, streamlined certification, and regulatory cooperation, improved tariff access may not translate into meaningful export growth for Indian farmers and processors. In this sense, the promise of the framework will be tested not at the border but in the regulatory space.

There is also the question of future negotiations. While the current framework excludes sensitive sectors such as dairy, staple grains, and genetically modified crops, these areas are likely to feature in subsequent rounds. For Indian farmers, the immediate impact of the agreement is largely neutral. There is no direct threat to MSP, public procurement, or food security mechanisms, and no sudden exposure of staple crops to imports. Benefits are more likely to accrue to export-oriented farmers and processors in the short term, while risks remain indirect and long-term. Whether these gains become inclusive will depend on how effectively farmer producer organisations are strengthened, how value chains are integrated, and how smallholders are supported in meeting quality and compliance requirements.

Ultimately, the India–US trade framework should be viewed as a platform for cooperation rather than a zero-sum contest. It reflects cautious liberalisation, strategic alignment, and recognition that future agricultural competitiveness will be driven less by border protection and more by innovation, value addition, and institutional strength.

For India, the choice is whether to treat this framework as a limited political arrangement or as an opportunity to prepare agriculture for a more competitive, resilient, and farmer-centric future. The agreement itself does not determine outcomes; India's preparedness does.

A QUIET BUDGET, BUT A LONG GAME

At first glance, Union Budget 2026–27 appears subdued on agriculture. There were no sweeping reform announcements, no dramatic subsidy overhauls, and no immediate structural reset.

But this Budget is best viewed not in isolation, but in continuity with recent policy initiatives. Many of its priorities build on digital platforms, productivity schemes, and institutional reforms already underway. Seen through that lens, the Budget's focus becomes clearer: it is less about short-term signalling and more about building infrastructure for long-term agricultural growth.

Why The Shift Is Significant

This shift in emphasis is significant. Agriculture still employs roughly 45% of India's workforce while contributing about 15% to GDP, reflecting a persistent productivity gap. Bridging that gap requires more than higher production. It demands technology adoption, diversified value chains, and stronger market integration — all of which depend on consistent policy direction rather than episodic interventions.

The Budget signals continuity with cautious recalibration. Public spending on agriculture and allied sectors has risen modestly to about Rs 1.6 lakh crore, reaffirming the sector's importance. Yet fertiliser subsidies alone remain close to Rs 1.7 lakh crore, illustrating how deeply input support continues to shape agricultural policy. Subsidies provide stability, but their current structure often distorts nutrient use, encouraging excessive nitrogen application while neglecting balanced soil nutrition.

Reforms Are Essential

Reform here is both an economic and environmental imperative. Fertiliser subsidies must gradually be rationalised, not

About the **AUTHOR**

Raghavan Sampathkumar
Executive Director, Federation of Seed Industry of India

withdrawn abruptly, and redirected toward promoting balanced nutrient use. Investments in soil testing, micronutrient support, precision application technologies, and awareness campaigns can improve yields while protecting soil health. Such a shift would strengthen farm productivity rather than weaken farmer support.

A second structural priority is edible oil dependence. India imports nearly 60% of its edible oil consumption, making it one of the country's most significant agricultural vulnerabilities. Reducing this dependence requires more than procurement incentives. It calls for sustained investment in oilseed productivity — improved varieties, better hybrids, extension support, and market signals that make oilseed cultivation competitive with cereals. Productivity gains in oilseeds would not only reduce imports but also promote crop diversification and improve farmer incomes.

The Budget's continued emphasis on digital public infrastructure can support this transition. Integrating farmer databases, advisory systems, and research outputs into scalable platforms can improve extension delivery and reduce information gaps. Real-time advisories on weather, soil conditions, pest threats, and crop economics can help farmers make more informed cropping decisions — including shifts toward higher-value or import-substituting crops.

Encouragingly, the Budget also sustains investment in agricultural research and education, with allocations approaching Rs 10,000 crore. But public research alone cannot meet India's productivity needs. The next phase of agricultural growth will depend heavily on innovation in superior varieties, hybrids, and climate-resilient technologies — areas where private sector participation is indispensable.

The Road Ahead

India must therefore create a stronger enabling environment for private investment in agricultural R&D. Predictable regulatory pathways, faster variety approvals, and science-based decision-making can unlock investment in seed innovation, hybrid development, and crop protection technologies. Such investments yield productivity gains that are far more durable than subsidy-driven support.

The broader message emerging from Budget 2026–27 is that infrastructure, research, and digital systems are being strengthened as the foundations of future growth. But infrastructure alone does not guarantee transformation. It must be accompanied by policy choices that encourage efficient resource use, technological innovation, and market-driven diversification.

Three Top Priorities

First, fertiliser subsidies must be gradually rationalised to promote balanced nutrition rather than skewed nutrient use, supported by soil health investments and precision application systems.

Second, reducing edible oil import dependence must become a national productivity mission, driven by superior seed technologies, hybrid adoption, and sustained value-chain incentives.

Third, India must actively crowd in private sector investment in agricultural innovation, particularly in seeds, hybrids, and climate-resilient technologies, through predictable, science-based regulatory frameworks.

These are not radical departures. They are logical extensions of the direction policy has already begun to take. The question is not whether the transition has started, but whether it will move fast enough to shape outcomes.

Budget 2026–27 may not have produced dramatic agricultural headlines. But it reinforces a gradual shift from input-driven support toward productivity-led growth.

If this shift is sustained and matched with reforms that encourage balanced nutrient use, innovation, and diversification, the subtle signals of this Budget could still translate into meaningful long-term gains.

India's agricultural transformation will not arrive through a single announcement. It will emerge from sustained investments, institutional clarity, and the willingness to redirect resources from past practices toward future productivity.

The Budget has pointed in that direction. The next steps must now follow with greater urgency.

IIT Ropar's ANNAM.AI

ALLIANCE FOR NEXT-GEN NOURISHMENT THROUGH AGRICULTURE MODERNIZATION

This Centre of Excellence (CoE) in Artificial Intelligence for Agriculture, hosted at IIT Ropar, is dedicated to developing scalable, AI-driven solutions for sustainable and precision farming and established by the Government of India under the Ministry of Education's national initiative to set up AI CoEs addressing key sectors like agriculture, healthcare, and sustainable cities, combining academic research with real-world agricultural impact.

The primary goal of IIT Ropar's ANNAM.AI is to leverage artificial intelligence and cutting-edge technology to transform agriculture in India:

- Using AI, computer vision, IoT, and data science to solve real agricultural challenges, including soil health, irrigation, pest/disease detection, weath-

About the **AUTHOR**

GOI has selected IIT Ropar's ANNAM.AI as the Centre of Excellence for agriculture, aimed at building AI-driven solutions that can reach farmers at scale. In the first phase, the initiative will focus on key agricultural states—Punjab, Uttar Pradesh, and Haryana—before expanding to other regions across the country. IIT Ropar's Dean, Dr. Pushpendra P. Singh, is leading this initiative, bringing decades of experience in artificial intelligence, data science, and large-scale digital systems. An academic and technology leader, he has worked extensively on AI, machine learning, and data-driven decision platforms, with a focus on applying advanced research to real-world challenges

er forecasting, and supply chain issues.
- Driving sustainable farming practices
- Thus, improving crop yields and farm efficiency

Phase 1A Target Region:

- Punjab
- Uttar Pradesh
- Haryana

Key Messages

IIT Ropar is leading one of three national Centers of Excellence in Artificial Intelligence, with a focus on agriculture, under a Rs.990 crore Government of India initiative. ANNAM.AI, the CoE at IIT Ropar, is part of a national strategy to Make AI in India and Make AI work for India—strengthening India's credentials in the global AI landscape.

AANAM.AI, the CoE, is a data-driven National Agriculture Intelligence Advisory that leverages AI/ML, cyber-physical systems, computer vision, virtual reality, and digital twin-based solutions to transform India's agricultural ecosystem. ANNAM.AI is India's National Backbone for Agricultural AI Intelligence, enabling large-scale, reliable, farmer-friendly AI systems. AANAM.AI includes a robust R&D capability, strong institutional credibility, national-level legitimacy, access to top talent, and the ability to operate effectively across the entire agricultural value chain.

ANNAM.AI focuses on developing AI solutions that are practical, scalable, and tailored to the real challenges faced by Indian farmers—from soil health to water use and crop monitoring. ANNAM.AI has initiated Academic and skill development programs, such as hackathons, internships, and joint PhDs, to build sector-specific talent and align its efforts with the Skill India initiative for a developed Bharat by 2047.

ANNAM.AI's work aligns with national priorities for food security, climate resilience, and rural development, ensuring technology translates into on-ground benefits for the sustainability chain. Strong differentiator from private agritech start-ups through research depth,

ANNAM.AI's work aligns with national priorities for food security, climate resilience, and rural development, ensuring technology translates into on-ground benefits for the sustainability chain

data moat, and public-good mission (DPI & SDG capping).

National Missions & Flagship Priorities Supported by AANAM.AI

AANAM.AI, as a Centre of Excellence (CoE) for Agriculture Intelligence, aligns closely with the Government of India's Viksit Bharat @2047 vision and supports the following national, digital, and AI-led missions that are central to the Prime Minister's development agenda:

- **Viksit Bharat @2047 / Developed India Vision** - Contributes to building a technology-driven, inclusive, and future-ready agriculture ecosystem, a critical pillar of India's economic growth and rural transformation.
- **Atmanirbhar Bharat** - Strengthens self-reliance in agriculture by reducing dependency through indigenous AI solutions, smart advisory, and data-driven governance.
- **Digital Agriculture Mission (DAM)** - Enables AI-led, data-driven advisory systems, smart farm intelligence, and real-time decision-making across the agri value chain.
- **AgriStack** - Supports the creation and utilisation of farmer-centric digital public infrastructure (DPI) through advanced analytics, AI/ML models, and interoperable platforms.
- **IndiaAI Mission** - Advances the adoption of artificial intelligence in agriculture through use cases such as crop intelligence, yield forecasting, climate risk assessment, and precision farming.
- **Digital India Mission** - Strengthens digital public infrastructure for agriculture, integrating AI, cyber-physical systems, computer vision, and data platforms to empower farmers and institutions.
- **National Mission on Sustainable Agriculture (NMSA)** - Promotes climate-resilient and resource-efficient farming using AI/ML, digital twins, and predictive analytics.
- **Pradhan Mantri Fasal Bima Yojana (PMFBY)** - Enhances crop monitoring, loss assessment, and yield estimation through AI, computer vision, and remote sensing technologies.
- **National Food Security Mission (NFSM)** - Supports productivity enhancement, crop planning, and demand-supply forecasting using advanced data intelligence.
- **Rashtriya Krishi Vikas Yojana**

(RKVY) - Facilitates innovation, agri-startups, and technology deployment at state and district levels.

- **Sustainable Development Goals** - Project direct contribution to SDG 13 (Climate Action), SDG 2 (Zero Hunger), and India's Paris Agreement Commitments.

Technologies:

The initiative also ensures access to high-end computing, sensor laboratories, and interdisciplinary research teams. Collaborations and memoranda of understanding (MoUs) have been established with the Punjab Agri Export Corporation Ltd. (PAGREXCO), the Northern Farmers (a farmer-producers organization), and the Indian Institute of Soil Sciences in Bhopal.

The AI-CoE leverages strong early-stage R&D along with a robust technological concept designed to meet the needs of the agri-ecosystem. Key innovations include:

1. **Annam Chat Engine (ACE):** The Agri-advisory service that has significant scalability potential. Key components include the Farmer Chat Bot, a digital assistant that delivers timely, hyperlocal agricultural advice, weather updates, and market insights to farmers. It helps bridge the gap between farmers and modern technology, empowering them to make informed decisions in the field. KCC Agent Interface (Kisan Call Centre): A streamlined digital platform enabling agricultural advisors to respond efficiently to farmer queries, access expert resources, and provide region-specific guidance in real time.

Krishi Intelligence provides advanced analytics of field data to deliver precise, timely crop advisory services

ANNAM Information Center (AIC) at IIT Ropar: This center equips farmers with AI-driven tools for smart, sustainable agriculture, enabling real-time analytics, offline AI solutions, and tailored guidance to enhance productivity and resilience.

2. **SWAN:** It drives Micro Climate Intelligent Infrastructure (MCII), serving as a next-generation smart weather station, continuously monitoring key environmental parameters with high precision. By integrating sensors for temperature, humidity, rainfall, wind, UV, and air quality, SWAN creates a real-time microclimate profile that supports data-driven decision-making. Its intelligent analytics help farmers optimize irrigation and crop planning, enable researchers to study local climate variability, and assist institutions in building resilient, climate-aware infrastructure. It ultimately transforms raw environmental data into actionable insights, strengthening both sustainability and operational efficiency.
3. **Krishi Intelligence:** A digital decision-support solution that employs an intelligence layer to understand and offer advice for crops, including (i) crop identification, (ii) crop damage assessment, and (iii) pest management. Krishi Intelligence provides advanced analytics of field data to deliver precise, timely crop advisory services. It automatically identifies crops using image and sensor-based intelligence, evaluates the extent and nature of crop damage with high accuracy, and detects early signs of pest infestation to guide targeted interventions. By integrating these capabilities into a unified platform, Krishi Intelligence empowers farmers, extension workers, and institutions with actionable insights that enhance productivity, mitigate losses, and foster climate-resilient agriculture.

FROM BIRD FEED TO BRANDED NUTRITION

REPOSITIONING GUJARAT GROUNDNUT FOR EU PEANUT BUTTER LEADERSHIP

Executive Proposition

India—despite being the world's largest groundnut producer—currently exports a substantial share of groundnut to the European Union as **low-value bird feed**, inadvertently earning the dubious distinction of being a **#1 supplier of feed-grade peanuts**. This represents a strategic, ecological, and economic failure.

My recent article on the issue:

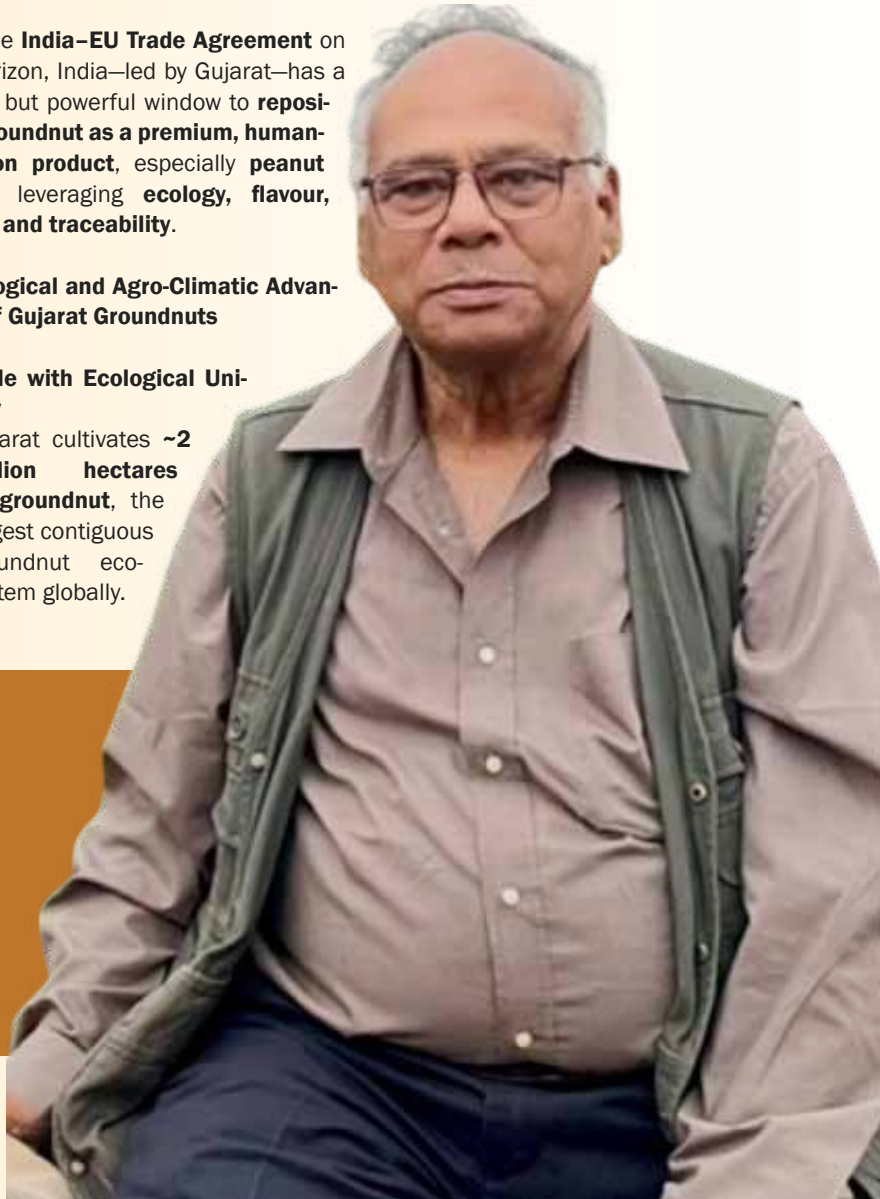
"Repositioning Groundnut — The Pride of Gujarat: From Bird Feed Exports to Global Health Food Leadership"
Mukti Sadhan Basu, Ph.D | Nov 13, 2025
https://www.linkedin.com/pulse/repositioning-groundnut-pride-gujarat-from-bird-feed-food-basu-ph-d-yfpsc

With the **India–EU Trade Agreement** on the horizon, India—led by Gujarat—has a narrow but powerful window to **reposition groundnut as a premium, human-nutrition product**, especially **peanut butter**, leveraging **ecology, flavour, safety, and traceability**.

I. Ecological and Agro-Climatic Advantage of Gujarat Groundnuts

1. Scale with Ecological Uniformity

- Gujarat cultivates **~2 million hectares of groundnut**, the largest contiguous groundnut ecosystem globally.



About the **AUTHOR**

Dr. M S Basu, Ex. Director ICAR, Visiting Scientist ICRISAT and UNIDO International Consultant on Aflatoxin (Africa)

- Predominantly **semi-arid, low-humidity** climate → **naturally suppresses aflatoxin-producing Aspergillus fungi**.
- Long sunshine hours + sandy loam soils → **higher oleic acid synthesis**, directly linked to nutty aroma and shelf stability.

2. Coastal Influence and Flavor Chemistry

- Proximity to the **Arabian Sea** moderates night temperatures.
- High diurnal temperature variation enhances **Maillard precursor compounds** (free amino acids and reducing sugars), critical for **roasted nutty flavour**—a key sensory expectation in EU peanut butter.
- Comparable to terroir logic used in **olive oil, wine, and cocoa**.

3. Ecological Sustainability Groundnut:

- Fixes **60–120 kg N/ha**, reducing synthetic fertilizer dependence.
- Requires **30–40% less water** than rice or sugarcane.
- Organic systems (as piloted in Saurashtra): a) Reduce pesticide residues—critical under EU MRL norms, b) Improve soil carbon and resilience.

The European Union (EU) peanut butter market is valued at approximately USD 1,600 million and is projected to reach USD 2,500 million within the next five years.

Conclusion: Gujarat groundnut is not just scalable—it is *ecologically aligned with EU sustainability standards*.

II. Why Exporting Groundnut as Bird Feed is a Strategic Mistake

1. Economic Absurdity

India is exporting **nutrition at feed prices**.

2. Reputational Damage

"Bird feed" classification reinforces:
a) Perception of **poor quality**
b) Weak post-harvest handling
c) Aflatoxin risk stigma
d) This undermines India's negotiating position in **high-value food trade**.

3. Opportunity Cost

Every container shipped as feed-grade peanuts:
a) Displaces **value-added peanut butter,** b) Locks farmers into low-price volatility and c) Prevents India from shaping EU consumer perception

Policy Imperative:

Phase out feed-grade exports to EU and redirect supply into food-grade processing clusters.

III. Peanut Butter: The Natural Upgrade Path

EU Market Context

EU peanut butter market: **USD 2+ billion**, growing at **6–8% annually**. Demand drivers:
a) Plant protein, b) Clean label foods, c) Vegan and fitness segments and d) Current suppliers: USA, Argentina—*not ecologically superior to Gujarat*.

India's Differentiation

1. **Nutty flavour (not bland protein paste)**
2. **High oleic stability → no hydrogena-**

tion
3. **Organic & aflatoxin-safe origin**
4. **Short supply chain from farm to port**

IV. Proven Model: Saurashtra–Rajkot Pilot

Product Streams
1. **Peanut Butter (EU Focus)** Organic, High-oleic, Aflatoxin <2 ppb, and no added sugar or palm oil
2. **Cold-Pressed "Kaccha Ghani" Edible Oil**
a) Natural aroma retained. b) Nutraceutical positioning and c) Suitable for EU ethnic & health markets
3. **Extra-Bold Table Groundnut**
High protein, Low oil, Snack & roasting segment

For further reading:
War to Conquer the Lost Pride of Gujarat Groundnut
https://www.linkedin.com/posts/mukti-sadhan-basu-ph-d-30769459_groundnut-aflatoxin-india-activity-6741229411548442624-MIbR?utm_source=share&utm_medium=member_ios&rcm=ACoAAAxhjbcBUs-DsaYYgQT3jnt0uZoix5XrX0g

Key Learnings
- **Aflatoxin control is possible at farm level**, not just at export inspection.
- Organic systems in semi-arid Gujarat are **commercially viable**.
- Sensory quality beats price competition.

V. Gujarat's Readiness Across the Value Chain
- **Seed systems:** High-oleic, bold varieties available
- **Post-harvest:** Drying, grading, blanching, sorting
- **Processing:** Modern roasting, grinding, cold pressing
- **Ports:** Kandla, Mundra—shortest transit to EU
- **Testing:** NABL labs, EU-compliant QA possible
- **Entrepreneurial base:** MSMEs already exporting oil & snacks

Missing link: Policy signal + export reorientation.

VI. Trade Complementarity: A Win-Win EU–India Equation
India Exports: Peanut butter, Cold-pressed groundnut oil, and Organic table peanuts
India Imports: Olive oil, Canola (00 grade) and Sunflower oil

STRATEGIC GAINS

For India:
a) Reduced palm oil dependency, b) Healthier edible oil basket, c) Stable farmer income, and Value-added exports
For EU:
a) Reliable plant protein source, b) Sustainable supply chain, and c) Market access to India's edible oil demand
This is **trade symmetry**, not imbalance.

VII. Policy Recommendations (Actionable)
1. Export Reclassification
• Discourage groundnut exports as bird feed to EU
• Incentivize food-grade processing through GST/PLI
2. Peanut Butter Export Mission
• Gujarat as lead state
• Cluster-based organic sourcing
• Common aflatoxin control infrastructure
3. Mutual Recognition
• Align aflatoxin testing protocols with EU
• Fast-track organic equivalence
4. Branding India Groundnut
• "Gujarat High-Oleic Peanut"
• Terroir-based GI positioning (in the line of Darjeeling Organic Tea)

Positioning India as a Lead Supplier of Peanut Butter to the European Union
The European Union (EU) peanut butter market is valued at approximately USD 1,600 million and is projected to reach USD 2,500 million within the next five years. India, despite being one of the world's largest groundnut producers, currently exports only about USD 30 million worth of peanut butter to the EU.
With focused policy intervention, **exports can scale up to USD 250-300 million.**
Strategic Snapshot: Market Scale vs India's Export Presence
Both the EU market size and India's export position are shown below on a common USD million scale.

Conclusion: A Trade Reset; Not a Trade Deal

India does not need to **enter** the EU peanut butter market.
It needs to **correct its own export mindset**.
From exporting **bird feed peanuts** to exporting **branded nutrition**, Gujarat can anchor a new chapter in India–EU agri-trade—ecologically sound, economically rational, and reputationally transformative.

STRENGTHENING OUR STARTUPS

SIGNIFICANCE OF CORPORATE SOCIAL RESPONSIBILITY

Corporate Social Responsibility (CSR) has become a pivotal concept in the business world, embodying a company's commitment to contribute positively to society beyond mere profit generation. It encompasses ethical practices that benefit the employees, environment, and the community while ensuring business sustainability. CSR can be particularly significant for startups as it helps in building trust, enhancing brand reputation, and laying the foundation for long-term growth. This article delves into the origin and growth of CSR, its legal framework in India, and the relevance of CSR for startups and society, with a focus on its global success and insights on startups in food sector.

Food startups will be essential to creating resilient and inclusive food systems as technology develops and sustainability becomes an economic need

Range of Benefits

The integration of CSR can offer a range of benefits for startups. While established corporations have long embraced CSR as a core part of their operations, startups can also leverage CSR to enhance their brand, attract investment, and build a sustainable business model. Several key reasons underscore the significance of CSR for startups:

1. **Building Trust and Reputation:** Trust is a valuable currency for startups, which are often new to the market and lack a long track record. CSR can help startups build trust among consumers, investors, and other stakeholders.

2. **Attracting and Retaining Talent:** Today's workforce increasingly values purpose-driven organizations. Studies have shown that millennials and Gen Z workers, who are poised to make up the majority of the workforce in the coming decades, prefer to work for companies that align with their social and environmental values. Startups with a strong CSR focus can, therefore, attract and retain top talent.

3. **Access to Investment:** In recent years, there has been a rise in impact investing, where investors seek financial returns alongside social or environmental impact. Startups that incorporate CSR into their business models may be more likely to

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attract investment from impact investors who are looking for a dual return on investment—both financial and societal.

4. **Mitigating Risks and Ensuring Long-term Sustainability:** CSR can help startups to mitigate risks associated with environmental regulations, social activism, and reputational damage. Moreover, by aligning their operations with societal values, startups are better positioned to build lasting relationships with customers and communities, thereby ensuring long-term business sustainability.

5. **Community Engagement and Support:** Startups often rely on local communities for their growth, and CSR can be an effective tool for building positive relationships with these communities. By contributing to local development initiatives—such as education, healthcare, or environmental conservation—startups can foster goodwill and support from the communities they serve.

Insights on Startups in the Food Sector

In recent years, the food industry has become one of the most innovative and vibrant startup ecosystems. Food startups are revolutionizing the production, distribution, and consumption of food due to changing customer preferences, technology developments, and increased awareness of convenience, sustainability, and health. From farm to fork, entrepreneurs are discovering innovative solutions to persistent problems and opening up new markets.

Changing Consumer Behaviour as a Growth Driver

Consumers today are more knowledgeable and particular than in the past. They look for individualized experiences, ethical production, nutritional value, and openness in sourcing. Startups that provide clean-label products, plant-based substitutes, organic foods, and functional nutrition have found success as a result of this change. Another important factor is convenience, since meal kits, ready-to-eat meals, and on-demand food services are becoming increasingly popular, especially in urban areas.

Technology at the Core of Innovation

One of the biggest facilitators of food entrepreneurs is technology. Business can forecast demand, minimize food waste, and improve supply chains with the aid of artificial intelligence and data analytics. Food delivery services and cloud kitchens use digital technology to scale quickly and with less overhead. In the meantime, food-tech advancements like vertical farming, precise fermentation, and alternative proteins are upending conventional food production techniques and providing scalable answers to global food security issues.

Sustainability as Competitive Advantage

Sustainability is now a key differentiation for businesses rather than a specialty issue. Startups that prioritize minimizing food waste, enhancing packaging, cutting carbon emissions, and assisting regional farmers are drawing in customers and investors. Circular economy models, such as reusing food waste to produce new goods, demonstrate how sustainability and profitability may coexist.

Funding Trends and Investment Landscape

Food businesses are attracting a lot of interest from investors, especially those with scalable strategies and distinct value propositions. Growth is being fuelled by impact investing, corporate collaborations, and venture capital in industries such as agri-tech, alternative proteins, and health-conscious food companies. But given the aggressive competition for capital, entrepreneurs must show that they have traction, stand out from the competitors, and have a clear route to success.

Challenges Facing Food Startups

Food businesses confront many obstacles despite the opportunities. Thin margins, supply chain interruptions, quality control, and regulatory compliance can all impede expansion. Gaining the trust of customers and producing high-quality products on a large scale continue to be challenges. Startups that strike a balance between creativity, operational rigor, and flexibility are successful.

Feeding the Future

CLIMATE-SMART AQUAFEED FOR A RESILIENT BLUE ECONOMY

India needs to make its aquaculture sector more resilient to the fallout of climate change, with its marine farms critical to global fish production, domestic food security and millions of livelihoods. The country produced over 18.4 million tons of fish production in FY 2023-24, making it the world's third-largest fish producer. Aquaculture, accounted for three quarters of this total, with only China producing more from its inland fisheries. What's more, the sector, which accounts for 5 percent of India's agricultural GDP, provides livelihoods for over 50 million people across the value chain.

But the sector is at risk from climate change. Temperature swings, unseasonable weather and extreme events are adversely affecting fish populations. Let's face it – mitigating global warming-induced climate change, let alone reversing it, is too much to hope for. But building resilience through adaptation isn't. Transitioning to climate smart feeds is a critical step towards building this resilience.

Climate-smart feeds as a resilience imperative

Climate smart feeds can help fish cope better with the impacts of climate change. Using low-carbon ingredients also makes production more environmentally friendly. For instance, feeds can be formulated to mitigate the impact of rising water temperatures on fish. Warmer temperatures typically affect metabolism, feeding patterns and immunity of fish. However, specially formulated feeds are designed to enhance digestibility and improve feed conversion ratios, thereby maximizing nutrient utilization and minimizing waste. The use of such feeds in turn deliver consistent growth rates among fish, even in conditions of thermal stress.

Immunity can be similarly bolstered. For instance, fish are especially vulnerable to disease outbreaks in variable climates. However, a combination of heat-resistant probiotics, immunostimulants, and antioxidants may enhance disease

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resistance under these conditions.

"Winter feed / Temperature Appropriate Feed" – A Success Story In The North India Aquaculture Farmers

Fish are poikilothermic meaning their metabolism is directly influenced by water temperature. In colder months, as temperature drops, their metabolism slows down, resulting in reduced feed intake and lower appetite.

To optimize feeding during this period, the following strategies shall be implemented. Provide easily digestible nutrients and minimize roughages to match the fish reduced metabolic activity.

Implement demand-based feeding during the warmer part of the day when fish are more active. Select protein sources rich in highly digestible proteins, essential amino acids and energy ingredients that provide easily digestible energy.

Incorporate feed palatability enhancers and appetizers to stimulate intake and appetite. Add antioxidants, anti-inflammatory additives, prebiotics and organic acids to support the fish immune system, help combat stress, and protect against pathogen.

For last 2 culture seasons, Godrej Aquafeed winter formulated fish feed has helped lacs of farmers in the northern and eastern parts of the country to sustain body growth, combat diseases and reduce mortality in the winter season resulting in better incomes by the farmers selling their produce at attractive prices during the summer season.

Adaptation is the only way for the aquaculture industry to cope with a warming planet. Increasing the use of algae or seaweed as sources of biofuels powering the production of feedstock can help reduce emissions from the manufacturing process

Precision Feeding: Optimizing Inputs, Reducing Impact

But it's not just what you feed the fish but how and how much you feed them. In this aquaculture can take inspiration from conventional agriculture, most notably by employing the practice of precision feeding. Precision feeding, like precision farming, involves harnessing technology and data analytics to precisely calibrate the quantity of inputs administered to the crop's (or the fish's) needs.

In agriculture this would involve the precise administering of nutritional interventions, like water or nitrogen or fertilizers, and crop protection products. In Aquaculture it involves the precise calibration of feeds. Feeding the fish only as much as they need and not more or less helps fish farmers to strike a balance, maximizing productivity while minimizing waste.

This in turn reduces water pollutants like excreta as well as methane emissions. The carbon footprint of feeds themselves can be reduced. Insect-based or plant-based feeds for instance are good alternatives to generic fishmeal while being cleaner and helping minimize nutrient waste.

Similarly, increasing the use of algae or seaweed as sources of biofuels powering the production of feedstock can help reduce emissions from the manufacturing process. At the end of the day adaptation is the only way for the aquaculture industry to cope with a warming planet. An approach rooted in science and technology can help speed the transition along. Protecting the aquaculture industry is certainly about protecting food security, global and domestic. It's also about protecting a way of life threatened by climate change.

GROWING APPETITE FOR DIFFERENTIATED PRODUCTS

High-protein grains, specialty maize, processed foods, healthier snacks, and traceable farm-origin ingredients are seeing high rise in demand

Achieving income growth for farmers lies in connecting them to opportunities.

For decades, the Minimum Support Price (MSP) has been the backbone of India's agricultural safety net. It has played a vital role in providing price assurance to farmers and stabilising food security. It acknowledges that the men and women who grow are food must be supported. However, if our true goal is to *raise farmer incomes* – not just protect them from downside risk – we must acknowledge a hard truth: MSP alone cannot deliver income growth at scale.

The future of Indian agriculture lies not only in price floors, but in market alignment – matching what farmers grow with what markets actually demand, and ensuring farmers participate meaningfully in the value that demand creates. We must find a way to ensure that farmers build competence and an understanding of market opportunities that makes them offer what the market demands.

Incentivising Differentiation, Quality, Innovation

MSP works best for a narrow set of crops and a limited geography. Even today, effective procurement is concentrated in a few states and primarily benefits wheat and paddy growers. Large sections of Indian farmers – especially those cultivating coarse cereals, horticulture, or specialty crops – remain outside the MSP umbrella.

More importantly, MSP is fundamentally defensive. It prevents distress, but it does not incentivise differentiation, quality, or innovation. Income growth, on the other hand, comes from producing crops that command a premium, from improving productivity by embracing technology and , and from participating in organised markets that reward consistency and quality. If we want farmers to earn more, we must move from a mindset of price protection to one of value creation.

Markets Signal Value – How do we Harness Them

Across India, consumption patterns are changing rapidly. Urbanisation, rising incomes, modern retail, and food processing are reshaping demand. There is growing appetite for differentiated products – high-protein grains, specialty maize, processed foods, healthier snacks, and traceable farm-origin ingredients.

Yet, much of our production planning remains disconnected from these signals. Farmers often grow what they have always grown, not because it is

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most profitable, but because it is familiar, subsidised, or perceived as 'safe'.

Market alignment means answering three simple but powerful questions before sowing:

1. Who will buy this crop?
2. At what quality and specification?
3. At what assured price or price range?

When farmers grow with the awareness of these answers, income outcomes change dramatically.

Lessons from Popcorn Maize

At Gourmet Popcornica, our work with popcorn maize offers a clear example of how market alignment can transform farm economics.

Popcorn maize is not procured under MSP. It is a niche crop with specific quality requirements – kernel size, moisture levels, popping expansion, and varietal purity. Traditionally, Indian farmers have been unaware of its market potential, while processors relied on imports.

By aligning farmers directly with market demand, the equation shifted. Through access to the right seed varieties, agronomic guidance, and assured offtake, farmers began growing popcorn maize as a market-linked crop, not a speculative one.

The results have been promising. Popcorn maize yields incomes significantly higher than conventional maize, with lower price volatility and clearer demand visibility. Most importantly, farmers are no longer price-takers at the mandi; they are suppliers to a defined value chain.

This is not an isolated story. Similar opportunities exist across specialty grains, oilseeds, pulses, fruits, vegetables, and industrial crops – if we design systems that connect farms to markets.

The Role of Private Enterprise and Institutions

Market alignment does not happen automatically. It requires collaboration across the ecosystem, with both the Government and corporations playing an active role. The objective should not be to replace MSP, but to complement it with market-first pathways that unlock higher incomes.

The future of Indian agriculture lies not just in protecting farmers from risk, but in connecting them to opportunity. Market alignment is not a buzzword – it is the missing link between hard work in the field and prosperity at the farm gate

Private enterprises can play a catalytic role by:

- Investing in contract farming and buy-back models
- Sharing market intelligence and technological developments with farmers
- Supporting input quality, extension services, and post-harvest handling
- Building processing capacity that anchors local demand

At the same time, public institutions must enable this shift by focusing on:

- Farmer Producer Organisations (FPOs) that aggregate scale and bargaining power
- Transparent, enforceable contract farming frameworks
- Infrastructure for storage, grading, and logistics
- Data-driven crop advisories linked to market trends, not just weather

Empowering the Farmer: From 'What Can I Grow?' to 'What Should I Grow?'

The most profound shift required is a mindset change – among policymakers, extension systems, and farmers themselves. Farmers must be able to make informed decisions – instead of asking, *'What crop is* supported?', they must ask, 'What crop is demanded?'.

This will enable them to maximise value per acres, instead of maximising acreage. Instead of short-term price assurances, we must build long-term market relationships. When farmers are treated not just as producers, but as partners in value chains, agriculture becomes aspirational again – especially for the next generation.

The Way Forward

Raising farmer incomes is one of India's most urgent economic and social imperatives. MSP will remain an important instrument, but it cannot shoulder this responsibility alone.

True income growth will come from:

- Aligning crops with consumption trends
- Rewarding quality and differentiation
- Integrating farmers into organised markets
- Sharing value more equitably across the chain

IREF WELCOMES TARIFF CUTS; PREDICTS GLOBAL BOOST FOR INDIAN RICE

Indian Rice Exporters Federation Says Tariff Rationalisation Shall Strengthen Competitiveness for Indian Rice in Global Markets

The Indian Rice Exporters Federation (IREF), led by its National President Dr. Prem Garg, has issued a statement addressing recent developments regarding tariff adjustments on Indian-made goods. According to early indications, the United States may reduce the tariff on select Indian products to 18%, compared with the earlier 25% rate that had been weighing on exporters. This anticipated reduction—should it be officially confirmed—would mark a significant and positive shift in the trading landscape, particularly for the rice sector, which remains a vital contributor to India's agricultural export profile.

Dr Prem Garg is the National President of The Indian Rice Exporters Federation (IREF)

Industry participants are also encouraged by signals from U.S. authorities suggesting that the additional penalties under discussion in relation to India's import of Russian oil may be waived. If both developments materialise as expected, India's effective tariff burden would decline from the currently elevated level to 18%, thereby restoring a level playing field with major competing origins such as Thailand and Pakistan. Competitor nations exporting to the U.S. are currently tariffed at approximately 19%, and aligning India's tariff position to this band would eliminate the competitive disadvantage Indian exporters have faced in recent quarters.

Dr. Garg noted that the prospect of tariff parity has already generated a wave of optimism across the rice export ecosystem. "This potential recalibration

of duties is seen as a constructive and timely step for our industry," he said. "Restoring tariff parity will enhance India's competitiveness in key markets, support stronger demand, and help strengthen India's position as a dependable supplier of high-quality rice."

The Federation emphasized that the news comes at an important moment for the sector. India is entering the new marketing season with record rice production estimated at approximately 149 million metric tonnes, reflecting not only strong cultivation conditions but also resilient domestic fundamentals. With such robust availability, India is well-positioned to meet global demand efficiently and consistently. Against this backdrop, any reduction in tariff-related barriers would further empower exporters to capitalize on expanding market opportunities.

Indian Rice Is Valued Globally

Despite elevated global uncertainties and fluctuating geopolitical developments, Indian agricultural products—particularly rice—continue to hold an indispensable position within global supply chains. Recent export patterns further illustrate this dynamic: shipments of Indian rice to the United States increased even after the duty on Indian rice was steeply raised—from an initial 10% to 50%. This resilience underscores the essential nature of Indian rice for international buyers and consumers, who value its quality, reliability, and competitive price-performance ratio.

"These trends reaffirm our belief that India's competitiveness is structurally strong and not merely a function of tariff advantages," Dr. Garg added. "Even under sharply higher duties, demand for Indian rice strengthened. This gives us full confidence that once tariff parity is restored, Indian exporters will experience improved offtake, higher volumes, and more favourable price realization."

From a pricing standpoint, a tariff reset would immediately enhance the landed-price competitiveness of Indian rice. This improvement is expected to translate into stronger demand across both basmati and non-basmati categories, enabling businesses to defend and expand their market share in the United States. The ability to compete more effectively with alternative origins—such as Pakistan, Thailand, and Vietnam—will also support long-term sustainability and growth for India's rice export sector.

In addition to the U.S.-related developments, the Federation addressed parallel questions concerning the possibility of an additional tariff linked to India's broader trade relationship with Iran. IREF noted that evolving trade frameworks, including the possibility of future free trade agreements, typically arise from a combination of strategic, geopolitical, and economic considerations. These frameworks extend beyond purely commercial motivations and often reflect broader diplomatic alignment.

Federation Is Optimistic About Opportunities Ahead For The Sector

Based on the Federation's current assessment and visibility, IREF does not anticipate any additional disruption to India's trade with Iran. Export flows have remained stable, and the Federation expects continuity in the near term. The organisation will continue monitoring developments and advocating for clarity to ensure exporters can plan with confidence.

Vice President Mr. Dev Garg highlighted the organisation's commitment to proactive engagement with all relevant stakeholders, including government authorities, trade partners, logistics providers, and exporters themselves. "Our responsibility is to ensure that exporters are fully prepared for any procedural changes that may arise from tariff adjustments or evolving policy frameworks," he stated. "We remain committed to supporting stable, rules-based trade that delivers value to consumers, strengthens supply chains, and secures India's position as a leading global rice supplier."

Vi Exports India Pvt Ltd successfully ships a consignment of 7,000 MTs of FRK rice to Madagascar

Africa continues to face widespread nutrition deficiencies. One of the most effective solutions lies in strengthening access to nutrient-rich staple foods like rice. Adoption of Fortified Rice Kernels (FRK) has emerged as a powerful strategy to combat micronutrient deficiencies at scale.

Madagascar recently placed an order for 7,000 tonnes of FRK from Vi Exports India Pvt Ltd, an esteemed member of the Indian Rice Exporters' Federation (IREF). On 19 February, the consignment was flagged off from Kandla Port by APEDA, marking a historic milestone in India's commitment to global nutrition and value-added agricultural leadership. The initiative has given new strength to the resolve of self-reliant agriculture, increasing prosperity of farmers and Viksit Bharat. The shipment reflects India's nutritional capabilities and technological strength.

The Future of RICE CULTIVATION IN INDIA UNDER CHANGING CLIMATE PATTERNS

Rice is a part of India's culture and economics. More than half of India's population depends and relies on rice as a staple diet and as an added nutrition to their diet. Rice farming, which has always been a solid base for Indian agriculture, adapted to the planet's shifting climate patterns with remarkable resilience, creativity, and foresight.

The Indian agriculture system has been able to secure the rice field and the future of rice fields even in the challenging climate patterns. A quiet revolution is taking place in the laboratories, research centers, and communities to secure the survival of India's most important crop in a world that is becoming hotter and less predictable. This gradual change and development of rice may only be the start of shifting the plant's creative period where its cultivation is linked and connected to be-

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ing environmentally friendly and modern simultaneously.

Development of Next-Generation Rice Cultivars That Can Withstand The Effects Of Heat, Drought, And Flooding

Over the last ten years, improving climate resilience has been a top focus for Indian scientists and policymakers. Indian Council of Agricultural Research (ICAR) and the National Rice Research Institute (NRRI) are at the forefront of creating next-generation rice cultivars that can withstand the effects of heat, drought, and flooding. Direct-Seeded Rice (DSR) and the System of Rice Intensification (SRI) are gaining popularity amongst farmers due to their water-efficient and sustainable nature which ensures soil health, less reliance on standing water, and frequently results in higher yields with fewer inputs. Such efficient techniques have changed the game in areas where water is scarce, conserving energy and water while preserving productivity.

In today's modern world, a new and powerful ally is technology. Digital weather forecasts, mobile-based advice networks, and precision agricultural tools are helping farmers make smarter decisions faster. Early-warning systems enable timely reactions to adverse weather, while satellite monitoring and soil data guide more effective fertilizer and irrigation use. By giving rural communities access to current information, technology's integration into traditional farming has aided in closing the knowledge gap between science and the soil.

The policy environment has also evolved to reflect these advances. Through initiatives like the National Innovations in Climate Resilient Agriculture (NICRA), the government has worked and will work to support and motivate farmers financially and scientifically to promote climate-resilient agriculture. The ecosystem surrounding rice cultivation has improved because of crop insurance programs, incentives for using modern irrigation, and campaigns to raise awareness of sustainable farming practices. Additionally, through public-private partnerships, the corporate sector has started to support training programs, digital platforms, and seed development that reach far into rural India.

The ecosystem surrounding rice cultivation has improved because of crop insurance programs, incentives for using modern irrigation, and campaigns to raise awareness of sustainable farming practices

Regionally Specific Solutions Play Vital Role

This shift is primarily being driven by India's farmers, who can easily adapt and are quick to learn. Communities all around India are coming up with regionally specific solutions, from women's self-help groups running communal irrigation systems to young farmers experimenting with novel types. This spirit of adaptation and institutional support keeps the story of Indian rice uplifting rather than alarming.

The future of rice cultivation in India will depend on how well modern discoveries are combined with traditional knowledge. Farmers can preserve productivity while lowering environmental stress by diversifying crop cycles, improving soil fertility with organic inputs, and optimizing water management. If funding for research, rural infrastructure, and digital inclusion is maintained, innovation will have a positive impact on India's agricultural landscape.

India has a long history of agricultural innovation. Adapting from outdated and traditional irrigation methods to contemporary climate-smart alternatives has been the nation's greatest strength. While climate change poses a significant challenge, it also offers an opportunity to build a more resilient and sustainable agricultural future. In order to guarantee that India's paddy fields continue to flourish and serve as both symbols of abundance and models of adaptation and progress, scientists, policymakers, and farmers must collaborate.

FROM FIELD TO MARKET

HOW BUDGET 2026–27 STRENGTHENS INDIA'S AGRICULTURE AND ALLIED VALUE CHAINS

For much of the past, India's agricultural policy discourse focused on production volumes. Budget 2026–27 signals a clear shift in emphasis—from how much we grow to how much value farmers, fishers and allied producers ultimately retain. With an overall allocation of Rs.1.62 lakh crore for agriculture and allied sectors, the Budget positions these sectors not merely as recipients of support, but as drivers of valueled, marketoriented growth.

Policy interventions span the entire continuum—from inputs and scientific production practices to postharvest infrastructure, processing, branding, logistics, and export competitiveness. The objective is a more efficient farmtofork system marked by lower losses, higher quality, and predictable returns for producers, alongside better outcomes for consumers.

Agriculture: Moving Beyond Output to Value Creation

Agriculture in Budget 2026–27 is framed around value creation rather than output alone. The focus shifts decisively beyond the farm gate to address longstanding constraints that suppress farmer incomes. Investments in postharvest infrastructure—including sorting, grading, primary processing, cold chains, and decentralised storage—aim to reduce losses and stabilise prices, enabling farmers to time their market entry rather than sell under compulsion.

Market integration forms the second pillar. Strengthened Farmer Producer Organisations

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(FPOs), womenled selfhelp groups, cooperatives, and digital pricediscovery platforms are positioned as central institutions for aggregation, negotiation, and branding. This institutional architecture reduces transaction costs and improves price realisation, particularly for small and marginal farmers.

The third pillar is qualityled differentiation. Support for packaging, branding, traceability, and foodsafety compliance enables producers to move from selling commodities to marketing products. By linking quality with remuneration, the Budget improves the share of consumer value that accrues to farmers while ensuring safer and more consistent food supplies.

Complementing these measures are efforts to strengthen input access and climatesmart practices, recognising soil health, water efficiency, and resilience as economic assets. Targeted support for processing clusters and rural enterprises further localises value addition, creates nonfarm employment, and enhances household resilience against climatic and market shocks. In aggregate, the agriculture strategy ties productivity to market power, translating public investment into higher and more predictable farm incomes.

Sustainability, Diversification and Technology as Enablers

A strong signal in Budget 2026–27 is the renewed emphasis on sustainable farming systems. The National Mission on Natural Farming, supported by Rs.750 crore, promotes chemicalfree practices through training and certification. Beyond environmental gains, the economic rationale is clear: as global markets tighten residue and sustainability standards, natural farming enhances access to premium segments, while improved soil health strengthens longterm competitiveness.

Equally strategic is the pivot towards crop diversification and highvalue agriculture. Horticulture emerges as a key beneficiary, with focused support for regionspecific crops and postharvest value chains. Dedicated programmes for coconut, cocoa, cashew and sandalwood in coastal regions, and almonds, walnuts and pine nuts in hill states, mark a departure from cerealcentric policy. By aligning production with agroclimatic strengths, the Budget encourages geographic specialisation and the development of globally recognised Indian brands that export quality and identity, not just volume.

Embedding Value Creation

Budget 2026–27 does not promise instant transformation. Its strength lies in sequencing—aligning sustainability with productivity, technology with tradition, and markets with inclusion. By embedding value creation across agriculture and allied sectors, the Budget lays the foundation for higher rural incomes, stronger export competitiveness, and a more resilient agrifood economy—one that serves farmers, consumers and the broader economy alike.

Technology is positioned as a force multiplier. The proposed BharatVISTAAR platform, integrating AgriStack with ICAR's packages of practices through a multilingual AI interface, is expected to improve access to timely, datadriven advisories on crop planning, weather risks and pest management. This reflects a deeper shift towards predictive, informationled farming decisions, reducing uncertainty for smallholders.

Fisheries: Translating Scale into Sustained Incomes

Fisheries exemplifies the Budget's valuechain approach. Budget 2026–27 allocates Rs.2,761.80 crore to the sector—a ~60% yearonyear increase—underscoring its centrality to inclusive growth. Of this, Rs.2,530 crore is dedicated to schemebased interventions, with Rs.2,500 crore under PMMSY supporting seed and feed availability, modern ponds and cages, landing infrastructure, ice plants, cold chains, and firstmile logistics. The Rs.30 crore allocation for FIDF sustains momentum in harbours, landing centres and processing facilities.

Building on a decade that saw fish production rise from 95.79 lakh tonnes to 197.75 lakh tonnes and exports double to Rs.62,408 crore, the Budget focuses on incomecentric outcomes. The integrated development of 500 reservoirs and Amrit Sarovars will enhance inland fisheries productivity and local employment, while strengthened market linkages for Fish FPOs, womenled groups and startups will improve postharvest handling and price realisation. Measures to enhance export competitiveness, alongside safeguards for responsible fishing, support income growth without compromising sustainability.

Dairy: Strengthening Everyday Income Streams

Dairy, a critical source of regular cash flow for rural households—particularly women—benefits from a comprehensive valuechain approach encompassing clean milk collection, chilling, quality testing, processing, packaging and branding. Expanded villagelevel infrastructure reduces spoilage and enables qualitylinked payments, while support for local processing of valueadded products such as paneer, curd and ghee retains margins within producer communities. Improved branding and compliance allow cooperatives and producer companies to capture a larger share of the consumer rupee, benefiting both producers and consumers.

Processing, Exports and Market Linkages

Across agriculture and allied sectors, processing, branding and exports act as income multipliers. Targeted facilitation lowers input costs for processing, improves compliance with quality standards, and expands market access. Strengthened collectives, digital logistics and retail linkages shorten supply chains, enabling producers to capture more value while delivering fresher, safer products to consumers at stable prices.

THE FOOD PROCESSING SECTOR
MARKET MECHANICS AND THE ROAD AHEAD

The food processing sector today stands at a defining moment in emerging economies like India, where the opportunity size is as large as the challenge. Sitting at the juncture of agriculture, industry, and consumer markets, food processing is no more about value addition but central to food security, farmer income, sustainability, and national economic resilience.

Food processing has become the backbone of the Indian rural economy. Better infrastructure for processing can help reduce the losses in post-harvest significantly, besides opening up avenues for employment in rural areas and strengthening regional value chains. With increasing urbanisation, the demand for safe, convenient, nutritious food products also increases, casting additional responsibility for sustainable scaling upon the processors themselves.

Despite being one of the largest producers of agricultural commodities in the world, India processes only 10 percent of its total agricultural output. This depicts inefficiency and also an opportunity to reduce post-harvest losses, provide stability to the income of the farmers, and meet the changing needs of the consumers of the country. This can be achieved by further integrating the farmers, the financial sector, and the markets, especially in rural and semi-urban regions.

Consumer Expectations Are Redefining Processing Models

Consumers are increasingly influenced by health, transparency, and sustainability drivers. The clean-label movement has accelerated the pace of formulation and sourcing evolution, prompting processors to eliminate artificial ingredients without compromising food safety, shelf life, and price points.

The recent surge of plant-based and alternative food products shows an important lesson from market corrections: long-term success depends on good taste, nutrition, value, and affordable pricing. In a market like India, innovation must be inclusive, serving both urban consumers and the wider mass market.

The area of food wastage too today holds a prominent place. Though the communication around sustainability is good, the actual delivery on dimensions of food wastage reduction, utilization of by-product generation, and processing patterns is variable. This calls for

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in-depth visibility for the supply chain, including agriculture aggregation.

For processors, this means a fundamental rethinking of the approach to their products, packaging, and procuring. The winning brands will be those which manage to successfully merge innovation with accessibility. This means making the products not only innovative but also affordable.

Technology as an Enabler, Not a Silver Bullet

Digital technologies are transforming food processing. Their results are determined by their successful implementation. Like in other sectors, artificial intelligence is becoming a necessity in quality assurance, forecasting, and compliance checking. Analytical technologies are in use to improve efficiency in all processing operations.

IOT enables the tracking of the status of the produce, the storage conditions, and the processing conditions. However, there is a lack in the adoption of this technology owing to costs and skills, especially for small and medium-scale processors.

Integrated rural platforms that offer data intelligence, advisory services, and market linkages are becoming critical. Project AVIO Agritech, led by Bartronics India Limited, was developed with the aim of filling some of the existing gaps by establishing traceable data flows within the agri and food value chain.

Another important aspect that cannot be neglected is developing digital literacy and operational capacities of farmers and small processing entities. Technology adoption will not succeed in isolation. It should be accompanied by additional support for training and facilitating partnerships, such that all stakeholders are capable of useful engagements with it.

COLLABORATIONS ARE CRUCIAL

Development of rural infrastructure, rural connectivity in the cold chain, and the development of access to embedded finance are crucial in the development of a resilient end-to-end supply chain. Collaboration between the government, industry, and technology players can help maximize the potential in the development of these infrastructures, including the interests of the smaller players.

Sustainability: A Core Business Imperative

Food systems consume nearly 30 percent of the world's total energy and account for more than one-quarter of the greenhouse gas emissions. A large percentage of the impact of food systems stems from food losses and processing inefficiencies, and hence, sustainability is a critical business and operational concern.

Energy optimisation with special emphasis on thermal processing can help unlock an improvement of 20 percent. Non-thermal technologies like high pressure processing, pulsed light technology, and ultraviolet technology are becoming increasingly popular due to the safety and nutritional benefits that accompany them.

Sustainability also plays a part in the profitability of the business. This is especially seen in the aspect of efficiently utilizing resources where waste is also a big factor. Current trends have seen investors favouring their businesses even more.

Strengthening Supply Chain Resilience under a Changing Climate

Climate volatility is increasingly impacting agricultural production and food value chains, with effects on quality, availability, and price volatility. Smallholder farmers are more impacted due to rain-fed farming practices and limited access to markets as well as finance.

Resilient supply chains necessitate a more coordinated effort among stakeholders involved. It can be aided by the application of digital traceability tools and flexible procurement structures to mitigate risks in the supply chain.

The Strategic Way Forward

The future of food processing will be about blending innovation with human potential, blending sustainability with profitability, scalability with inclusiveness. Food processing is not just a business; it is a national infrastructure. Its success will define the promise of India's agricultural surpluses being translated into economic, nutritional, and sustainability prosperity.

THE EVOLVING LANDSCAPE OF FOOD PROCESSING

OPPORTUNITIES AND CHALLENGES AHEAD

The food processing sector today stands at a decisive crossroads, shaped by rapid technological change, evolving consumer expectations, and increasing pressure to build sustainable and resilient systems. Once viewed largely as an extension of agriculture, food processing has now emerged as a strategic industry that connects farmers to markets, reduces wastage, ensures food security, and adds significant economic value. As the sector evolves, it is witnessing several transformative trends, while also confronting complex challenges that require thoughtful, long-term solutions.

One of the most defining shifts in food processing is the growing adoption of digital technologies and smart manufacturing practices. The integration of automation, data analytics, artificial intelligence, and real-time monitoring systems is improving efficiency, consistency, and traceability across processing facilities. These technologies enable processors to optimize energy usage, monitor quality parameters, predict equipment maintenance needs, and reduce operational downtime. Digital tools are also helping organizations gain deeper insights into supply chains, allowing better planning and faster response to disruptions. For a sector where margins are often tight, such efficiency gains are becoming essential rather than optional.

Fundamental Transformation in Consumer Preferences

At the same time, consumer preferences are undergoing a fundamental transformation. Today's consumers are more informed, health-conscious, and discerning about what they eat. There is a clear shift toward foods that are natural, convenient, minimally processed, and nutritionally balanced. Clean-label products, free from artificial additives and preservatives, are gaining preference, while demand is rising for foods with functional benefits such as immunity support, digestive health, and enhanced nutrition. This change is pushing food processors to rethink product formulations, invest in research and development, and innovate continuously to meet evolving dietary expectations.

Closely linked to this health-driven shift is the growing interest in plant-based and alternative protein products. Environmental sustainability, ethical considerations, and lifestyle changes are driving consumers to explore protein

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Mr. Vilas Shinde is the Chairman & Managing Director of Sahyadri Farms, India's largest farmer-owned producer organization and top grape exporter based in Nashik, Maharashtra. Sahyadri Farms acts as an integrated platform for over 18,000 farmers, providing end-to-end services from farming technical support to processing, and marketing fruits like grapes, bananas, and tomatoes

sources beyond conventional animal-based products. Advances in food processing technologies have made it possible to create plant-based foods with improved taste, texture, and nutritional profiles. As this segment grows, it presents both an opportunity for diversification and a challenge in terms of technology investment and consumer education.

The Significance of Sustainability

Sustainability has also become central to decision-making in the food processing industry. Companies are increasingly aware that long-term growth cannot come at the cost of environmental degradation. There is a stronger focus on reducing food waste, improving energy efficiency, conserving water, and adopting eco-friendly packaging solutions. Many processors are exploring circular economy models, where by-products and waste streams are converted into value-added inputs such as animal feed, bioenergy, or secondary food ingredients. Sustainability today is not only about compliance or responsibility; it has become a critical factor in brand trust and market competitiveness.

While new technologies and product innovations open doors to growth, they often involve high capital expenditure. Collaborative models, shared infrastructure, and supportive policy incentives can play a vital role in addressing this balance

Another significant trend in reshaping the sector is the growing demand for transparency and traceability. Consumers want to know where their food comes from, how it is grown, and how it is processed. Technologies such as digital tracking systems, QR codes, and blockchain-based solutions are enabling end-to-end traceability from farm to fork. This transparency strengthens food safety, builds consumer confidence, and helps processors meet customer, regulatory and export requirements more effectively providing the confidence to FBO to improve further.

The Altering Food Processing Landscape

The expansion of e-commerce and direct-to-consumer channels has further altered the food processing landscape. Digital platforms have shortened the distance between producers and consumers, offering convenience, personalization, and wider product access. For processors, this shift provides valuable insights into consumer behavior and preferences, but it also demands greater agility in packaging, logistics, and inventory management.

Despite these positive developments, the food processing sector continues to face significant challenges. One of the most persistent issues is the volatility of raw material supply and pricing. Agricultural inputs are highly dependent on climatic conditions, global market fluctuations, and logistical disruptions. Such volatility makes cost planning dif-

ficult and affects both profitability and pricing stability. Building stronger linkages with farmers, investing in aggregation models, and using data-driven forecasting can help mitigate some of these risks, but they require scale and sustained commitment. Mindset of adopting Food Safety and Quality culture practices is also lacking.

Infrastructure constraints remain another major hurdle, particularly in developing regions. Inadequate cold storage, inefficient cold chain transportation networks, and fragmented logistics systems lead to substantial post-harvest losses. These inefficiencies not only reduce returns for farmers and processors but also impact food availability and affordability. Strengthening infrastructure requires coordinated investment from the private sector and policy support from governments to create enabling ecosystems.

Regulatory Compliance

Regulatory compliance is also becoming increasingly complex. Food processors must adhere to stringent standards related to food safety, quality, labeling, and environmental norms. While these regulations are essential to protect consumers, compliance can be resource-intensive, especially for small and medium enterprises. Streamlined processes, capacity-building initiatives, and access to technical guidance can help ensure that regulatory frameworks support growth rather than hinder it.

The availability of skilled manpower poses another challenge. As processing facilities become more technologically advanced, the demand for skilled professionals in food science, quality control, engineering, and digital operations continues to rise. However, the supply of trained talent has not kept pace with industry needs. Bridging this gap will require focused investment in skill development, industry-academia collaboration, and continuous upskilling of the existing workforce.

With the right investments, policies, and partnerships, food processing can emerge as a powerful engine of inclusive growth, benefiting farmers, consumers, and the broader economy alike

Finally, the sector faces the delicate task of balancing innovation with affordability and sustainability. While new technologies and product innovations open doors to growth, they often involve high capital expenditure. For many processors, especially smaller players, the challenge lies in adopting innovation without compromising financial viability. Collaborative models, shared infrastructure, and supportive policy incentives can play a vital role in addressing this balance.

The food processing sector is undergoing a period of profound transformation. Driven by technology, changing consumer expectations, and sustainability imperatives, it holds immense potential to create value across the food value chain. However, realizing this potential requires addressing structural challenges with foresight, collaboration, and resilience. With the right investments, policies, and partnerships, food processing can emerge as a powerful engine of inclusive growth, benefiting farmers, consumers, and the broader economy alike.

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THE DIGITAL FOUNDATION OF INDIA'S AGRICULTURAL FUTURE

UNDERSTANDING DPI'S ROLE IN FARMER PROSPERITY

Just as Aadhaar revolutionized identity verification and UPI transformed financial transactions, Digital Public Infrastructure (DPI) is now poised to reshape how over 11 crore farmers access services, make decisions, and connect with markets. At its core is lies a simple yet powerful vision: to provide every farmer with a digital identity, a "*Kisan ki Pehchaan*", that serves as their gateway to credit, insurance, subsidies, real-time advisories, and market opportunities.

DPI is fast replacing traditional agricultural governance which relies extensively on paperwork, physical verification, and disconnected databases. DPIs, comprising foundational elements like AgriStack, the *Krishi* Decision Support System, and comprehensive Soil Profile Mapping, address these systemic challenges by creating open-source, interoperable digital frameworks.

For farmers, this means transitioning to seamless, real-time access to personalized crop advisories based on their soil health, timely weather alerts, instant credit approvals using verified digital identities, and direct connections with buyers who offer fair prices. For the government, DPIs promise transparent scheme implementation, accurate production estimates and swift response to agricultural crises. All this while reducing costs and minimise leakages from rural welfare programs.

The next evolutionary step in India's agricultural DPI is the Agriculture Data Exchange (ADeX), developed as an open-source, interoperable public good

The Architecture of Trust: Understanding AgriStack

At the core of India's agricultural DPI lies AgriStack, a farmer-centric infrastructure built on three foundational, authenticated registries. The Farmer Registry maintains dynamic, verified data on farmer demographics, landholdings, family details, and schemes availed. The Geo-referenced Village Map Registry enables precise digital crop surveys with spatial accuracy. The Crop Sown Registry records actual plantings each season through mobile-based ground surveys.

The centrepiece of this architecture is the Farmer ID: a unique, authenticated digital identity that serves as the single source of truth for all farmer-related transactions. The Farmer ID links dynamically to UIDAI's Aadhaar for demographic authentication, state land records portals like Maharashtra's Maha Bhumi Abhilekh for ownership verification, and insurance databases like the PMFBY portal for crop and risk data.

The real innovation isn't just in creating these registries; it's in how they integrate into operational workflows. When procurement platforms implement real-time API integrations with AgriStack, they can perform instant verification checks during farmer onboarding. Companies like NCDEX e Markets Limited (NeML),

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Views expressed are personal

which manages Government's various MSP procurement operations across the country, have pioneered unified workflows where registration proceeds only when Aadhaar data matches AgriStack data across demographic details, landholding records, and crop-sown information. This instant authentication eliminates ghost farmers, inflated crop areas, and duplicate registrations, problems that have plagued government procurement for decades.

The technical architecture supporting this verification relies on RESTful APIs with OAuth 2.0 authentication, ensuring secure, consent-driven data exchange. Fallback logic becomes crucial when dealing with incomplete data: if AgriStack information is temporarily unavailable, authenticated land records or verified PMFBY data can serve as alternative sources, maintaining operational continuity without compromising security. This modular approach, where multiple authenticated sources validate each other, creates redundancy that strengthens rather than weakens the system.

From Data Trust to Transactional Finality

The distinction between establishing data trust and achieving transactional finality is critical to understanding DPI's true potential. AgriStack establishes data trust by authenticating identities and ownership. But converting this verified data into guaranteed financial outcomes requires operational platforms with robust risk management, settlement infrastructure, and market liquidity.

Consider the mechanics of an MSP procurement platform by NeML enhanced by DPI integration. Traditionally, farmers arrived at mandis with paper documents, faced manual verification, and waited weeks for payment due to unverified bank details and identity mismatches. High rejection rates stemmed from data inconsistencies across disconnected government databases. The absence of reliable inventory data also meant that subsequent stock disposal auctions achieved suboptimal price realization, costing the public exchequer significant value.

DPI integration within the NeML digital platform transforms this entire cycle. When authenticated Farmer IDs link to verified bank accounts through the Aadhaar-Based Payment System and PFMS rails, Direct Benefit Transfer becomes both instant and accurate. Market platforms that integrated AgriStack early, such as NeML's systems deployed for Maharashtra's procurement operations, report significant reductions in payment settlement time (from weeks to days) and steep drops in administrative discrepancies post-procurement. The verified identity chain means that the farmer who sold the produce is guaranteed to receive payment, eliminating settlement risk.

For government stock disposal, DPI-powered analytics provide real-time, district-level inventory insights. Decision-makers can determine optimal auction timing, lot sizes, and market selection based on actual verified stock levels rather than estimates. In Maharashtra, where NeML's e-auction platform has integrated AgriStack data into disposal workflows for commodities like Mustard Seed procured under MSP, the results demonstrate measurably higher price realization compared to non-DPI channels. This isn't simply about technology; it's about how verified data flows through the entire procurement-to-disposal cycle, creating value at every stage.

Agricultural Data Exchange: Democratizing Innovation

The next evolutionary step in India's agricultural DPI is the Agriculture Data Exchange (ADeX), developed as an open-source, interoperable public good. ADeX facilitates secure, standards-based, and consent-driven data sharing between data providers (government agencies holding AgriStack, soil health, weather, and market data) and data users, including agri-application developers, financial institutions, and input suppliers.

ADeX's architecture follows consent management protocols similar to India's Account Aggregator framework. Farmers

grant explicit consent for their data to be shared with specific service providers for defined purposes and durations. This consent layer ensures that while data democratization enables innovation, farmer agency remains protected.

For this ecosystem to function effectively, it requires entities with integrated technology stacks; end-to-end platforms combining procurement, auction, settlement, logistics, warehousing, and quality assaying, that can consume ADeX data and translate it into actionable market operations. NeML's Market-as-a-Service architecture, for instance, demonstrates how pre-configured DPI gateways enable platforms to instantly redirect supply based on real-time demand signals or conduct large-scale, transparent disposal of surplus stocks while ensuring guaranteed settlement to farmers. As ADeX matures, such ADeX-ready platforms will be critical in converting democratized data access into tangible farmer benefits.

Realizing DPI's full potential requires more than technological infrastructure; it demands operational excellence in converting verified data into guaranteed outcomes. The platforms and partnerships that successfully bridge the gap between digital trust and transactional finality will define agricultural commerce for decades to come.

The Maharashtra Blueprint: DPI in Action

Maharashtra's experience with DPI integration offers valuable lessons for other states. Selected as a pilot site in Beed district for AgriStack testing, the state has moved aggressively toward comprehensive DPI adoption. The MahaAgri-AI 2025-29 policy framework envisions AI-powered agriculture built on DPI foundations, encompassing predictive analytics, computer vision for crop monitoring, and automated advisory systems.

The state's farmer registry portal developed by NeML, integrates with national AgriStack components, demonstrates the phased deployment approach necessary for successful DPI implementation. High-stability APIs like Aadhaar authentication were prioritized first, providing immediate fraud reduction benefits. As additional DPI components mature (soil health databases, KCC registries, weather station networks under Mahavedh), they can be plugged into existing platforms through modular API gateways.

The quantifiable results from early DPI integration in Maharashtra's MSP operations are instructive. NeML's platforms, which implemented mandatory AgriStack authentication during farmer onboarding, reported elimination of ghost farmer registrations, as procurement quantities now align with verified production data. The reduction in payment processing time and increase in disposal auction prices demonstrate that DPI delivers tangible financial benefits to both farmers and the exchequer. Critically, Maharashtra's approach highlights that DPI infrastructure alone is insufficient; it requires operational partners with domain expertise to navigate complex logistics, risk management, and market dynamics.

The Integration Challenge: Bridging Digital Blueprint and Market Reality

The gap between DPI's digital blueprint and market reality represents both the greatest challenge and opportunity in India's agricultural transformation. DPI provides authenticated, standardized data layers. But converting these into farmer prosperity requires entities that possess several critical capabilities simultaneously: nationwide KYC-compliant participant networks providing demand-side liquidity, robust centralized risk management systems controlling counterparty exposure, integrated banking and logistics partnerships enabling physical delivery, and two-decade operational track records managing government-mandated high-value commodity transactions.

The technical integration requirements are substantial. Platforms must develop pre-configured DPI API gateways and adapters for multiple authentication sources, implement auditable fallback logic for handling incomplete data scenarios, build rule engines that convert raw DPI data into enforceable procurement workflows, and maintain modular architectures enabling rapid deployment of new DPI components as they become available. The experience of early integrators like NeML, which began building DPI connectivity even before core agricultural DPIs fully matured, illustrates the complexity involved. Their platforms required integration with Aadhaar, AgriStack's Farmer Registry, state land portals like Maha Bhumi Abhilekh, and insurance databases like PMFBY, each with different API protocols and data formats.

Building the Foundation for Viksit Bharat

As India works toward its Viksit Bharat@2047 vision, agricultural DPIs will serve as the digital foundation upon which the next Green Revolution is built. The transformation from fragmented, paper-based systems to an integrated, authenticated digital ecosystem is already underway, with 70 million farmers now possessing digital identities and states rapidly adopting AgriStack components.

For policymakers, the question is straightforward: which entities have demonstrated not just technological capability but institutional credibility, market liquidity, and proven execution in managing the nation's food security mandate?

The answer to that question will determine whether India's agricultural DPI becomes merely another digital initiative or the transformative force that delivers prosperity to 11 crore farming families while ensuring national food security. The digital blueprint exists. The challenge now is operational execution, and that requires partners who have already proven they can deliver.

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UNNATI-GRAMOPHONE BET ON THE RETAIL LAST MILE

AI, CREDIT, AND THE 3-6 ACRE FARMER

In India's agritech story, the flashiest moments often happen on screens—new apps, dashboards, satellite maps, AI claims. But the decisive moments still happen in the same place they always have: the local agri-input retailer's shop, where farmers ask what seed to pick, what pesticide to trust, and whether the season will be kinder this time.

That reality shapes the post-merger blueprint of Gramophone and Unnati—a combination that aims to merge agronomy intelligence with B2B distribution and fintech rails. In a call with Tauseef Khan, Co-founder & CEO of Gramophone (now part of the merged with Unnati), the thesis came through clearly: if agritech is to move from engagement to impact, it must be built around the ecosystem's most practical anchor—retailers—and then scaled with AI-led advice, supply-chain predictability, and integrated financing.

The farmer they're building for

Tauseef's description of the core user base is precise: farmers with 3 to 6 acres of land. This segment is large enough to treat farming as a primary livelihood, yet small enough to remain exposed to the usual risks price swings, input timing errors, uncertain credit, and the uneven quality of advice.

Very small landholders, he noted, often treat agriculture as a secondary income stream, making their engagement patterns and their ability to pay for solutions—fundamentally different. By contrast, the mid-sized farmer has higher intent and greater urgency: better yield, fewer losses, and fewer wrong bets.

Mr Amit Sinha is the Co-founder of Unnati, a technology-led B2B agri-inputs distribution and digital marketplace platform connecting retailers and farmers through an asset-light, data-centric model

Mr Tauseef Khan is the Co-founder and CEO of Gramophone, an agritech platform focused on strengthening the agri-input ecosystem through agronomy, data-led decision-making, and supply-chain intelligence.

This is where Gramophone's deep agricultural experience and Unnati's distribution strength are expected to complement each other: one understands the on-ground decision cycle; the other strengthens the rails that move inputs, information, and credit through the system.

Digital adoption isn't one curve. It's three layers

One of the most grounded parts of the conversation was Khan's breakdown of farmer digitisation into three layers, a model that explains why many "digital agriculture" products feel successful in engagement metrics but struggle to translate into transactions.

Information consumption (80–90%): Farmers are already highly digital when it comes to learning—especially through audio and video.

Transactions without money (30–40%): Engagement deepens when farmers can take actions—enquiries, advisory flows, product discovery, booking interest without having to pay online.

Online financial transactions (10–15%)

The sharpest drop comes when money must move digitally. Trust, habit, documentation, and ecosystem readiness still limit this layer.

Retailers, interestingly, are often more ready than people assume. There is low resistance among retailers when technology improves their advisory role and helps grow the business. For them, "going digital" isn't ideological—it's incremental advantage.

Adoption also varies by age and geography. Younger farmers (roughly 20–40 years) tend to be more comfortable navigating tools, while older farmers rely more on relationships. Regionally, there is stronger adoption in parts of South India and Maharashtra, moderate engagement in the East, and slower last-mile payments in some northern regions—though the gap is narrowing.

What the merger is trying to unlock: AI that changes outcomes, not just content

In the ongoing-merger, the combined vision is ambitious: cover 70–80% of agricultural land with AI-led solutions and integrated financing across 10 states. That's a scale goal that goes beyond building a product; it implies building a platform that can absorb regional fragmentation and still feel local at the last mile.

The building blocks are practical and operational:

- AI for precise knowledge and advice

Not generic tips, but context-aware recommendations tied to crop, region, and season.

- Supply-chain efficiency and prediction

AI-driven engines that anticipate demand for seed and crop-protection products—availability, pricing, and timing—so shortages and last-minute buying reduce.

- A common platform to consolidate fragmentation

Bringing smaller regional players onto a shared distribution-and-tech backbone, rather than reinventing the wheel state by state.

- Integrated "input-to-financing" solutions

Embedding formal credit access into the input journey, improving working-capital flow and reducing dependence on informal cycles.

This is the next step after years of learning: five to six years of ecosystem understanding, followed by a faster push for scale in the next two years.

Information consumption is already high. The real unlock is making advice and supply predictable and then embedding credit into that last-mile journey.

WHAT TO WATCH NEXT

The merger's success will likely be judged by whether the combined entity can deliver four outcomes at scale:

- **Advice that measurably improves decisions (and reduces costly input mistakes)**
- **Supply predictability for crop protection and seeds, reducing shortages and price shocks**
- **Embedded credit access that feels native to the input journey**
- **A platform that scales nationally while staying trusted locally through retailers**

India's agriculture doesn't just need more information. It needs reliability—in advice, availability, and affordability. The merger of Gramophone with Unnati makes that reliability scalable.

Very small landholders, he noted, often treat agriculture as a secondary income stream, making their engagement patterns and their ability to pay for solutions—fundamentally different.

The constraints nobody can "app" away: policy patchwork, cold chains, and seasonality

For all the optimism, we have to collectively work upon India's structural hurdles and constraints that determine whether agritech can scale profitably and reliably.

Fragmented state regulations

Operating across states means dealing with different rules and frameworks, an obstacle for any company trying to build a pan-India agri-input and financing ecosystem. Khan pointed to ongoing dialogues around standardization, but acknowledged the friction remains real.

Cold-chain gaps

Underdeveloped cold chains limit commodity shelf life and market efficiency—reducing farmers' ability to capture value, and restricting the scalability of market linkage claims. The infrastructure deficit is not just a logistics issue; it shapes pricing, waste, and trust.

Agricultural cyclicity

Unlike consumer tech that can iterate daily, agriculture learns in seasons. That limits feedback loops and slows "learn-and-scale" cycles especially when operating in remote regions.

The missing middle in talent

There is a shortage of skilled mid-level talent—people who can execute across field operations, retail enablement, and tech workflows. Upskilling is not optional; it becomes a core strategy.

Why education reform has become a scaling lever

Current academic curricula are often too theoretical, while job roles in agritech are changing too fast for traditional training to keep up.

The prescription is practical and industry-oriented:

- More applied, hands-on training
- Shorter, job-aligned courses
- On-the-job learning as a formal bridge
- Upskilling programs to close competency gaps before graduates enter field roles

For agritech to scale, the workforce pipeline must adapt from classroom-heavy learning to application-first readiness.

THE POST-HARVEST ECOSYSTEM

The real shifts in Indian agriculture today are happening *after* the harvest. While we have long focused on boosting production, it is now the post-harvest ecosystem: storage, credit, and market access that is transforming the way farmers engage with markets and build resilience.

Over the years, we have seen how near-farm infrastructure, like micro-warehousing and scientific storage, helps farmers avoid distress sales and improve income. Timely and accessible credit at the farmgate has enabled more farmers, especially women and youth, to hold their produce and access better markets.

We hope to see continued support for these proven interventions. Decentralised infrastructure, inclusive finance, and stronger FPOs are essential to strengthen the rural economy and build climate resilience where it is needed most.

Need To Align Subsidy Frameworks

To ensure long-term vibrancy in the sector, there is a need to align subsidy frameworks for both individual farmers and corporate stakeholders. While individual subsidies have enabled adoption at the grassroots, corporates play a catalytic role in bringing

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infrastructure, technology, and scale. A harmonised approach, where subsidies are designed to incentivise collaboration across the value chain, can create multiplier effects. For instance, supporting FPOs and private players to co-invest in warehousing, digitisation, or storage-linked credit will accelerate impact and reduce redundancies. It is wise to promote such blended models to unlock shared value at the last mile.

The agritech startup ecosystem is playing a vital role in this shift. Start-ups working on farm-level technologies, such as drones, AI-based quality grading, and climate advisories, are bringing precision, transparency, and scale to agricultural operations. These tools must be designed to work for smallholders: simple to use, affordable, and effective in low-resource settings. With the right support, such innovations can directly enhance productivity, reduce losses, and create new rural livelihoods.

Recent government support for agri-infrastructure and startups has created important momentum. There is opportunity to build on that and strengthen what delivers lasting value at the last mile.

New Support Systems

One of the most important transitions is the move from peri-urban to near-farm warehousing. In the past, the bulk of India's storage infrastructure was situated far from production centres, limiting access for smallholders. Today, with over 90% of Arya.ag's warehousing network located in primary and secondary markets, farmers are gaining local access to infrastructure that allows them to hold their produce and sell when prices improve. This shift has resulted in 20–30% better price realisation compared to immediate post-harvest sales.

Equally transformative is the way credit is now embedded within this decentralised storage network. Farmers can convert their stored produce into digital balances, pledge them as collateral, and access credit without the need for land titles. In FY 2024–25, Arya.ag enabled over USD 1.5 billion in financing through this model, with zero NPAs. This shift is especially meaningful for first-time borrowers and women-led FPOs, who often lack access to traditional lending channels.

The Importance of Micro-Warehousing

Micro-warehousing is a powerful tool in remote and climate-sensitive regions. These modular units, often deployable in under 24 hours, offer safe, on-demand storage options that align with smallholder needs. Hermetic storage structures, which do not require chemical fumigation, have proven effective in maintaining grain quality and reducing contamination risks. These are no longer pilot solutions, they are practical, scalable responses to real gaps in infrastructure.

Technology is stitching these services together into seamless user experiences. With just a smartphone, farmers and FPOs can now locate warehouses, assess grain quality, secure finance, and connect with buyers. Each bag of produce is tokenized as an electronic balance, visible to both sellers and institutional buyers. This not only brings transparency into pricing and payments but builds a credible digital footprint for smallholder transactions.

Intelligent Use Of Data

Intelligent use of data is further enhancing this ecosystem. Satellite-based monitoring, AI-driven grading, and real-time climate advisories are now informing how and where produce is stored. Arya.ag's AryaShakti platform offers hyperlocal insights on crop health and pest risks, helping farmers make better decisions. These insights feed directly into post-harvest operations — from deciding what to store, to managing loan tenures, creating a continuous loop of visibility and optimisation.

At the market end, decentralised storage is enabling more structured, transparent trade. Aggregated, quality-assured produce stored closer to the source allows buyers to place long-term procurement orders. In Varanasi, for example, Arya.ag supported women-led producer groups to store and sell local paddy varieties, earning them 20% higher prices than what open markets typically offered. With full payment assurance and built-in traceability, such transactions are becoming the norm, not the exception.

New Livelihood Opportunities In Rural Areas

The infrastructure-led approach is creating new livelihood opportunities. Rural youth and women are stepping into roles as warehouse managers, quality coordinators, and sourcing agents. Arya.ag's 4E model: Enterprises, Employment, Earnings, Empowerment — has trained hundreds of local leaders who are now anchoring operations in their own villages. With some support from the government through skilling and entrepreneurship schemes, this network can scale dramatically in the years ahead.

The sustainability implications of scientific warehousing deserve policy attention. Food loss post-harvest can exceed 7% in the absence of proper storage. With hermetic solutions and better logistics, this can be reduced to under 1%. In Arya.ag's network, storage interventions have already saved over 490,000 MT of produce and nearly a trillion litres of water. As India looks to enhance food security and climate resilience, post-harvest infrastructure must be seen as a sustainability asset, not just a supply chain necessity.

The post-harvest layer is not just a support service, but a strategic foundation for India's agricultural growth. When a farmer gains the ability to store, access finance, and sell with confidence, the entire value chain becomes stronger.

AGRI PROCESSING FOR RUBBER SECTOR

CAN INDIA BUILD A WORLD-CLASS RUBBER INDUSTRY WITHOUT FIXING PROCESSING FIRST?

India's rubber industry is at once an economic powerhouse and a paradox. We are one of the world's largest consumers of natural rubber, fuelling everything from passenger car and truck tyres to conveyor belts, industrial seals and surgical elastomers. But behind the gleam of finished products and export orders sits a critical reality:

We have yet to fix the foundational step, processing, on which all future growth depends. And unless we do, the dream of a truly world-class rubber industry will remain incomplete.

Why Processing Isn't Just a Step, it is a Must

Most people first think of tyres when they hear "rubber industry." But the journey begins much earlier: when tapped latex and field coagulum are cleaned, graded and transformed into consistent, compliant raw materials such as Ribbed Smoked Sheets (RSS) and technically sound latex grades. Processing determines whether downstream manufacturers receive uniform quality, predictable properties, and material that meets global specifications.

Without quality processing, even the most advanced tyre plant cannot achieve global competitiveness. Variability in raw rubber quality ripples through production, raising reject rates, driving up costs, and undermining customer confidence.

The Current Reality: Gaps and Opportunities

India's rubber ecosystem is a vibrant mix, millions of smallholders, dozens of processing clusters, and a strong manufacturing base. Yet processing remains fragmented, inconsistent and under-capitalised.

Here are the structural realities shaping our sector today:

Domestic Supply Doesn't Meet Demand

Despite earnest efforts in plantation expansion, domestic natural rubber production remains far below national consumption, creating an ongoing supply gap. This deficit, on top of volatile global markets, keeps input costs high for manufacturers.

About the **AUTHOR**

Mr Anay Gupta is President of All India Rubber Industries Association

Price Instability Hits Everyone

Rubber prices swing widely due to international trends and local production swings. Farmers lack the cushion of minimum support prices like other crops, leaving them exposed to market risks. Recent farmer protests have even demanded MSP intervention and classification of rubber as a horticultural crop.

Smallholders Dominate, But Struggle

Over 80% of our rubber comes from smallholder farmers operating on tiny plots, often with limited resources for modern tapping methods and little bargaining power. This translates into variable quality and supply inconsistency at the front end of the value chain.

Compliance and Sustainability Are Rising Demands

Global markets, especially Europe are demanding sustainability, traceability and environmental compliance across the supply chain. This means processing units must meet not only quality thresholds, but also environmental norms and traceability requirements — a significant shift from historic practice.

Why Processing is the Strategic Bottleneck

At its core, processing is where raw rubber is prepared for purpose. From unrefined latex to industrial-grade raw material, processing impacts:

>>Quality consistency across batches.

>> Global certification readiness, essential for export markets.

>>Value retention within India, instead of exporting low-margin raw forms.

>> Traceability and sustainability compliance, increasingly required by major importers.

Without investing in modern, coordinated processing infrastructure, we risk always being a step behind global leaders.

What Success Looks Like and What We Can Learn

Global leaders in rubber such as Thailand and Malaysia, invested early in centralised processing hubs, quality control labs, and robust linkages between growers and manufacturers. These helped ensure uniform, certified raw material, traceability from farm to factory, easier adoption of global quality standards and value addition before export, boosting revenues.

India must not just emulate but adapt such models to our unique landscape, one dominated by smallholders and regional diversity.

Human Stories Behind the Numbers

Consider the smallholder in Kerala who rises before dawn to tap trees only to see her produce go into a nearby processor with outdated equipment and no quality grading. Or the young engineer in an MSME tyre plant whose production halts because inconsistent raw rubber fails a batch test.

These aren't abstract statistics; they are real people facing real barriers, whose productivity and pride depend on a stronger processing ecosystem.

Actionable Steps for India's Rubber Future

To build global competitiveness, the Indian rubber industry must prioritise processing in every strategic decision:

- **Modernise Processing Infrastructure**

Upgrade existing facilities with modern washing, grading and testing equipment, and encourage cluster development with shared services.

- **Strengthen Farmer-Processor Integration**

Build long-term contracts that tie processors and manufacturers directly with farmer groups, improving quality and reducing intermediaries.

- **Promote Quality Standards and Testing**

Invest in accredited labs and enforce rigorous grading protocols that enable Indian rubber to be trusted globally.

- **Boost Skill Development**

Processing isn't low-skill work; it's a craft requiring training in quality analysis, chemical handling and compliance.

- **Align Policy with Industry Needs**

Government support, from infrastructure incentives to export facilitation, must reflect the strategic importance of processing in the value chain.

A Call to Collective Vision

The promise of India's rubber industry is real. Demand is growing. Manufacturers are innovating. But quality, consistency, and sustainability begin long before the tyre plant floor, they begin at processing tables and smokehouses across the country.

Without fixing processing first, all other aspirations - be it global export leadership, world-class manufacturing or higher farm incomes, risk stalling.

If India wants to seize its rightful place on the global rubber stage, we must start by strengthening the very foundation on which that future is built.

Fix processing. Raise quality. Empower people. Transform India's rubber story.

AGRI-FOOD INDUSTRIES IN INDIA

Prospects and Challenges

About the **AUTHOR**

Mr Abhay Dandwate is Chief Risk Officer and Head Strategy, National Bulk Handling Corporation Pvt. Ltd. (NBHC)

The agri-food industry in India spans the entire value chain — from farm production and harvesting to processing, packaging, storage, transportation, and retailing. As a cornerstone of the Indian economy, agriculture and allied sectors contribute over 15 percent to the nation's GDP and provide employment to nearly half of the workforce. Beyond economic contribution, the sector is central to National Food Security, ensuring affordable and safe food for a population exceeding 1.4 billion people. Food Processing further enhances industrial growth, value addition, and export earnings, strengthening India's position in global agricultural trade.

Rapid urbanization, rising incomes, an expanding middle class, and changing lifestyles have increased demand for processed, packaged, convenience, and ready-to-eat foods. Consumers seek higher standards of quality, safety, hygiene, branding, and product variety. This shift presents substantial opportunities for food manufacturers, retailers, and supply chain operators.

Changing Demand Patterns

Globally, demand for organic and value-added foods is rising. India's diverse agro-climatic conditions and

agricultural heritage give it a comparative advantage in these segments. Traditional exports such as basmati rice and spices continue to perform strongly, while newer categories—including frozen foods, dairy products, snacks, beverages, and processed fruits—are expanding rapidly. Health awareness and sustainability concerns are further shaping demand patterns. India's production of millets, pulses, fruits, vegetables, and horticultural crops positions it well to meet the growing global appetite for nutritious and sustainable food products. Government campaigns promoting millets and balanced diets have stimulated renewed interest in traditional grains and health-focused foods.

GOI has introduced several initiatives to modernize the agri-food sector. The Pradhan Mantri Kisan Sampada Yojana focuses on expanding food processing capacity, improving cold chain infrastructure, and reducing post-harvest losses. Complementary initiatives such as Make in India and Startup India promote investment in food processing technologies, packaging innovations, and supply chain development. Trade diversification efforts through bilateral agreements have also strengthened India's export footprint.

Transformative Role of Technology

Technology is playing a transformative role across the value chain. IoT-based sensors, drone monitoring, satellite imagery, and data analytics enable optimized input use and improved crop productivity. These tools support evidence-based policymaking and enhance supply chain efficiency. Blockchain applications for traceability and food safety are gradually gaining ground, helping build consumer trust and improve global acceptance of Indian products.

The rise of e-commerce and digital agri-marketplaces has further enhanced market access for farmers. Direct farm-to-consumer linkages reduce intermediaries, improve price realization, and increase transparency in transactions.

Our Strengths

India's agri-food ecosystem includes dairy, sugar, rice, wheat, tea, spices, fisheries, seafood, and processed foods.

As processed food consumption increases, ensuring consistent compliance with safety standards becomes essential. Strengthening testing infrastructure and reducing adulteration remain priorities

The dairy sector is a global leader, with India being the world's largest milk producer. Valued at approximately INR 18.97 trillion in 2024, it contributes nearly 5 percent to the national economy. Growing urban demand for branded and value-added dairy products is expected to drive further expansion. The sector plays a vital role in rural income generation and women's employment, supported by expanding cold chains and processing infrastructure.

India is also one of the largest producers and exporters of rice, particularly basmati varieties. Given India's dominant share in global rice trade, export policy decisions significantly influence global supply and pricing.

The fisheries and seafood sector is another key contributor, with India ranking among the top global fish producers and exporters. Marine and inland fisheries, particularly shrimp aquaculture, have grown rapidly over the past two decades. However, export performance can be influenced by international trade measures and tariff policies.

Despite robust growth potential, the agri-food sector faces persistent structural constraints.

Our Challenges

Multiple intermediaries between farmers and markets result in inefficiencies and high post-harvest losses—estimated at 30–40 percent for perishable goods. Limited cold storage, inadequate logistics, and uneven infrastructure reduce competitiveness and product quality. Small and marginal farmers, constituting over 80 percent of India's farming population, often lack access to modern technology due to financial constraints, low digital literacy, and poor rural infrastructure. This results in productivity gaps and limited integration with advanced processing systems. Micro and small food processing enterprises often struggle to secure affordable credit for modernization, certification, and expansion. High collateral requirements and procedural hurdles restrict growth and innovation.

Variations in agricultural marketing regulations across states create compliance challenges. Food safety enforcement capacity requires strengthening, particularly among small processors. Periodic export restrictions to control domestic prices may also affect international market confidence.

Agriculture is highly sensitive to climate change. Erratic monsoons, heatwaves, floods, and droughts disrupt crop yields and supply chains. Long-term concerns include soil degradation and water scarcity.

Investment in integrated cold chains, storage facilities, and processing hubs through public–private partnerships can reduce losses and enhance efficiency. Promoting FPOs can improve collective bargaining power and market access for smallholders. Digital Advisory Services and targeted mechanization subsidies can raise productivity and integration.

Strengthening regulatory frameworks and enhancing the capabilities of the Food Safety and Standards Authority of India can improve consumer trust and export competitiveness. Expanding credit guarantees, encouraging venture funding, and supporting market linkages can accelerate the growth of small and medium enterprises.

Climate-smart agriculture—including crop diversification, water-efficient irrigation, renewable energy use, and circular economy practices such as waste-to-energy conversion—will be critical for long-term resilience and sustainability.

RURAL WOMEN AND FOOD PROCESSING

INDIA'S NEXT GROWTH REVOLUTION

India feeds the world, but it does not process what it grows.

Despite being one of the world's largest agricultural producers, India trails its global peers in value addition through food processing. While the United States process 60%–80% of its agricultural output, and China processes around 23%, India processes less than 10% of its produce, underutilising a key economic lever that could reduce food waste and boost farmer incomes. One of the biggest missing links is value addition.

China faced similar structural constraints — fragmented landholdings and small farmers — yet moved decisively to integrate agriculture with processing and industry.

While significant progress has been made in improving logistics in rural India, along with introducing new credit schemes and subsidies for rural communities, structural transformation is still lagging.

Cold chains, warehousing, and rural processing clusters are still underdeveloped. Farmer-Producer Organisations are failing due to internal conflicts, compliance hurdles and lack of managerial capacity. Repeated politically influenced loan waivers have weakened repayment discipline. Most critically, farmers remain disconnected from organised value chains and strong consumer brands.

India continues to produce but not process enough. Yet the solution may already exist — in India's villages, led by women.

The Power of 90 Million Women

Over 90 million women who are part of India's Self-Help Group (SHG) movement are one of the largest grassroots organised networks in the world, and more than 70% are engaged in food and agri-allied activities.

Initially formed to enable financial inclusion for women, it is now an economic engine waiting to be structured.

Government schemes such as Pradhan Mantri Formalisation of Micro Food Processing Enterprises Scheme provide credit-linked capital subsidies and financial assistance — including support of up to Rs.3 crore for SHG women entrepreneurs.

Women, for whom the art of making delicious food is second nature and who have strong policy support, still often lack an understanding of food safety–compliant production and the technical know-how required to run a sustainable business. Moreover, without the presence of a stable market linkage partner, much of the training and policy support fails to translate into real outcomes. What is missing is integration — with women at the centre.

If this vast women-led network is systematically organised into food safety-compliant food processing, branding, and distribution ecosystems, India can unlock decentralised value addition at scale. Instead of transporting raw produce across states for processing, value can be created near farms. And farmers' role in the food supply chain could be elevated, thus resulting in an improvement in income.

Food processing could become

About the **AUTHOR**

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a strong lever for bringing economic change in rural economy

Building an Integrated Women-Led Supply Chain System

Scaling rural food enterprises requires an end-to-end business model that solves for infrastructure, quality, sustainable demand, and finance.

Consumer-focused products with branding would drive sustainable demand, its production in villages needs to be standardised and must be married with standardised food safety and hygiene practices aligned with ISO and HACCP frameworks.

Pricing of products must ensure sustainable margins & payments for SHG entrepreneurs. Above all, such a system requires a central integrated entity — one that binds production, training, compliance, technology, capital access, branding, and distribution into a single functional machine. Without integration, the traditional rural food production remains fragmented and non- scalable.

FarmDidi: From Village Kitchens to National Leadership

This is where FarmDidi demonstrates what is possible.

FarmDidi has built a fully integrated, end-to-end supply chain that connects decentralised SHG-led production with organised markets. Rural women operate as trained micro-entrepreneurs running standardised village-level units, many of which are being upgraded into GMP-aligned manufacturing facilities with structured hygiene SOPs, documentation systems, and batch-level traceability.

FarmDidi Operating Model

Sales & Distribution	D2C Platform	D2B2C	D2B	Banking / Financing Partners + Govt. Schemes Facilitation	Food R&D	Tech enablement + Traceability
Packaging & Labelling	In-house					
Lab Testing	In-house + Lab Partners					
Governance	Food Safety & Risks Mgmt	Trainings	Product Quality Management			
Processing	SHG led Manufacturing Units					
Agri Output + Sourcing	FPOs/ WPOs	Traders	Distributors			

By owning the entire value chain — from sourcing to consumer brand — FarmDidi converts fragmented rural production into a cohesive, commercially viable FMCG system.

To ensure quality and consistency in this de-centralised setup, FarmDidi provides comprehensive support:

- **Finance Facilitation:** Farm Didi helps SHGs secure loans from both government schemes and private institutions. The capital is used for establishing dedicated GMP-compliant units.
- **Training and Skill Development**: Didis receive training in food business practices, quality, and hygiene through FarmDidi's platform and regular in-person visits to villages. They are taught SOPs to ensure consistency.
- **Tech led Supply Chain Management**: FarmDidi supplies pre-mixed masalas and ingredients to ensure consistent taste across all batches, while Didis procure other raw materials from vendors fixed and quality-checked by the FarmDidi team. The inventory and raw materials are tracked via FarmDidi technology platform.
- **Logistics and Marketing**: FarmDidi manages raw material sourcing, logistics, packaging, marketing, and sales, allowing Didis to focus solely on production. Each product is uniquely labeled with the name of the Didi who made it, providing them with recognition and respect beyond just income.
- **Tech Enablement and Traceability**: A mobile app facilitates order management, quality tracking, procurement, inventory, and training for Didis. Consumers can use QR codes on products to trace details like the Didi who made it, the preparation process, ingredients, and even lab reports, building trust and transparency.

FarmDidi today is the #1 pickle brand on Amazon, with nearly 60% of its revenue comes from direct-to-consumer (D2C) channels, proving that rural women-led products can build strong brands, command consumer loyalty, and compete in premium digital marketplaces.

Decentralized kitchens produce close to farm sources, preserve freshness of products and reduce wastage. It also helps in building climate resilence by providing additional livelihood opportunities for farmers.

When a jar of pickle reaches a household in Mumbai or Bengaluru, it carries more than flavor. It not just carries home like quality taste for consumers but also income stability for a rural family.

CURRENT DYNAMICS IN FOOD PROCESSING AND KEY CHALLENGES

The food processing sector is a critical pillar of agricultural transformation, food security, and rural employment in India. Despite being one of the world's largest producers of agricultural commodities, India processes only a small share of its output, resulting in high post-harvest losses and limited value realization for farmers. This article examines the current dynamics shaping the Indian food processing sector, including demand shifts, policy support, technological adoption, and sustainability imperatives. It also highlights persistent structural challenges through India-specific data and case studies and proposes pathways for inclusive and resilient sectoral growth.

India's food processing sector occupies a strategic position between agriculture and consumers. The sector contributes approximately 8–9% of Gross Value Added (GVA) in manufacturing and around 11% of agricultural GVA, while employing over 7.5 million people, largely in rural areas. With rising urbanization, income growth, and changing dietary preferences, demand for processed and value-added food products has increased steadily.

However, the sector continues to face fundamental bottlenecks related to infrastructure, supply chain fragmentation, regulatory complexity, and limited integration of farmers. Understanding these dynamics is essential for unlocking the sector's potential to double farmer incomes, reduce food losses, and strengthen food security.

Expanding Domestic and Export Demand

India's food consumption patterns are shifting rapidly toward:

* Ready-to-eat and ready-to-cook foods
* Packaged staples and snacks

* Processed fruits, vegetables, dairy, and meat products

The Indian processed food market is projected to grow at 8–10% annually, supported by rising middle-class incomes and organized retail expansion. Export opportunities are also increasing, particularly for processed rice, spices, dairy products, and organic foods, with agri-exports crossing USD 50 billion

About the **AUTHOR**

Ms Neetuben Kanani is Founder and Director of Sajeevan Life Pvt. Ltd. She has won many prestigious awards for her contributions to agriculture

in recent years.

Policy Push and Institutional Support

The Government of India has identified food processing as a priority sector. Key initiatives include:

* Pradhan Mantri Kisan Sampada Yojana (PMKSY)
* Mega Food Parks and Mini Food Parks
* Production Linked Incentive (PLI) Scheme for Food Processing
* Support for FPOs, cold chains, and value-added processing

These interventions aim to reduce post-harvest losses, attract private investment, and strengthen farmer–processor linkages.

Technology and Modernization Trends

Larger food processing enterprises are increasingly adopting:

* Automation and mechanized processing lines
* Cold storage and controlled-atmosphere logistics
* Digital traceability and quality control systems

At the same time, technology adoption among MSMEs remains uneven due to high costs and skill gaps.

Sustainability and Circular Economy Approaches

Climate change, water stress, and waste management concerns are reshaping food processing strategies. Emerging trends include:

* Renewable energy use in processing units
* Valorization of food waste into bioenergy, compost, and biochar
* Adoption of ESG and sustainability reporting standards

Such approaches align food processing with India's climate and sustainability commitments.

Key Challenges Facing the Sector

High Post-Harvest Losses

India loses an estimated Rs 90,000 – Rs 1,00,000 crore annually due to post-harvest losses, particularly in fruits and vegetables. Limited cold storage capacity, poor rural logistics, and fragmented marketing channels are key contributors.

Fragmented Raw Material Supply

Over 85% of Indian farmers are small and marginal, leading to:

* Inconsistent quantity and quality of raw material
* Seasonal supply fluctuations
* Weak traceability and aggregation

This fragmentation reduces efficiency and increases procurement costs for processors.

Infrastructure and Logistics Constraints

Despite progress, gaps remain in:

* Cold chains and refrigerated transport
* Rural processing facilities
* Reliable power and water supply

These constraints disproportionately affect small processors and rural enterprises.

Regulatory and Compliance Complexity

Food processors must comply with multiple regulatory frameworks, including food safety, labeling, environmental clearances, and export certifications. For MSMEs, navigating these requirements increases costs and delays market entry.

Limited Access to Finance and Skills

Food processing requires high upfront capital and has long payback periods. MSMEs often face:

* Limited access to affordable credit
* High interest rates
* Shortage of trained manpower in food technology and quality assurance

Case Studies from India

Case 1: Farmer Producer Organizations (FPOs) in Value Addition

Several FPO-led processing initiatives in Maharashtra and Gujarat have demonstrated that aggregation combined with primary processing (grading, sorting, minimal processing) can increase farmer incomes by 15–25%. However, scalability remains limited due to capital and market access constraints.

Case 2: Cold Chain Expansion in the Dairy Sector

India's dairy processing sector has benefited from investments in cold chains and cooperative models. Organized dairy processing has significantly reduced spoilage and improved price stability for farmers, illustrating the importance of infrastructure-backed aggregation.

Case 3: Small-Scale Food Processing and Women SHGs

Under schemes supporting women Self-Help Groups, small food processing units (pickles, spices, millet products) have enhanced local employment and nutrition outcomes. These models show promise but require stronger market linkages and branding support.

Way Forward

To realize the full potential of India's food processing sector, the following priorities are essential:

* Strengthening farmer aggregation through FPOs and cooperatives
* Expanding decentralized processing and cold-chain infrastructure
* Simplifying regulatory compliance through digital platforms
* Promoting sustainable, waste-to-value processing models
* Enhancing skill development and access to finance for MSMEs

Public–private partnerships and technology-driven solutions will be central to building resilient and inclusive food processing value chains.

Integrated Infrastructure Development, Farmer-Centric Models

India's food processing sector is at a transformative stage, shaped by rising demand, policy support, and sustainability imperatives. While significant progress has been made, persistent structural challenges continue to limit its contribution to farmer incomes and food system resilience. Addressing these challenges through integrated infrastructure development, farmer-centric models, and regulatory reforms can enable the sector to play a decisive role in India's agricultural and economic future.

FOOD PROCESSING

CULTIVATING A SUSTAINABLE FUTURE FOR INDIAN AGRICULTURE

Oyedesi Agritech Services Pvt. Ltd. (Bengaluru) is a mission-driven agritech and sustainable food-systems company building an end-to-end natural-farming value chain that reconnects farmers and conscious consumers. We combine district-level infrastructure (AgriHubs), farmer capacity building, traceable procurement, bio-input production, and digitally-enabled market linkages (O2O2O — Online → Offline → Online) to create resilient rural livelihoods, healthier food, and investable climate assets.

Our working ground includes the Oyedesi Brindavan Research Organic Farm (80 acres, Bengaluru region) which serves as an R&D and training nucleus for agronomy, input trials, and farmer demonstration.

Vision

To transform India's agricultural landscape into the world's most climate-resilient, equitable, and nutritious food system — making India a global food bowl through natural farming, decentralized infrastructure, and inclusive rural entrepreneurship.

In an era where environmental degradation, climate change, and farmer distress converge to challenge traditional agriculture, Oyedesi Agritech Services Pvt Ltd emerges as a visionary catalyst for transformative change. At a time when global food systems need not just productivity but resilience, equity, and sustainability, Oyedesi is pioneering a holistic approach that bridges the gap between ground-level farmer needs and future-ready agricultural practices.

About the **AUTHOR**

Mr. D. K. Jain is the Founder & Promoter of Oyedesi Agritech Services Pvt Ltd. He founded the company with Mrs. Vijeta Jain and Mrs. Pushpa Adiveppa Masur

Rooted in Purpose: Reimagining Agriculture with Compassion and Innovation

Oyedesi Agritech was founded on a simple yet powerful belief — agriculture must be sustainable, profitable, and healthy for both people and the planet. The company's core purpose is to empower small and medium-scale farmers in India with knowledge, tools, and market linkages that enable them to transition from conventional farming to regenerative, climate-smart agriculture.

This purpose arises from a clear observation: while India's farmers are resilient and hardworking, they often lack access to affordable quality inputs, real-time agronomic insights, and reliable market channels. Oyedesi aims to fill these gaps through innovation, education, and partnership.

Mission: Growing Prosperity Through Regenerative Agriculture

Oyedesi's mission crystallizes into three strategic pillars:

Promote Sustainable Agriculture Practices: By enabling adoption of natural farming, soil health management, water conservation techniques, and climate-resilient crop planning, Oyedesi seeks to reduce farmers' dependency on chemical inputs and enhance ecological balance.

Empower Farmer Communities: The company is committed to strengthening farmer livelihoods through capacity building — from agronomic training and digital advisory to access to quality biofertilizers, organic inputs, and soil analysis services.

Build Equitable Market Linkages: Sustainable agriculture is only meaningful when economically viable. Oyedesi connects producers with premium markets, agri-value chains, and conscious consumers who value traceability, quality, and environmental stewardship.

Vision: A Regenerative Agrarian Prosperity for India

Oyedesi's vision extends far beyond commercial success. The company envisions an India where agriculture nourishes communities, restores ecological balance, and catalyzes inclusive prosperity. Specifically, the vision is:

"To be India's leading catalyst in transforming farming from an extractive practice to a regenerative, profitable, and climate-resilient enterprise — benefiting farmers, consumers, and the environment."

This vision aligns with global sustainable development priorities while remaining rooted in local realities — from semi-arid terrains of Karnataka to wet monsoon belts across southern states.

Value Creation Model: Impact Beyond Yield

What distinguishes Oyedesi in the agritech landscape is its value creation model, which integrates social impact with commercial viability:

Soil-Health as a Core Asset

Oyedesi champions soil regeneration as the foundation for long-term agricultural productivity. Through soil testing labs, customized nutrient plans, and bio-input recommendations, farmers regain control over soil fertility — leading to healthier crops, reduced input costs, and higher resilience to climate stress.

Sustainable Input Ecosystem

At a time when global food systems need not just productivity but resilience, equity, and sustainability, we are pioneering a holistic approach that bridges the gap between ground-level farmer needs and future-ready agricultural practices

By facilitating access to biofertilizers, microbial inoculants, and natural pest management tools, Oyedesi enables farmers to transition away from synthetic chemicals, improving ecological balance and consumer health.

Digital & Field Advisory

Combining digital advisory platforms with field extension officers, Oyedesi equips farmers with real-time recommendations, season-specific crop plans, and weather-smart decisions — democratizing access to agronomic expertise.

Market Linkages & Value Chains

Through strategic partnerships with buyers, processors, and conscious retail networks, Oyedesi ensures that farmers receive fair prices for sustainably produced crops — unlocking profitability in regenerative farming.

Training & Capacity Building

From field demonstrations to structured farmer training programs, Oyedesi systematically builds human capital, enabling communities to adopt resilient farming systems confidently.

Sustainability at its Core

What truly sets Oyedesi apart is its holistic sustainability ethos — one that views economic viability, ecological health, and social equity as interdependent goals rather than separate targets. The company's programs are designed to:

- Reduce greenhouse gas emissions through natural farming
- Improve water use efficiency and soil carbon sequestration
- Enhance biodiversity on farmlands
- Build rural income resilience and youth engagement in agriculture

Through sustainable agriculture, Oyedesi is not just improving yields — it is creating farmers who are better stewards of their land and more secure in their livelihoods.

The company actively participates in national and state-level agricultural initiatives, aiming to strengthen rural value chains and contribute to India's vision of doubling farmers' incomes sustainably.

Looking Ahead: Scaling Impact with Innovation and Partnerships

As Oyedesi expands its footprint across Karnataka and beyond, its strategy blends policy alignment, technology adoption, and public-private partnerships with farmer producer organizations (FPOs). This collaborative mindset ensures that solutions are scalable, inclusive, and context specific. Agriculture should not survive on subsidies alone. It must evolve into an investable, climate-resilient asset — where farmers are entrepreneurs, soil is capital, and food carries integrity.

KNOWLEDGE-SHARING, INNOVATION SHOWCASES, RECOGNITION FOR BARLEY FARMERS

AB InBev India recently marked the 6th Annual Barley Growers Day in Chomu, Rajasthan, in the presence of Shri Jhabar Singh Kharra, Honourable Minister of Urban Development & Self-Governance, Government of Rajasthan, reinforcing its commitment to strengthening India's barley ecosystem through its flagship SmartBarley Program.

The initiative continues to empower over 2,000 farmers across Rajasthan, Haryana and Uttar Pradesh, while advancing sustainable agriculture, scientific farming practices and resilient local supply chains. In India, the SmartBarley program has delivered results over the last decade across its three core pillars, farmer skill development, digital connectivity and financial empowerment.

Commenting on this edition, Ms Ingrid De Ryck, Chief Sustainability Officer, AB InBev said, "SmartBarley reflects how sustainability comes to life at AB InBev, through strong local partnerships, innovative agriculture practices and a deep commitment to farmers' livelihoods. We are grateful to our farmer partners for their leadership and openness to innovation. By investing in skills, connectivity and sustainable agriculture practices, we are helping farmers build resilience while advancing our global ambition to source high quality ingredients and strengthen agricultural ecosystems for the long term."

Shri Jhabar Singh Kharra, Minister for Urban Development & Self Governance, Government of Rajasthan at AB InBev India's 6th Edition of Barley Growers Day with Ms Ingrid De Ryck, Chief Sustainability Officer, AB InBev and Mr Bratin Roy, Director - Corporate Affairs, AB InBev India

400+ Farmers from Rajasthan, Haryana, Uttar Pradesh and Punjab at the 6th Edition of AB InBev India's Barley Growers Day

Technology-Enabled, Sustainable Barley Cultivation

The 2026 edition of Barley Growers Day brought together farmers, agronomists, research experts, supply-chain part-

Jivraj Rao from Paota, Rajasthan being felicitated as the Grower of the Year at the 6th edition of AB InBev India's Barley Growers Day by Ingrid De Ryck, Chief Sustainability Officer, AB InBev Ricardo Obara, VP - Procurement & Sustainability, Budweiser Brewing Company APAC

ners and policymakers for a full day of knowledge-sharing, innovation showcases and farmer recognition. The event spotlighted AB InBev India's focus on technology-enabled, sustainable barley cultivation, at a time when domestic malt-quality barley is becoming increasingly critical for India's agri and beverage value chain.

Globally, AB InBev operates agriculture programs across key barley-growing regions to support farmers with science-based agronomy, sustainable agriculture practices, digital tools and stronger market access. In India, this global approach is translated into deep, long-standing partnerships with barley farmers. In India, AB InBev has been working with barley farmers since 2009, with the SmartBarley framework formally launched in 2016. The company said it will continue to expand the program into new regions, increase per-farmer land allocation to malt-quality barley and deepen long-term farmer partnerships.

"We thank our farmer partners for their trust and adoption-led regenerative practices. Their partnership is what turns ambition into measurable outcomes and builds the resilient barley supply chains of the future," said Mr Arun Jacob Mathews, Director - Procurement & Sustainability, AB InBev India. "We have proven that when farmers are equipped with regenerative agriculture practices and timely insights, they build the resilient supply chains of the future."

Resilient agricultural systems are foundational to sustainable business growth, delivering measurable outcomes for farmers, supply chains and the broader agri economy

Targeted, High-Impact Health Interventions

As part of its broader commitment to farmer well-being, AB InBev India is also supporting a vision care intervention for barley farmers in Rajasthan. In partnership with VisionSpring Foundation, the company is facilitated vision screenings and prescription eyeglass provision for 400+ barley farmers in Chomu, addressing a critical yet often overlooked factor affecting farm productivity and safety.

The initiative builds on insights from a previous pilot, which revealed that a significant proportion of farmers were living with uncorrected vision impairments despite the vision-intensive nature of agricultural work. Research-backed evidence indicates that correcting vision can improve productivity by up to 30%, while also enhancing comfort, confidence and workplace safety. Through targeted, high-impact health interventions, AB InBev India aims to remove structural barriers that limit farmer potential and strengthen resilience across its agricultural value chain.

Strengthening Local Supply Chains

SmartBarley continues to scale as AB InBev India's farmer first platform, linking science, digital tools and market access to strengthen domestic barley sourcing. The company will advance evidence-based interventions, and 2026 procurement plans to build more resilient, local supply chains. Barley Growers Day 2026 is part of AB InBev's global 'Cheers to Farmers' platform, underscoring that resilient agricultural systems are foundational to sustainable business growth, delivering measurable outcomes for farmers, supply chains and the broader agri economy.

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