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Web Designer - Mr Rahul Singh

Graphics - Akash Bhargav

Subscription - Mohd Aijaz

Field Officer - Sumit Gaur

Circulation - Rajkumar

Graphic Designer

A. Rehman

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E-mail: editor@agriculturetoday.in
info@agriculturetoday.in

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UNLOCKING GROWTH AND OVERCOMING CHALLENGES IN INDIA'S AGRICULTURAL COMMODITIES

India's agricultural commodities sector holds substantial promise as well as enduring challenges that demand integrated efforts from all stakeholders. The sector stands as a backbone of the Indian economy, with recent policy reforms and increased investments accelerating its growth trajectory. The government's significant hike in Minimum Support Prices (MSP) for diverse crops aims to boost farmers' income, reduce import dependency, and stabilize market prices. Complementing this, the increased agricultural budget funding fuels infrastructure and technological upgrades essential for this sector's advancement.

Technological integration is a major opportunity reshaping Indian agriculture. The adoption of AI, blockchain, and IoT technologies improves crop prediction, supply chain transparency, and product traceability. Initiatives like the expansion of Farmer Producer Organizations (FPOs) and their inclusion in the electronic National Agriculture Market (eNAM) enhance farmers' collective market power, enabling better price realization. Digital platforms connect farmers with advisory services, credit, and weather updates, improving resilience and productivity. Export opportunities remain robust as India maintains a strong position in agricultural commodities, backed by rising global demand and evolving consumer preferences for organic and sustainable products.

Despite these positives, the sector grapples with significant hurdles. Weather unpredictability driven by climate change threatens crop yields and food security. Fragmented landholdings and low mechanization levels limit scalability and efficiency. Soil health degradation due to excessive chemical inputs, high post-harvest losses from inadequate storage infrastructure, and supply chain inefficiencies reduce overall profitability and farmer incomes. Additionally, uneven access to technology among farmers hampers broad-based productivity improvements. Inflationary pressures and market volatility add layers of complexity especially for input costs.

The path forward requires continued emphasis on sustainable farming practices, greater investment in climate-resilient crops, expansive infrastructure development, and scaling up digital inclusion. Strengthening market linkages and empowering farmers through collective bargaining will be crucial for inclusive growth. India's agricultural commodities sector is well positioned to be a driver of rural prosperity and global trade competitiveness if these opportunities and challenges are managed prudently.

This transformative landscape marks a critical phase for Indian agriculture to ensure food security and farmer welfare while embracing innovation and sustainability.

Rajni Shaleen Chopra




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Indogulf Cropsciences Ltd.

CORPORATE OFFICE :

501, Gopal Heights, Netaji Subhash Place, Delhi - 110034 (INDIA)
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Australia Office :

INDOGULF CROPSCIENCES AUSTRALIA PTY. LTD.
Maestri Towers' Suite 100 Level 4, 515 Kent Street,
Sydney NSW 2000 Australia



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From the CEO's desk

Driving Sustainability and Innovation in India's Agricultural Commodities Market



India's agricultural commodities sector is at a pivotal juncture, offering immense opportunities alongside notable challenges.

The sector benefits from rising global demand for Indian agricultural products due to their quality and affordability, backed by government incentives and expanding international trade agreements. India's agricultural produce holds significant export potential, bolstered by increasing preferences for organic and sustainable products in global markets.

The sector's evolving dynamics is constantly impacting farmers, agribusinesses, and the broader economy. Technological advancements like precision agriculture, digital marketplaces, AI-driven advisory services, and blockchain for traceability are transforming production, supply chains, and market access. The government's focus on infrastructure expansion — including warehousing, cold storage, and cluster development near consumption centres — enhances value addition and reduces post-harvest losses. With projected growth in foodgrain

warehousing and increased farmer empowerment through Farmer Producer Organizations (FPOs), the sector is poised for sustainable growth and better income realization for farmers.

However, the sector faces critical challenges that need urgent attention. Climate change has introduced erratic weather, droughts, floods, pest outbreaks, and groundwater depletion, all threatening crop yields and food security. Fragmented landholdings and low mechanization constrain economies of scale and productivity, while poor soil health due to excessive chemical use undermines sustainability.

Market inefficiencies, weak price discovery, and reliance on intermediaries keep farmer incomes volatile and often below potential. Additionally, technology adoption remains uneven, particularly in rural areas, limiting the benefits of digital tools. Infrastructure gaps in storage and logistics contribute to high post-harvest losses, estimated to cost the sector billions annually. Inflationary pressures and currency fluctuations add cost challenges, especially for agrochemical and input producers.

Balancing these opportunities and challenges requires coordinated efforts from policymakers, industry stakeholders, and farmers. Embracing innovations like AI, remote sensing, sustainable farming practices, and robust digital platforms can bridge efficiency gaps and improve resilience. Strengthening market linkages and scaling up FPOs will enhance farmers' share in value chains. Investing in climate-resilient crops and eco-friendly inputs is crucial for long-term sustainability.

India's agricultural commodities sector stands at the threshold of a transformative phase with the potential to not only boost the economy but also empower millions of farmers while promoting sustainability. Vigilance and proactive strategies will be key to unlocking these benefits and overcoming the sector's deep-rooted challenges.

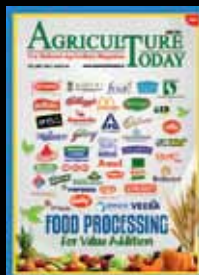
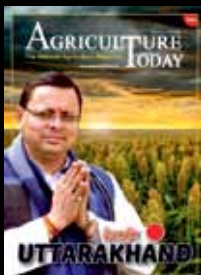
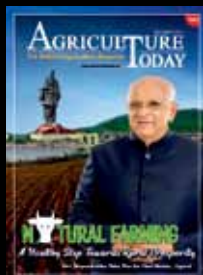
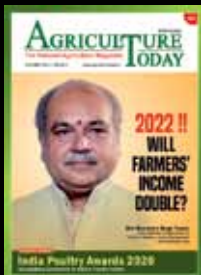
Haris Khan



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SAFEGUARDING INDIA'S DAIRY SECTOR IN GLOBAL TRADE

India stands at a pivotal juncture as it negotiates a comprehensive Bilateral Trade Agreement (BTA) with the United States. As President of the Indian Dairy Association (IDA), I remain steadfast in my commitment to safeguarding the interests of the 80 million small and marginal farmers who form the backbone of our nation's dairy sector.

India's Unique Dairy Model: A Grassroots Success

India's dairy industry is not only the largest in the world by volume but also one of the most inclusive and community driven. Unlike many developed countries, our growth has not relied on government subsidies. Instead, it is powered by millions of rural households—predominantly women—who depend on dairy for both nutrition and income. Milk, in rural India, is more than a commodity; it is a lifeline.

Risks in Global Trade Negotiations

As India and the US work to double bilateral trade to \$500 billion by 2030, the US push for greater market access in dairy presents a signifi-

About the **AUTHOR**

Dr RS Sodhi is the President of Indian Dairy Association (IDA), an apex body representing dairy industry professionals, planners, milk producers, research scientists, and academicians and former Managing Director of GCMMF Ltd (AMUL)



cant challenge. The American dairy sector is characterized by heavy subsidies and industrialized practices, creating an uneven playing field for our smallholder farmers. The recent re-imposition of a 26% tariff on Indian imports by the US has already impacted our export sectors, highlighting the risks of liberalization without adequate safeguards.

Strategic Use of Non-Tariff Barriers

Recognizing these challenges, the Indian government is wisely considering the use of WTO-compatible non-tariff barriers (NTBs) to protect our dairy sector. These measures—rooted in legitimate food safety and cultural sensitivities, such as the use of non-vegetarian feed in American cattle—will help India maintain its sovereign right to regulate food imports that do not align with our public health and cultural standards.

IDA's Strategic Focus Areas

As we navigate these negotiations, the IDA urges a multi-pronged approach:

- **Dairy as a Sensitive Sector:** Dairy must remain excluded from tariff concessions and protected by NTBs where necessary.
- **Boosting Export Competitiveness:** We should leverage global trade disruptions to expand Indian dairy exports to Asia, the Middle East, Africa, and emerging markets like Russia and Mexico.
- **Enhancing Productivity:** Investments in better breeding, feeding, and farmer support programs are essential for long-term competitiveness.
- **Securing Farmer Income:** It is vital to ensure that 70-80% of the consumer price continues to reach farmers through cooperatives and local value chains.

Key Issues for Sustainable Growth

At the recent Dairy Industry Conference in Patna, I highlighted the urgent need to reduce milk production costs through improved breeding, feeding, and circular economy practices. Policymakers must recognize that the price paid to farm-



Crossbreeding, alongside preserving indigenous cattle, is vital for a sustainable future

ers is not inflationary; it is their rightful income. Our supply chain's strength lies in the fact that 80-85% of the consumer rupee reaches the producer.

Long-term infrastructure investment—across both cooperatives and the private sector—is crucial, especially in underrepresented regions like Eastern India. I also called for a reduction in the high GST on ghee and other dairy products to stimulate consumption, and for buffer stocking of skimmed milk powder (SMP) and white butter to manage seasonal fluctuations and stabilize milk prices.

Global and Domestic Market Dynamics

The global dairy market is projected to grow from USD 991.5 billion in 2024 to USD 1,505.8 billion by 2033, driven by health consciousness, technological advancements, and rising demand in emerging markets. India's dairy sector continues to thrive, with 11.9% value growth in Q4 FY25, supported by strong rural consumption, festive demand, and innovative value-added products.

Protecting Quality and Consumer Trust

The recent surge in paneer adulteration cases is deeply concerning. The IDA fully supports the Food Safety and Standards Authority of India's (FSSAI) proactive consultation on regulating dairy analogues. Clear labelling bans on loose sales, and restrictions in HoReCa establishments are essential to protect consumers and uphold industry integrity. All stakeholders must collaborate to promote traceability, certification, and consumer education.

Commitment to Sustainability and Innovation

At the National Conference on "Dairying: A Sustainable Approach for Transforming Livelihoods and Health" in Raipur, I emphasized the need for enhanced productivity through genomics, nutrition, and management. Crossbreeding, alongside preserving indigenous cattle, is vital for a sustainable future. The enthusiasm of farmers, students, and experts at such events showcases the sector's vibrancy and potential.

A Call for Collective Action

India's dairy sector is at a crossroads. By protecting our unique model, investing in productivity, ensuring fair farmer incomes, and upholding quality standards, we can secure a robust, inclusive, and future-ready industry. Let us work together—industry, government, and consumers—to ensure that Indian dairy continues to nourish livelihoods, health, and national pride.

AGROCHEMICAL INDUSTRY TRENDS

WHAT FARMERS SHOULD KNOW IN 2026

The Agrochemicals industry is going to face a profound transformation in 2026, shaped by environmental imperatives, technological innovation and evolving farmer expectations. For farmers and Agri-input companies alike, this is a pivotal moment to adapt, innovate, and lead. As a company embedded in the Agri-input ecosystem, we believe it's essential to decode these trends and help farmers make informed decisions that ensure productivity, profitability, and sustainability.

A shift Towards Sustainable Solutions

One of the most significant shifts in the agrochemical landscape is the growing preference for sustainable inputs. Farmers are increasingly turning to biopesticides, biofertilizers, and plant growth regulators derived from natural sources. These products not only reduce the ecological footprint of farming but also align with global regulatory trends that are phasing out harmful chemical residues.

Biopesticides, for instance, offer targeted pest control without the collateral damage to beneficial insects or soil health. Biofertilizers enhance nutrient uptake and improve soil microbiology, reducing dependence on synthetic fertilizers. As an Agri-input company, we are investing in research and development

to bring these next-generation products to market, ensuring farmers have access to effective and eco-friendly alternatives.

Digital Agriculture: The New Normal

Technology is no longer a luxury in agriculture - it's a necessity. Precision farming tools, powered by artificial intelligence and machine learning, are helping farmers make smarter decisions about input application. Drones are being used for targeted spraying, reducing waste and improving coverage. Soil sensors and satellite imagery provide real-time data on crop health, enabling timely interventions.

As part of our commitment to farmer success, we are integrating digital advisory services with our product offerings. Through mobile apps and field-level support, we help farmers optimize dosage, timing, and method of application, ensuring maximum return on investment.

Farmer-Centric Innovation

At the heart of these trends is a renewed focus on the farmer. Innovation today is not just about new molecules—it's about solving real problems on the ground. Farmers need inputs that are effective, af-



About the **AUTHOR**

Mr Sanjay Aggarwal
is the Managing
Director of
Indogulf
Cropsciences
Ltd



As an Agri-input company committed to innovation, we are investing in research and development to bring these next-generation products more and more to the market. Our goal is to ensure farmers have access to effective, eco-friendly alternatives that meet both agronomic and environmental standards

fordable, and easy to use. They also need support in understanding how to integrate these products into their existing practices.

We are proud to be part of this transformation, offering not just products but partnerships. Through field demonstrations, training programs, and personalized advisory services, we empower farmers to make confident choices. Our goal is to be more than a supplier - we aim to be a trusted ally in every farmer's journey.

Greener Inputs, Smarter Farming

One of the most prominent changes in the agrochemical landscape is the grow-

ing demand for sustainable agricultural inputs. Farmers are increasingly turning to biopesticides, biofertilizers, and plant growth regulators derived from natural sources. These products not only reduce the environmental footprint of farming but also align with global regulatory movements that are phasing out harmful chemical residues.

Biopesticides offer targeted pest control without damaging beneficial insects or degrading soil health. Unlike conventional pesticides, they work with nature rather than against it, preserving bio-

diversity and promoting long-term soil vitality. Biofertilizers, on the other hand, enhance nutrient uptake and improve soil microbiology, reducing the need for synthetic fertilizers and contributing to healthier crop cycles.

As an Agri-input company committed to innovation, we are investing in research and development to bring these next-generation products more and more to the market. Our goal is to ensure farmers have access to effective, eco-friendly alternatives that meet both agronomic and environmental standards.

Leading the Change Together

The agrochemical industry in 2026 will be defined by three key pillars: sustainability, technology, and farmer empowerment. For farmers, this is a time to embrace innovation and explore new possibilities. For Agri-input companies, it's a call to lead with purpose, responsibility, and vision.

As we look ahead, collaboration will be essential. Farmers, researchers, policymakers, and industry leaders must work together to create an agricultural future that is productive, profitable, and planet-friendly. The choices we make today will shape the food systems of tomorrow.

The agrochemical industry in 2026 will be defined by sustainability, technology, and farmer empowerment. For farmers, this is a time to embrace change and explore new possibilities.

For Agri-input companies, it's a time to lead with purpose and innovation. Together, we can build an agricultural future that is productive, profitable, and planet-friendly.



KHARIF'S BATTLE WITH AN UNCERTAIN SKY

The erratic and uneven monsoon in Kharif 2025-26 is one of the toughest seasons in history

The 2025-26 season is proving to be a very challenging for both Kharif and Rabi crops, led by the highly uneven rainfall across regions in India. Northwest India recorded large excess rainfall, and Central India and the South Peninsula received some surplus precipitation. However, the East and Northeast saw deficits. The erratic rainfall pattern, followed by earlier than usual post-monsoon cyclones disrupted harvests and has delayed Rabi sowing in key producing states. Crop quality has suffered, and despite comfortable water availability, concerns remain over Rabi prospects. The late onset of winter and temperature variations expected from mid-February 2026 will be crucial in determining final yields and shaping the overall agricultural outlook.

Kharif Area and Production have been a mixed bag even as area increased but production may not have.

The final acreage in Kharif-2025 needs close scrutiny as it reflects not just the impact of the timing and quantity of rains but also demand and the past price trends.

Coarse Cereals: Led by ethanol and feed demand, Maize emerged as

the key growth driver with acreage up by 12.6%, while small millets posted a 22% rise. Notable acreage gains have been recorded in Karnataka, Madhya Pradesh, and Maharashtra.

Sugarcane: Ample water availability and remunerative prices and stable returns under the FRP system have spurred acreage gains, particularly in Uttar Pradesh, Maharashtra, and Karnataka.

Rice: Paddy acreage has risen as monsoon rains re -

About the **AUTHOR**

Mr Bhaskar Natarajan is Chairman, Agriwatch and Mr Nityanand Rai is Senior Research Analyst at Agriwatch. The company offers daily prices, news, insights, expert analysis and reports to make critical business decisions in the agriculture sector



PRODUCTION ESTIMATES FOR KHARIF 2025

Pulses Segment	Kharif Production 2024-25	AW Final Kharif Estimate-2025-26	% Ch. Over Last Year
Urad	11.20	8.70	-22.32
Tur	35.69	30.03	-15.84
Moong	12.27	11.92	-2.81
Major Pulses Total	59.15	50.65	-14.37
Kharif Paddy	1150.90	1124.50	-2.29
Kharif Maize	235.4	261.90	11.26
Soybean	108	84.7	-21.57
Groundnut	71.98	64.5	-10.39
Sugarcane	4084	4472	9.50
Cotton*	307.33	297.9	-3.07

Source: AgriWatch * Lakh bales, Others Fig. in LMT

TOP ACREAGE GAINERS IN KHARIF SEASON-2025

Kharif Crop	Normal Area (5 Yrs Average)	Area Sown (In Lakh Hectare)		% Change Over 2024
		2025	2024	
Coarse Cereals	180.71	194.67	183.54	6.06
Sugarcane	52.51	59.07	57.22	3.23
Rice	403.09	441.58	435.68	1.35
Pulses	129.61	120.41	119.04	1.15
Oilseeds	194.63	190.13	200.75	-5.29
Jute & Mesta	6.6	5.56	5.75	-3.30
Cotton	129.5	110.03	112.97	-2.60
Grand Total	1096.65	1121.45	1114.95	0.58

Source: Agriculture Department of India

maintained conducive alongwith strong procurement policies. The expansion most notable across Odisha, Chhattisgarh, Andhra Pradesh, and Tamil Nadu.

Pulses: Total pulse acreage increased modestly to 120.41 lakh hectares (+1.15%), led by tur and urad reflecting the supply gap and farmer resilience despite uneven rainfall.

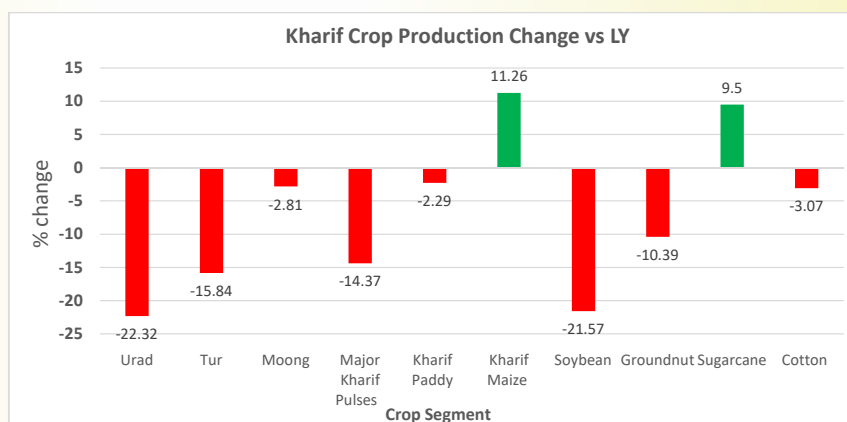
Major Losers

Oilseeds: The farmers shifted to cereals and pulses with reduced acreage in soybean (-7%) and groundnut (-3.2%), as a result of the sustained impact of cheaper imported oils (palm and oils from GM seeds like soy) have disillusioned our farmers.

Cotton: After barely any uptick in demand for over a year, area fell as many growers moved into pulses and cereals.

The chart below shows the change in the production of key crops expected this season despite the increase in acreage in many of these.

An added woe is that these crops are also beset with severe quality loss. Basmati in Punjab-Haryana suffered lodging and degraded export quality while Urad and Moong also have quality issues. Cotton and Maize are arriving in the markets with excess moisture and falling demand. Where the quality falls below specifications, even governments agencies will not be able to procure and farmers are likely to face losses.



Rabi : Will the crisis compound?

As we write this in Mid-November, 2025, the Rabi Outlook remains very preliminary.

Wheat sowing has gained pace after a fortnight's delay due to delay harvest of paddy, labour shortages, and high soil moisture and the shortened sowing window and impending cold wave could affect germination and lead to an estimated 3-5% area shrinkage over last

year, with farmers shifting to less input-intensive crops like mustard and gram. Add to that the forecast of La Niña conditions for winter.

The cumulative impact requires skillful management of food security and macroeconomic stability. The 2025-26 food grain production is expected to stay below 354.64 MMT - the target and the first significant decline in three years. Price pressures could intensify with pulses, edible oils, and cotton facing sustained inflation through H1 2026 and imports surging; Basmati exports could go down due to quality issues. Availability constraints may require government to relook policies. Declining farm incomes will contract purchasing power, creating broader economic headwinds.

India is definitely heading for interesting times.

PROTECTING INDIA'S HARVEST THE RISE OF A MODERN HORTICULTURE ECOSYSTEM



India's horticulture sector stands at a pivotal moment. The journey of fruits and vegetables must be protected not only at the farm level but equally in the crucial hours and days that follow harvest. Over the years, I have seen firsthand how progressive cultivation practices and scientific orchard management have expanded yields across the country. Despite these advances, the true value of our produce is often won or lost in the post-harvest stage.

The Urgency of Post-Harvest Management

From Kashmir's high-altitude apple orchards to the citrus belts of central India, the need for systematic, reliable, and consumer-centric post-harvest management has never been more urgent. Ensuring that produce reaches consumers with its freshness, flavour,

and nutritional integrity intact requires a coordinated ecosystem—modern storage, efficient logistics, hygienic handling, transparent communication, and robust infrastructure. It is in the span between harvest and home that India can unlock its next leap in horticultural excellence.

The Weak Link: Post-Harvest Losses

Historically, this stage has been the weakest link in our value chain. Fruits and vegetables, being living biological materials, continue to respire and lose moisture after harvest. Without scientific handling, they deteriorate rapidly. Temperature abuse, rough handling, microbial contamination, and inefficient transport systems remain silent contributors to India's high post-harvest losses. Even as farmers modernise their orchards and adopt high-density planting, much of their effort risks being undone once



About the **AUTHOR**

Mr Rakesh Kohli is the Managing Director of the Harshna Group, a leading player in India's horticulture sector. His vision for integrated, science-driven solutions for orchard management, post-harvest technology, and supply chain innovation has set new benchmarks for quality and sustainability in Indian horticulture

the produce leaves the farm.

Integrated Private-Sector Intervention

I believe that this is where integrated private-sector intervention becomes vital—creating systems capable of preserving quality through every step of the journey. Having spent years working closely with growers across the Kashmir Valley, I have come to deeply understand both the vulnerabilities and the extraordinary potential of this sector. These experiences have shaped my vision for the Harshna Group: to strengthen practices at the farm level, introduce scientific post-harvest handling, and build infrastructure that protects produce until it reaches the consumer.

Building a Complete Value Chain

This philosophy guides us through the entire value chain—from orchard-level engagement and technical advisory to specialised logistics, world-class Controlled Atmosphere (CA) storage, modern packhouses, and now, our upcoming entry into the delivery segment that will complete the farm-to-home continuum.

Transforming Storage: CA Facilities in Kashmir

Among our most transformative contributions has been the expansion of CA storage facilities in Kashmir. These units have revolutionised the way apples are handled, allowing them to be stored for months without compromising crunch, colour, or sweetness. By helping farmers avoid distress sales and stabilising market prices, our storages have enhanced grower incomes while ensuring that consumers enjoy consistently high-quality produce.

Precision in Packing and Logistics

My commitment to scientific precision has led us to invest in packhouses equipped with advanced sorting, grading, and hygiene systems. Padded conveyor belts, sanitised washing lines, food-grade crates, and traceable packaging not only reduce bruising and microbial contamination but also significantly extend shelf life—meeting the



expectations of modern consumers and organised retail alike.

Logistics form another critical link. Our cold-enabled transportation networks are designed to minimise breaks in the cold chain. Whether we are moving apples from Sopore to Delhi or distributing produce across regional hubs, we maintain an unwavering focus on temperature consistency, hygienic loading, and time-efficient movement. With our upcoming entry into the delivery segment, we intend to carry this discipline all the way to the doorstep—ensuring that the quality preserved at the farm remains intact until the very last mile.

This integrated model—where a single organisation supports farmers, manages storage, oversees packing, controls logistics, and soon delivers directly to consumers—sets a new standard for accountability and freshness in Indian horticulture.

Consumer Awareness and Retailer Responsibility

Post-harvest excellence cannot rely on infrastructure alone. Consumer awareness plays a decisive role. Even the freshest produce can deteriorate quickly if stored improperly at home. I have seen consumers unintentionally hasten spoilage by keeping incompatible items together, washing fruits too early, wrapping vegetables in airtight plastic, or refrigerating produce that prefers ambient conditions.

Recognising this gap, we at Harshna Group have committed ourselves to advocating consumer education—through informative packaging, digital advisories,

and transparent labelling. When consumers learn how to store leafy greens, separate ethylene-sensitive fruits, and revive slightly dehydrated vegetables, they become active partners in reducing waste and preserving quality.

Retailers, too, shoulder vital responsibility. Our collaborations with organised and independent retailers focus on improving in-store handling, maintaining clean and well-cooled display units, training staff, and ensuring that cold-chain discipline continues until the point of sale. When retailers adopt produce-sensitive practices, consumers experience longer-lasting freshness while growers benefit from stronger, more stable demand.

Quality is not an accident but an engineered outcome. Excellence must be built layer by layer: starting with scientific farming, continuing through packhouse precision and cold-chain integrity, and culminating in a customer-focused delivery experience that closes the loop. Each stage reinforces the next, building a framework that safeguards the intrinsic value of India's horticultural abundance.

The Road Ahead

As India positions itself as a global leader in fruits and vegetables, the road ahead lies in reducing wastage, elevating consumer satisfaction, and embracing a scientific, system-driven approach to every stage after harvest. With integrated players like Harshna Group, I am confident that we are steadily building a future where every fruit and vegetable tells the story of a journey protected with intention and delivered with purpose.

India's Honey Industry Faces a Crisis of Trust, Not Production

India produces an estimated 133,000 metric tonnes of honey annually and ranks third globally in honey exports. Yet domestic consumption remains among the world's lowest, at just 20 to 40 grams per capita each year compared to a global average of 2 kilograms. This paradox of abundant production and minimal consumption reveals a crisis that has little to do with supply and everything to do with trust.

The 2020 adulteration scare, which exposed inconsistencies in testing across major brands, was only a symptom. The real problem lies deeper, in



a structural maze of fragmented standards, overlapping regulatory frameworks, inconsistent testing protocols, and persistent consumer misinformation that has eroded confidence in Indian honey. When consumers cannot distinguish between genuine purity and adulteration, between crystallization

and contamination, between scientific claims and marketing hype, they simply stop buying.

Trust Can Be Rebuilt If Foundations Are Laid

This trust deficit, more than production constraints or export volatility, is the true



About the **AUTHOR**

Ms Namrata Khanna is Director – India Honey Alliance, a consortium of stakeholders across the value chain of the Indian honey industry, ranging from top brands, exporters, foundations, scientific experts and beekeepers. Her core strength lies in building multi-level relationships with key stakeholders across government and the private sector, managing stakeholders across multilevel projects, and aligning them for a common purpose

challenge facing the sector. And unlike production capacity, trust can be rebuilt if the right foundations are laid. The problem begins with the question of standards. Walk into a honey testing laboratory in India and ask what 'purity' means, and you may get different answers depending on which protocol the lab follows. A sample might pass one testing framework and fail another, not because the honey has changed but because the testing protocols are not harmonised, with differing interpretations & misalignment.

The systemic inconsistency creates cascading failures. It enables adulteration, as ambiguity allows unscrupulous producers to exploit loopholes. It punishes honest producers, particularly small beekeepers and manufacturers, who find compliance outcomes unpredictable and investments in quality irrational. And it destroys consumer confidence irreversibly, as people hear that major brands have 'failed purity tests' without understanding whether this reflects testing anomalies or genuine contamination.

Trust, once broken, requires extraordinary effort to restore. The solution is not necessarily stricter enforcement but harmonized standards, consistent testing infrastructure, consumer education & awareness about Indian honey & its varied properties.

Access To Knowledge, Infrastructure, And Viable Economic Incentives For Beekeepers Can Significantly Increase Their Revenue

Adding to this is the fragmented and largely unorganized beekeeper base on which India's honey production depends. Most beekeepers operate without access to modern equipment, systematic training, or scientific practices. Consequently, bee colony mortality due to pesticide exposure and poor disease management remains high, seasonal and regional production varies drastically, and quality consistency becomes difficult to maintain. This fragmentation constrains both production and quality. Without the tools, knowledge, or incentives to produce premium honey, the sector defaults to a commodity mindset,



India has everything required for the rapid growth of the honey sector except convergence. Building that convergence is the sector's true challenge and its greatest opportunity

competing on price rather than quality.

However, experience shows that when beekeepers realize premium honey commands two to three times the price of ordinary honey, the behaviour changes. When aggregators and farmer producer organizations understand that traceable, certified supply chains attract premium buyers, they begin investing in

certification and collection infrastructure. Where beekeepers receive systematic training in sustainable hive management, disease prevention, and seasonal practices, colony mortality falls and production consistency improves.

This transformation is not theoretical. Regions that have embraced cooperative structures and training initiatives consistently show better production quality and stability. The missing link is not capability but access to knowledge, infrastructure, and viable economic incentives.

The challenge of misinformation compounds the issue. Consumers often mistake crystallization for adulteration, conflate testing protocols with quality guarantees, and absorb myths about honey composition and authenticity spread across social media. Even legitimate, science-backed health claims get entangled with exaggerated marketing narratives. When consumers cannot separate genuine quality markers from commercial claims, they retreat into scepticism, which is very difficult to reverse through conventional advertising.

Rebuilding trust therefore requires a shift in how honey is perceived through proper communication. One way is to promote honey through science-based consumer education & awareness campaigns. A good place to start would be to explain the why and what of crystallization of honey. Another could be the



relevance of different testing protocols, and their requirement. The tried & tested health benefits grounded in both Ayurveda and modern nutrition could well change the way people look at honey beyond its therapeutic uses. This communication, if multilingual and rooted in regional contexts, will leverage the credibility of scientists, nutritionists, and Ayush & Unani practitioners. It will also address the evolving middle-class consumer who is becoming health-conscious but lacks access to clear, trustworthy information.

Policy Fragmentation Is A Challenge

Behind all these challenges lies a deeper structural issue: policy fragmentation. Production falls under the Ministry of Agriculture, exports under the Ministry of Commerce, food safety under FSSAI, traditional medicine under Ayush, and food processing incentives under MoFPI. Each operates within distinct mandates, time-

If stakeholders across government, industry, and civil society commit to shared goals of science, quality, and transparency, the honey sector can witness a remarkable transformation

lines, and priorities, making consensus on standards or coordinated reform slow and complicated. The result is misaligned policies, scattered training programs, and a reactive rather than strategic approach to export competitiveness and consumer awareness. What India's honey industry needs is not more regulation but better coordination—a unified policy roadmap

that aligns standards, harmonization, beekeeper training, export positioning, and domestic consumption growth.

On a positive note, the sector's fragmentation is also its greatest opportunity. Because the system is still evolving, India has the chance to leapfrog directly toward global best practices rather than settling into suboptimal models. Countries like New Zealand and Australia have shown that credibility, not volume, drives global success. Their honey sectors achieved premium positioning through uncompromising quality standards, transparent supply chains, and scientific validation. India possesses the raw potential, production scale, traditional knowledge, and scientific expertise to do the same. The missing link is coordination across standards bodies, training networks, regulatory agencies, and communication platforms.

When these elements align, India's honey sector can stop competing on price and start competing on credibility. Domestic consumption will grow as trust is restored. Export premiums will rise as buyers recognize consistent quality and traceability. Beekeepers will earn better margins, making quality-focused production economically sustainable.

The future of India's honey industry rests on a simple but decisive choice of convergence. If stakeholders across government, industry, and civil society commit to shared goals of science, quality, and transparency, the transformation could be profound. Coordination and convergence can result in the evolution of honey from an occasional household remedy into a trusted, everyday staple, and India can claim not just leadership in production but also in credibility. If standards remain misaligned, if beekeepers remain unsupported, if misinformation goes unchallenged, and if policies continue in isolation, the sector will remain trapped in low-value commodity production, vulnerable to recurring quality crises.

India has everything required for this transformation except convergence. Building that convergence is the sector's true challenge and its greatest opportunity.



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WHAT DPDP RULES 2025 MEAN FOR INDIA'S FOOD AND AGRICULTURE SECTOR

On 14 November 2025, the Ministry of Electronics and Information Technology (MeitY) notified the Digital Personal Data Protection (DPDP) Rules, 2025, under the enacted Digital Personal Data Protection Act (DPDPA), 2023. This marks a key shift in India's privacy regulation framework, establishing a clear system to protect personal data and strengthen the rights of Data Principals.

Although the impact of these Rules spans many industries, the food and agriculture sector will witness a transformative shift. As digital adoption accelerates across agritech platforms, cooperatives, Farmer-Producer Organisations (FPOs) and drone-service providers, these Rules will make the personal data management process more meticulous and streamlined. This personal data includes geo-spatial information, information on loyalty programmes, financial histories, land records, procurement logs and traceability systems. The DPDP Rules set clearer expectations on how such personal data must be handled, stored and shared, benefitting farmers, food businesses, retailers and consumers.

Businesses that have already embedded privacy into their processes will only need minor adjustments to meet the new standards, while those with inadequate security measures may face fines of up to INR250 crore. Some believe that the framework might need additional clarity on certain definitions and operational thresholds. However, the general

consensus reveals that its phased and pragmatic rollout are its strong attributes. The Rules also serve as a useful guide for global agribusinesses operating in India, enabling them to integrate DPDP-specific requirements into their existing personal data protection ecosystem to strengthen compliance.

Key elements in DPDP Rules for the agriculture sector

The journey from the Draft DPDP Rules

(Draft Rules) released in January 2025 to the final Rules notified in November 2025 reflects a mature regulatory framework that has moved towards a more calibrated and implementation-sensitive regime. Unlike other personal data protection regulations, the updated Rules define the responsibilities of a Data Fiduciary in a detailed manner.

From an agriculture and food systems perspective, the Rules offer clear guidance on how organisations should man-



About the AUTHORS

Mr Srinivas Kuchibhotla is Partner and Lead, Agribusiness Technology and Transformation at Deloitte India. Mr Mayuran Palanisamy is Partner, Digital Trust and Privacy, Technology & Transformation, Deloitte India

age personal data across the value chain:

- **Agri-tech companies** gain clarity on how to manage farmer databases, drone and sensor output, and soil and geospatial data.
- **FPOs and cooperatives** can ensure compliance while capturing personal data during enrolment, subsidy linkage and procurement activities.
- **Food processors and supply-chain operators** get guidance on managing traceability records, certification data, movement logs and digital procurement workflows.

Importantly, the Rules also account for the realities of rural ecosystems (multilingual communication, assisted consent and multi-party data sharing) to make adoption easier.

The making of the final Rules

One of the most prominent developments in the final Rules is the introduction of a phased compliance schedule, which gives organisations sufficient time to ensure compliance. The foundational provisions and the Data Protection Board (DPB) framework take effect immediately. The Consent Manager requirements will take effect after a year, and the core operational compliance obligations are deferred to an 18-month window. This phased structure is particularly helpful for agribusinesses that work across multiple locations and manage seasonal workloads, as well as varying digital literacy levels. The extended timeline allows them to reimagine farmer data capture and create consent processes that are easy to follow in rural areas. The extended timeline allows them to reimagine the personal data captured by farmers create consent processes that are easy to follow in rural areas.

A material shift in data retention obligations

The most notable change in the Rules is the one-year data retention requirement. The final Rules require fiduciaries to retain personal data, traffic data and logs generated during processing for a minimum of one year. From a compliance and risk management perspective, this change will be felt across every sector.



WHAT THESE RULES MEAN FOR YOU

Deloitte India has released a detailed Point of View (POV) on the DPDP Rules, 2025, designed to help leaders move from “What does this mean for us?” to “How do we turn this into an advantage?”. The Deloitte POV on the DPDP Rules 2025 can be downloaded on: <https://deloitte/60457evCS>

In agriculture, it affects every part of the value chain.

Food processors will need to retain traceability and contamination records for longer. Agri-tech platforms must retain drone imagery, soil and geospatial data, advisories and weather-linked insights. Input companies will need to store retailer and farmer purchase histories, while supply-chain operators will need to keep transport and cold-chain movement data for the full duration.

These requirements mean that organisations will need stronger logging systems, reliable storage and better safeguards, especially during busy procurement seasons when data inflow rises sharply. Many will have to rethink how they manage information from start to finish to mitigate the risks associated with storing larger volumes of personal data for longer periods.

Higher accountability for consent managers

While the final Rules defer the effective date for Consent Manager obligations, the accountability expectations remain largely unchanged. In the agricultural ecosystem, consent processes will need to be multilingual and simple, especially for farmers who often rely on assisted or offline communication. The extended timeline gives organisations the space opportunity to create mechanisms that are easy to follow while meeting the compliance requirements outlined in the Rules.

Implications for the food and agriculture sector

The DPDP Rules create a clearer, more reliable personal data environment for the food and agriculture sector. They create stronger expectations around consent, retention and accountability, which helps build trust among farmers and consumers, while giving agri-tech firms, FPOs and cooperatives a steadier foundation for managing farmer information. These steps also support the responsible use of drone, satellite and sensor-based data, which now play a key role in precision farming. For food processors and integrated agribusinesses, the framework brings their governance practices closer to global expectations. Better-aligned personal data processes simplify audits and help organisations position themselves as “export-ready” partners. As the sector continues to digitise, the Rules offer a timely opportunity to modernise personal data practices and build confidence across the entire value chain.

THE ORGANIC CIRCLE OF LIFE

LINKING SEEDS, SOIL, FISH AND FARMERS IN HARMONY

In 2003, we decided to farm organically, after having seen the environmentally harmful consequences and the decline of ecosystem services that come alongside conventional farming methods.

We farm rice, vegetables—mostly tomatoes, chillies, brassicas, leafy vegetables, beans and tubers—and fruits, such as papaya, guavas and lemons. These, we sell directly on local markets and to a farmer's cooperative (CSA).

Seed Bank Nursery & Production

We are one of the first Certified Organic Seed Producer companies in India. We have successfully propagated of more than 500 varieties of organic high-yielding vegetable seeds that are locally adaptable and climate resilient.

We are also training and empowering farmers through seed preservation techniques for sustainable agriculture and creating communities and seed villages.

Rice

We have a gene pool of around 108 varieties of rice, which are indigenous to India and Southeast Asia. We produce rice seeds as well as rice for commercial sale, including aromatic rice—called Joha—and sticky gum rice, black rice, soft rice etc. We grow around 20 acres of rice during monsoon from June until November. We also have fish cum paddy cultivation where we have rice and fishes together along with ducks. Azolla is also released in the paddy fields for enhancing nitrogens. Further, we inoculate *Azospirillum* and *Phosphorus sol-*



About the **AUTHOR**

Mr Neelam Dutta is the Managing Director and Founder of Pabhoi Greens and is engaged in multi-faceted organic farming, Biodynamic Farming and natural Vedic farming methods. This expertise has been continually enriched through a collaborative partnership with Sativa Rheinau, a well-regarded Swiss organic and biodynamic seed company, since 2015



bilizing bacteria-PSB by root treatment and we practise System of Rice Intensification (SRI) methods too. Around 40% of our produced rice is being sold, 30% we use for seed production, 10% for research purposes and the rest for on-farm consumption.

Tomatoes And Other Vegetables

We have over 140 varieties of heirloom tomatoes with are both determinate (dwarf) and indeterminate. Each has distinctive colours, taste, texture, shape and size. The seeds are adaptable to the diverse Indian climatic zones.

We have an extensive variety of exotic and local vegetables which can be reproduced and are non-GMO. Our seed bank includes varieties of lettuce, herbs,

Fish

Around 1/2 of our farmland is devoted to fish breeding and reproduction. We breed carp fish, catfish and anabas. To preserve the genetic purity, we do single breeding, as well as selective breeding. Further, we maintain a two-year rotation policy on breeding so that gene pool depression does not occur. Beyond the grown-up fish, we sell spawn fish (three-day-old fish), fry and fingerlings, for others to grow. Every year, we produce around 8000kg of grown fish, 8500000 spawn, and 600000 fish fry and fingerlings. We have 8 nursery tanks, 10 rearing tanks, 9 stocking tanks and 6 brood tanks, plus, we have fish breeding eco hatcheries. All fish are fed with in-house, organic feed.

We strive to create a more supportive environment for the agricultural sector, paving the way for positive transformations in our industry and society

Dairy, Duckery & Apiary

38 cows and 50 ducks are an integral part of the farm. We do not only produce milk but the cow dung and cow urine are integral to the vermicompost and the bio pesticides.

16 honeycombs, which ensure better pollination and honey production, are all around the farm.

Vermicompost & Natural Soil Enhancers

We produce around 300 metric tonnes of pure organic vermicompost manure. We also produce Vedic formulas like Panchagavya, Jeevaamrut, Sashyagavya, Amrutpani etc. and cow urine and neem-based biopesticides. We make anaerobic and aerobic compost and also Trichoderma based enhanced compost and biofertilizers. We provide around 80% of the vermicompost to Assam and its neighbouring states.

Training and Community Building

Since 2008, training and community building is one of the most important

components at Pabhoi Greens. We aim to disseminate the knowledge and practices of organic farming and seed saving through the farming community and the wider society.

Our training workshops include:

- a) seed conservation, production and breeding,
- b) training on fishery and fish breeding,
- c) organic farming, crop rotation, production of Vedic formulas and biofertilizers.

We work in partnership with women's groups from Nagaland and Arunachal Pradesh. They are now trained especially on seeds and post-harvesting to ensure that they can conserve and produce seeds.

We host university students as interns on the farm, and train school children in organic farming and environmental education. In total, we have trained about 8000 like-minded people over the last 4 years, including NGO officials.

Cooperative Farming

One of our main goals is to have good networks and cooperatives among organic farmers in the entire northeastern region of India to collectively learn, support and sustain each other. Thus, we started our state's first-ever organic cooperative with 31 like-minded farmers. Further, women self-help groups were created in both Nagaland and Arunachal for organic farming and seed production.

Agro-Tourism and Farm Stay

The farm has started the first organic farm stay in the region. Visitors can fish, farm and cook their own food. Eco-friendly bamboo and mud houses were built in early 2020. The farm is surrounded by Lush Tea gardens, which are more than 100 years old and are a major attraction of tea tourism.

Government Liaisoning and Policy Change

We actively work with the Assam Department of Horticulture and organic FPOs/ FPCs on promoting organic farming across different districts of Assam.



India's Chilli Sector

OPPORTUNITIES AND CHALLENGES



India's chilli industry stands as one of the most vibrant sectors in the agricultural landscape, blending tradition, innovation, and global opportunity. Yet, it also faces real-world challenges that affect thousands of farmers. The experience of Hunugund Farmer Producer Company Limited (FPO), based in Bagalkot District, Karnataka, offers a ground-level view of both the possibilities and the hurdles that define India's chilli journey—from local farms to global markets.

Opportunities In India's Chilli Sector

- **Expanding Domestic and Global Demand:** Chilli is more than just a spice—it's an integral part

of Indian cuisine and a major export commodity driving global demand. India exports chillies to more than 150 countries, making it one of the world's leading suppliers. For Hunugund FPO, the primary focus lies in tapping this export potential through consistent quality production, efficient aggregation, and direct engagement with international buyers. Alongside its export-driven initiatives, the FPO has also ventured into packaging and branding under its own label, mainly to cater to domestic consumers, adding value to surplus produce and creating a recognizable identity in local markets. This dual approach—commodity export as the main driver and branded sales for local consumption

About the **AUTHOR**

Mr Ravi Sajjanar is the Founder of Hunugund FPO, empowering local farmers by providing access to high-quality seeds, modern agricultural practices, and sustainable farming solutions. Mr Sajjanar was awarded the 'Best Young Farmer Award' by University of Agricultural Sciences (UAS), Dharwad and District Rajyotsava Award by Bagalkot Zilla Panchayat

as a secondary stream—has strengthened its overall business model and improved farmer income.

- **Technology and Mechanization: A Game Changer:** Farming, traditionally labour-intensive, is evolving through mechanization. Hunugund FPO's investment in modern tools—like seed drill sowing machines and combine harvesters—has helped farmers save time, reduce labour costs, and improve productivity. Mechanization not only increases yield but also ensures uniformity and efficiency, vital for maintaining quality in export-oriented production.
- **Farmer Aggregation and Collective Power:** The FPO model empowers small and marginal farmers who, individually, may struggle to access markets or negotiate fair prices. By pooling resources, knowledge, and produce, Hunugund FPO enhances farmers' bargaining power. Collective marketing ensures better price realization, while shared infrastructure reduces costs. This collaborative model also makes it easier to implement uniform quality standards—a key requirement for export certification.
- **Diversification and Value Addition:** One of the biggest lessons from Hunugund's journey is the importance of **diversification**. Depending solely on one crop exposes farmers to risk from price fluctuations and weather uncertainties. By cultivating multiple crops and exploring value-added products like packaged and branded chillies, the FPO has stabilized income streams. Value addition not only increases profitability but also creates opportunities for rural entrepreneurship and employment.
- **Supportive Government Policies:** India's push to strengthen Farmer Producer Organizations and promote agri-exports has opened new doors. Policies offering financial assistance, infrastructure grants, and export facilitation have encouraged organizations like Hunugund to expand their horizons. The government's emphasis on quality certification, export promotion, and skill development complements FPO efforts on the ground.

Strong Foundation - Hunugund FPO

Established in 2018, Hunugund FPO is rooted in the rural heartland of Bagalkot, working across 18 villages and covering about 6,300 hectares of farmland. With 1,000 farmer-shareholders, the collective supports its members through technology, training, and market linkages. Its diverse business portfolio includes soya bean, millet, maize, pulses, turmeric, fruits, and vegetables, in addition to its star crop—chilli.

In FY 2024–25, the FPO achieved a business turnover of ₹15.8 crore from chilli alone, handling about 820 metric tonnes, showing remarkable growth and market confidence.

Challenges in India's Chilli Sector

While the opportunities are immense, the chilli sector also faces complex challenges that need continuous attention.

- **Quality Variations and Export Standards:** Meeting the stringent quality requirements of global buyers is no easy task. Differences in chilli varieties, inconsistent harvesting methods, and inadequate post-harvest handling can affect quality. Hunugund FPO's early export efforts faced hurdles in maintaining consistency and meeting moisture and color standards demanded by international markets.
- **Supply Chain and Logistics Issues:** Efficient supply chain management is critical for perishable commodities like chilli. Delays in transport or lack of proper storage facilities can lead to spoilage or price losses. Many small farmers still lack access to cold storage, drying units, and processing facilities, making the entire value chain vulnerable.
- **Financial Barriers and Market Volatility:** Chilli farming requires significant investment in seeds, fertilizers, and irrigation. However, access to affordable credit remains limited. Price volatility, driven by both domestic and international market fluctuations, makes income unpredictable. Without insurance or financial buffers, farmers often face uncertainty despite good yields.
- **Knowledge and Skill Gaps:** Technology adoption is not just about equipment—it's about understanding best practices. Many farmers are still learning about scientific farming methods, integrated pest management, and ex-

port compliance. Training programs are crucial but require long-term commitment and consistent follow-up.

- **Regulatory and Export Compliance:** For small FPOs, navigating complex export documentation, certifications like APEDA or Spice Board approval, and meeting residue and pesticide standards can be overwhelming. The process demands time, money, and specialized knowledge—resources that many rural collectives lack.

Insights from Hunugund FPO's Journey

Hunugund FPO's experience shows that the path from local farming to global trade is built on learning, adaptation, and collaboration.

- **Continuous farmer training** is vital to ensure quality and consistency, especially for export markets.
- **Adoption of modern technology** helps overcome labour shortages and improves productivity.
- **Quality control and grading systems** are essential to meet export standards and build buyer confidence.
- **Strong partnerships** with exporters, government departments, and technology providers create shared value.
- **Diversification and branding** safeguard against market volatility and open new income streams.
- **Investment in storage and logistics infrastructure** reduces post-harvest losses and improves profitability.

These lessons underline that success in the chilli sector goes beyond production—it requires integrated value chain management, farmer empowerment, and a vision to scale sustainably.

HARNESSING AI TO BOOST MILK, INCOME, AND CLIMATE ACTION

When I founded eVerse.AI in 2022, after a full year of developing our core technology, my initial plan was to enter the U.S. dairy market. The logic was simple: tech adoption is higher, funding access is easier, and data-driven farming has more traction there. But as I examined India's dairy landscape more closely, I realized something crucial—my own backyard needed technology far more urgently than any foreign market could.

India is the world's largest milk producer, but it struggles with fundamental inefficiencies. Small dairy farmers—who comprise over 95% of the market—lack access to data tools, monitoring systems, or meaningful support to enhance productivity and animal health. Whatever agricultural technology exists here is designed for large, organized farms that make up just a fraction of the sector. I knew then that if we could develop cost-effective, data-driven solutions for India's smallholder dairy farmers, we could not only improve their incomes but also make a measurable impact on climate change.

That realization shaped the mission of eVerse.AI: to bring cleantech innovations into the dairy sector, bridging pro-

ductivity with sustainability.

Building the foundation

Alongside my co-founders—Director Vi-dhi Gaur and Vice President Shailendra Narwade—I began to assemble a team in Nagpur, my home city. We grew steadily to a 23-member group, driven purely by conviction and purpose. Over the last three years, we have filed five patent applications, onboarded 18 B2B clients, and impacted over ten lakh B2C users through our digital and IoT solutions.

Our model rests on two interconnected solution stacks that address different but complementary challenges in dairy farming: Connected Cow and Green Cow. These platforms represent the core of how we envision the future of sustainable animal agriculture.

Connected Cow: Productivity reimaged

Connected Cow focuses on improving farm profitability and animal well-being. The idea stemmed from seeing how farmers often lack timely information about their

cattle's health and reproductive cycles. Missing early signs of sickness or heat cycles results in lower fertility rates and lost milk yields.

We developed an IoT-powered smart cow collar, priced at ₹5,000, that collects real-time data on the animal's health and activity. The device, built on an AI/ML platform, continuously monitors metrics like movement, temperature, and chewing patterns. The data is transmitted to our Connected Cow app, where farmers receive instant alerts if their cows show symptoms of sickness, distress, or estrus. This allows for faster veterinary interventions and better breeding management.

To make these insights more accessible, we created Cow GPT, our generative AI assistant built on the Claude LLM foundation model (Claude Sonnet). It interprets complex data

About the AUTHOR

Mr Ashish Sonkusare, an IIT Bombay Computer Science graduate, is the former Head of AI at Amazon Web Services and currently leads eVerse.AI, innovating climate tech and sustainable dairy solutions in India.





and offers simple, actionable advice on animal nutrition, health, and productivity. Farmers can simply describe an observed behavior—say, “The cow isn’t eating much today”—and Cow GPT analyzes the likely cause and suggests remedies. Importantly, we have made both the app and platform free for farmers, ensuring that cost never becomes a barrier to using technology. The results are improved fertility cycles, better milk yields, and a drop in preventable illnesses – hence higher income for farmers.

Green Cow: Turning cows climate-positive

Livestock, especially cattle, emit methane during digestion, accounting for nearly 40% of agricultural greenhouse gas emissions in India. Methane is over 25 times more potent than carbon dioxide in trapping heat over a 100-year period, making dairy farming a major contributor to climate change.

This challenge inspired our second innovation: the Green Cow solution stack. Our aim was to measure, manage, and monetise methane reduction. Using portable handheld devices, we began monitoring methane emitted by individual livestock. Then, we designed intervention programs to reduce emissions—ranging from optimizing feed formulations to improving rumination efficiency.

In December 2024, we launched

BRIDGING PRODUCTIVITY WITH SUSTAINABILITY

What drives me most is the possibility of transforming rural livelihoods while combating climate change from within the dairy barns of India. Every improved fertility cycle, every recovered cow, and every unit of methane reduced represents both progress for the farmer and a step forward for the planet.

Our mission at eVerse.AI is to prove that artificial intelligence, when designed for real people and real animals, can nurture not just profitability but purpose. The Indian dairy farmer deserves modern tools, and the world deserves a cleaner dairy industry—and that’s exactly what we are endeavouring to build.

the Maharashtra Methane Mission, a pioneering initiative under which verified methane reductions are converted into carbon credits. All revenues from these credits flow directly back to the farmers at no cost to them. We built the system so that each farmer participating in our project can earn an additional ₹3,000 per cow annually purely from carbon credits.

Competing with the world—but on our own terms

In India, our main competition comes from Stellapps, which offers a leg-mounted pedometer-type device. Globally, players like AllFlex, DeLaval, and Data-mars have similar offerings, but their hardware often struggles with Indian conditions. Our local breeds differ vastly from European ones, both anatomically and behaviorally. The challenge motivated us

to design devices suited specifically for Indian environments and farm realities.

In the broader cleantech domain, we cross paths with companies like altM in Bengaluru, active in agri-carbon projects. Very few Indian startups work on livestock-related methane mitigation, giving eVerse.AI a unique position at the intersection of animal data science, clean technology, and carbon finance.

The road ahead

Over the next few months, we plan to enter markets in Bangladesh, Africa, New Zealand, and the U.S. Each region presents different cattle genetics, feed systems, and emission baselines, but the fundamentals of data-driven, climate-positive dairy remain the same. India is ready for technology-driven sustainability in dairy farming.

INDIA'S UNIQUE DIVERSITY IN POTATO PRODUCTION

A State wise Powerhouse Series

India produces over 60 million tonnes of potatoes annually, making it the world's second-largest potato producer—behind China's 95 million tonnes and ahead of the European Union (~55 million tonnes) and the United States (~20 million tonnes). What sets India apart is its regional diversity and a uniquely integrated value chain. Punjab, Haryana



About the
AUTHOR

**Mr Soundararadjane S is
Chief Executive Officer,
HyFarm - HyFun Foods**

and Uttar Pradesh form the backbone of seed-potato production, anchoring an ecosystem that spans seed development, storage and logistics and engages more than 45 million smallholder farmers. Uttar Pradesh and West Bengal dominate table-potato output, while Gujarat, Punjab and Madhya Pradesh lead in processing-grade varieties—together creating one of the world's most resilient potato supply chains.

Punjab – The Seed Bowl of India

With over 32,000 hectares under high-quality seed potato cultivation, Punjab produces approximately 0.6 million tonnes of high-quality seed potatoes annually serving as the engine of India's planting cycles across major potato-growing belts.

Punjab's comparative advantage lies in its controlled winter climate, progres-



sive farmer networks, and strengthening infrastructure. This includes tissue culture laboratories, mini-tuber production systems, and robust contract seed multiplication programs. Public-private partnerships and state-led R&D are accelerating the shift toward disease-free, high-yielding varieties.

How Punjab Compares with the Netherlands

The Netherlands, long regarded as the global seed potato leader, cultivates around 40,000 hectares, generating 1.5 to 1.8 million tonnes of seed potatoes annually—most of which are exported. Its strength lies in precision farming, a strict certification regime (S, SE, E1–E3), and an export-oriented ecosystem.

“While Punjab currently focuses on India’s vast domestic needs, it is rapidly closing the gap through technology adoption, private-sector participation, and R&D collaboration. Punjab’s evolution signals India’s growing ambition to become self-reliant and globally competitive in high-quality seed potato production.”

Uttar Pradesh & West Bengal – The World’s Largest Fresh Potato Powerhouse

Together, Uttar Pradesh and West Bengal form the backbone of India’s fresh potato supply, producing a combined 25+ million tonnes annually—a scale unmatched anywhere else in the world for table potato consumption.

Uttar Pradesh and West Bengal dominate table-potato output, while Gujarat, Punjab and Madhya Pradesh lead in processing-grade varieties—together creating one of the world’s most resilient potato supply chains

Uttar Pradesh – The Fresh Table Potato Giant

As India’s largest potato-producing state, Uttar Pradesh cultivates over 600,000 hectares, yielding more than 16 million tonnes annually—primarily for fresh consumption across India and neighbouring regions.

Its strength lies in its agro-climatic diversity, enabling staggered harvests and a year-round supply. The state is a major producer of popular fresh table varieties such as Kufri Bahar, Kufri Jyoti,

A Future-Ready Ecosystem

India’s potato ecosystem is not monolithic—it’s a tapestry of regional strengths:

- **Punjab** ensures a reliable supply of high-quality seed potatoes, forming the foundation for India’s planting cycles.
- **Uttar Pradesh and West Bengal** together anchor the world’s largest fresh potato economy, built on diverse agro-climates and widely adopted varieties.
- **Gujarat** is driving India’s emergence in the global frozen food segment with French fry-grade processing, drawing structural parallels with Belgium.
- **Madhya Pradesh** is powering the snack food revolution with traceable, high solids crisping potatoes.

Adding to these established powerhouses are the next wave of specialized states. Himachal Pradesh, Haryana, and Rajasthan are catching up rapidly in seed potato production, building capacity to serve both domestic and export markets. Bihar and Assam are reinforcing their role as reliable table potato suppliers for eastern India and cross-border trade. Maharashtra is expanding its footprint in crisping-grade varieties, complementing Madhya Pradesh, while Karnataka and Tamil Nadu are carving a niche in off-season cultivation, ensuring year-round supply for processors and fresh markets alike.

“Together, these layers of regional specialization are deepening India’s resilience, enhancing year-round availability, and building a diversified portfolio that positions India not just as a producer, but as a truly global potato powerhouse.”



and Kufri Pukhraj, which are known for their high yields, adaptability, and consumer appeal.

“A dense network of mandis, cold storage facilities, and vibrant farmer communities ensures both market stability and supply chain depth, making UP the cornerstone of India’s fresh potato economy and a vital force for national food security”.

West Bengal – The Eastern Powerhouse of Table Potatoes

With over 400,000 hectares under potato cultivation, West Bengal contributes nearly 10 million tonnes annually—primarily consumed in eastern and northeastern India, as well as neighbouring countries like Bangladesh and Nepal.

What sets West Bengal apart is its early-season harvest, fertile alluvial soils, and dense potato-growing landscape. The state extensively cultivates varieties such as Kufri Himalini, Kufri Jyoti, and Kufri Pukhraj, well-suited to its agro-climatic conditions and local market preferences.

“A rich tradition of smallholder-driven production, coupled with strong mandi systems, interstate trade, and a vast cold storage network—especially in districts like Hooghly, Bardhaman, and Bankura—makes West Bengal a critical contributor to India’s fresh potato economy”.

Gujarat – India’s French Fry Frontier

Gujarat has emerged as the epicentre of French fry-grade potato production in India, with over 24,000 hectares under varieties like Santana, Kufri Frysona, and Innovator—cultivated specifically to meet stringent processing-grade standards for frozen fries.

The state produces approximately 1.2 million tonnes of French fry-grade potatoes annually, supported by a robust farm-to-factory ecosystem.

Gujarat’s success is rooted in its ideal winter temperatures, sandy loam soils, and well-structured contract farming frameworks. The state has developed integrated infrastructure, including grading lines, cold storage, and export-compliant processing facilities.

How Gujarat Compares with Belgium

Often referred to as the world capital of frozen fries, Belgium processes over 5 million tonnes of potatoes annually, largely geared for export to global QSR chains and supermarkets. The Belgian model thrives on precision farming, cold chain excellence, and close grower-processor collaboration.

While Gujarat is still scaling up in volume, it mirrors many of Belgium’s structural strengths—variety-specific farming, processing-integrated supply chains, and export readiness. With rising invest-

ments and technical know-how, Gujarat is laying the groundwork to become India’s equivalent of Belgium in the global frozen potato space.

“This combination of favourable agronomy, organized value chains, and export orientation is transforming Gujarat from a raw producer to a world-class supplier of high-quality frozen potato products, helping position India in international quick-service restaurant (QSR) and retail markets”.

Madhya Pradesh – The Crisping Potato Capital

Madhya Pradesh (MP) is positioning itself as India’s crisping-grade leader, with over 20,000 hectares dedicated to potato varieties suited for chips, and an annual production volume exceeding 1 million tonnes.

The state focuses on high dry matter, crisping-specific cultivars such as Lady Rosetta, Chipsona, and other high-solids varieties that meet domestic and export processing standards.

“With its central location, suitable climate, and increasing collaborations with regional processors, MP is becoming a key node in India’s snack food revolution. Its growing network of traceable supply chains, post-harvest infrastructure, and dedicated farmer programs is enabling the production of processing-grade potatoes that align with global quality benchmarks”.

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Powering UTTAR PRADESH'S RURAL ECONOMY

THE CHALLENGES AND TRIUMPHS OF SUGARCANE FARMING



Sugarcane in Uttar Pradesh (especially Western Uttar Pradesh) is not merely an agricultural commodity; it symbolizes the soul, politics, and socio-economic identity of the region. This crop, flourishing from the hard work of farmers, even determines the political 'temperature' of Uttar Pradesh.

The lives of over 5 million farm families in the state are sweetened through sugarcane. Despite the delayed payments by mills—often by one to two years—in the western part of the state, sugarcane re-

mains cultivated as the main cash crop. For the crushing season 2025-26, UP is estimated to produce about 10.25 million tonnes of sugar. Furthermore, the state has now surpassed others in ethanol production. Ethanol production through sugar mills has been increased eightfold, with the state currently producing around two billion litres of ethanol.

The area under sugarcane cultivation in Uttar Pradesh has also increased. According to departmental figures, the sugarcane area is rising year by year. Over the last year, the area has grown



About the **AUTHOR**

Mr Bishan Kumar Nehwal is a social reformer, an agripreneur, and a socio-economic thinker who has worked across the globe. He is the driving force behind the ambitious "1 Billion Tree" initiative, a testament to his dedication to environmental sustainability



by 92,052 thousand hectares, bringing the total cultivated area to 2.853 million hectares. In terms of yield, the average sugarcane productivity in UP was 72.38 tonnes per hectare in 2016-17, which increased to 83.25 tonnes per hectare in 2024-25, resulting in an additional production of approximately 10.87 tonnes per hectare. During the 2024-25 crushing season, sugar mills crushed about 1,900 lakh quintals of sugarcane, producing approximately 9.245 million tonnes of sugar.

Production Growth Amid Rising Costs and Economic Challenges

Despite this massive production, sugarcane farmers are still struggling with deep-seated issues like economic insecurity, delayed payments, under-weighting (Ghattauli), rising input costs, and climate crisis. While UP is achieving record production, the cost of cultivation is increasing disproportionately, yet farmers are not getting a corresponding price for their crop. Basic costs for sugarcane production have seen a significant increase over the last five years. With a massive increase of approximately 40% in Diesel price, an 11% increase in Urea Fertilizer (□/Bag), Other critical fertilizers like DAP and Potash, and pesticides, have also seen notable price increases. Farming tasks (like weeding, tying, and stripping sugarcane) are primarily dependent on manual labour. Labour costs have seen the sharpest increase, at 50%. Electricity & Irrigation have seen a remarkable 55% increase, from □2,200 per acre in 2019 to □3,400 per acre by 2024.

The situation is dire: the country's farmers, nearly 80% of whom are marginal farmers (less than 3 acres), are sinking into poverty and debt due to continuously rising input costs. An analysis of agricultural and other sector data shows that whatever a farmer earns from farming is largely spent on diesel, petrol, and fertilizers, leaving them to struggle for their family's livelihood.

A few years ago, the government institution Shahjahanpur Sugar Cane Institute reported the cost of cultivating one quintal of sugarcane as □304. If the Central Government's claim of providing "105% more than the cost price" is considered



valid, the fair value of sugarcane should realistically be □600–□650 per quintal.

All sugar mills in the state stop crushing by May. Naturally, the payment for sugarcane supplied from October to May, if unpaid, falls into the category of arrears, which legally mandates interest. However, sugar mills are currently not paying interest on arrears, and this matter has been pending in court for a long time.

Sugar mills admit that their financial situation has improved since they focused on ethanol production. But they are employing a separate tactic here: they produce ethanol using the sugarcane supplied by farmers to the mills, yet they show the ethanol plant as a separate "legal entity." This allows them to isolate the ethanol earnings from the farmers' payments. Simply put, mills receive payment from oil companies within 15 days but withhold the farmer's money for months.

The government is focusing on 'Atmanirbhar Bharat' (Self-Reliant India). It must correct all those policies which deepen the crisis in the sugarcane sector. If reforms are not implemented in time, the country will pay a heavy price—not only will farmers' incomes decrease, but a major burden will also fall on consumers' pockets

The Need for Fair Pricing and Policy Reforms

The government must curb this inconsistent financial management by sugar mills and directly link ethanol payments to the farmers' sugarcane payments to ensure transparency in cash flow.

The sugarcane farmer of Uttar Pradesh is not just a producer but the pivot of the rural economy. Their hard work, worries, and hopes are intertwined with this crop. Their labour not only runs the sugar industry but also keeps transport, employment, and rural markets active. Till the farmer receives a fair price and technical assistance on time, the sweetness of sugarcane will not truly enter their lives.

Recognizing the urgency of the situation and addressing the silent suffering of the farmers, the government should implement comprehensive reforms to address the root causes of the sugarcane farmers' crisis. Resolving the issues of sugarcane farmers is not merely a matter of electoral gain but of ensuring the livelihood of millions of families and building a strong rural economy. The political party that has strengthened this 'lifeline', honestly resolved the issue of sugarcane arrears, and prioritized the interests of the farmers, has dominated the political landscape of this region and will continue to do so. Governments and political parties must formulate long-term policies that stabilize sugar mills financially, guarantee timely payment to farmers, and integrate agriculture with water conservation. Only then will this 'lifeline' of Uttar Pradesh be secured, strengthening the country's economy and politics.

UNLOCKING INDIA'S ORGANIC FOOD POTENTIAL

OPPORTUNITIES, CHALLENGES, AND THE ROAD AHEAD

India is at an exciting crossroads. With millions still linked to farming, rising consumer interest in healthier food, and growing global demand for sustainably produced ingredients, organic agriculture isn't just a curiosity anymore — it's a real opportunity for livelihoods and trade. As someone who processes and exports organic spices, herbs, oilseeds, botanical extracts, millets, cereals, edible and essential oils, and other ingredients to the USA, EU and Australia, I've seen both the promise and the problems up close.

Non-perishable organic products — spices, millets, extracts, essential oils — are already among India's strongest export lines. Yet if we want to grow this sector in a way that's fair, reliable and profitable, students, policymakers, farmers, exporters, researchers and entrepreneurs will need to pull in the same direction. This piece is a practical look at where the opportunities lie and what we need to fix.

India's strengths are obvious: biodiversity, traditional farming knowledge, lots of smallholders, and cost advantages. Programs like the National Programme for Organic Production (NPOP) and state initiatives have pushed organic acreage up. Our spices — turmeric, ginger, long pepper, cumin — and botanical extracts are well-known for their therapeutic properties, while millets and oilseeds are gaining traction as consumers shift toward plant-based and functional foods.

That said, premium buyers increasingly expect consistency, traceability and solid documentation. That is where we often fall short.

Why The World Wants Indian Organics

Global demand for organic products keeps rising. Consumers care more about chemical-free food, ethical sourcing and minimal processing. The US and EU are huge markets with stringent rules — but that's also where the premium dollars are. Australia, too, is an attractive market because of its strong standards and buyers willing to pay for quality.

About the **AUTHOR**

Mr Gurpratap Singh Walia is Director, Future Agri & Foods Private Limited, Punjab, and has over 13 years of experience in agro commodities as a seasoned processor and exporter, with a dedicated focus on organic products since 2019



Traceability And Sustainability — Not Optional Anymore

Traceability is the backbone of organic trade today. Buyers want to know the whole story: where a product came from, how it was grown, and what benefits it delivered for people and the environment.

In our business, we invest heavily in farm-to-fork traceability — digital records, audits, regular residue testing. It protects both buyers and farmers: fewer surprises, fewer rejections, and clearer accountability.

Sustainability ties into this. Regenerative practices — rotations, rebuilding soil health, natural pest management and water-smart cropping — reduce environmental harm and also lower costs for farmers over the long run. If India wants to be seen as a leader in organic products, these practices need incentives, technical support and wider adoption.

Where India Needs To Do Better — The Domestic Market

India's home market for organic produce is still small and fragmented. A few sticking points:

- **Price and trust.** Many consumers see organic as expensive. Worse, mislabelled or fake products have damaged trust. Brands and retailers must invest in certification and transparency, and in educating consumers about what organic truly means.
- **Patchy supply chains.** Organic production is dominated by small, marginal farmers who lack access to good seeds, storage, processing and logistics. Without aggregation, supply is inconsistent — which hurts both local retail and exports.
- **Complex certification.** For many farmers the paperwork, inspections and testing are onerous. Simplified processes, subsidies and group certifications (through FPOs) would help.
- **Weak links to processors.** Too many farmers aren't plugged into processors or exporters who can offer stable offtake. Strengthening contract farming and farmer-producer organisations can bridge



With clear traceability, stronger certification systems, smarter sustainability incentives and better cooperation across the value chain, India can truly lead — not only in supplying organic goods, but in doing so in ways that deliver real social and ecological value

this gap.

The Export Hurdles

Exporters face their own challenges:

- **Strict regulations.** USDA Organic, EU Regulation 2018/848, Australia's standards — each set tight rules on residues, documentation and chain of custody. Non-compliance can mean rejected shipments and lost trust.
- **Rising compliance costs.** Tests, audits and traceability systems cost money. Small exporters often struggle to absorb recurring expenses.
- **More competitors.** Countries like Sri Lanka, Vietnam, Peru and Turkey are scaling up organic production. India needs to compete on quality, added

value and branding — not just price.

- **Logistics unpredictability.** Freight spikes, container shortages and port delays still bite exporters, even for non-perishables.

A Practical Road Forward

This sector will grow if it's supported across the value chain:

1. **Support farmers:** Training on organic agronomy, soil care, post-harvest handling and record-keeping; fair prices and long-term purchase agreements.
2. **Public policy:** Simplify certifications, subsidise costs, fund community drying/processing/storage hubs, and promote export clusters.
3. **Focus on value addition:** Move beyond raw commodity exports to ingredients and finished products — extracts, oils, milled goods, nutraceutical inputs and blends that carry higher margins.
4. **Invest in research and education:** Universities and research institutes should develop region-specific organic protocols, resilient seeds for organic systems, and practical studies on residues and soil health. We also need more trained people in sustainable supply chain management.

India's organic sector is about more than export numbers. It's about healthier landscapes, resilient rural incomes and responsible trade. If we get this right, the world won't just buy our spices and extracts — they'll trust them.

TOGETHER WE GROW

INDIA URGENTLY NEEDS A NATIONAL BAMBOO BOARD

India needs a National Bamboo Board to position our country as the world leader in Bamboo.

As Chairman of the Bamboo Society of India, I recently wrote to the Hon'ble Prime Minister Shri Narendra Modi ji, appreciating his initiatives in giving bamboo its due importance and declaring it a grass, making it easy to harvest and transport. This step and many other steps shall help India emerge as a leader in bamboo as it has the required potential.

India today has a historic opportunity to lead the world in the bamboo sector, just as China did two decades ago. With the largest bamboo area globally (13.96 million ha, 136 species) and millions of farmers awaiting assured income, India can transform bamboo into a symbol of Atma Nirbhar Bharat and a pillar of Viksit Bharat @2047.

This aligns directly with Shri Modi ji's vision for the following:

1. Doubling farmers' income through crop diversification

About the **AUTHOR**

Mr Punati Sridhar IFS (Rtd) is Chairman, Bamboo Society of India and former Principal Chief Conservator of Forests, Head of Forest Force, Karnataka

2. Green Growth Mission under Panchamrit commitments.
3. Make in India and Export-led growth, targeting sunrise sectors.
4. Vocal for Local → Global, creating global brands for Indian bamboo.
5. Rural employment and empowerment of tribal & artisan communities.

Why Urgent Action is Needed

- a) Despite being the world's largest bamboo resource base, India's share in the \$60 billion global bamboo market is less than 5%, while China alone commands \$30 billion annually.
- b) There is crying need for research in all sectors of bamboo including cultivation, processing, Industrial use, Handicraft manufacturing, machine design, marketing and export.
- c) Farmers remain discouraged due to lack of poor planting guidance, buy-back guarantees, and restrictive state-level permissions as the felling permission and transit permission have not been fully relaxed in many states.

It is sad to note that the National Bamboo Mission has not delivered the scale needed to position India globally. Without decisive intervention, India risks losing its natural leadership position in bamboo to smaller nations like Vietnam and Thailand.

The Way Forward

A National Bamboo Board can address these challenges. A statutory National Bamboo Board (NBB), modelled on Coffee, Tea, and Spices Boards, will achieve the following.

1. Provide one-point leadership and coordination.
2. Ensure extensive research in Bamboo sector right from cultivation, harvesting, processing, utilisation, Machinery development, Industrial development and marketing.
3. Ensure scientific cultivation with buy-back arrangements.
4. Build industrial hubs for bamboo-based furniture, composites, lumber, Plyboard, textiles, pulp, paper, charcoal, biomass, and green en-



Why National Bamboo Mission Has Been Unable To Achieve Its Objectives

In the states, the National Bamboo Mission (NBM) is fragmented among departments like Agriculture, Horticulture, Forests, Industries. They have little knowledge or interest in bamboo, and there is no single nodal authority to focus attention on NBM. This is why progress in NBM is negligible and funds remain unused.

- ergy.
5. Enable India to export □50,000 crore of bamboo products annually by 2030.
6. Position bamboo as a major contributor to carbon neutrality and degraded land restoration.
7. Generate carbon credits for bamboo sector

India's Global Opportunity In Bamboo

Global market: USD 98.3 billion by 2028.

China's dominance: USD 30 billion/year.
India's potential: With resources and manpower, we can capture 10% of global trade.

Carbon advantage: Bamboo sequesters 50–60 tons CO₂/ha/year → a game-changer for India's climate leadership.

Expected Outcomes by 2030

- * 10 lakh ha new plantations across degraded and farmlands, especially on field bunds.
- * 5–7 million green jobs for youth, tribals, and rural women.
- * Exports rising from □300 crore → □50,000 crore annually.

* 1,000 MSMEs and 5 Bamboo Industrial Hubs established.

* India overtakes Vietnam and Thailand to emerge as the global bamboo leader, next only to China.

Financial Outlay (2026–2030)

Component - Outlay (Rs in Crores)
R&D, Testing, Species Development – Rs 500 crore
Cultivation & Farmer Support – Rs 1,000 crore
Industrial Hubs & PPPs – Rs 2,000 crore
Market Promotion & Branding – Rs 300 crore
Skill Development – Rs 200 crore
Policy & Carbon Credits – Rs 100 crore
Restoration & Green Growth – Rs 400 crore
Total – Rs 4500 crore

The only way to achieve these goals is by creating a Bamboo Board with dedicated personnel and offices and staff across India collaborating with respective state departments of Agriculture, Horticulture, Industries, Economic and commerce and Forest Departments. We have requested the Hon'ble Prime Minister to take urgent decisions in the matter in the interest of our nation.

Horticulture

THE GAME CHANGER FOR INDIA'S DRYLANDS

India's tryst with horticulture has quietly transformed its agricultural landscape. Once viewed as a side act to cereals, fruits and vegetables have today become the face of resilience in the country's drylands and rainfed regions. From mango orchards in Karnataka's Western Ghats to pomegranate belts of Solapur and turmeric valleys of Erode, horticulture is scripting a story of rural prosperity — albeit with lessons yet to be fully learned.

The New Landscape of Indian Horticulture

As per the latest estimates (National Horticulture Board, 2023–24), India's total area under horticulture has expanded to 28.4 million hectares, accounting for nearly 19% of the gross cropped area. The sector contributes around 33–34% of India's Agricultural GDP, producing a staggering 352 million tonnes of fruits, vegetables, spices, plantation crops, and flowers — surpassing the total foodgrain output for over

a decade now.

This is a remarkable leap from 2013, when the horticulture area stood at 18.6 million hectares (8.4%) and its contribution to Agri-GDP was just above 30%. The productivity gains, diversification of crops, and growing consumer demand for high-value nutrition-rich produce have all played their part.

So why isn't horticulture's share in GDP growing faster, despite such leaps in production and area?

About the **AUTHOR**

Mr Sandeep Sabharwal
is the Co-Founder of
Sajeevan Life Pvt Ltd, one
of India's leading Biochar
& Agroforestry Carbon
Projects implementors

A Lesson from the Ground: The Uttara Kannada Experiment

The answer lies in the missing links of post-harvest management, marketing, and value addition.

Over the past 18 months, my work with farmer groups in Uttara Kannada district of Karnataka revealed this stark reality. The district, endowed with a wealth of horticultural produce — banana, mango, jackfruit, pineapple, kokum, ginger, and an array of non-timber forest produce — seemed ideal for a farmer-led value chain revolution.

The journey began with two self-help groups (SHGs) of women in Siddapur taluka, experimenting with dehydrated fruit processing. The results were inspiring — neatly packed, high-quality dried fruits that could fetch premium prices. Encouraged by this, the larger farmers' collective began mobilizing resources to establish a full-fledged dehydrated fruit enterprise.

But before the processing unit could be operational, the group decided to try aggregating and selling fresh Alphonso mangoes in Hubli's APMC. North Karnataka's Alphonso arrives 20–30 days after Maharashtra's and Konkan's harvest, missing the initial high-price window. Add to this the lack of demand forecasting, absence of packhouse facilities, and no processing backup — and the outcome was predictable. Within a fortnight, the farmers lost ₹9.3 lakh.

A local philanthropic organization stepped in to bail them out. But how many farmer collectives across India have such lifelines?

Three Hard Truths from the Field

That experience distilled a few critical lessons about horticulture in India's drylands:

1. Production without Value Chains is a Mirage

Expanding horticultural acreage is meaningless without investment in supply chains, logistics, and market linkages. Farm-level value addition, sorting, grading, cold storage, and local aggregation centres are not luxuries — they are survival essentials.

A Call for “Bharat–India Jodo” in Horticulture

If India wants to make horticulture the driver of inclusive rural prosperity, we must bridge the gap between traditional Bharat and global India — between the small orchardist and the international consumer. This calls for:

- **Organized FPO networks** focused on value addition, not just production.
- **Skill-building programs** for young agri-entrepreneurs and SHGs in processing, packaging, and marketing.
- **Public–private partnerships** that ensure farmers retain equity in the value chain.
- **Export promotion councils** dedicated to region-specific branding — Alphonso of Uttara Kannada, Jackfruit of Sirsi, Kokum of Konkan.
- **Cluster-based planning** that links horticulture with food processing parks and carbon-smart agriculture.

2. Marketing Value-Added Horticulture is a 100x Challenge

While the government's *Operation Greens* and *PMFME* schemes provide frameworks, what's missing is entrepreneurial mentorship and private-sector energy. For every rupee spent on production, at least ten need to be spent on branding, packaging, and positioning.

3. Professional Assistance is the Missing Piece

Farmers today grow world-class produce but lack access to market analytics, price forecasting, digital traceability, and export compliance. Without trained professionals at the FPO level, the produce rarely reaches its true market potential.

have the greatest potential for horticultural expansion. With rainfall variability increasing and groundwater stress mounting, horticulture offers 3–5 times more income per hectare than cereals, with lower water footprints in crops like pomegranate, custard apple, moringa, and spices.

States like Madhya Pradesh, Rajasthan, and Telangana are experimenting with dryland orchards, community-based nurseries, and integrated agroforestry systems that merge trees with crops. Such models stabilize incomes and improve soil organic carbon and biodiversity.

Government Push, Private Pull

The government's MIDH (Mission for Integrated Development of Horticulture) continues to be the backbone of public investment. Under PM Krishi Sinchai Yojana, micro-irrigation has covered over 15 million hectares, benefitting fruit and vegetable growers immensely. The private sector's entry through startups, cold-chain companies, and agri-tech platforms is redefining the sector.

Digital marketplaces, traceability apps, and export linkages are transforming how smallholders connect with consumers. Companies are experimenting with solar dryers, small-scale biochar-based cold rooms, and low-cost logistics to serve small and marginal farmers. The next green revolution may well be a “rainbow revolution” driven by fruits, flowers, and forests.

The Billion-Dollar Gap

India's horticulture economy is estimated at ₹9–10 lakh crore annually, but nearly ₹60,000–70,000 crore worth of produce goes to waste due to poor post-harvest infrastructure. That's roughly 15–20% of total output, and in perishable segments like fruits and vegetables, losses can touch 30%.

This waste isn't just economic — it's environmental. Each tonne of rotting produce releases methane, a greenhouse gas over 25 times more potent than carbon dioxide. So, building cold chains and dehydration units isn't just good economics — it's climate-smart agriculture.

Drylands: The Future Frontier

India's drylands and rainfed regions

DIGITAL TRANSFORMATION IN AGRICULTURE

OPPORTUNITIES AND CHALLENGES FOR ENTREPRENEURS

Agtech holds the promise of making Indian farmers more profitable while boosting the overall contribution of agriculture to the nation's economy. In the segment of digital opportunities, precision farming emerges as a transformative pathway. Armed with data analytics, sensors, and satellite imagery, entrepreneurs can empower farmers with real-time insights into crucial factors such as soil health, weather conditions, and crop performance. This wealth of information becomes a potent tool for farmers, enabling them to make informed decisions, optimize resource utilization, and ultimately enhance productivity.

E-marketplaces and supply chain management are undergoing a paradigm shift through digital platforms. Entrepreneurs can craft solutions connecting farmers directly to consumers, eliminating intermediaries and streamlining the supply chain. These digital marketplaces not only ensure fair prices for farmers but also make quality produce more accessible to consumers.

The evolution of user-friendly farm management

About the **AUTHOR**

Mr. Rajesh Aggarwal is the Managing Director of Insecticides (India) Ltd



software is another noteworthy opportunity. Entrepreneurs can develop solutions aiding farmers in planning, monitoring, and analysing their agricultural activities. Covering a spectrum of tasks from crop rotation to pest management, these digital tools act as comprehensive guides for farmers seeking to optimize their operations.

Blockchain technology, known for transparency and traceability, finds its place in agriculture. Entrepreneurs can design blockchain solutions to trace the journey of agricultural products from farm to fork, assuring consumers of quality and authenticity, thereby cultivating trust in the supply chain.

The entrepreneurial landscape is ripe for startups addressing specific agricultural challenges. Water management, pest control, and sustainable farming practices are focal points for innovative solutions. Entrepreneurs can carve out niches, developing solutions that cater to the unique needs of Indian farmers and contribute to sustainable agricultural practices.

Challenges On The Horizon

However, amid these opportunities lie challenges. One primary challenge is the digital literacy of the farming community, especially in rural areas. Entrepreneurs must design user-friendly solutions and invest in training programmes to bridge this gap. In remote agricultural regions, inadequate infrastructure and inconsistent internet connectivity pose significant challenges. They must consider these limitations and design solutions that can function in low-connectivity environments.

Also, one would need to consider that all the agritech companies are working with a very niche segment of farmers till date and commercialization on a large scale where these technologies will be available at a cost within the reach of even small and marginal farmers. We need to wait and watch for the same as before this, it is really difficult to ascertain the real benefits of technology in agriculture. Although things are moving in the right direction and we all are very optimistic for the same.



Natural farming is not a trend; it is a return to our roots. And in that return, we find not just nourishment, but peace

The cost of implementing digital technologies can be a barrier, particularly for small-scale farmers. Entrepreneurs need to create scalable and affordable solutions to ensure widespread adoption across different economic strata within the farming community. Cybersecurity concerns also loom large, given the sensitive nature of agricultural data. Entrepreneurs must prioritize the development of secure platforms to safeguard farmers' information. As the regulatory landscape in agriculture evolves, entrepreneurs need to navigate and comply with existing regulations while advocating for policies that promote the seamless integration of digital technologies into the sector.

Digital transformation in agriculture presents a myriad of opportunities for entrepreneurs in India. By addressing the challenges head-on and developing innovative, farmer-centric solutions, entrepreneurs can contribute significantly to the modernization of Indian agriculture.

Grow Your Own Green World

At first, the idea of maintaining your own lush green garden might feel overwhelming—the soil, the watering, the upkeep. But once you begin, you realize it's less about perfection and more about nurturing life. The rewards are incredible - healthier meals, a calmer mind, and a deeper connection to nature.

Plants like tulsi, mint, coriander, and ajwain are not only low maintenance but incredibly beneficial for your gut health. They improve digestion, reduce bloating, and bring balance to your system, all straight from your backyard. Most of these can be easily grown in pots with well-drained soil, a bit of sun, and regular watering, making them perfect even for urban balconies or small patios.

Other powerful additions to a home garden include mushrooms like shiitake and lion's mane, which support digestion, reduce gut inflammation, and help maintain a healthy gut lining. Microgreens, which are young greens picked just a few days after they begin to sprout, are also a fantastic option. Rich in fiber, antioxidants, and enzymes that feed good gut bacteria, they are incredibly easy to grow. With just quality seeds and a simple kit, you can enjoy a fresh harvest in under a week.

And it's not just about food. Gardening is therapeutic. It reduces stress, improves mood, and invites mindfulness into your daily routine. Watching something grow under your care instils a unique sense of fulfilment and teaches patience and consistency.

Growing your own food connects you deeply with nature, your body, and your well-being. It gives you control over what exactly your family needs, where it is to be grown, and how it is to be nurtured. This way, you feel more secure of what you consume and how it impacts your health. What's beautiful is that even a small step like reusing kitchen waste as compost or harvesting rainwater can create a more sustainable home ecosystem.

It's not about having acres of land; it's about making the most of what you have. A sunny windowsill, a balcony railing, or a small terrace can be your starting point.

India's Sone ki Chidiya Moment

TRANSFORMING AGRICULTURE FOR POSPERITY



We are a country that grows everything from aromatic rice and premium spices to exotic fruits and organic millets, but we still struggle with post-harvest losses, market linkages, and uneven adoption of sustainable practices. This is the paradox of Indian agriculture — abundant in potential yet often restrained by fragmented systems.

India's agri ecosystem is incredibly vast and versatile. We are among the world's top producers of rice, wheat, milk, pulses, fruits, and vegetables. The diversity of our agro-climatic zones enables year-round cultivation and the production of over 46 major crops and 100+ minor crops.

Beyond traditional farming, allied sectors such as dairy, poultry,

fisheries, and horticulture have added multiple layers of economic resilience.

The global demand for Indian agri commodities is also on a steady rise. In FY 2023-24, India's agricultural exports crossed USD 50 billion, with rice, spices, fruits, vegetables, and marine products leading the chart. This shows that our farmers, when supported with the right systems, can compete globally. Yet, beneath these achievements lie serious gaps in consistency, infrastructure, and organized trade.

The Pesticide Paradox: When Excess Becomes a Burden

One of the most pressing concerns in the current scenario is the excessive use of chemical fertilizers and pesticides in several regions.

While the Green Revolution of the 1960s made India self-sufficient in food grains, it also led to over-dependence on chemical inputs. According to the Ministry of

About the **AUTHOR**

Ms Shyama Jha is the MD of SJAR Consulting and the Founder of Millet Magic Foundation and Nav Aan Foods, focusing on impactful grassroots projects in rural heartlands of the UP, East & Northeast India and gradually expanding to other parts of the country

Agriculture's data, India uses around 165 kg of fertilizer per hectare, with states like Punjab and Haryana exceeding 250 kg/ha — well above the sustainable threshold.

This has led to soil degradation, loss of microbial life, and even residue issues that affect both exports and public health. In contrast, the global trend is moving toward regenerative and organic models.

This imbalance highlights the urgent need for scientific, localized guidance and farmer training in integrated nutrient management and organic alternatives.

The Natural Strengths of India's Organic Heartlands

Despite challenges, India still holds some of the most naturally sustainable farming regions in the world.

The Northeastern states, Uttarakhand, Himachal Pradesh, Jammu & Kashmir, and parts of Southern India have remained relatively low in chemical dependency. Their terrain, traditional methods, and biodiversity have organically preserved farming in its truest sense.

For example:

- Sikkim became the world's first fully organic state, with over 75,000 hectares certified.
- Meghalaya and Nagaland have strong organic movements in horticulture and spices.
- Uttarakhand and Jammu & Kashmir continue to produce high-quality apples, pulses, and herbs naturally suited to organic certification.

These regions offer India a unique edge in the global organic market, which is projected to reach USD 212 billion by 2026.

However, the benefits will only be realized when these regions are properly connected to organized markets and modern infrastructure.

Logistics and Warehousing: The Invisible Backbone

For most hilly and remote terrains — especially in the Northeast, Himalayan belt, and tribal interiors — the major challenge isn't production, but post-har-

If guided by vision and backed by inclusive investments, India's agri sector can once again become what it once symbolized — Bharat, the Sone ki Chidiya — a land of abundance, diversity, and prosperity

vest handling and connectivity.

Poor roads, lack of temperature-controlled transport, and inadequate warehousing lead to post-harvest losses of nearly 15–20% in perishable commodities like fruits, vegetables, and spices.

A farmer may grow the best organic ginger or turmeric, but without the right storage and logistics support, both quality and value are lost before reaching the market.

What's needed is an integrated farm-to-market infrastructure — aggregation centers, mini packhouses, temperature-controlled logistics, and processing units — placed closer to production clusters.

Investing in this infrastructure not only reduces losses but also enhances export readiness and quality consistency.

The Market Gap: Organizing the Unorganized

Another critical gap in India's agri commodity landscape is the absence of an organized market structure.

While eNAM (the electronic National Agriculture Market) and agri-tech platforms have improved transparency, the reality is that most farmers still rely on local traders or unstructured middlemen.

This leaves them vulnerable to price fluctuations and often without real-time market data.

Organizing agriculture means building collective structures like Farmer Producer Organizations (FPOs), digital traceability systems, and fair-trade

mechanisms that bring farmers closer to the end market.

When farmers are treated as entrepreneurs and not just producers, the ecosystem evolves — efficiency improves, incomes rise, and value chains become more equitable.

Opportunities on the Horizon

The future belongs to organized, traceable, and sustainable agriculture.

Three major trends are shaping this transformation:

- 1. Tech-Enabled Agri Systems:**
2. From satellite-based crop monitoring to AI-driven supply chains, technology is making agriculture smarter and more predictable.
- 3. Consumer Demand for Clean Food:**
4. Post pandemic, global consumers are demanding transparency, traceability, and natural products — a huge opportunity for India's organic and traditional crops.
- 5. Climate-Smart Farming:**
6. The focus on water efficiency, carbon reduction, and soil health is attracting both policy attention and climate-linked finance, making agriculture a key player in sustainability investments.

From Challenges to Sone ki Chidiya

India's agriculture is standing at a crossroads.

On one side lies fragmentation, chemical fatigue, and outdated systems. On the other lies technology, sustainability, and collaboration.

The path forward is clear — we must organize, modernize, and humanize agriculture at once. And above all better the farming and its technique the sooner we conquer the challenges of carbon credits as natural and systematic farming can be a bigger source of generating carbon credits in near future adding up to India's initiative towards Environment Social Governance.

But this time, the gold won't be in palaces — it will shine in our farmlands, cooperatives, and sustainable rural enterprises. And that is the real wealth of a new, self-reliant India.

EMPOWERING FARMERS WITH FRESHWATER PEARL FARMING IN INDIA



Pearls, known as the moonstone, are considered a highly precious gem. Pearls can be farmed with the help of a living organism called the mussel. Mussels are found in almost every river, pond, and canal in villages. Pearl cultivation can be carried out using the mussels available in village waters.

Pearls captivate all with their beauty and lustre. In India, pearls worth Rs 30 crore are imported every year from China and Japan, even though all the resources needed for pearl cultivation are available domestically.

Mussels are found in almost every river, pond, and canal in villages. We can double our income by practicing pearl farming using these locally available mussels. Pearl farming can be integrated with fish farming, creating a combined farming system that will further enhance our income.



Employment Opportunities In Pearl Farming Sector

- i) Net making
- ii) Pond construction
- iii) Mussel farming
- iv) Handicraft production from dead mussels
- v) Integrated pearl farming businesses
- vi) Designer pearl shops or showrooms

Raising awareness and providing training are essential to boost pearl farming in India.

Farming Of Designer Pearls

Collect mussels from rivers, ponds, or canals and keep them for 3–4 days to help

About the **AUTHOR**

Mr Ashok Manwani is an innovative freshwater pearl expert. He is engaged in adopting innovative simple farming techniques & doing innovative pearl farming

them adjust to the local water conditions. Place the mussels in trays with the valves facing upward, allowing them to naturally begin opening their shells.

Next, handle them using an AK Opener (an innovative tool) and position them on a wooden mussel stand (also an innovative design). Using a spatula, gently open the mantle cavity of each mussel and insert the design beads into the mantle. You can place two beads, one on either side.

Tie the mussels in nets and place them in the fishpond in such a way that they can be checked periodically. Provide rice bran, groundnut cake, mustard cake, cow dung, and similar materials daily as

food, adjusting the quantity according to the size of the pond.

The colour of the pearl culture pond should be a light green. If the water colour changes to dark green, stop supplying food, as this is an indication of overfeeding—remember that mussels and fish share the same food. Clean the mussel nets every month, remove any dead mussels, and replace them with new ones.

Within 8 to 10 months, you will observe shiny pearls forming in each mussel. Carefully take them out, wash them with soap and salt, then apply oil. Store the pearls in an airtight plastic bag or box, where they can be kept for years until you find buyers.

Project Cost

If we combine fish farming with pearl farming, income can double. The cost to produce one pearl, including mussels, nets, beads, food, and maintenance, is approximately Rs. 30. The price of a finished pearl varies between Rs. 300 and Rs. 500, depending on its shine, shape, and size.

With the help of a hexa blade, you can carefully cut the design pearl from the shell. You can then craft beautiful pendants to sell at a high price, earning a good profit. Additionally, many attractive handicrafts can be made from the dead mussels, further increasing your income.

We received an innovation award for creating handicrafts from mussels, as they are shiny and useful in our daily households. These include items like diyas, agarbatti stands, mobile stands, pen stands, and many more.

I and my wife Kulanjan Dubey Manwani have done significant work in the Indian pearl sector. We have been pioneers in adopting innovative and simple farming techniques in pearl culture across various states in India for the past 17 years.

Our innovations in the field of Design Pearl Culture

1. An opener used to open mussels, which anyone can easily make at home for just Rs. 20-25.
2. A wooden mussel stand that any car-

Awards for Innovative Work

1. Central Institute of Fisheries Aquaculture (CIFA), Bhubaneswar, 2011
2. Jabalpur Award, 2011
3. Central Institute of Fisheries Education (CIFE), Mumbai, 2013
4. Indian Institute of Integrative Medicine (IIIM), Jammu & Kashmir, 2014
5. BioVed, 2015
6. Panjab Rao Krishi Ratna Award (Jai Jawan Jai Kisan Farmers Forum), Nasik, 2015
7. Malkolak Knowledge Centre Award, Goa, 2015
8. AIFA's First Progressive Farmers Award, Delhi, 2017



penter can craft for Rs. 150-200.

3. India's first voice-enabled innovative Presentable Mobile Institute (PMI) book designed for uneducated farmers, which explains every page with audio.
4. Over 300 innovative handicrafts made from shining dead mussels.
5. India's first portable Kissan Mobile Institute (PMI) powered by solar technology, providing practical training on pearl culture at village locations such as chaupals, fields, and Panchayats. It seats one trainer and can certify 30-50 farmers based on their proficiency.

We have trained thousands of farm-

ers, created affordable tools for pearl farming, and fostered awareness across multiple states, striving to make India a leading hub for quality freshwater pearls. We have received numerous awards recognizing our innovation and contribution to sustainable pearl farming.

India's first Kissan Portable Mobile Institute

India's first Kissan Portable Mobile Institute (PMI), a solar-powered unit that can be taken anywhere in villages—be it a chaupal, farmers' field, or Panchayat—to provide practical training on pearl culture. This institute seats one trainer and can certify 30-50 farmers based on their skill category. It includes all facilities available at well-equipped agricultural institutes.

These innovations have greatly empowered farmers by simplifying pearl farming technology, promoting awareness, and enabling accessibility to training in rural areas, thus expanding the reach and impact of pearl culture in India.





AMALSAD SOCIETY

GUJARAT'S MODEL PACS BLENDING CREDIT, MARKETING AND COMMUNITY WELFARE

Amalsad Vibhag Vividh Karyakari Sahakari Khedut Mandli Ltd., founded in 1941, is a shining example of how community-based organizations can thrive in India. Located in the cooperative Gandevi Taluka of Navsari District, South Gujarat. For over 82 years, it has been a vital part of the local economy and an inspiring success story. The cooperative has received many awards and recognitions. It won the prestigious NCDC Best Cooperative Award in 2004, given by the Prime Minister of India, and it is the only primary cooperative society in Gujarat to have an ISO certification. Serving 17 villages with a population of around 120,000, it is known as one of the best cooperative organizations in the state and across

By making advanced machines available through FPOs, CHCs, and rental platforms, Shaktiman's Hi-Tech Farm Solutions supports the vision of democratized access to mechanization

the country.

Amalsad Vibhag Vividh Karyakari Sahakari Khedut Mandli Ltd. offers a wide range of services to its members. It acts as a bank, helps farmers market their products like Chikoo and Mango,

and operates a consumer retail department. This retail department is part of a Public Distribution System (PDS) that sells packaged groceries, clothes, fertilizers, and building materials. Since 2004, the cooperative has used a management information system (MIS) to improve efficiency and decision-making. The cooperative has two main collection centers, one in Amalsad and the other in Kachholi. Farmers bring their crops to these centers, where the produce is sorted, graded, and packaged before being sent to premium markets. Most of the Chikoo is sold in Azadpur Mandi, Delhi. The cooperative also processes mangoes through the VJFS Federation, making mango pulp, pickles, and canned vegetables. In the financial year 2023-24, the cooperative achieved im-



pressive sales of about Rs. 264.3 million in consumer activities.

The success of the cooperative is largely due to its governance and management team. The Board of Directors, elected by "A" type members, the man-

The Amalsad Cooperative

Amalsad Vibhag Vividh Karyakari Sahakari Khedut Mandli Ltd serves farmers by facilitating commodity trading, processing innovation, and providing financial services. The cooperative, located in Amalsad at Navsari district in Gujarat has been case study for its successful process innovations, such as increasing farmer income by 15% through streamlined commodity marketing

agement secretary, the office superintendent, and the general supervisor form the core team. They evaluate new activities, analyze market data, and plan operations to ensure better rates for farmers. They also make smart investment decisions with the cooperative's reserves and surplus, distributing dividends among members by investing in portfolios like Kribhco and IFFCO. The cooperative bank has over 8,500 savings accounts and prides itself on a strong sense of trust, having no reported fraud cases in its history. In addition to its banking and marketing services, the cooperative also operates as a credit society for its active members, offering credit facilities amounting to Rs. 33, 62, 12,980 at a reasonable interest rate of

About the AUTHOR

Mr Ashish A Naik is the Secretary of Amalsad Vibhag Vividh Karyakari Sahakari Khedut Mandli Ltd at Navsari district in Gujarat



7% in 2023-24. This allows members to access necessary funds without the burden of high interest rates, further supporting their financial stability.

Members benefit from a 7% discount on purchases from all outlets except the petrol pump and can enjoy a three-month interest-free credit period. The cooperative's outlets are also popular with non-members because of the lower prices. Initially, the cooperative was founded to protect people from exploitation by freedom fighters. Today, it faces new challenges, such as the younger generation's focus on profit over community welfare. Despite these challenges, the cooperative continues to adapt and prioritize the well-being of its members.

The cooperative's excellence is further highlighted by winning the National Council of Cooperative Development (NCDC) award twice. It has 9,187 members, divided into A-Class (2,994 active members who deliver Chikoo) and B-Class (6,193 non-active members). It provides essential items at reasonable rates through its branches in all 17 villages, with the main office located in Amalsad. Its main activities include collecting Chikoo and Mango, grading and packaging these fruits for sale, and supplying agricultural inputs like seeds, fertilizers, and plant protection chemicals. In 2023-24, the cooperative reported total working capital of Rs. 959,166,350, reserves of Rs. 254,782,135, and a net profit of Rs. 875,196, showcasing its strong financial health and ongoing commitment to its members.

Trailblazing Work

The base of the Indian cooperative credit structure (CCS) is made up of Primary Agricultural Credit Societies (PACS), which offer vital short- and medium-term rural credit for both agricultural and non-agricultural uses. While credit services represent the main objective of most PACS, some, such as Farmer Service Societies (FSS), also provide farm inputs and marketing services for farm outputs. Gujarat's Amalsad Society is the most notable of these societies. Awarded the 'NCDC Best Cooperative



Model Of Cooperative Success

The Amalsad cooperative Society is more than just an organization; it's a lifeline for many farmers and workers in Amalsad and a model of cooperative success, combining banking services, agricultural support, retail operations, and community welfare activities. Its comprehensive approach to serving the needs of its members has made it a standout example of what cooperative societies can achieve in India.

Award' by the Indian Prime Minister in 2004, it has been recognized as one of the leading cooperatives in the nation.

The Amalsad Coop Consumer Store is a part of a main cooperative credit society with multiple purposes. Situated in the cooperatively dynamic Gandevi taluka of South Gujarat's Navsari district, the society governs 17 villages. In addition to providing full-service banking to its members, it also meets the marketing requirements of nearby farmers who grow chikoo and mangoes. The village of Kachholi and Amalsad serve as the organization's two primary collection sites. These centres are where farmers bring their crop produce for sale through the society. Produce of every kind is carefully graded and sorted, with the exception of Chikoo, which is processed first before being sent to upscale markets to be sold.

The Kachholi collection centre, which is close to the Ambika River, has the potential to grow as an ecotourism destination. The society with 17 retail stores is also a big part of their revenue those elegantly designed store sells clothes, packaged groceries, and ceremonial items like firecrackers. The society, which is renowned for its open-

ness, publicly posts the costs of every product it buys and sells. Since all of its operations were computerized as early as 1991, it is also technologically advanced. Additionally, the society runs a petrol pump of its own.

Multi-Faceted Support To Farmers

The cooperative provides financial assistance in the form of loans to farmers, organizes workshops and training sessions to educate them on new farming techniques and sustainable practices, and engages in community development projects such as building infrastructure, enhancing local schools, and providing healthcare services and the society is also heavily involved in a range of member welfare initiatives. It holds eye camps in addition to operating a homeopathic doctor.

The society has formed a fruit-processing federation with other 11 local societies in order to improve the marketing of mangoes, another important produce of the region. In order to guarantee full plant utilization, this federation occasionally sources fruits from outside the area for use in the production of a variety of packaged and canned goods made from mangoes and other fruits.

Every product is sold under a single brand name.

The society has since kept up its activity expansion to accommodate its members' changing needs. The society's many accomplishments and contributions to the economic development of 17 villages, benefiting about 1, 20,000 people through cooperative activities, today bear witness to the vision of its founders. At least one member of the cooperative belongs to each household, making a total of 9,187 enrolled members from these villages comprised of the society.

The organization is the backbone of the local farming community, and both its management and staff are always willing to take on new challenges. By consistently improving the lives of its members and their communities, the Amalsad Society has cemented its position as an essential support system for the rural economy

Genesis and Growth

The first significant milestone came in 1944 with the establishment of the Kachholi Retail Shop, marking the society's initial step into retail operations. This was followed by the launch of the Amalsad Retail Shop in 1947, further expanding its retail presence.

As the society grew, it diversified its services to meet the needs of its members and community. In 1948, it began offering agricultural advances, supporting local farmers with essential financial services. This commitment continued with the introduction of a rebate scheme for consumers in 1949, aimed at enhancing affordability and accessibility.

In 1950, the society initiated a Savings and Fix Deposit Scheme, promoting financial security and stability among its members. The introduction of Consumer Credit in 1952 further demonstrated its dedication to facilitating economic empowerment through accessible credit facilities.

The society's expansion was not confined to retail and financial services alone. In 1955, it defined the operational criteria for each cooperative society under the Cooperative Registrar,



ensuring standardized practices across its network. This institutional framework laid the groundwork for sustainable growth and governance.

Over the decades, the society continued to innovate and expand its footprint. From establishing additional retail shops like Kotha, Ancheli, Vasan, and Kolva in the late 1950s to venturing into agriculture produce marketing with mangoes, chikus, bananas, and elephant fruits, the society diversified its operations and geographical reach.

The year 1968 marked a significant milestone with the celebration of its Silver Jubilee, symbolizing 25 years of service and growth. During this period, the society reinforced its commitment to modernization by constructing administrative buildings, godowns, and mills at various locations, enhancing operational efficiency and member services.

In 1992, the society achieved another milestone with the computerization of

all its activities, ushering in a new era of efficiency and transparency. This technological advancement was complemented by ISO 9001-2000 certification in 2008, recognizing its adherence to international quality standards and best practices.

Contributions To Cooperative Excellence

Throughout its history, the society has been recognized for its contributions to cooperative excellence and agricultural development. Awards such as the National Cooperative Excellence Award in 2004 and 2006 underscored its leadership and impact in the cooperative sector.

Today, the society stands as a testament to the power of cooperative principles in fostering economic development, social well-being, and community resilience. With a legacy built on integrity, innovation, and inclusive growth, it continues to evolve, meeting the changing needs of its members and upholding its commitment to cooperative values.

Collective Effort and Vision for Prosperity

Today, the Amalsad Cooperative is known for its strong support of agriculture and the local economy. It provides essential services like loans, fertilizers, seeds, and farming tools to help farmers increase their productivity. Additionally, the cooperative helps with buying and selling agricultural products at fair prices. The cooperative has also embraced modern technology and advanced tools to meet the needs of today's farming community and continues to support agriculture and the livelihoods of local farmers.

Currently, the Amalsad Cooperative represents 8,292 members from 17 agricultural villages, working together to ensure continuous progress and development. This cooperation has led to significant improvements in the local economy and quality of life for its members.

Overall, the Amalsad Cooperative is a shining example of how working together can lead to significant progress and prosperity for everyone involved.

FROM A TERRACE EXPERIMENT TO A MILLET REVOLUTION HOW YOUNG INDIA CAN LEAD THE NEXT AGRI- ENTREPRENEURSHIP WAVE

It all began on a small terrace in Faridabad during the pandemic. While most people were busy experimenting with sourdough and banana bread, I was sprouting millets and lentils under the sun — drying, grinding, and testing recipes that could make healthy eating effortless. What began as curiosity soon turned into purpose — to make millets accessible, aspirational, and relevant for modern India.

What started as a lockdown experiment soon grew into Millium, a brand under SatGuru Superfoods, built on one simple but powerful belief: food should be healthy, easy to make, and delicious. Our mission became “Healthy Bhi, Jaldi Bhi” — a promise to bring sprouted millets and lentils to every kitchen in a form that fits the modern lifestyle.

Through SatGuru Superfoods’ journey, I’ve seen firsthand that agri-entrepreneurship is not just about building a brand — it’s about building capacity. Today, I actively mentor young founders, food technologists, and students exploring food innovation, encouraging them to build sustainable ventures rooted in India’s traditional grains.



The Millet Moment: India’s Ancient Grains, Reimagined

Long before quinoa and oats took over our breakfast bowls, millets were India’s superfoods — nutrient-dense, hardy grains grown in the toughest of climates. For years, they remained in the background, dismissed as “poor man’s food.” But the tide is turning.

The United Nations declaring 2023 as the International Year of Millets didn’t just put India’s millets on the global map — it reminded us of their true value. Millets are climate-smart crops: they require less water, grow in

About the AUTHOR

Ms Palak Arora is a trained food technologist and is the Founder and CEO of SatGuru Superfoods, a startup which has won many trailblazing awards

ATG Award in 2022

In 2022, I was felicitated by Agriculture Today Group as the Youngest Entrepreneur in the Millet Industry, a recognition that reaffirmed my belief that innovation in food doesn't have to come from legacy players — it can begin with a determined experimenter and a clear mission to make healthy eating mainstream. Since then, I've continued to advocate for millet-based innovation across national forums and industry dialogues.

Today, SatGuru Superfoods manufactures sprouted millet and sprouted lentil-based ready-to-cook and ready-to-eat products at our own gluten-free facility in Faridabad, Delhi NCR. But beyond the brand, it's part of something much bigger — the quiet revolution transforming India's agriculture and food landscape. And this revolution has space for thousands of young, skilled agri-entrepreneurs ready to make their mark.

semi-arid regions, and thrive without chemical inputs. They're naturally rich in fibre, protein, and minerals, making them ideal for today's health-conscious consumers.

This rediscovery presents a once-in-a-generation opportunity for India's youth. With global attention on sustainable nutrition, the millet sector is becoming a goldmine for innovation — from farm mechanization and supply chain upgrades to ready-to-eat (RTE) and ready-to-cook (RTC) product development.

Having participated in key policy dialogues and millet forums, I've come to realize that India's millet ecosystem is as dynamic as it is demanding. Here's how the next generation of agri-entrepreneurs can carve their niche within it.

Opportunities Sprouting in the Millet Sector

The millet value chain is vast — and every gap is a chance for innovation. Here's where young entrepreneurs can make an impact.

Value-Added Processing

From sprouted flour and porridge mixes to millet snacks and nutrition bars, there's a growing demand for convenient, healthy formats. That's exactly the space Millium occupies — blending science with taste and tradition.

Branding and Storytelling

Consumers today care as much about how their food is made as what it con-



tains. Transparent brands that empower farmers, promote sustainability, and focus on clean-label ingredients can win lasting trust.

Agri-Tech Integration

Digital traceability, precision drying systems, and AI-based sorting are no longer distant ideas. For tech-driven youth, millets offer the perfect intersection of agriculture and innovation.

Government Support

With dedicated millet missions, incubation grants, and government initiatives promoting product innovation, there's an enabling ecosystem ready to back serious entrepreneurs.

Export Potential

As global consumers shift to gluten-free, sustainable diets, Indian millets are poised to take centre stage in international markets.

The Roadblocks: Why Innovation Must Walk Hand-in-Hand with Patience

Of course, the millet opportunity comes with challenges that demand creativity and persistence.

The Cooking Challenge

One major barrier is that people often don't know the right way to cook millets — they either overcook, undercook, or skip essential pre-treatments like soaking or sprouting. Others simply don't have the time for these primary processes. That's where ready-to-cook and ready-to-eat millet mixes step in, making nutrition effortless without compromising authenticity.

Processing Complexities

Millets are diverse — what works for ragi won't work for bajra or jowar. Each grain behaves differently during cleaning, de-husking, or sprouting. SatGuru Superfoods solved this by setting up its own gluten-free processing unit with precise, controlled methods to ensure consistency and quality at every stage.

Consumer Awareness

Despite the growing buzz, millets are still not mainstream. To make them aspirational, startups need to innovate beyond nutrition — through exciting flavors, modern packaging, and storytelling that connects with today's consumers.

A Generation That Can Feed the Future

India's millet story is not just about a comeback — it's about reclaiming our connection with food, soil, and sustainability. My journey with SatGuru Superfoods taught me that innovation doesn't always start in boardrooms; sometimes, it begins with curiosity, a few grains, and a willingness to learn.

To every young dreamer out there — the future of food is waiting for you. The seeds of opportunity are already sown. It's your time to nurture them, innovate with them, and let them grow into something transformative.

FROM SOIL TO SOUL

REVIVING INDIA'S SPICE AND GRAIN LEGACY

India has conventionally been called the Land of Spices and Grains, where some of the most aromatic, flavor-filled, and nutritious produce in the world grows on our very soil. From the golden turmeric fields of Erode to the fragrant coriander from Madhya Pradesh, down to the lush rice paddies of Punjab and the vibrant red chilies of Guntur, every region has a tale to tell about its culture, soil, and climate in its very specific way.

The journey of Nivarani & Ananta LLP started with one simple yet powerful vision: the re-introduction of purity, authenticity, and regional identities into Indian kitchens. We source whole spices, rice, pulses, and dry fruits directly from farmers in their native regions, ensuring every product retains its natural essence, untouched by artificial colours, additives, or solvents.

Agriculture Industry Opportunities in India

There is enormous unexploited potential in Indian agriculture, particularly in the spice segment, rice, pulses, and

dry fruits. While it accounts for almost 40% of the spice production in the world, it still is one of the largest producers and exporters of rice and pulses. However, most of the value addition is happening outside India, thus providing an enormous opportunity for domestic brands to engage in processing, branding, and global positioning.

This has changed the dynamics in the market, and today, the consumer is ever more interested in natural, unadulterated, and origin-based products. Consumers are seeking food that is traceable in origin, sustainably sourced, and rich in regional character. For companies like ours, this trend offers fertile ground in which to grow by creating transparent bridges between farmers and consumers.

E-commerce and other digital marketplaces have further transformed the agri-landscape, whereby small and medium

enterprises can now link up directly with the end-user, reducing dependence on middlemen. This will ensure a more equitable price for farmers and a larger profit margin for them. Government initiatives such as "One District, One Product" (ODOP), Agricultural Export Clusters, and PM Formalization of Micro Food Processing Enterprises Scheme (PM-FME) are opening up newer avenues for rural-based agri-enterprises to scale globally.



About the **AUTHOR**
Ms Amritasha Chhabra
 is Founder, Nivarani & Ananta LLP, a women-led agro enterprise rooted in the vision of empowering farmers and showcasing India's agricultural strength on the global stage



Challenges Along the Way

* **Fragmented Supply Chains:** The value chain of agriculture is fragmented in general in India. It has various intermediaries of different quality standards, which eliminate traceability and standardization.

* **Climatic Change:** Irregular rainfall coupled with increased temperatures and unseasonal weather changes affects yields and quality most significantly in spice and pulse farming in Andhra Pradesh, Maharashtra, and Rajasthan.

* **Inadequate post-harvest infrastructure:** Lack of proper facilities for drying, grading, milling, and packaging has been the cause of post-harvest losses and reduced export competitiveness.

* **Price Volatility:** Markets fluctuate, and unstable demand makes it difficult for farmers and processors to plan for sustainability.

* **Limited farmer awareness:** Most smallholders are not aware of global standards for quality certification, sustainable farming, and residue-free cultivation that give access to premium markets. Companies like Nivarani & Ananta LLP are, therefore, in the midst of a delicate balance between farmers' welfare and consumer trust, with business sustainability thrown in for good measure. While less utilized than many of the other methods of dispute resolution, court-annexed arbitration does continue to be used, though not universally.

The Road Ahead

Collaboration, innovation, and value creation will define the future of India's agriculture. Strengthening farm linkages, encouraging climate-resilient and sustainable practices, and investing in processing and branding within India can transform our agri sector into a global benchmark of quality and integrity. Empowerment of farmers in terms of training, mechanisms of fair trade, and modern infrastructure will uplift not only rural livelihoods but also ensure that the country cements its position as a trusted global supplier of spices, grains, pulses, and dry fruits.

We, at Nivarani & Ananta LLP, believe in being part of this transforma-



Building Trust, Celebrating Culture

Our goal is to spread India's agri-heritage beyond national boundaries by turning every spice, grain, and pulse into a story about the soil that can be proudly carried to every kitchen worldwide. This is not merely trade; it's about building trust, celebrating culture, and redefining how the world experiences Indian agriculture.

tional journey in which Indian agriculture transforms from raw production into purposeful value creation, every farmer's effort is recognized, and every consumer savors products that carry the story of purity, honesty, and heritage.

Broadening Perspectives: Fortifying FPO Channels and International Outreach

Nivarani & Ananta LLP has built strong relationships with FPOs in several states as we continue to expand our presence in the domestic market, guaranteeing direct farm-to-market integration. Our current FPO channels are now highly efficient, enabling reliable supply, guaranteeing procurement transparency, and preserving the integrity of each product that is delivered to the store. Through fair trade methods and steady revenue streams, this foundation has allowed us to help local farming communities in ad-

dition to tracking each batch back to its source.

Our next strategic move is to take India's agriculture story to the international arena with this robust home ecosystem in place. We are actively looking to work with international distributors, importers, and buyers who share our commitment to sustainability, authenticity, and purity. By forming export alliances, we hope to establish India as a reliable source of superior, ethically sourced agricultural products that satisfy international standards, in addition to being the world's biggest producer.

In North America, the Middle East, and Europe, demand for naturally grown, clean-label, residue-free products is at an all-time high. Indian businesses like ours may claim a legitimate position on international shelves by meticulous curation, value addition, and adherence to foreign certifications.

WHAT INDIA MUST DO TO LEAD THE WORLD IN BAMBOO

When I look across the lush green bamboo groves of Tripura, I often find myself wondering why India, with such vast natural wealth, continues to underperform in the world bamboo market. We are the second-largest cultivator of bamboo globally, with 136 species spread across nearly 14 million hectares, producing more than 3 million tonnes annually. Yet, our share in the global bamboo economy stands at only about 4 percent, in stark contrast to China's 65 percent—with less than half our bamboo-growing area.

Having worked in the sector for nearly two decades, both in the field and through research, I have seen how deep the structural and policy gaps truly run. The National Bamboo Mission (NBM), launched in 2006–07 and restructured in 2018 with broader goals of processing, value addition, and entrepreneurship, has given new momentum to bamboo cultivation in India. Unfortunately, the outcomes on the ground have not matched the promise.

Why the National Bamboo Mission Missed the Mark

The intent of the NBM was noble—to



About the AUTHOR

Mr Samir Jamatia is Bamboo Technologist with Bamboo Forum of Tripura and is a Life Member of Bamboo Society of India

establish a complete value chain from plantation to product and elevate bamboo as a futuristic green industry. Many

of its interventions have failed to meet the needs of the bamboo-growing communities, artisans, and entrepreneurs it was meant to empower.

In Tripura, the bamboo species distributed under the mission have low commercial value. For example, most plantations here involve the *Bambusa tulda* variety, introduced through the Tripura Bamboo Mission in 2008 and 2010. While the programme offers full government subsidy—up to ₹50 lakh for two hectares under the Annual Action Plan of 2020–21—the bamboo provided does not translate into viable incomes for farmers.

The *Bambusa tulda* variety simply cannot compete with high-yield cultivars like *T. oliveri* (Kanak Kaich Wa). In my experience, *Bambusa tulda* converts only about 15% of its stick units into usable material, leaving the rest as waste. In contrast, *T. oliveri* (Kanak Kaich Wa) can generate above around ₹2 lakh per hectare annually by the fourth year. Farmers planting *B. Tulda* on the same land earn at least ₹1 lakh less.

B. tulda is lighter and weaker, which affects both quality and marketability. Its commercial demand today is mostly limited to incense stick factories or other

units. But logistics challenges for *B. tulda* (Bamboo pole) from Tripura to Pan India. When yield, strength, and price all work against the farmer, it is difficult to build any value-adding ecosystem around such a species.

The Problem of Land and Ownership

The deeper issue goes beyond species selection. Policy design assumes that bamboo plantations will expand mostly on non-forest lands. This approach may make administrative sense, but it completely disregards the lived realities of tribal and forest-dependent communities in the Northeast.

In Tripura, above 60% of land is classified as forest, and only about 27% is agricultural. Expecting large-scale bamboo plantations to emerge solely on non-forest lands is unrealistic. Thousands of tribal farmers survive by cultivating within or near forest zones, where legal ownership overlaps with forest department authority.

To access financial support under schemes like the NBM or credit from NABARD, farmers must produce land ownership documentation. For tribal cultivators, that is often impossible. Their traditional rights, though recognized under the Forest Rights Act, 2006, remains inconsistently implemented. Many live under the constant threat of eviction if the forest boundary overlaps with their cultivation. This single barrier shuts out a major portion of potential bamboo growers from institutional support.

If we truly wish to see India become a bamboo power, we must make the mission inclusive of forest-dependent communities. Forest-based bamboo cultivation already happens under projects such as Tripura's JICA programme and the National Afforestation Programme. These models can be scaled and formally integrated into national policy.

Competing Crops and Fragmented Agencies

Another major obstacle lies in comparison—and competition—with other crops like rubber. Tripura is India's second-

largest rubber producer, after Kerala. Rubber farming enjoys the full support of the Rubber Board, which assists cultivators with land deeds, financial incentives, and insurance. The bamboo sector, in contrast, operates under fragmented bureaucratic oversight—shared among the ministries of agriculture, commerce, environment, and textiles—with no single nodal body providing continuity or comprehensive insurance coverage.

As a result, farmers often switch to rubber because the system there is predictable and secure. If the central government were to establish a dedicated, autonomous National Bamboo Board with the same authority as the Rubber or Tea Boards, the entire sector could transform within a decade.

The Artisan's Dilemma

Equally concerning is the lack of effective support for artisans and craft-based entrepreneurs. During my field visits, I often meet skilled weavers and basket makers—many of them women—who have the creativity and traditional technique to produce exquisite designs. Yet, the training programmes they attend under various government initiatives repeat the same basic curriculum: mats, stools, and baskets. They neither introduce new machinery nor link artisans to modern markets.

Many trainees complain that stipends are delayed or not received at all. Most do not have access to credit, design inputs, or meaningful product diversification. If bamboo-based livelihoods are to flourish, craftsmanship must evolve into entrepreneurship. Training should integrate design, branding, and e-commerce literacy along with income assurance. Collaborations with design institutes (like NID and ITI).

The Missing Market Link

The industrial demand for bamboo has weakened sharply since the closure of two major paper mills in Nagaon and Panchgram in 2017. Those facilities, run by Hindustan Paper Corporation, were the largest procurers of bamboo in Northeast India. Their collapse left

thousands of farmers stranded, and the industrial demand shifted almost entirely to incense-stick manufacturing. Consequently, many cultivators in Assam's Karbi Anglong, as well as in parts of Tripura and Mizoram, have begun transitions to crops like betel nut, pineapple, or rubber.

Without strong downstream industries—paper, bio-composites, engineered boards, furniture, or bamboo textiles—the plantation base cannot grow. For the bamboo sector to thrive, entrepreneurs must be incentivized through low-interest loans, guaranteed procurement for quality material, and export-oriented processing hubs.

The Way Forward

The future of Indian bamboo lies in balancing ecological sustainability with economic viability. We need a holistic, science-based approach that uses region-specific high-yield species, empowers tribals through secure land rights, and builds modern value chains directly linked with industries and global markets.

Tripura's experience offers valuable lessons: with proper species selection, technical guidance, and institutional backing, the state's bamboo potential could rival top global exporters. But reform must be systematic—supported by research, transparent funding, and policy coherence across ministries.

If India is to rise as a bamboo leader, it must see bamboo not as a minor rural crop but as a strategic renewable resource—an economic powerhouse waiting to be unlocked. With the right intent, investment, and inclusion, we can turn our ancient bamboo culture into a modern green industry that sustains both the planet and its people. The November 2017 amendment to the Indian Forest Act was crucially done by legally defining bamboo as a grass. Now the most critical step is to give it the "parent" it needs—a dedicated Board with the vision and authority to transform India's vast bamboo potential into a global leadership position. The green gold is in the groves; we now need the will and the wisdom to mint it.

RICE DIPLOMACY

Cultural, Legal and Diplomatic Frontier for India



Rice is more than a basic food in Asia; it's a rich archive of culture, history, and, lately, diplomacy. Whether it be the fragrant Basmati from India, the soft Koshihikari from Japan, or the fragrant Hom Mali from Thailand, rice has emerged as a marker of both national identity and cultural assertion. In recent times, nations have been utilising their food heritage as a part of their soft power, effectively deploying cultural persuasion, geography, and food branding to persuade other countries to make economic decisions.

India's basmati is situated at the rare intersection of culture, commerce and diplomacy. It has been used time



About the **AUTHORS**

Ms Priyanka Garodia is Geopolitical Research Analyst, South Asia at Advanced Study Institute of Asia at SGT University, Gurgaon.

Ms Khushi Kesari is the Program Officer at the History Lab, Advanced Study Institute of Asia (ASIA), SGT University

and again to create channels of economic cooperation globally by India. This strategic leveraging of using rice or other staple crops to create cultural legitimacy, economic clout and global influence can be termed as “rice diplomacy”. Beyond trade, rice diplomacy reflects how nations are developing identities and reputation based on what they produce, protect and share.

Basmati as Cultural Capital

Basmati has long been a part of North India’s cultural and culinary memory before it became a product of valued export. The long history of basmati can be traced through texts such as *Heer Ranjha* and *Ain-i-Akbari*. These texts have mentioned scented rice varieties, with Mughal chroniclers praising their fragrance and delicate grains. The name “*basmati*” itself is derived from the Sanskrit term “*vasmati*”, which means “fragrant”. This highlights the linguistic and cultural lineage of the grains. For centuries, the Indo-Gangetic plains of Punjab, Haryana and Uttarakhand have provided the perfect soil and climate conditions that define the aroma and texture of the rice.

Today, basmati’s importance extends far beyond the plate. It represents cultural and agricultural continuity, serving as a bridge between rural traditions and global taste. A similar instance can be seen with Japan’s Koshihikari or Thailand’s Jasmine rice, both of which serve as emblems of national pride. Despite this, basmati’s significance stands out in terms of scale and diplomacy as it is India’s most exported rice variety, accounting for over 4 billion USD in annual trade. This turns heritage into not just a livelihood but also a cultural soft power.

Law and Authenticity

Basmati’s global fame brings value but also vulnerability. To protect its identity, in 2016, India had registered Basmati rice under the Geographical Indication of Goods (Registration and Protection) Act 1999. The registration links the name to regions where the rice is produced. It includes the plains of Punjab, Haryana, Himachal Pradesh, Delhi, Western



Tracing Basmati’s journey from Indian fields and pastures to the shelves of global markets is not simply about agriculture but also geopolitics

Uttar Pradesh and parts of Jammu and Kashmir. The framework allows only rice produced in this region to be sold as Basmati, preserving its authenticity and heritage. However, in practice, this protection is far from optimal. Mislabelled exports, blending with non-basmati varieties and irregular oversight continue to damage its credibility. Internationally, the situation is similar. India’s recent bid for GI Recognition for Basmati in the European Union has been challenged by Pakistan, which argues that Basmati is a part of their shared agricultural heritage.

This incident highlights how the legal framework, combined with national pride, acts. Strengthening domestic coherence between intellectual property, agricultural, and trade laws would not only support farmers but also enhance India’s credibility abroad.

Reforming The Roots

The varied challenges faced in the GI recognition of Basmati, calls for reforms which must begin at the roots. Strengthening the link between seed laws and GI protection is crucial. It is important that farmers have access to certified seeds that meet the official GI standard, ensuring genetic purity and consistency

across regions. Steps like DNA fingerprinting and quality mapping are being undertaken by certain institutions like the Basmati Export Development Foundation (BEDF) and the Agricultural and Processed Food Products Export Development Authority (APEDA). Digital traceability systems such as BasmatiNET and blockchain-based export tracking pilots are some steps which can be largely adapted to build a transparent farm-to-market chain.

The benefits of these technological advancements extend beyond efficiency to the realm of diplomacy as well. When India showcases such credible systems of verification, it also builds global trust. The capacity to trace every shipment of rice exported empowers India in trade negotiations and bolsters its standing as a trustworthy holder of heritage crops.

Reforming the roots, thus, means connecting farmers, scientists, and diplomats into one continuum, where every grain embodies proof of origin, proof of quality, and proof of national pride. In doing so, India uses agricultural reform as soft power, demonstrating to the world that authenticity can go hand in hand with innovation.

Grain Geopolitics

Tracing Basmati’s journey from Indian fields and pastures to the shelves of global markets is not simply about agriculture but also geopolitics. The aromatic grain has long been pinned at the centre of a quiet contest between India and Pakistan - each claiming historical and geographical prerogatives to its heritage. This contest has bubbled up into courts of trade and markets of consumer goods, most transparently in the European Union’s Geographical Indication (GI) negotiations and in the United States’ disputes over imports.

This struggle conveys how food heritage is intertwined with national identity and economic strategies. For India, to protect Basmati is not only about retaining access to markets, but maintaining cultural ownership and rural livelihoods. At the same time, as global consumer demand rises for authentic and traced products, Basmati’s story strengthens



India's soft power. This soft power is rooted in its rich cultural history that promotes images of craft, biodiversity, and tradition. It has managed to transform food into a frontier of diplomacy, a consequence of which has resulted in issues of shared heritage and equitable recognition emerging in South Asia, where cultures have long evolved through mutual influence.

South-South Cooperation

Given India's assertive posturing in its immediate vicinity, in which it sees itself as a regional leader, it could spearhead the concept of rice heritage as a collaborative platform. A Heritage Rice Network could be established based on South-South cooperation that connects rice producers to Thailand, Vietnam, and Myanmar. This Heritage Rice Network would facilitate exchanges on best practices of Geographical Indication protection, digital traceability, and branding for sustainability. Not only could this network support farmers regionally against market dilution from industrial agriculture, but it could also provide collective bargaining power by enhancing local

A Heritage Rice Network could be established based on South-South cooperation that connects rice producers to Thailand, Vietnam, and Myanmar

farmers' negotiating positions with traders in both global and regional trading spaces. Also, the network could promote agricultural diplomacy and solidarity of culture via a platform of shared agrarian traditions.

Therefore, India can reposition its rice diplomacy as a mechanism of trade and a model for postcolonial agency to establish the value of its own traditions as a collective effort to innovate and protect heritage.

The Road Ahead

Rice diplomacy goes beyond simple trade or culinary preferences: it is rather about how countries represent themselves on the global stage. The case of

Basmati illustrates a broader problem for India: how to transform an authentic piece of cultural heritage into strategic capital. While technological interventions and legal protection can form the base of this transformation, true and lasting foundations will be constructed when the interests of farmers, the capacity of the state, and the intent of diplomacy are aligned. If India desires to assume the apex position in cultural diplomacy, the policy approach to India's heritage crops will have to shift from protectionism to partnership.

India needs more than simply to defend Basmati; it needs to present Basmati as a model for ethical trade, scientific transparency, and shared heritage. With stronger GI enforcement, farmer education on trade, and strategic policies for inter-state collaboration, one grain of rice can be rebranded as a symbol of trust and partnership. Diplomacy on rice is, therefore, not a figurative use of the term but a true, actionable sense of the word. It is the tangible demonstration of the possibility for culture, commerce, and ethical consideration to thrive alongside one another.

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