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Founder & Editor-in-Chief	MC Dominic
Managing Director	Shiny Dominic
Group Editor & CEO	Mamta Jain
Senior Sub-Editor	Shivam Dwivedi
VP - Marketing	Megha Sharma
Circulation	Abdus Samad
Graphic Designer	Sandeep Singh

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FMR. M C DOMINIC
Founder & Editor-in-Chief Krishi Jagran and
Agriculture World
Founder & President -Agriculture Journalist
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THE VISION

Sustainability and Self-Reliance: Pillars of India's Agricultural Transformation

As India moves steadily toward the vision of a Viksit Bharat by 2047, agriculture remains the beating heart of this transformation. It is not just a sector of the economy—it is a lifeline for millions, a steward of our natural resources, and a gateway to inclusive development. The future of Indian farming depends on how effectively we integrate sustainability, science, and self-reliance into our agricultural ecosystem.

From bio-agricultural inputs and soil regeneration to animal-based farming systems and clean planting programs, the current discourse in agriculture reflects a singular priority: the need to shift from extractive to regenerative practices. This shift must not be postponed. It is not a choice but a necessity.

Climate change is no longer a looming threat—it is a daily reality. Its impact is visible in the rising cycle of farm debt, erratic rainfall, depleting groundwater, and shrinking biodiversity. To counter this, we must invest in climate-resilient ecosystems, farmer-centric policies, natural farming practices, and research that empowers smallholders. Our response must be systemic, science-led, and inclusive.

At the same time, we must not forsake the wisdom of traditional practices. By thoughtfully integrating indigenous knowledge with modern innovations—such as natural farming techniques, precision irrigation systems, community-based seed banks, and digital platforms for market access—we can create low-cost, high-impact solutions that are both sustainable and scalable. These approaches are uniquely tailored to the social, environmental, and economic realities of our rural communities, ensuring long-term resilience and self-reliance.

And as we move from a model of subsistence to one of sustainability, we must always remember who this transformation is for. The farmer in the field, the rural woman leading a self-help group, the young agri-innovator—all must be central to our vision. Their resilience, creativity, and courage are the true drivers of progress.

In this decisive decade, let us recommit to building an agriculture that is ecological in practice, economical in outcome, and ethical in principle. Only then can we achieve a truly inclusive and prosperous Viksit Bharat.

Reimagining Agriculture for a Viksit Bharat: Innovation, Inclusion, and Ecological Revival



Today's farming landscape in India is brimming with unprecedented possibilities, reflecting a sector at a transformative crossroads. Moving beyond traditional, input-heavy methods, Indian agriculture is rapidly embracing smarter, data-

driven solutions that hold the promise of sustainability and prosperity. Innovations such as clean planting materials are revolutionizing fruit productivity, while advances in livestock management are helping improve soil health and boosting rural incomes. These changes are not just incremental; they are redefining what sustainable farming truly means for India's diverse and unique agro-ecological landscape.

The modern farmer needs more than just subsidies—they require robust systems that function seamlessly, infrastructure that supports their endeavors, and cutting-edge innovations that empower them to thrive. Institutions like the Krishi Vigyan Kendras (KVKs), often called the IITs of grassroots agronomy, play a pivotal role in this transformation. Strengthening these centers,

ensuring they are respected and well-resourced, is essential for disseminating scientific knowledge and fostering innovation at the farm level.

Moreover, the empowerment of women farmers, youth entrepreneurs, and rural changemakers is critical. These groups are not merely beneficiaries but must be viewed as leaders driving climate-smart agriculture and agri-business innovation. Providing them with inclusive financial services, targeted training, and access to technology is not an act of charity but a strategic imperative that will accelerate India's agricultural evolution.

The vital intersection of health and agriculture highlights the importance of universal insurance models and nutritional security through sustainable food systems. It underscores the fact that agriculture is not only about producing food but about enhancing overall well-being and health.

As we embrace this decade, let it be a time to sow bold ideas and nurture lasting change. A Viksit Bharat is within reach—but only if agriculture is seen not as a problem to be managed, but as a powerful catalyst for transformation and growth.

SHINY DOMINIC
Managing Director

Viksit Krishi for Viksit Bharat



As we move towards the vision of Viksit Bharat by 2047, agriculture stands at the heart of this journey. It is not just a means of livelihood but a symbol of our strength, sustainability, and self-reliance. Agriculture, which feeds over a billion people, has the power to transform India from a developing to a developed nation.

Agriculture ensures that no Indian sleeps hungry. From wheat fields in Punjab to rice paddies in Tamil Nadu, our farmers work tirelessly to provide food for the nation. As we aim for a healthier and more productive population, diversified farming including millets, pulses, fruits, and vegetables is becoming crucial for nutritional security.

For a Viksit Bharat, the prosperity of farmers is a priority. The government has introduced schemes like the PM Fasal Bima Yojana for crop insurance, PM Krishi Sinchai Yojana for irrigation, and e-NAM for direct market access. These reforms, along with the promotion of agri-startups and value-added products, are key to doubling farmer incomes and reducing rural poverty.

A developed nation uses modern tools for age-old practices. Indian agriculture is witnessing a revolution with Drones for spraying fertilizers, AI-based crop

monitoring, Digital advisories on weather and pricing. Such innovations make farming more efficient, profitable, and less dependent on guesswork.

Agriculture and allied sectors like animal husbandry, dairy, and food processing offer huge employment opportunities. With the rise of Farmer Producer Organizations (FPOs), even small farmers now have bargaining power and access to larger markets. This leads to rural development, reduced migration, and balanced growth.

India has the potential to become an agriculture export hub. We are already leading exporters of rice, spices, and marine products. By improving quality standards, storage, and branding, Indian farmers can serve the world, earning foreign exchange and global recognition.

As climate change becomes a reality, sustainable practices are more important than ever. Techniques like organic farming, zero-budget natural farming, and micro-irrigation help conserve resources and protect the environment. Agriculture is not just a sector... It is the soul of India. For a Viksit Bharat, we need an agriculture system that is profitable, sustainable, tech-savvy, and inclusive. Empowering farmers means empowering the nation.

Jai Jawan, Jai Kisan, Jai Vigyan, Jai Anusandhan!

MAMTA JAIN
Group Editor & CEO

Bio Inputs: For the Evergreen Revolution

Agriculture is a cornerstone of development for almost any nation, influencing various dimensions such as economic growth, food security, rural development, environmental sustainability, technological innovation, and social well-being. This article highlights the role that bio-agricultural inputs can play in fostering a more competitive, sustainable and modern agricultural sector.

Bio-agricultural inputs, such as biostimulants and biopesticides, are gaining prominence globally as sustainable complements to chemical inputs. These biological products are derived from natural sources like plants, microorganisms or circular waste, and they play a crucial role in developing a more efficient and sustainable agriculture.

Biostimulants: Enhancing Growth and Resilience

Biostimulants are substances or microorganisms that, when applied to plants or soils, aim to improve nutrient use efficiency, tolerance to abiotic stress, quality traits, or the availability of confined nutrients in soil or rhizosphere. The novelty is that, even at a regulatory level in Europe or in the U.S., they are defined by their function rather than their content. They aim to complement all other inputs from chemical or biological origin. They are analogue to a human food supplement that seeks to provide a particular benefit.

Their benefits are multifaceted, but impact many stakeholders across the whole food-production ecosystem, policymakers, consumers and society in general. Some of them are listed below:

- **Farmers' Competitiveness: Studies** have shown that biostimulants can significantly increase crop yields by enhancing nutrient use efficiency and promoting plant growth. They help farmers reduce dependency on chemical fertilizers, while also improving qualitative traits, making farming more profitable and helping to augment exports. In the context of frequent disruptive climatic events, biostimulants help farmers adapt and mitigate their impact, increasing their resilience.



CARLOS RODRÍGUEZ-VILLA FÖRSTER
Managing Director ALGAENERGY

- **Soil Regeneration:** Soils are the farmers' main asset, but their erosion evolves at a worrying speed. By stimulating beneficial microbial activity and improving nutrient cycling, biostimulants enhance soil structure, water retention, and nutrient-holding capacity. This leads to healthier soils with a greater content in soil organic carbon, supporting long-term agricultural productivity.

- **Climate Change Mitigation:** Biostimulants help plants withstand abiotic stresses such as drought, extreme temperatures, and high soil salinity by strengthening plants' natural defense mechanisms. This resilience is crucial in the face of climate change, which poses significant challenges to agriculture. This is particularly beneficial in regions with poor soil conditions or limited water availability.

- **Nutrient Density and Food Quality:** Biostimulants improve the nutritional quality of crops by enhancing nutrient uptake and assimilation. This results in healthier, more nutritious food that benefits both consumers and farmers' competitiveness.

- **NUE and Geostrategic dependance:** many biostimulants have demonstrated that they can contribute to greater efficiency in the use of fertilizers. Being fertilizers an essential input that is often imported, biostimulants offer an opportunity to significantly reduce the dependance on certain imports, without compromising the productivity.

Biopesticides: Sustainable Pest Management

Biopesticides are derived from natural materials such as plants, bacteria, and certain minerals. Unlike biostimulants that don't aim to replace but complement any other input, biopesticides offer an eco-friendly alternative to synthetic pesticides:

- **Environmental Safety:** Biopesticides are biodegradable and less harmful to non-target organisms, including humans and beneficial insects. This often makes them a safer option for pest management.

- **Pest Resistance Management:** Unlike synthetic pesticides, biopesticides reduce the risk of pests developing resistance. This promotes long-term effectiveness in controlling pest populations.

- **Support for Sustainable Practices:** By integrating biopesticides into pest management strategies, farmers can reduce their reliance on chemical pesticides, promoting more sustainable agricultural practices which are often a market demand.

Accelerating Growth in the Bio-Inputs Sector

If the benefits of bio-inputs are so obvious and impactful, how come they are not used by all farmers globally? This question responds to many factors that need to be addressed. Some of them are highlighted below:

Regulatory Frameworks

Improved regulatory frameworks are needed to facilitate the adoption of bio-inputs. Governments should implement regulations that streamline the registration and approval processes for bio-inputs, enabling that innovation reaches the market. Moreover, incentives such as tax breaks, subsidies, and grants can encourage farmers to adopt bio-inputs and support sustainable farming practices.

Additionally, policies that promote collaboration between research institutions, industry, and farmers can drive innovation and adoption.

Investment in R&I and market introduction

Increased investment is crucial for advancing bio-input technologies. Often, a particular product claims to increase yields by an average of 8%, but this can mean 1% in Year 1 and 15% in Year 2. It's difficult to adopt any new technology that is not predictable, whose benefit is not always measured in an isolated manner. Biological inputs need to show consistency year on year. This means that more investment is required to improve both, the products themselves - particularly their specificity -, but also the knowledge about how to use them. Very frequently, the problem is less related to the product and more to the understanding of the product, as the introduction of biological products requires a level of technical expertise across the distribution that is not available in the existing channels that companies want to leverage, which have been developed for the distribution of chemical inputs. A non-obvious additional investment is always required on that front.

Greater Awareness

Raising awareness about the benefits of bio-inputs is essential for their widespread adoption. Collaboration with other stakeholders such as food companies looking to reduce their carbon footprints, crop insurers looking to mitigate their risks, or universities looking to develop science and innovations, can further disseminate knowledge and promote best practices. The responsibility is shared amongst many more stakeholders than only the farmers.

Conclusion

The integration of bio-agricultural inputs into farming practices offers a sustainable path forward, that enhances competitiveness and modernizes food production. These inputs help to ensure food security, enhance rural livelihoods, and promote environmental sustainability. Their adoption is early stage, and farmers are instrumental to materializing their potential impact, but they must be supported by all who benefit from it: companies, policymakers and consumers.

Agriculture at the Core of 'Viksit Bharat': Driving Sustainable and Inclusive Growth



ANIL KUMAR SG
Founder, Samunnati

As India advances toward its 2047 vision of Viksit Bharat- a future marked by a self-reliant nation, inclusive development- agriculture stands at the forefront of this transformation. With half of India's population dependent on farming and agricultural contributing nearly 18% to the GDP, it will play a vital role in securing food security, generating employment, and driving economic advancement.

In recent years agriculture's role has transcended traditional boundaries. It now encompasses goals of environmental sustainability, rural development, and technological innovation, ensuring that growth is not only inclusive but also resilient. In the context of Viksit Bharat, food security is not merely about feeding a population- it's about nation-building. To adequately realize the potential of agriculture in achieving the Viksit Bharat vision, structural reforms and collaborative action at the grassroots level are essential.

Collectivization of farmers through various forms of collective organizations, such as Farmer Producer Organizations (FPOs), Collective Farming Businesses (CBBOs), and other cooperatives, has emerged as a powerful strategy to enhance the livelihoods of small-holder farmers. By leveraging the power of collectivization, they can overcome several challenges and build a more prosperous and sustainable future.

Farmer Producer Organizations (FPOs): Engines of Growth

One of the transformative initiatives aiding this vision is the ecosystem of Farmer Producer Organizations (FPOs). They are offering economies of scale, boosting bargaining power, and promote modern, sustainable practices. They also reduce dependency on middlemen, enable access to formal credit, and allow farmers to sell directly to institutional buyers. As such, FPOs form the backbone of rural economic empowerment, ensuring that every farmer becomes part of India's development journey.

These efforts are not just about providing solutions—they are about creating an ecosystem where all stakeholders thrive. By bridging the gaps in finance, market access, and advisory support, they are enabling higher incomes for farmers, Stronger, more resilient farmer collectives, efficient value chains that reduce wastage and maximize profitability and a sustainable agricultural future for India. With its farmer-first approach and scalable impact model, this is redefining the way agriculture operates in India—ensuring that no smallholder farmer is left behind in the journey towards growth and prosperity.

To ensure that initiatives like FPOs deliver long-term impact, they must be strengthened by sustainable agricultural practices and technology-driven innovations. Integrating sustainable practices and AI tools strengthens efforts by boosting productivity, resilience, and farmer empowerment to thrive in a rapidly evolving agri-economy.

Sustainable Agricultural Practices: The Key to Long-term Growth

Addressing longstanding challenges is crucial to unlocking India's agricultural potential. Fragmented land holdings hinder scalability and mechanization, posing a significant challenge to Indian agriculture. Productivity remains low compared to global benchmarks. Climate vulnerability, water scarcity, and erratic monsoons undermine income stability. Weak infrastructure leads to high post-harvest losses, and many farmers lack access to affordable credit. In addition, overuse of chemical inputs has led to soil degradation, impacting long-term productivity.

To overcome these challenges and realize the vision of 'Viksit Bharat', India has to adopt sustainable agriculture practices for long term growth. Practices such as crop rotation, organic farming, and precision irrigation preserve soil health, conserve water, and promote biodiversity. Moreover, sustainable practices will strengthen the resilience of rural communities, enabling them to better adapt to climate change and environmental challenges.

Therefore, India must focus on promoting climate smart agriculture initiatives through water water-efficient irrigation and drought-resilient crops; encouraging natural and organic farming to protect soil and biodiversity; improving farmers' access to markets to ensure fair pricing; providing accessible credit and financial tools such as insurance and grants; and strengthening rural infrastructure with investments in cold storage, warehousing, and post-harvest technologies.

AI-based New Technology: Transforming Agriculture for the Future

The rise of artificial intelligence presents a unique opportunity to revolutionize agriculture and empower Indian farmers facing numerous challenges, from Mausam (unpredictable weather) to mandi (market fluctuations). The integration of AI into both global and Indian agriculture encompasses a wide range of applications, including pest and weed detection, agricultural robotics, crop health assessment using drones, precision farming through predictive analytics, and AI-driven crop price forecasting. These advancements are not only transforming farming practices, but also setting new standards for efficiency and sustainability.

One notable example is technology for predictive maintenance (PdM), which automatically initiates maintenance based on signals from equipment using sensors and measuring devices. In precision agriculture, PdM yields invaluable real-time insights into crop health, nutrient levels, disease spread, and climate conditions. However, it's essential to view AI as a tool rather than a solution to all problems. Contextual data, farming practices, and local conditions must accompany technologies like

satellite imagery to ensure their effectiveness. Therefore, a phased and community-involved adoption strategy is crucial to maximize AI's benefits.

Growing Forward: A Comprehensive Approach to Agriculture

India's agricultural sector is undergoing a significant transformation, driven by the government's focus on sustainability and technology integration. This shift is crucial for achieving the vision of "Viksit Bharat" by 2047. Several government initiatives have been launched to promote sustainable agriculture practices, improve productivity, and enhance the livelihoods of farmers.

PM-KUSUM aims to promote solar irrigation, reducing dependence on fossil fuels and enhancing energy security for farmers. National Mission on Sustainable Agriculture (NMSA) promotes Climate-Smart Agriculture (CSA) practices, enabling farmers to adapt to climate change and improve soil health, digital public infrastructure for Agriculture and Aspirational District Program (ADP) launched by NITI Aayog, focuses on improving socio-economic outcomes in aspirational districts, including agriculture and water management. A key initiative under the ADP is promoting Farmer Producer Organizations (FPOs), which empower smallholder farmers by providing access to resources, markets and technologies.

India's journey toward Viksit Bharat 2047 hinges on the inclusive and sustainable growth of its agricultural sector. With strategic investments, farmer-centric innovations, and collaborative partnerships between government, private players, and startups, agriculture can become the catalyst for national transformation. By addressing persistent challenges and embracing opportunities across sustainability, infrastructure, and technology, India can build an agricultural ecosystem that is not only productive and resilient, but also equitable and future-ready. In empowering its farmers, India empowers its future- and paves the path to a truly developed nation.

Kan Biosys Honored in Delhi by Indo-French Chamber of Commerce

Pune, April 22: Kan Biosys, a renowned multinational company in the field of biological inputs, has been honored with the Jury Special Award by the Indo-French Chamber of Commerce. The prestigious Indo-French Business Awards 2025 ceremony was recently held at the French Embassy in Delhi. Kan Biosys' Founder and Managing Director, Sandeepa Kanitkar, received the award from Thierry Mathou, the French Ambassador to India.

This year marked the 7th edition of the Indo-French Business Awards. Kan Biosys earned the distinction of being the first multinational company in the organic agriculture input sector in India to receive this recognition. The award acknowledges the company's innovative research and high-quality, toxin-free organic solutions that support the production of safe agricultural products. Several leading companies from sectors such as IT, defense, banking, services, manufacturing, and solar energy were also felicitated at the event.

After receiving the award, Sandeepa Kanitkar expressed, "Kan Biosys is a proud Indian company delivering global-quality agricultural inputs through research and innovation. Our consistent focus on quality has earned the trust of millions of farmers across the world who rely on our products to grow toxin-free and high-yield crops. It's a great honor that the Indo-French Chamber has acknowledged our work." She emphasized the increasing challenges farmers face due to climate change, including declining soil productivity caused by the overuse of chemical fertilizers and water. In this scenario, Kan Biosys' organic fertilizers and crop protection solutions have become vital tools

for improving soil health and promoting sustainable agriculture.

Recently, Kan Biosys entered into a strategic partnership with French multinational company De Sangosse, whose agricultural products are used by farmers in 28 countries worldwide.

The Indo-French Chamber of Commerce and Industry promotes technology exchange, business development, and investment between India and France. It represents more than 750 companies actively working in coordination between the two nations. The upcoming year, 2026, has been declared the "Year of Innovation" for India and France—a joint initiative announced by Indian Prime Minister Narendra Modi and French President Emmanuel Macron. The Chamber is playing a pivotal role in this collaboration, with a focus on themes like agri-startups, sustainable farming, food security, healthcare, and space research.

Photo Caption:

Kan Biosys, a multinational company, was recently honored with the Jury Special Award by the Indo-French Chamber of Commerce at a ceremony held at the French Embassy in Delhi. Founder and Managing Director Sandeepa Kanitkar accepted the award. From Right to Left – Mr. Jean Touboul, CEO, Pernod Ricard India; then Dr. Thierry Mathou, Ambassador of France to India; then Ms. Sandeepa Kanitkar, Founder & Managing Director, Kan Biosys; Ms. Payal S. Kanwar, Director General, Indo-French Chamber of Commerce and Industry (IFCCI); and Mr. James Collins, Director & CTO, Aerolloy Technologies Ltd. (A PTC Industries Ltd. Company), during the Indo-French Business Awards 2025 held at the French Embassy, New Delhi.



Agriculture: A holistic vision for Viksit Bharat



PROF. (DR.) BALVINDER SHUKLA
Vice Chancellor, Amity University

India as a growing economy lies with the fact that only be empowering agriculture sector, holistic development of the nation that is envisioned by the viewpoint of “Viksit Bharat” cannot be attained without uplifting the agriculture. The vision of our honourable prime minister, for India to become “Viksit Bharat”, need is there for agriculture to must evolve into sustainable and diversified sector to feed a huge population that supports livelihood and contributes towards national progress. The call for Viksit Bharat @ 2047 signifies the enduring vision to uplift India as a self-reliant and developed nation by 2047. As per the World bank, India has a per capita Gross National Income (GNI) of \$2390 as of 2022. Thus, to achieve this status of developed nation, a six-fold increase in per capita GNI is a task that calls out for inclusivity in farmers income and growth rate in agricultural GDP.

Sustainable agriculture practices become keys for ensuring food security, environmental health and economic stability with key factors like efficient resource utilization, organic farming, crop diversification and resilience. Sustainability in agriculture ensures environmental conservation, employment opportunities in rural areas with development in different allied sectors of agriculture including dairy, poultry, food processing etc can contribute to income diversification and thus align with the vision of “Viksit Bharat”. Women and youth empowerment curbs agriculture into attractive and profitable occupation that contributes significantly in India’s GDP. Agricultural marketing in India needs to undergo a paradigm shift by 2047 with digital and smart innovative technologies

India has rich agricultural heritage with diverse agro-climatic zones which acts as backbone of Indian economy. In this modern world of technology, innovation and industry, agriculture plays a pivotal role in shaping nation’s economy. As our country is progressing with a vision of “Viksit Bharat”, that means “developed India”, the sector of agriculture acts as a centre stage for transformation with sustainability. Agriculture is not only about food production as it contributes significantly to Gross Domestic Product (GDP), Rural development as well as employment generation. The main concern for

that bridge the gaps between farmers and buyers. Indian agriculture is poised to compete in global markets to full potential in future and thus is another critical aspect of achieving Viksit Bharat 2047. Agriculture contributes to around 18 percent to country’s GDP and thereby its growth is crucial for developing Indian economy as agricultural sector has a pivotal role to play in sustaining the world’s largest population with advanced farming techniques and systematic improvements in post-harvest and value addition chains. The role of government initiatives like Doubling Farmer’s Income, Digital agriculture, Mission for Integrated Development of Horticulture has been critical towards this view point of developed India.

The alignment of agriculture with view of “Viksit Bharat” embraces the digital transformation and innovation with interventions like Precision farming, use of IoT and AI based analytics, digital platforms like eNAM (electronic National Agriculture Market), weather monitoring which when combined with the traditional farming can significantly boost the crop productivity that ensures higher income and growth for farmers and rural community. The Artificial Intelligence drives advancements in drones, tractors and other streamlined agriculture tasks propel agriculture towards “Viksit Bharat”. Integration of climate resilient technology with sustainable agriculture empowers the farmers to align and promote the view point of “Viksit Bharat” with sustainable agriculture, policies like PM-KISAN, Pradhan Mantri Krishi Sinchayee Yojana, Paramparagat Krishi Vikas Yojana lead to the thrust of Atmanirbhar Bharat (Self-Reliant India) that perfectly aligns with the goal of “Viksit Bharat” as agriculture acts as key pillar for ensuring economic resilience and food sovereignty. The practice of sustainable and resilience agriculture will make the dream

of Viksit Bharat” achievable by 2047 with paradigm shift in practice of agriculture. This requires a collaboration among the stakeholders involving government, private sectors, academia, society and farmers.

Agriculture is not only a sector of economy but it’s a foundation of India’s development that emphasis on sustainable practices, inclusive policies, technological innovations that lead towards holistic approach which is an essential component for “Viksit Bharat”. The public and private sectors need to collaborate in order to build the hub for agri-innovation that upscales the financial capacity of the farmers and thus contributes in GDP of the country. The E-platforms are crucial and instrumental for modernization of agriculture sector that nurtures the vision of rural and economic development which is instrumental in developed nation building. Indian agriculture has the potential to be a role model for other countries to shine as an epitome of innovation, sustainability and production as the empowerment in the agriculture sector plays a crucial role with vision of “Viksit Bharat”.



DR. DURGESH KUMAR TRIPATHI
Associate Professor, Amity Institute of Organic Agriculture.

Agriculture for Viksit Bharat

Suggestions for Directional Change in Agricultural Research



The Indian Agriculture is now lesson worthy growth story for the world. It is now feeding the world population not by filling stomach only but also providing nutritional and health securities, but the world is facing situations of CCPT (Conflict between nations, Climate change, chance of Pandemic like COVID, and Tariff diplomacy). Each nation trying to become self-reliant in all respects and so is the Bharat. Ever increasing population and their demands in such situations demand a directional change in Indian Agricultural Research and Education. Future agriculture will be technology driven. Automation, Internet of Things (IoT), robotics in agriculture will be taking centre stage in light of conditions world is envisaging for the future.

We are well equipped in developing hybrid varieties and have done fairly well for higher yields, but it needs attention towards developing capacities in speed breeding using robotics, artificial Intelligence (AI), environment management in all kinds of agricultural fields Land preparations to on farm

DR S. N. JHA
President Indian
Society of Agricultural
Engineers (ISAE) & DDG
(Agricultural Engineering),
ICAR

operations including harvesting, primary processing, transport and storage of produce using AI equipped machineries/robots are need of the hour. Some big ticket researches need priority are:

(i) Focus on development of smart humanoid robots for automating tasks like planting, weeding, and harvesting. This using sensors and AI shall analyze soil conditions, detect pests, and optimize resource usage on continuously and act as per need automatically in all above mentions on farm or off farm operations.

(ii) Post-harvest particularly secondary, tertiary and quaternary level of processing are not being considered as part of agriculture by the policy makers. We in fact is presently are in comfortable zone for food production, so research direction should be changed towards this to save produce after harvest and promote agricultural based industries in rural India (the real Bharat).

(iii) Agriculture for industry or I say Industrial Agriculture for which we should earmark some lands and other resources for producing raw materials for scarce plant based, protein, minerals, pharmaceutical ingredients, silicon for semiconductors, materials for automobile parts, buildings, road constructions, energy storage for replacing lithium ion based battery etc. Lists are unlimited for which we are dependent more than 80-90 % on other countries.

(iv) We also need to start building facilities and researches for finding alternative ways of producing foods, other than the modern agriculture, using natural vegetation, cellulosic crop residue using modern chemistry, IoT and robotics, advance 3-D printing technologies etc. After all natural resources and number of farmers are depleting, but foods requirements will be increasing. Researches on the alternative ways of producing foods therefore need to be thought now for not being behind any country in future.

(v) A team need to be built for developing robotic cows/buffaloes not only for milk but also for transport in difficult and strategic site of the country.

(vi) Deep see farming, predictive fishery and development of plant based fish and fish products hold promise to investigate when water is becoming a scarce valuable depleting resources needed for fish farming.

(vii) Technologies for nondestructive and quick inspection and valuation/pricing of foods and other produce using spectroscopy, sensor technologies and IoT in all field of agriculture are needed for safe eating for having healthy population of the country.

(viii) All in one we have to focus on Agriculture 5.0 but pre-requirement of their full success depends on variety to be developed should be suitable for above purposes. Varietal development programme should focus for one time fruiting, uniform and easily reachable canopy besides productivity, climate resilience of the crop in general and horticulture in particular.

(ix) Intensive mass awareness programme for safe eating and food loss and waste prevention should be an integral part of not only Indian agriculture but also of other government and private agencies' programmes.

(x) Any research, development and extension programme must include all disciplines of scientists and extension personnel.

All above thoughts may be combined under one umbrella of "Precision Agriculture (PA)". PA is not new but direction needs considerable shift. Deployment of right trained scientists and extension personals at right place need to be analysed honestly and change suitably, besides a major portion of funds need to be allotted for the purpose. Agricultural Engineers who can do these job better than any other professionals, are in scarce in teaching, research and extension of Agriculture. All state Governments and related institutions should form a dedicated department/institutions, may name as "National Institute of Agricultural Robotics and AI" and deployment of Agricultural Engineers at places of programme implementations and extension chain holds great promise to full fill the aspiration of Viksit Bharat sooner than later.

Brief Biodata of Author

The Author is Deputy Director General (Agricultural Engineering), ICAR, and Presidents of Indian Society of Agricultural Engineers and Bihar Agriculture Science Academy. He is pioneering research on nondestructive evaluation and pricing of food materials using spectroscopy and sensor technology, besides pioneer research for processing and value addition of makhana (gorgon nut) in India.

Building India's Clean Plant Program- Indispensable for Viksit Bharat



DR. BNS MURTHY
Ex. Horticulture Commissioner,
Govt of India

Despite substantial investments in critical horticultural components such as infrastructure, irrigation, agro-chemicals, processing, and post-harvest management, India's average fruit productivity remains below the global average. A key factor contributing to this under-performance is the use of inferior planting material often infected with systemic pathogens, particularly plant viruses. Here a special significance is attached to perennial horticultural crops (mostly fruit crops) as there is a long gestation period and effects are known only in later stages of orcharding. Hence, genuine and quality planting material (true to type and pathogen free) is the key to success. Further, there are several private nurseries operating in the country and many of them follow traditional methods and lack adequate infrastructure and sell plant material of unknown pedigree additionally it is compounded by un-availability of standardized root stocks and non-maintenance of healthy stocks of elite varieties. At present India has 4554 fruit crop nurseries- comprising of 1580 under Public sector and 2974 under private sector. Only few are accredited with an annual target production of 1387 million plants, just meeting 35 to 40 per cent of the demand. The rest is concerned to traditional / farmers own material in vogue and sometimes non-availability results in restricted area expansion.

The concept of the Clean Plant Program is unique in itself and does not exist in India. The Clean Plant Program (CPP) is a plant health management program and utilizes an ISO-like systems approach to achieve nursery certification. The Indian CPP is an ambitious and transformative initiative aimed at revolutionising the country's fruit crop sector. Approved by the Union Cabinet in August 2024, the first phase of the program has an outlay of ₹1,766 crore and is expected to significantly enhance the quality and productivity of fruit crops in the country. India's Clean Plant Program draws inspiration from global best practices, including those in the United States, Canada, Australia and Netherlands. These countries have pioneered clean plant programs, and India aims to tap into this expertise. The program will be jointly implemented by the National Horticulture Board (NHB) and the Indian Council of Agricultural Research (ICAR) with support from the Asian Development Bank (ADB). The Clean Plant Program is expected to benefit Indian farmers by providing access to high-quality, virus-free

planting material, eventually contributing to the growth and sustainability of the horticulture sector making it more competitive and sustainable in the long term.

A clean plant is the product of a long and methodical process, designed to ensure that harmful and economically important pathogens are identified and removed before a plant is distributed to growers and nurseries. The clean plant production is based on a 4 tier system which includes production and maintenance of foundation materials at the clean plant centers (CPCs) and its multiplication under the nursery stock certification system. A clean plant is a plant that has been tested and found free of targeted pathogens and maintained in G1 blocks. The G1 plants are then propagated in recognized certification programs. Studies show there is a clear benefit of using clean stocks globally. For eg., grapes leaf roll disease causes losses from \$25,000 to over \$226,000/ha over a 25-years in California. Pierce's disease causes losses estimated at \$92 million/year. Citrus Greening in Florida caused loss of \$9 billion from 2006-2016, also a 40% reduction in citrus acreage. Plum pox virus caused losses to an extent of 810 hectares of orchards. Little cherry disease and X-disease in Pacific NW caused an estimated 12% reduction of cherry production in 2020 and losses of 400 hectares of sweet cherry and 300 hectares of stone fruit trees. All these issues have been successfully addressed by respective country level CPPs.

With increasing domestic consumption, a growing demand for planting materials of fruit crops resulting in the large-scale import them internally there is significant outflow of valuable foreign exchange. For eg., between 2018-2023, the import of planting materials saw a substantial rise, increasing from 21.44 lakh in 2018 to 49.57 lakh in 2020 to 10 million plants in 2023 just for Apple alone. Currently, the import process for plants is lengthy, requiring a two-year quarantine period. The introduction of Clean Plant programme aims to reduce this quarantine period and make it easier for farmers to access disease-free and authentic planting material. With the focus on priority crops, high-value horticulture crops, training programs for scientists, farmers, nursery growers and other stakeholders the government has allocated ₹ 1765.67 cr over a span of seven years (2023-2030). Establishment of dedicated clean plant centres and will adhere to international standards for maintaining plant health and cleanliness. Collaboration with private

players, research institutions, and state governments would substantially increase.

The key objectives of the program include, and not limited to yields enhancement of horticulture crops and promoting climate-resilient varieties. Implement proactive virus and disease control measures to protect the ecosystem. Prioritize affordable access to clean plant material for all farmers, with emphasis on women farmers and region-specific clean plant varieties. Initially, the program will focus on fruit crops, including almond, apple, avocado, berries, citrus, grapes, guava, litchi, mango, pomegranate and walnut. Nine world-class Clean Plant Centers (CPC) will be established across India, equipped with advanced diagnostic therapeutics and tissue culture labs. These CPCs produce high-quality, propagative plant material and maintain blocks of pathogen-tested plant material. Along with this a robust certification system implementation under the Seeds Act 1966 to ensure accountability and traceability in planting material production and sale is on anvil. In the program, large-scale nurseries will receive infrastructure support for efficient multiplication of clean planting material as well.

The Clean Plant Program (CPP) is a game-changer in itself. CPP offers numerous economic benefits to farmers, the horticulture industry, and the county's economy. Higher productivity is ensured as disease-free planting materials lead to healthier crops, resulting in increased yields and productivity; improved crop quality-clean plant material reduces the risk of disease and pests, resulting in higher-quality crops that command better prices. By way of using disease-free planting materials, the crop losses due to disease and pests would get minimised, thereby reducing the economic impact of these losses. With this, farmers can reduce their pest management costs reaping higher yields and better prices for crops ultimately leading to increased income thereby improving their livelihoods. The other benefits include, enhanced competitiveness by way of accessing global markets since, the program helps farmers and the industry meet international quality standards, enabling them to access global markets this results in increase of exports and earn foreign exchange. The CPP can also create new job opportunities in the horticulture sector, contributing to economic growth and development.

The Clean Plant Program (CPP) may face several

challenges, including high initial investment for the establishing clean plant centres requiring substantial funding and quality of global standards and may be time-consuming. Without adequate awareness and training which may be complex, farmers and nurseries might hesitate to adopt new system. The cost of clean planting materials may be higher than traditional planting materials, which could be a barrier for some farmers. Scalability issue in terms of production of large quantity planting material from G1 stage (few plants) to G4 stage requiring long duration. Similarly may be difficult to scale up to reach more farmers and cover larger areas in the targeted period. Increasing virus and virus like organism spectrum over time would be challenge to for diagnosis and elimination. Establishing a system for monitoring and evaluating the program's impact may be a challenge as it depends on regulatory changes in laws or policies affecting agriculture. Overall, the CPP may face several challenges, but with careful planning, implementation, and monitoring, these challenges they can be addressed systematically. And eventually the program can achieve its goals of transforming the lives of Indian farmers, improving their livelihoods and contributing to the country's horticultural growth and development. Since the program partners with other organizations and stakeholders to increase its impact and reach achieving objective in mission mode is not implausible.

Healthy and genuine planting material is the first step for a successful crop production, and this becomes all the more important in horticultural crops which are perennial

The program focuses on providing farmers with certified disease-free planting materials to boost crop yields, quality, and climate resilience.

By increasing crop yields and improving quality, CPP can contribute to improved food and nutritional security, promoting sustainable agriculture practices, reducing the environmental impact of farming.

About the Author:

The author is involved in Horticultural Research, administration and policy making aimed at skilling farmers to create next-gen farmers with latest technological developments in farming, agri-business & market intelligence.



Gujarat Natural Farming Science University Halol, Dist. Panchmahal (Gujarat)

To strengthen and expand natural farming, thereby reducing the use of synthetic chemicals and promoting clear benefits to soil and human health.



OUR MISSION

To promote Natural Farming practices, emphasizing the sustainable use of natural resources for the well-being of farmers and rural tribal communities in India, through soil conservation to enhance environmental quality.

COURSES OFFERED

1. B.Sc. Agri. (Hons.) Natural Farming
2. M.Sc. Natural Farming

COLLEGES

1. College of Natural Farming, Halol
2. College of Natural Farming, Amreli

ACTIVITIES

- For training, 40 farmers from each district of Gujarat have been selected to establish District-Wise NF Resource Centers, where they will train local farmers.
- A total of 383 five-day residential training sessions were conducted to train 11,469 Krishi Sakhis in Gujarat, with 1,050 to be selected as para-extension workers at the village/cluster level.
- Working as implementing agency for formation and promotion 10,000 FPOs.
- The university has executed 16 different extension approach, benefiting over 57,000 beneficiaries in a year
- The university has adopted five villages to provide guidance and resources for promoting Natural Farming practices.
- Under the Nagarvan project by the Social Forestry Department, the university established various biodiversity models by planting 28,000 plants from over 90 different species on its campus.
- The Ministry of Agriculture, GoI, designated GNFSU as a Center of Natural Farming to train scientists and FMTs of the western states of India under NMNF.

MoUs

GNFSU has conducted MoUs with 28 different organizations, including SAUs, corporate entities, and religious organizations, for collaboration in research, extension, and education in Natural Farming.

FACILITIES

- Well-equipped farmer training Centre
- University Bhavan
- PG institute
- Hostels
- Residence (Completed Soon)
- Bio-Input Lab
- Gaushala (Indigenous Breed)

RESEARCH

1. Comparative Assessments on effect of Natural Farming and Conventional Farming Practices on soil health
2. Experiment aims to develop a package of practices for field and horticultural crops.
3. For research, 50 practicing natural farmers from Gujarat have been selected to conduct research and assess the impact of NF practices on soil health at farmers' fields.
4. Qualitative and quantitative studies of dung and urine from different breeds
5. Testing and validation of farmers innovations.
6. Research on validation of Natural Farming Bio-Inputs in various crops.
7. Effects of NF practices on soil/plant health and crop production
8. Indigenous seed collection, improvement and multiplication.
9. Breeding of positive millet focuses on developing high-yielding, climate-resilient, and nutritionally enhanced millet varieties



www.goau.gujarat.gov.in Reg@gnfsu.edu.in | Dee@gnfsu.edu.in +91 9033427963

Gujarat Natural Farming Science University At. Po. Halol, Taluka Halol, Block Halol, Dist. Panchmahal. Pin Code: 389350

Sustainable Agriculture Practices and Soil Health: Cornerstones for Viksit Bharat



DR PRAFULL GADGE
Founder & Managing Director
BIOME TECHNOLOGIES

India, with its vast agrarian roots and a population heavily dependent on agriculture for livelihood, stands at a pivotal crossroads. As the nation envisions a future of inclusive growth and prosperity under the banner of Viksit Bharat (Developed India), one area that demands immediate and sustained attention is agriculture. In particular, the adoption of sustainable agricultural practices and the preservation of soil health are crucial for ensuring food security, environmental balance, and long-term economic stability.

The Need for Sustainable Agriculture in India

India's agricultural sector contributes significantly to the GDP and employs over 40% of the workforce. However, over the years, challenges such as overuse of chemical fertilizers and pesticides, depleting groundwater, soil degradation, and the impacts of climate change have threatened the sustainability of agriculture.

Sustainable agriculture refers to farming practices that meet the current food and textile needs without compromising the ability of future generations to meet their own needs. This involves methods that are environmentally sound, economically viable, and socially responsible.

As India strives to become a developed nation, sustainable agriculture is not a choice but a necessity. It ensures the longevity of natural resources, improves farmer incomes, and protects biodiversity.

Soil Health: The Foundation of Sustainable Agriculture

Soil is more than just a medium for plant growth; it is a living, dynamic system that plays a vital role in the ecosystem. Healthy soil is rich in organic matter, teeming with microbial activity, and capable of retaining moisture and nutrients. Unfortunately, years of intensive

farming, monocropping, excessive tillage, and unbalanced use of fertilizers have led to severe soil degradation across many parts of India.

According to the Indian Council of Agricultural Research (ICAR), nearly 30% of India's total land area is degraded. Loss of soil fertility directly impacts agricultural productivity, leading to higher input costs and lower yields, thus exacerbating the agrarian crisis.

Restoring and maintaining soil health and soil microbial health is therefore fundamental to achieving the goals of Viksit Bharat.

Key Sustainable Agriculture Practices to Improve Soil Health

1. Organic Farming: By eliminating chemical fertilizers and pesticides, organic farming improves soil structure and fertility. The use of compost, green manure, and crop residues enhances the organic content of soil and supports microbial diversity.

2. Crop Rotation and Diversification: Rotating different crops helps break pest and disease cycles, improves soil nutrients, and reduces dependency on chemical inputs. Leguminous crops, in particular, fix atmospheric nitrogen and enrich the soil.

3. Integrated Nutrient Management (INM): This approach combines organic, inorganic, and biological sources of nutrients in a balanced manner. It ensures optimal crop growth and sustains soil fertility in the long run.

4. Conservation Tillage: Reduced or zero tillage minimizes soil disturbance, preserves soil structure, and reduces erosion. It also enhances water retention and carbon sequestration in the soil.

5. Agroforestry: Integrating trees with crops and livestock not only increases biodiversity but also stabilizes the soil, prevents erosion, and improves nutrient cycling.

6. Use of Biofertilizers and Biopesticides: These are eco-friendly alternatives to chemical inputs. Biofertilizers like Rhizobium and Azotobacter enhance nutrient availability, while biopesticides help control pests without harming the environment.

7. Vermicomposting: The use of earthworms to convert organic waste into nutrient-rich compost is a sustainable and cost-effective way to boost soil fertility.

8. Water-Smart Techniques: Practices like drip irrigation, rainwater harvesting, and mulching conserve water and prevent over-irrigation, which can cause salinization and nutrient leaching.

Government Initiatives and Policy Support

The Indian government has launched several initiatives to promote sustainable agriculture and soil health. Some key programs include:

- **Paramparagat Krishi Vikas Yojana (PKVY):** Promotes organic farming through cluster-based approaches and farmer training.

- **Soil Health Card Scheme:** Provides farmers with detailed reports on soil condition and recommendations on crop-specific nutrients. It must include soil microbial health.

- **National Mission for Sustainable Agriculture (NMSA):** Aims to promote climate-resilient agricultural practices, soil and water conservation, and improved resource use efficiency.

- **Pradhan Mantri Krishi Sinchai Yojana (PMKSY):** Focuses on "More crop per drop" by improving irrigation infrastructure and efficiency.

For the dream of Viksit Bharat to become a reality, these policies must be effectively implemented at the grassroots level with active participation from farmers, NGOs, and the private sector.

The Role of Technology and Innovation

Technology has the potential to revolutionize sustainable farming in India. Precision agriculture using satellite imagery, GIS mapping, and IoT devices allows for optimized use of water and fertilizers. Mobile apps and AI-driven platforms can provide real-time advisory services to farmers, helping them make informed decisions.

Additionally, the use of drones for soil and crop health monitoring, blockchain for supply chain transparency, and genetic research for developing resilient crop varieties are promising innovations.

Empowering Farmers for a Sustainable Future

Farmers are at the heart of any agricultural transformation. For sustainable agriculture to take root, capacity building, awareness programs, and financial support are essential. Training farmers in best practices, encouraging the formation of Farmer Producer Organizations (FPOs), and ensuring access to markets and credit can significantly boost adoption.

Youth engagement in agriculture, especially through agri-tech startups, should be encouraged. A vibrant, tech-savvy, and environmentally conscious farming community will drive the engine of a developed India.

Conclusion

As India marches toward the vision of Viksit Bharat, ensuring sustainable agriculture and restoring soil health must be top priorities. These not only secure the nation's food and nutritional security but also build resilience against climate change and economic instability.

By embracing sustainable practices, leveraging technology, and empowering farmers, India can transform its agricultural sector into a model of efficiency, equity, and environmental stewardship — laying a strong foundation for a truly developed and self-reliant Bharat.

Role of Animal Agriculture in Viksit Bharat



DR PANKAJ KUMAR SHUKLA
Professor & Head, DUVASU, Mathura

Role of Animal Agriculture Towards Viksit Bharat

As India charts its path towards a Viksit Bharat (Developed India) by 2047, the role of animal agriculture is crucial in shaping the nation's future. Animal agriculture contributes significantly to food security, rural livelihoods, economic growth, and sustainability, making it a critical pillar in achieving India's vision of a developed and prosperous nation.

1. Animal Agriculture as a Catalyst for Economic Growth

Animal agriculture is an essential part of India's agricultural landscape, contributing over 30% to the Gross Value Added (GVA) in agriculture and allied sectors. The sector supports over 100 million rural households, playing a vital role in reducing poverty and improving the standard of living in rural India. By expanding the scope of livestock, poultry, dairy, and aquaculture, the sector can drive economic transformation, creating jobs, boosting trade, and promoting entrepreneurship.

India is a major producer of milk, eggs, meat, and leather, and animal products contribute significantly to both the national economy and global markets. India is currently the world's largest producer of milk, and its dairy sector is among the fastest-growing, contributing over \$120 billion to the national GDP. Similarly, India ranks second among the top producers of poultry and eggs, which not only ensure nutritional security but also enhance trade opportunities for the country.

2. Food and Nutritional Security: A Pillar for Public Health

Animal agriculture plays an indispensable role in ensuring food and nutritional security in India. As the population grows and urbanization increases, the demand for affordable and nutritious food is escalating. Animal-based foods—especially milk, eggs, and poultry meat—are rich sources of high-quality protein, vitamins, and essential nutrients that help combat malnutrition and undernourishment, which are still prevalent in parts of the country.

Milk is a critical dietary component for millions, especially in rural and semi-urban areas, where dairy farming is a primary livelihood. Eggs and poultry are

not only affordable sources of protein but also easily digestible, making them essential to tackling issues such as iron-deficiency anaemia, which affects millions of women and children in India. A strong and sustainable animal agriculture sector can bridge the nutritional gap by making nutritious food more accessible and affordable to the underserved and marginalized populations.

3. Livelihoods and Empowerment: Strengthening Rural Economies

One of the most significant contributions of animal agriculture is its role in providing livelihoods to millions of rural households. In India, a large portion of the population, especially women, are directly involved in backyard poultry farming, dairy farming, and small-scale livestock rearing. For smallholders and landless farmers, livestock is a vital asset that acts as a buffer against economic shocks, such as crop failures, and offers a steady cash flow through milk, eggs, and meat production.

In the context of a Viksit Bharat, animal agriculture is instrumental in women's empowerment. The sector provides income-generation opportunities for women through dairy farming, poultry farming, and animal husbandry, which they manage from home or in collaboration with other farmers. Women's Self-Help Groups (SHGs) in rural India have significantly contributed to the growth of animal agriculture by facilitating access to credit, markets, and training. By encouraging greater involvement of women in livestock-based activities, India can promote gender equality and ensure socio-economic inclusivity in its development journey.

4. Contribution to Export Markets: Enhancing India's Global Presence

Animal agriculture is not only a source of food and livelihood but also a key driver of export earnings for India. Products such as dairy, meat, leather, and poultry constitute a substantial part of India's agricultural exports. With the growing global demand for antibiotic-free, sustainable, and quality-controlled animal products, India has the opportunity to position itself as a major exporter to regions such as the European Union, Middle East, and Southeast Asia.

As global consumers become increasingly aware of the health risks associated with antimicrobial resistance (AMR), the demand for AMR-free and sustainably produced animal products is rising. India's animal agriculture sector, by adopting international best practices in antibiotic stewardship, biosecurity, and sustainability, can cater to this demand and secure a larger share of the global market. Achieving export-readiness through certification schemes, traceability, and quality assurance systems will ensure that India's animal products meet the highest global standards.

5. Sustainable Agriculture: Climate Adaptation and Circular Economy

The future of animal agriculture in a Viksit Bharat is closely tied to sustainability and climate resilience. Climate change poses significant challenges to agriculture, with extreme weather events, temperature fluctuations, and water scarcity affecting both crop and livestock production. However, livestock farming plays an important role in climate adaptation by integrating with crop production systems, such as integrated farming and agroforestry, to improve soil fertility and increase agricultural productivity.

Furthermore, the sector contributes to the circular economy through waste management practices such as manure composting, biogas production, and organic fertilization. Proper management of animal waste can help reduce greenhouse gas emissions and pollution while simultaneously providing renewable energy and organic fertilizers for farming. This circular approach ensures the sustainability of the sector and contributes to India's goals of becoming carbon neutral by 2070.

6. Policy Framework and Governance for a Viksit Bharat

To ensure the growth and success of animal agriculture, robust policy frameworks and governance mechanisms must be in place. Policies that focus on veterinary health, feed security, breeding improvements, and disease control will create an enabling environment for farmers. The government's support for breed improvement programs, fodder availability, and veterinary infrastructure will further strengthen the sector.

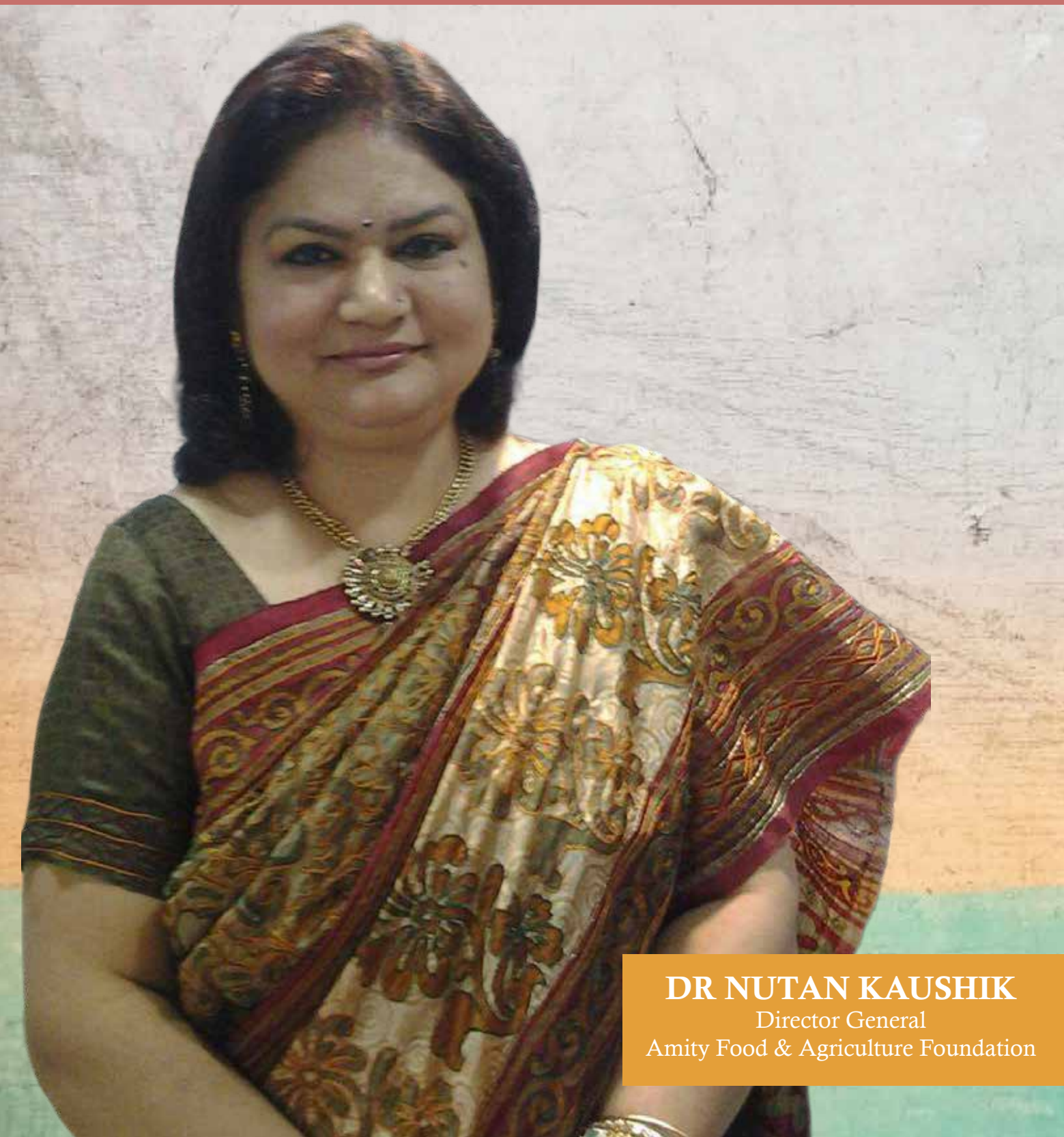
A comprehensive AMR (Antimicrobial Resistance) action plan, combined with biosecurity measures, will ensure that antibiotic use in livestock is regulated, preventing the development of resistance while maintaining animal health. Moreover, policies that promote public-private partnerships for agri-tech innovations, value-added processing, and farmers' training programs can create a sustainable and competitive livestock sector.

Conclusion: Animal Agriculture as a Pillar of Viksit Bharat

As India aspires to become a Viksit Bharat by 2047, animal agriculture is central to this vision. By harnessing the potential of the dairy, poultry, and livestock sectors, India can achieve food security, sustainable livelihoods, and economic growth. Through innovations, policy reforms, and market integration, animal agriculture can help drive inclusive and equitable development, support India's aspirations for global leadership, and provide the foundation for a prosperous and resilient future.

The transformative power of animal agriculture lies in its ability to address the nation's core needs—nutrition, livelihoods, economic resilience, and sustainability. By prioritizing this sector, India will not only uplift millions of farmers but also strengthen its position in the global food and agricultural markets, propelling the nation towards a Viksit Bharat.

Role of Agriculture in Rural Development in India under Viksit Bharat



DR NUTAN KAUSHIK
Director General
Amity Food & Agriculture Foundation

India's agriculture and allied activities accounted for approximately 16 percent of India's gross domestic product at current prices in FY 2023–24 (PE) and provided livelihood to about 46.1 percent of the workforce in 2023–24, underscoring its centrality to rural livelihoods even as India urbanizes and diversifies. Over the past five years, the sector has sustained an average annual growth rate of 4.18 percent at constant prices, reflecting resilience amid global headwinds, and in the first half of FY 2024–25 is growing at 3.5 percent in Q2, buoyed by robust Kharif output and favorable monsoons. The Central Sector Scheme for the Formation and Promotion of 10,000 Farmer Producer Organisations (FPOs) was launched by the Prime Minister on 29 February 2020 with a budget outlay of ₹6,865 crore till 2027–28. As of 30 June 2024, a total of 8,875 FPOs have been registered, mobilizing 1.97 million shareholder farmers with a cumulative paid-up capital of ₹630.3 crore, equity grants of ₹210.1 crore, and credit guarantee cover amounting to ₹50.4 crore; some 6,374 professional CEOs have been appointed, and nearly 3 million farmers (40 percent women) are now transacting business worth thousands of crores through these FPOs.

The One District One Product (ODOP) initiative has identified 1,102 unique products across 761 districts, promoting localized specialization to boost rural incomes and entrepreneurship. In Uttar Pradesh, leveraging this model, ODOP exports climbed from ₹86,000 crore in 2017 to an estimated ₹2 trillion by mid-2024, illustrating how district-level branding and value addition can transform local economies.

Under the Pradhan Mantri Formalisation of Micro Food Processing Enterprises (PMFME) scheme (2020–25), micro units receive credit-linked subsidies, technical and marketing assistance, and handholding support; with a ₹10,000 crore outlay, 92,549 micro food processing enterprises have been sanctioned for assistance as of 30 June 2024, enabling them to modernize and expand

operations.

The Pradhan Mantri Kisan SAMPAD A Yojana has underpinned large-scale infrastructure development, sanctioning 41 Mega Food Parks, 399 cold chain projects, 76 agro-processing clusters, 588 food processing units, 61 backward and forward linkage projects, and 52 Operation Greens projects by June 2024, thereby reducing post-harvest losses, generating rural non farm employment, and integrating farmers into value chains.

India originally notified 60 Agri Export Zones across 20 states between 2001 and 2005 to create specialised coastal and hinterland clusters focused on niche commodities; these zones have since completed their intended five year span, marking an early but valuable experiment in cluster based export promotion.

The nation's agricultural exports have soared from USD 0.6 billion in FY 1987–88 to USD 26.7 billion in FY 2022–23 under the stewardship of APEDA, at a compound annual growth rate of 12 percent, while overall agri food exports reached USD 53.1 billion in FY 2022–23. Despite curbs on staples such as rice and wheat to rein in domestic prices, exports held at about USD 50 billion in FY 2023–24, as India diversified into oilseeds, fruits and vegetables, and processed foods.

Fresh fruit and vegetable exports alone have surged 47.3 percent in volume between FY 2019–20 and FY 2023–24, driven by APEDA's financial assistance for packhouses, cold chain infrastructure, quality testing, and market development, and opening 17 new markets over the last three years.

Under the Viksit Bharat vision for 2047, these initiatives—combining collective action through FPOs, district level specialization via ODOP, food processing formalisation, robust infrastructure under PMKSY, and dynamic export promotion—are charting a course for a prosperous, inclusive, and resilient rural economy, unlocking India's full agrarian potential.

Agricultural policy and budgetary re-orientation for a “Viksit” Bharat

India, despite being a world leader in the production of agriculture, horticulture, spices and condiments, milk, egg and fish, has a poor share in world exports amounting to barely 6.84 per cent. Productivity and yield is less than a third in that of competing companies, and the domestic market in most commodities is protected by high tariff walls. This scenario of un-competitiveness is of concern. Furthermore, much of agriculture and horticulture produce (about 10 per cent) is lost due to post harvest, processing and logistics infrastructure related gaps. Also, the sector is besotted with constraints in terms of uneconomically sized and fragmented land holdings, as well as excessive dependence on rainfed cultivation. In this setting, policy needs to broadly focus on augmenting the agriculture (and allied activity) sector's contribution to the GDP through productivity enhancements and reducing post-harvest losses, increasing penetration into global markets, and simultaneously contributing to farmers' livelihood and inclusive growth.

Productivity increase may be facilitated by ensuring access to quality inputs related to seeds, pesticides, fertiliser, animal feed inputs, as well as to adequate advisory and extension services. FPOs may also serve as convenient facilitator platforms in this context. Watershed development, micro-irrigation systems, farm mechanisation, solar/electric fencing (for horticulture produce), and post-harvest facilities are other necessary infrastructure and critical investment options. These initiatives could considerably enhance the sector's contribution to GDP by at least 30-40 per cent.

However, the related Agriculture (and allied activities) component of the budget remains focused on increasing the disposable income with farmers through Direct Benefit Transfers (DBTs), subsidising fertiliser inputs, and

offering MSP. In fact, of the INR 5.3 lakh crore related budgetary outlay only INR 20,000 Cr is at best oriented towards productivity enhancing infrastructure and investment. About INR 40,000 Crore is the outlay on credit and insurance for agriculture activities. Notably, related outlays in productive investment in countries like China is over 14 per cent of budgetary spend on the sector. There is therefore need for re-orienting budgetary and scheme outlays to enhance the efficiency of investment in the Incremental Capital Output Ratio (ICOR) for the country. The ICOR basically reflects the incremental change in output for a given incremental change in investment at the national level. This will help India realise Viksit Bharat status perhaps even before 2047, and also with lower rate of GDP growth than the envisaged difficult to realise 8 per cent and more per annum as envisaged in the economic survey.

Increased investment in productivity enhancing options will therefore increase competitiveness for exports as well as increase the sector's contribution to GDP, and favorably reduce the ICOR from the present 4.5 to realise a "Viksit Bharat" status comfortably. Essentially, the National per capita income needs to rise from USD 2900 to USD 30,000 for India to realise developed economy credentials of a Viksit Bharat in a couple of decades or sooner. As per the Economic Survey 2025, in order to realise a growth rate of 8 percent per annum, there is a need to increase the Gross Domestic Investment (GDI) as a proportion to GDP from about 30 per cent presently to 35 per cent. Alternatively, or complementarily, increasing productivity and the very efficiency of investment will complement the growth trajectory.

While policy makers in the government understand the potential of investment-fuelled growth, budgetary

allocations evidently reflect a leaning towards the alternative consumption-fuelled growth. The INR 1 lakh odd crore in the hands of the urban middle class as additional disposable income

ensured by the increase in the Personal Income Tax (PIT) slab in the budget is also an initiative along these lines. The INR 63,500 crore spend under the PM Kisan Samman Nidhi only further magnifies this initiative. The concern is of fore-saking the investment stimulus in infrastructure spend and necessary spend on increasing field-level implementation of productivity enhancing options. The savings and investment multiplier in India at about 3.3 will certainly magnify the consumption spend. The concern, however, is of fore-saking the option of long-term growth that comes from investment in physical, technical, as well as logistical infrastructure. Long term stimulus to growth is unfortunately foreseen in this context. There is therefore, progressively need for appropriate re-orientation of policy and budgetary outlays.

V PADMANAND

Partner and Agriculture Industry Leader,
Transformation Consulting, Grant
Thornton Bharat



Agriculture: The Cornerstone of Holistic and Sustainable Development for a Viksit Bharat

India, a land rich in tradition, culture, and diversity, has always held agriculture at the heart of its economy and societal structure. As the nation envisions *Viksit Bharat* a developed, inclusive, and self-reliant India by 2047 the significance of agriculture cannot be overstated. Agriculture is not merely a sector; it is the backbone of rural livelihoods, food security, and ecological balance. By integrating sustainable agricultural practices and

and ensures food sovereignty. For a country aiming to become a global leader, the transformation of agriculture is pivotal—not just through increased productivity but through ecological and social sustainability.

The Growing Demand and Production Requirement With India's population expected to exceed 1.7 billion by 2047, food and nutritional security remain top priorities. It is estimated that India will need to produce more than



SURYAM CHAPARA
Head Marketing, JIVAGRO

promoting holistic rural development, India can chart a path toward inclusive growth, environmental stability, and long-term prosperity.

Agriculture: The Foundation of India's Economy

Agriculture continues to employ over 40% of the Indian workforce and contributes significantly to the GDP, especially in rural areas. Beyond its economic role, agriculture shapes social dynamics, sustains traditions,

450 million tonnes of food grains by 2050, a significant leap from the current 330 million tonnes. This growth must also include diverse food groups such as pulses, oilseeds, fruits, vegetables, and protein sources.

To achieve this, agricultural productivity must increase without degrading the environment, calling for a shift toward more sustainable and climate-smart farming methods.

Bridging the Gaps: Challenges in Achieving Production Goals

Despite several advancements, India still faces key challenges:

- **Yield Gaps:** Major crops in India often produce less per hectare compared to global standards.
- **Losses from Pests and Diseases:** Nearly 20–30% of crops are lost annually due to biotic stress.
- **Climate Vulnerability:** Erratic monsoons, temperature fluctuations, and extreme weather impact farming outcomes.
- **Post-Harvest Losses:** Lack of cold chains, poor infrastructure, and inadequate processing facilities lead to significant food wastage.
- **Resource Depletion:** Overuse of groundwater, chemical fertilizers, and poor soil management affect long-term productivity.

Role of Crop Protection Companies

To bridge these productivity gaps sustainably, crop protection companies play an essential role:

- **Reducing Crop Losses:** Through effective pest and disease management, they help safeguard crops and ensure stable yields.
- **Promoting Sustainable Solutions:** Increasing use of bio-pesticides, residue-free formulations, and Integrated Pest Management (IPM).
- **Farmer Training:** Educating farmers on safe, precise, and environmentally sound application methods.
- **Enabling Innovation:** Many companies invest in R&D for climate-resilient crop protection solutions that align with sustainable farming practices.

These efforts are vital for reducing farm losses, enhancing productivity, and ensuring safer food systems.

Collaborate with Government Initiatives to Ensure Sustainable Food Security.

The Indian government has launched several flagship schemes and initiatives aimed at building a resilient, productive, and sustainable agricultural sector:

- **Paramparagat Krishi Vikas Yojana (PKVY):** Promotes organic farming and eco-friendly inputs to reduce chemical dependency.
- **Pradhan Mantri Krishi Sinchai Yojana (PMKSY):** Aims at “Har Khet Ko Pani” by improving water use efficiency and promoting micro-irrigation.
- **National Mission on Sustainable Agriculture (NMSA):** Focuses on climate-resilient agriculture through soil health cards, agroforestry, and integrated farming systems.
- **PM-KISAN and PMFBY:** Ensure financial support and

risk mitigation through direct income support and crop insurance schemes.

• **Digital Agriculture Mission:** Promotes the use of AI, IoT, and GIS technologies to modernize farming practices and decision-making.

These initiatives reflect a shift toward sustainability, resource efficiency, and income security for farmers. Crop protection companies should

Steps Ahead: From Food Security to Global Food Leadership

While domestic food security remains paramount, India is also poised to play a larger role in global food security. Being one of the largest producers of rice, wheat, spices, pulses, and dairy, India has steadily increased agricultural exports, contributing to world food supplies.

Key steps in this direction include:

- **Agricultural Export Policy:** Aimed at diversifying export baskets, removing restrictions, and promoting export-oriented farming.
- **Infrastructure Support:** Development of Agri Export Zones (AEZs), mega food parks, and cold chain logistics under schemes like PM-FME.
- **Global Standards and Traceability:** Promotion of Good Agricultural Practices (GAP), organic certification, and blockchain-based traceability to meet international food safety norms.
- **Engagement in Global Food Diplomacy:** India has provided food aid and wheat exports to multiple countries, underlining its potential as a reliable global food supplier.

By increasing agri-exports, India not only boosts rural incomes and foreign exchange reserves but also contributes to the global fight against hunger and malnutrition.

Conclusion: Sowing the Seeds for a Viksit Bharat

As India marches toward its centenary of independence, the vision of a Viksit Bharat must be grounded in inclusive, sustainable, and transformative agricultural development. Achieving the required food production to feed a growing population while protecting natural resources is a balancing act—and agriculture sits at the core of it.

With continued government support, innovation in crop protection, sustainable practices, and a strong push toward exports, Indian agriculture is not only ensuring food for its citizens but also emerging as a global pillar of food security.

Let us drive today for a better tomorrow—green, inclusive, resilient, and truly Viksit.

Cattle-Based Agriculture: A Holistic Path to Sustainable Development and a Viksit Bharat

India's vision of becoming a Viksit Bharat—a developed, self-reliant, and sustainable nation—cannot be realized without transforming the backbone of our economy: agriculture. Our farmers, soil, water, and cattle form an intricate system that has sustained us for centuries. The future lies not in abandoning this legacy, but in reviving and refining it to meet modern challenges.

The Modern Agricultural Dilemma

While the Green Revolution brought a temporary increase in food production, it also left behind a trail of ecological and human health issues. Excessive use of synthetic fertilizers and pesticides degraded the soil, polluted water bodies, and caused a decline in biodiversity. The modern Indian farmer is now caught in a cycle of debt, dependency, and despair. Worse still, our food—once revered as medicine—has become a carrier of toxins, directly affecting the health of the population.

A critical, yet often ignored, aspect of this health crisis is the impact of chemically-grown food on liver function. The liver is the body's detoxification powerhouse. When we consume food laced with pesticide residues or synthetic additives, the liver is burdened with neutralizing these foreign substances. Over time, this can lead to impaired liver function, reduced immunity, and lifestyle diseases like fatty liver, diabetes, and even cancer.

This is why nutrition and liver health must be placed at the center of our agricultural planning. The path to a healthy India begins from the field.

Cattle: The Forgotten Foundation of Sustainable Farming

In my decades of hands-on farming experience, I have revived and refined India's traditional cattle-based agricultural model. In this model, desi cows are not just milk producers; they are life-nurturing engines of soil fertility, water conservation, and plant nutrition.

When cattle are allowed to roam freely on farmland, their

dung, urine, and hoof movement interact naturally with the soil. Decomposed dung not only acts as a powerful organic fertilizer but also creates microscopic holes in the soil that act as water harvesting pits. Rainwater percolates deep underground—up to 15 feet—creating a subterranean reservoir of moisture. Plants draw this moisture upward through capillary action and vapor percolation, reducing the need for surface irrigation.

This zero-energy, zero-expense irrigation system supports crops even during dry spells and significantly boosts soil microbial life, which in turn enhances the nutrient content of the food. Healthy soil yields healthy crops—and healthy crops support strong human organs, especially the liver, which depends on a clean, chemical-free diet to function properly.

Self-Sustaining and Zero-Budget: A Model That Works

My approach doesn't stop at ecology. It solves the economic crisis of farming too. I do not sell milk; instead, I leave it for the calves. This strengthens the calves, enabling early puberty (between 16–20 months), compared to the national average of 36 months or more. These healthy young animals grow quickly and can be sold by the third calving, creating regular income.

This self-sustaining cycle requires no loans, no fertilizer purchases, and no irrigation costs. My only investment is trust in nature's rhythm and the nurturing power of cattle. This model eliminates financial stress and ensures food security for the farmer's family.

Holistic Development through Agriculture

A truly Viksit Bharat must rise from the villages. Development is not only about urban growth and digital transformation—it is about nutritional security, water conservation, soil regeneration, rural income stability, and public health. Agriculture intersects all these areas:

Nutrition: Naturally grown crops—especially when

nurtured by cattle dung—retain essential micro and macronutrients, antioxidants, and enzymes that support not just general health but specific liver detox functions.

Liver Health: Chemical-free food lowers the toxic burden on the liver, reducing risks of liver disease, improving metabolism, and supporting hormonal balance.

Water Security: The cattle-based water harvesting system drastically reduces groundwater extraction and improves resilience against drought.

Education & Social Upliftment: Economically stable farmers are more likely to educate their children and break the generational cycle of poverty.

Employment: Youth trained in sustainable farming, veterinary care, and organic produce marketing can build livelihoods rooted in the village ecosystem.

Cattle as Brand Ambassadors of Swachh Bharat

Cattle do not just enrich the farm—they naturally uphold the goals of the Swachh Bharat Mission. They purify the soil, help recycle organic waste, and contribute to carbon sequestration through pasture-based grazing. Their role in keeping air, water, and soil clean is unmatched. I humbly urge our Hon'ble Prime Minister to declare indigenous cattle as natural brand ambassadors of Swachh Bharat and give them rightful representation on the mission's national portal.

A Call for Collaboration and Implementation

This indigenous cattle-based regenerative model is not theory. It is real, it is working, and it is scalable. I am ready to support farmers, institutions, NGOs, and governments in implementing this model across India—especially in water-scarce and resource-poor districts.

Agricultural universities should incorporate this system into their curriculum, and young minds must be inspired to see farming not as a fallback career, but as the most noble and futuristic profession of all.

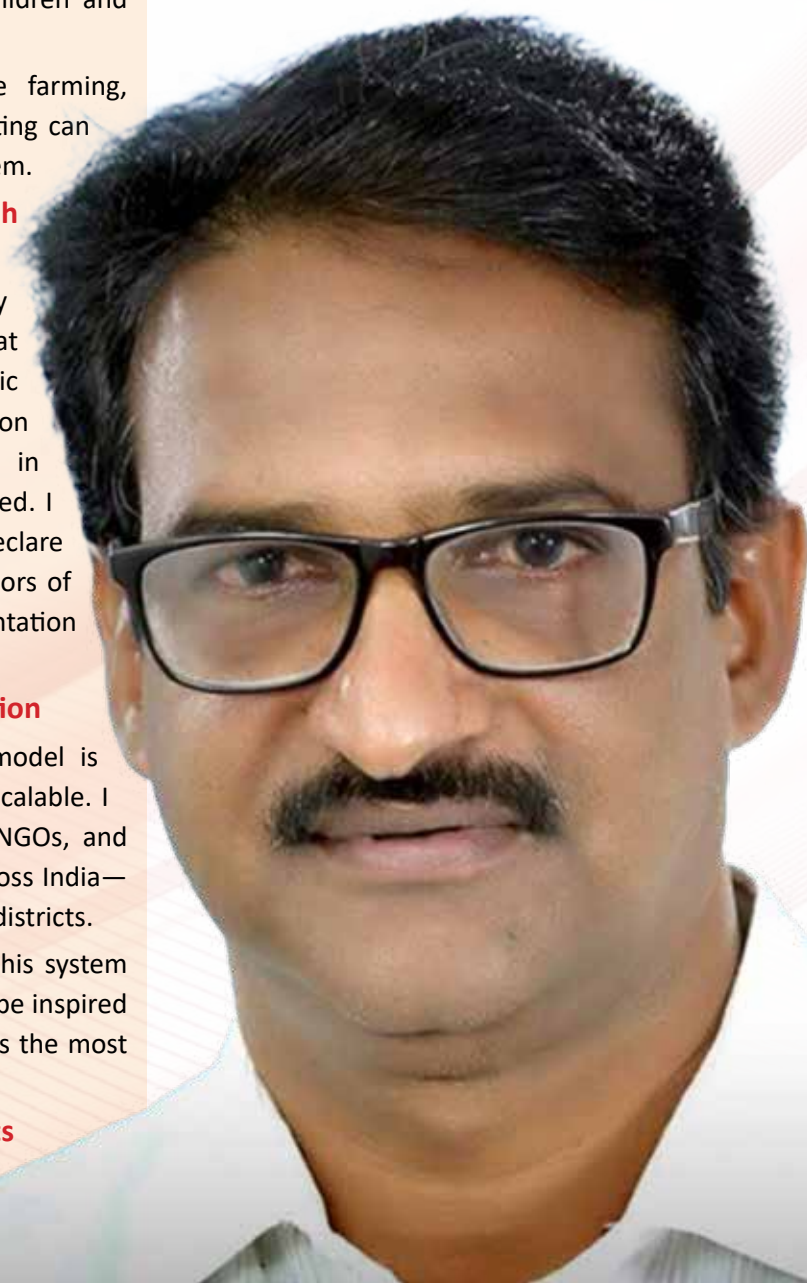
Conclusion: Building Bharat from Its Roots

A Viksit Bharat must not forget its soul. True development is that which sustains not just this generation, but the next seven. Let our progress be guided

by sustainability, self-reliance, and sanctity of nature. Let our villages prosper through cattle, clean food, and chemical-free soil. Let our liver and our land be healed by the same humble force: the Indian cow.

This is not a return to the past—it is a leap into the future with the wisdom of our ancestors in hand.

Jai Go-Mata. Jai Kisan. Jai Bharat.



SATISH BABU GADDE

Pioneer of Cattle-Based Regenerative Agriculture

Cycle of Debt: How Climate Change is Driving Farmers Deeper into Financial Crisis



DR ELIA JAFAR
Humanitarian and Development Professional

In the not-so-distant past, the dependence on rains for crops was not just common- it was natural. The recent years have seen an unprecedented drop in rainfed crop production which is concerning. By 2080, yields of staple crops like wheat and rice could decrease by 40% and 47%, respectively, threatening the livelihood of millions of Indians who rely on agriculture. These days, farmers deal with a disastrous combination of issues, including erratic weather patterns, rapidly rising expenses, and an acute shortage of financial assistance, which forces them into enormous amounts of debt.

Due to chronic droughts, sudden flooding, and changing planting seasons, rain patterns have become severely unpredictable, making it difficult for farmers to adjust. As yields decline and entire harvests fail, those who depend on rainfall look on hopelessly. Many farmers have to take up loans in order to maintain their farms and provide for their families. Every year, the cost of seeds, fertilizer, and insecticides rises. Desperate farmers turn to local moneylenders, who demand outrageous interest rates and keep them in a never-ending cycle of borrowing, when banks reject them.

In India, the average debt of a farming household was ₹74,121 by 2019. This presents a serious threat to small farmers. Additional loans are frequently given at the expense of their land after repeated crop failures. They are forced to make the difficult choices regarding selling their ancestral land, moving to a city, or, in the worst situations, taking their own lives when debt accumulates and repayment becomes unaffordable.

Many farmers remain vulnerable despite government programs like the Pradhan Mantri Fasal Bima Yojana, which attempted to offer crop insurance but included complex paperwork and limited outreach. Although the Kisan Credit Card program gave low-cost credit, many people cannot manage to afford it due to strict eligibility

standards and lengthy processing times. At the same time, these safety nets are being swamped by the rising frequency of climate calamities. Farmers are left open to the next crisis because, when compensation does come, it rarely covers genuine losses.

Financial pressures extend beyond loans. Labor costs, electricity bills, and transportation expenses continue to rise, eating away at already thin profit margins. Without proper storage facilities, small farmers must sell immediately after harvest when prices hit rock bottom. Predatory middlemen dominate agricultural markets, ensuring farmers receive pennies on the dollar for their produce.

Breaking this devastating cycle requires urgent action. A combination of financial support, climate resilience measures, and institutional credit access is essential.

- **Leverage MGNREGA for climate resilience.** The program includes 164 agricultural projects focused on natural resource management. Rainwater harvesting, micro-catchment development, and soil conservation efforts can boost productivity while providing off-season employment, reducing dependency on loans. These initiatives also help regenerate damaged land and improve soil health.

- **Expand drip irrigation through PMKSY.** Water conservation benefits are enormous—farmers use water more efficiently, see better yields, and spend less on inputs. Investing in rural water storage would further buffer against erratic rainfall.

- **Increase access to Kisan Credit Cards.** Small farmers desperately need institutional credit to escape predatory moneylenders. Simplifying applications and expanding coverage would make affordable loans accessible. Fair, transparent loan recovery practices must prevent further harassment of struggling farmers.

- **Deliver input subsidies directly to farmers.** Digital

bank transfers for fertilizers, seeds, and pesticides would bypass middlemen. Encouraging organic farming methods would reduce reliance on expensive chemicals while improving long-term soil health.

- **Support women farmers.** Despite forming a large part of the agricultural workforce, women lack land ownership, credit access, and training opportunities. Targeted education and financial support would strengthen entire rural communities. Cooperative models and self-help groups could improve women's access to markets.

- **Implement targeted debt relief.** Loan forgiveness provides immediate relief for farmers in crisis. While not solving underlying problems, restructuring repayment periods and reducing interest rates would prevent further financial ruin.

- **Improve market access.** Strong farmer-producer organizations help small farmers negotiate fair prices. Better storage facilities, cold chains, and direct market channels would reduce waste and boost earnings. Digital marketplaces connecting farmers directly with buyers could eliminate exploitative middlemen.

- **Promote crop diversity and climate-resilient farming.** Dependence on a single crop leaves farmers vulnerable to disaster. Government extension services should promote drought-resistant varieties and agroforestry models that ensure long-term sustainability.

- **Build rural financial literacy.** Many farmers remain unaware of existing government schemes that could help them. Local programs teaching fundamental financial knowledge would help farmers make smarter decisions about loans, insurance, and savings.

- **Encourage community risk-sharing.** Cooperatives and self-help groups allow farmers to pool resources and distribute risk. This improves access to credit, enables bulk purchasing at lower prices, and strengthens negotiating power with buyers.

Climate change already threatens millions of farming families. Without immediate action, the debt spiral will only worsen, devastating rural communities. Securing farmer livelihoods and ensuring food security requires a comprehensive approach—financial support, infrastructure development, and policy reform. The time to act is now, before more farmers lose their land, their hope, and their lives.

ABOUT DR. EILIA JAFAR

Humanitarian and Development Professional

True leadership is about creating positive change and empowering those most in need. Dr. Eilia Jafar has lived this principle through her work over the past two decades in disaster management and humanitarian efforts. Her career covers governance, climate change adaptation, and gender inclusion. With a strong academic foundation in management, engineering, and interdisciplinary studies, Dr. Jafar tackles complex challenges faced by vulnerable populations, especially in disasters. Her dedication is a testament to her commitment to improving lives and communities globally.

Starting with a Bachelor of Technology in Civil Engineering from Aligarh Muslim University, Dr. Jafar's educational journey continued with an MBA and later specialized in Disaster Mitigation through a Master of Science from Sikkim Manipal University. She also earned a Ph.D. in Business Continuity Management in Health Facilities from GGSIP University, New Delhi. This diverse academic foundation has been instrumental in her work in disaster management and public health.

In her role at CARE India, Dr. Jafar led the Disaster Management Unit, where she was instrumental in setting strategic goals, developing action plans, and overseeing large-scale projects related to disaster and conflict management. Her efforts extended to the development of standard operating procedures and strategic

programming frameworks, significantly enhancing the organization's impact.

Dr. Jafar's tenure with the International Federation of Red Cross and Red Crescent Societies (IFRC) further showcased her leadership in disaster risk reduction across South Asia. As the Regional DRR Manager, she provided technical support and capacity building to national societies in eight countries. Her initiatives included developing advocacy training curriculums, conducting community awareness programs, and integrating disaster risk reduction into core programs, thereby strengthening community resilience.

At SaveLIFE Foundation, Dr. Jafar served as the Chief Programs Officer, where she oversaw policy research and the on-ground implementation of programs focused on road safety and humanitarian work. Her leadership ensured that the organization's values were consistently demonstrated while enhancing systems for monitoring, learning, and evaluation to improve program quality.

Dr. Jafar's expertise has been sought in numerous consultancy assignments, including her role with the National Institute of Disaster Management (NIDM), where she contributed to the development of draft Adaptation Communications for COP27 and a thematic paper on adaptation. Her work with the German Federal Ministry for Economic Cooperation and Development (BMZ) involved a gender-sensitive evaluation of health infrastructure in India, underscoring the importance of gender inclusion in disaster management.

Her consultancy work also includes leading Oxfam India's Real-Time Review of the COVID-19 response and developing a training module on climate change for school children with ChildFund India. Throughout her career, Dr. Jafar has consistently emphasized the need to integrate gender and social inclusion into disaster management and humanitarian response efforts.

Dr. Jafar's influence extends well beyond India's borders. In 2015, she was selected for the prestigious International Visitor Leadership Program (IVLP), the U.S. Department of State's premier professional exchange program, recognizing her expertise and potential for global impact; she has participated in international missions in Nepal, Sri Lanka, Afghanistan, Bhutan, Pakistan, and Bangladesh. In Nepal, she supported the Nepal Red Cross Society in disaster management operation planning and developed a disaster risk reduction work plan. In Sri Lanka, she focused on capacity building for disaster risk reduction, while in Afghanistan, she provided training to the Afghan Red Crescent and supported the development of a disaster management plan. In Bhutan, she coordinated with the Ministry of Home and Cultural Affairs and facilitated community-based disaster risk management training. In Pakistan, she contributed to the development of a disaster recovery policy for internally displaced persons and school safety projects. She was also deployed to Lesotho, Africa to conduct community level assessments of vulnerabilities and capacities.

Dr. Jafar is also an accomplished author, having published numerous academic papers and articles in national and international journals and newspapers. Her work covers a range of topics, including business continuity management in healthcare, gender in emergencies, and sustainability in disaster management. Her insights have been featured on various media platforms, including DD News and Rajya Sabha TV, where she has shared her expertise on community-based disaster management and the Motor Vehicle Act.

Dr. Jafar's ongoing efforts will drive major improvements in disaster management and social inclusion. Her experience in shaping policies and mentoring leaders ensures that her work will continue to support and uplift vulnerable communities worldwide, making a lasting impact on humanitarian efforts and global support systems.

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Andhra Pradesh Sustainable Agriculture and farmers prosperity

The Andhra Pradesh state, being mainly the agrarian economy Government providing the technical knowledge support to the farmers in all the aspects of crop production, plant protection, post-harvest technology, value addition along with conservation of natural resources and climate change.

Sustainable agriculture

Department of agriculture organizing crop specific workshops which facilitate as a platform for in- depth discussions, problem solving and alternative approaches on all crop related aspects with crop experts, progressive farmers and officers of Agriculture Department and organised workshops ahead of the ensuing planting season.

Widespread adoption of climate resilient, natural farming practices, such as cover cropping, crop rotation diverse crops per season, to enhance soil fertility. Promoting region-wise priority of crops and varieties in Andhra Pradesh, Promoting adoption of agricultural techniques like reducing tillage, mulching, and agroforestry, to improve soil organic matter and water retention

Crop Specific workshops conducted on Paddy, Blackgram, Greengram, Redgram, Castor, Cotton, Maize, Bengalgram, Groundnut, Sesamum & Millets separately for each crop involving all stakeholders viz., farmers, field functionaries, processing units, FPOs, KVK Scientists, ANGRAU Scientists. These workshops focussed on all the aspects from sowing of seed to post harvesting, crop protection, crop production, etc.,

These crop specific workshops equipped the farmers with market driven technical knowledge and facilitated the discussions between the crop experts and progressive

farmers on varietal selections considering the consumer preferences, market trends, yield potentials of different varieties & climate resilience and also highlighted the role of farm mechanisation in reducing the cost of cultivation and value addition of the produce.

To fulfil the ambition of Hon'ble Chief Minister, Viksit Bharat and Swarna Andhra vision 2047 another major initiative was taken by Department of agriculture on Sowing of Summer Crops under Tubewells/ Borewells during lean crop season from March to June 2025 with target area of 90,000 Hectares with Summer Pulses - Greengram, Blackgram ,Summer Oilseeds - Sesamum, Groundnut and millet crops like Ragi & Korra. Adoption of this summer crop practise will help in generating additional income besides improving in Soil Organic Matter content in soil and also reducing the soil salinity.

Formulating strong policies to support innovative and sustainable technology, adoption at ground level

The state is also embracing modern technology, with increasing use of drones for pesticide and fertilizer spraying. AP is a pioneer in land records digitization through the e-crop system aiming to achieve 100% registration enabling accurate measurement and facilitating scheme disbursement.

AI, Remote Sensing, IoT, Geo-tagging, use of drones and robots in agriculture activities and facing climate change crisis. Organic farming, natural crop solutions and sustainable agriculture practices that will secure soil health and the planet and also ensure profitable farm income focusing on sustainability, technological advancement, and farmer welfare



SRI S. DILLI RAO IAS

Director of Agriculture, Dept. of Agriculture
& Managing Director, AP State Seeds
Development Corporation (APSSDC)

Feeding Future: The Role of Animal Nutrition in Building a Viksit Bharat

India's vision of becoming a developed nation by 2047, under the "Viksit Bharat @2047" mission, rests on several critical pillars, including food security, rural development, and economic growth. A key contributor to this vision is the animal nutrition sector, which plays a vital role in enhancing the quality and safety of animal products, improving public health outcomes, and driving rural prosperity. In this context, animal nutrition is not just about feeding animals; it's about building a sustainable, healthy, and prosperous future for India.

Livestock Sector: A Pillar of India's Economy

India's livestock sector is a cornerstone of our agricultural economy, growing at a remarkable 12.99% CAGR from 2014–15 to 2022–23. During this time, the share of livestock in the Gross Value Added (GVA) from agriculture and related sectors grew from 24.32% to 30.38%. This upward trajectory underscores how critical proper animal nutrition is for boosting productivity and efficiency. As the sector expands, it holds tremendous promise for meeting rising domestic demand and capturing export opportunities—if we continue to prioritise and fulfil the nutritional requirements of our livestock.

Animal Nutrition and Public Health: Combating Malnutrition

Animal-source foods like milk, meat, and eggs are critical for achieving nutrition security in India. With 35.5% of Indian children facing stunting, as reported by the National Family Health Survey (2019-21), improving access to protein-rich foods has become imperative.

Animal nutrition plays a crucial role here. Proper feeding practices lead to higher milk, meat, and egg yields, directly supporting the dietary needs of a growing population. Innovations by institutions such as the National Dairy Research Institute (NDRI)—including locally sourced milk replacers and calf starters—have significantly boosted dairy productivity.

Supporting Rural Livelihoods

The livestock sector is not only important for public health

but also plays a pivotal role in supporting the livelihoods of rural families. Many small and marginal farmers, particularly women, rely on livestock as their primary source of income. In these communities, nutritious feed for livestock is essential for ensuring productivity, which in turn supports economic stability and food security.

Feeding expenses make up as much as 60% of the overall cost of producing milk. Innovations such as those developed by the National Dairy Development Board (NDDB) in the form of feed supplements and additives help farmers improve the nutritional value of local feed resources, reducing costs and boosting profitability. Furthermore, technology-based solutions, like NDDB's computer software, enable farmers to optimise feed rations and provide area-specific mineral supplements, increasing overall production efficiency. Efforts like the S.M. Sehgal Foundation's animal nutrition kits, which have raised milk yields by up to 3 litres per buffalo, demonstrate how improved nutrition directly contributes to higher incomes for small farmers. For marginal farmers, these small improvements can translate into an annual income boost of INR 18,000, providing much-needed economic support.

Sustainable Livestock Systems: Addressing Climate Change

As India moves towards becoming a developed nation, environmental sustainability will be crucial. Sustainable livestock systems are integral to minimising resource depletion and ensuring long-term ecological health. The National Dairy Research Institute (NDRI) is at the forefront of research to improve feed quality and reduce methane emissions from ruminants through dietary adjustments, including probiotics and prebiotics. These innovations aim to improve rumen fermentation efficiency, which not only enhances animal health and productivity but also reduces the environmental impact of livestock.

In addition, solutions like biological treatments for straw and detoxification of anti-nutritional factors are helping improve feed availability, especially in drought-prone regions, contributing to more sustainable

agricultural practices. By minimising feed shortages and environmental degradation, animal nutrition can play a critical role in achieving India's sustainability goals.

Government Initiatives: Boosting the Livestock Sector
The Government of India has undertaken several initiatives to boost the livestock sector as part of its broader agricultural development goals. Take the Rashtriya Gokul Mission, for example—it focuses on conserving and improving indigenous bovine breeds, enhancing their genetic potential, and increasing milk production nationwide. As a result of this initiative, annual milk output climbed from 146.31 million tonnes in 2014–15 to about 239.3 million tonnes in 2023–24—a gain of roughly 63.5% over ten years.

The National Livestock Mission also aims to improve livestock production, quality, and capacity building, contributing to the overall growth of the sector. These government initiatives are critical to ensuring the sector's continued success and its contribution to the nation's development.

Challenges in the Livestock Sector

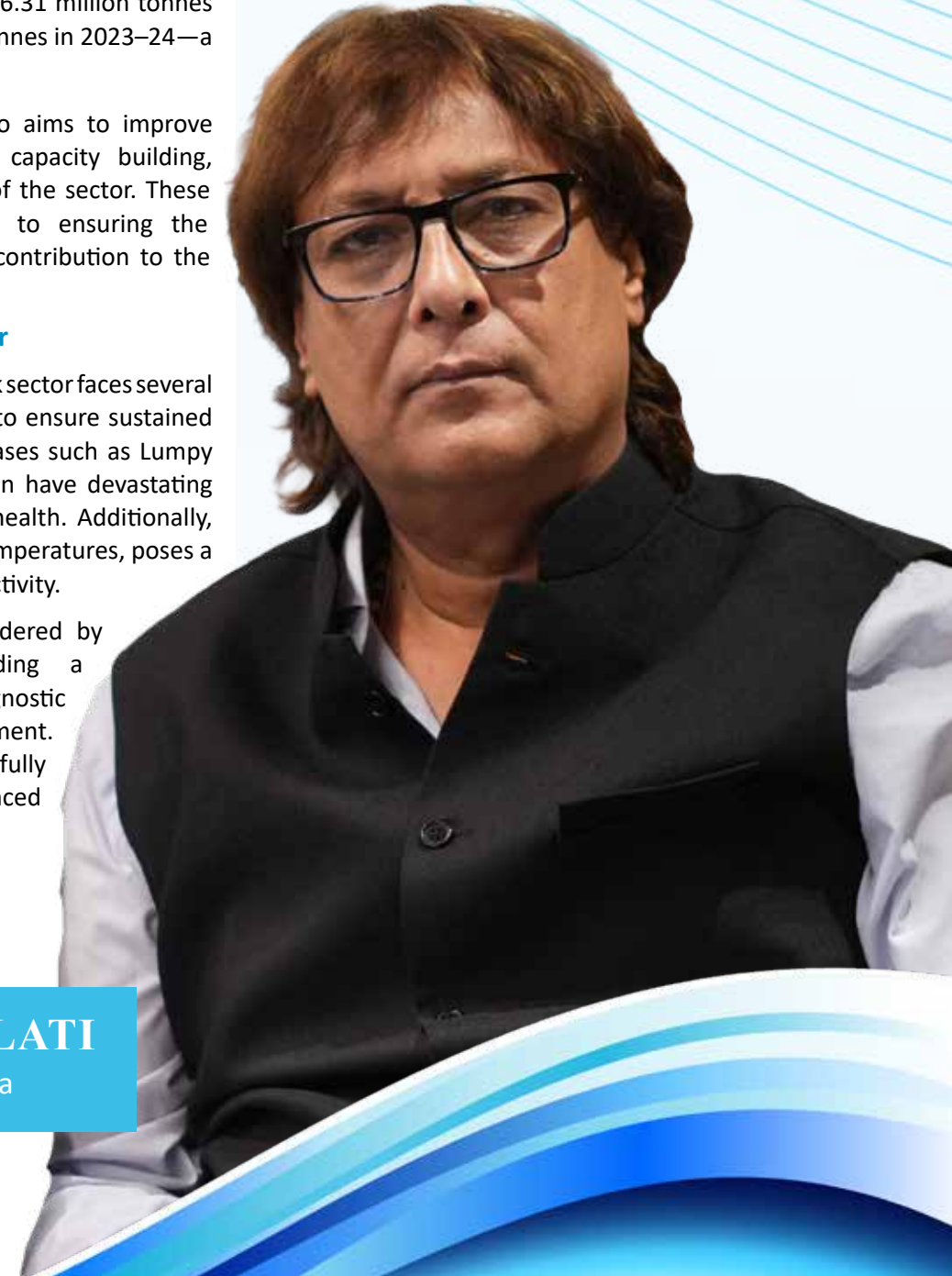
Despite its vast potential, the livestock sector faces several challenges that must be addressed to ensure sustained growth. Outbreaks of zoonotic diseases such as Lumpy Skin Disease and avian influenza can have devastating effects on both animal and public health. Additionally, climate change, particularly rising temperatures, poses a threat to livestock health and productivity.

The sector's growth is further hindered by inadequate infrastructure, including a shortage of skilled professionals, diagnostic laboratories, and modern equipment. Bridging these gaps is crucial to fully unlocking the benefits of enhanced animal nutrition.

Conclusion

DIVYA KUMAR GULATI
Chairman of CLFMA of India

Animal nutrition plays a key role in India's goal of becoming a developed nation by 2047. By boosting livestock productivity, tackling malnutrition, strengthening rural economies, and promoting sustainable agricultural practices, animal nutrition can be a catalyst for India's journey toward a prosperous and inclusive future. As the livestock sector evolves, India must prioritise innovations in animal nutrition, empower small farmers, and address current challenges to ensure the sector makes a significant contribution to building a Viksit Bharat.



Why KVKs Shouldn't Be Compared to IIts and IIMS and Why They Deserve For More Respect.



Random Thoughts Triggered by emotins

Recently, I came across a post that argued for transforming Krishi Vigyan Kendras (KVKs) into institutions like IITs and IIMS. While I appreciate the enthusiasm for reform and excellence in Indian institutions, the comparison is fundamentally flawed — not only because it misunderstands the role of KVKs, but because it undervalues what they've already accomplished over the past five decades. Let's unpack this properly.

1. KVKs and IITs / IIMS' Not Comparable by Design

IITs and IIMS are academic powerhouses. They're designed to produce high-end professionals, researchers, and corporate leaders. Their target audience is a small, urban, and mostly elite segment of India.

DR SHAIK N MEERA

Director, ATARI X, ICAR

KVKs, on the other hand, are grassroots field-level institutions under the Indian Council of Agricultural Research (ICAR), designed to bridge the gap between agricultural science and farm practice. They don't train MBAs or engineers — they train farmers, rural youth, and agri-entrepreneurs. Their job isn't to build Fortune 500 resumes — it's to help improve yields, reduce input costs, introduce climate-smart practices, and double farm incomes.

To compare KVKs to IITs is to compare a plough to a blueprint. Both are valuable — but for very different reasons.

2. What KVKs Have Actually Achieved In So Years

Here's what often gets lost in the noise, I quickly jotted down:

KVKs have been quietly revolutionizing Indian agriculture for decades.

Nationwide

- * From just a handful in the 1970s, India today has over 730 KVKs covering nearly every district.

- * These centers conduct thousands of field trials, training programs, and demonstrations annually, reaching millions of farmers. Read any annual report of ATARI, you will understand.

Catalysts for Yield Improvement and Productivity

- * KVK-led interventions in crop varieties, water-saving techniques, and integrated pest management have consistently improved yields by 15–30% across major crops.

- * For example, frontline demonstrations on pulse crops helped boost pulse productivity in rainfed areas by over 25%. We need special missions such as Cluster FLD schemes, Natural Farming, AgriDrone projects, to undertake interventions in a focused manner.

Farmer - Centric Innovations

- * KVKs have introduced region-specific best practices — from DSR/SRI (System of Rice Intensification) in Telangana and Tamil Nadu to climate-resilient millet varieties in dry zones. NRM technologies to Value addition, secondary agriculture to rural entrepreneurship etc.,

- * They've been instrumental in promoting organic farming, vermi-composting, integrated farming systems, and even drone-based advisory trials in recent years. You name one, we did it.

Capacity Building at Scale

- * KVKs conduct over 1.5 million training sessions

annually (farmers trained directly indirectly), equipping farmers, rural youth, and women with practical skills in horticulture, livestock, processing, and value addition.

- * Entrepreneurship development through Agri Incubation Units and Skill Development Programs has created thousands of local jobs. Get ARYA reports and you will know.

Digital Transformation

- * Many KVKs have adopted ICT tools, mobile-based advisories, and e-extension platforms like Kisan Sarathi and mKisan, helping reach farmers in real-time with weather, market, and pest alerts. Now part of bigger platforms such as VISTAAR, probably in future in AgriStack!

Role During Crises

- * During COVID-19, KVKs played a vital role in ensuring uninterrupted agri-advisory services, helping farmers with sowing, harvesting, and input planning when the system was otherwise paralyzed.

3.What's the Real Problem ?

It's not that KVKs need to be turned into IITs. It's that they need to be given the resources, recognition, and autonomy they deserve.

- * More funding for labs, interventions, staff, digital infrastructure, and mobility.

- * Policy alignment with national agri-export goals and climate adaptation.

- * Performance-linked metrics that reward real-world impact, not just paper trails.

KVKs already have the trust of the farming Community - Something most elite Institutions can't Claim.

What they need now is strategic elevation, not a rebranding exercise.

Let's Get the Narrative Right. India doesn't need IITs for agriculture. It needs institutions that work where food is grown, where monsoons matter, and where livelihoods depend on soil health, not stock markets. That's what KVKs are for!

And they're doing it. Quietly. Effectively. For over 50 years.

Let's stop comparing and start strengthening.

(Nothing official about this. Views are Personal and are based on insights developed over the years. they do not necessarily represent the organization that I am working for)

Transforming Agriculture with Zytonic Technology: A Sustainable Future for Organic Farming

The Need for Sustainable Organic Farming

Agriculture forms the backbone of our economy, but the increasing dependence on chemical fertilizers has led to serious environmental and economic concerns. Farmers today face multiple challenges, including soil degradation, erratic water availability, and declining productivity. To address these challenges, there is an urgent need for a transition to sustainable and profitable organic farming practices.

The key objectives of organic farming include:

- Adoption of sustainable and profitable farming techniques.
- Enhancing the economic status of farmers through organic mixed farming interventions.
- Producing affordable, safe, and nutritious food free from chemical residues.
- Improving the quality of horticulture and commercial crops, thus creating opportunities for export.

Challenges in the Transition to Organic Farming

Despite the benefits of organic and natural farming, several key challenges hinder widespread adoption:

- **Organic Matter Improvement:** The availability of high-quality Farm Yard Manure (FYM) in sufficient quantities is limited.
- **Soil Health Deterioration:** The depletion of essential nutrients affects plant growth and productivity.
- **Water Availability:** Groundwater depletion and unpredictable rainfall patterns create hurdles in sustainable agriculture.
- **Dependence on Chemical Fertilizers:** The lack of viable alternatives to chemical fertilizers results in deteriorating soil health and economic burden due to subsidies.
- **Effective Pest Management:** The absence of a robust pest control solution leads to chemical residues in crops, making them unsuitable for export.

Biofertilizers and Organic Fertilizers: The Future of Farming

Chemical fertilizers have spurred an urgent need for

alternative, non-chemical solutions such as biofertilizers and organic fertilizers. These alternatives play a crucial role in enabling the transition from conventional to organic farming. The key to successful organic farming lies in improving soil structure and fostering natural soil biology for enhanced nutrient availability.

One of the most effective and economical sources of organic carbon and organic matter is Farm Yard Manure (FYM). However, traditional methods of producing FYM involve natural bio-digestion, which takes 8-10 months and often remains partially digested. This inefficiency has been a major bottleneck in transitioning to organic farming.

Zytonic Technology: Revolutionizing Organic Farming

To address these challenges, **Zydex**, a pioneering research-based organization, has introduced the **Zytonic Technology Platform**—a breakthrough innovation that ensures sustainable and profitable organic farming. Founded in 1997 by Dr. Ajay Ranka, Zydex has emerged as a global leader with a presence in over 40 countries, offering innovative solutions across textiles, roads, waterproofing, paints, and agriculture. With its Zytonic Technology, Zydex provides a holistic solution for enhancing soil health, improving water efficiency, and enabling chemical-free farming.

Zytonic Godhan: A Game-Changer in Organic Farming

The first step towards successful organic farming is ensuring the availability of quality FYM. Zytonic Godhan technology, powered by a fungal bio-digester, accelerates the breakdown of animal dung, fodder, and crop residue into fully digested FYM. This results in:

- **Faster Decomposition:** FYM is ready in just 45-60 days compared to the traditional 8-10 months.
- **Increased Effectiveness:** The fully digested FYM is 4-6 times more effective in the field, reducing the quantity required per acre.

- **Better Soil Health:** It enriches the soil with organic carbon and enhances the activity of beneficial microbes.

Zytonic Biofertilizers: Ensuring Sustainable Crop Growth

Zydex's range of biofertilizers plays a pivotal role in improving soil structure, aeration, and water retention. By enhancing soil biology, these biofertilizers:

- Provide continuous nutrient availability to crops.
- Build tolerance against biotic (pests, diseases) and abiotic (drought, extreme temperatures) stresses.
- Reduce dependency on chemical fertilizers, ensuring healthier produce.

Key Benefits of Zytonic Technology

- **Enhanced Soil Structure:** Soft, porous soil with improved aeration and water retention.
- **Water Conservation:** Increased water infiltration reduces irrigation requirements and prevents topsoil erosion.
- **Sustainable Farming Practices:** Enables farmers to cultivate chemical-free, nutritious food.

Growing Adoption of Zytonic Technology

Zytonic technology is transforming agriculture across India, benefiting over 200,000 farmers nationwide. In Maharashtra, farmers cultivating sugarcane, paddy, horticulture crops (chilli, onion, turmeric, pomegranate, papaya, banana, vegetables), soybean, and cotton have significantly **reduced chemical fertilizer usage by 50-100%** while achieving improved productivity and soil health.

Farmers in Maharashtra using Zytonic technology have reported:

- **Higher crop yield** and improved produce quality.
- **Healthier soil conditions** leading to sustainable farming practices.
- **Reduced production costs** due to decreased chemical input requirements.

The Road Ahead: A Sustainable Future for Indian Agriculture

With Zytonic Technology, the transition to **profitable and sustainable organic farming** is no longer a distant dream but a present-day reality. By enabling farmers to **restore soil health, optimize water use, and eliminate chemical dependency**, Zytonic is paving the way for a **greener, healthier, and more prosperous** agricultural landscape.

As more farmers embrace this revolutionary technology, India is set to emerge as a **global leader in organic and chemical-free agriculture**, ensuring **nutritious food for all and a thriving economy** for our hardworking farmers.

DR SHAILENDRA SINGH

COO - Agro, Zydex Group



A Vision for Universal Health Insurance in India: Lessons from Krupa Arogya Suraksha



Last Monday, my 83-year-old mother slipped early in the morning and was unable to move. A moment of panic ensued, but without wasting time, we put her on a stretcher and rushed her to the nearest hospital, Suchirayu, in Hubli, North Karnataka. This hospital has been a trusted name for my family, not just because of its facilities but also because of the people who run it. The leading neurologist and neurosurgeon, Dr. Rajendra Dugani, a close family friend and a fellow Art of Living practitioner, has always been forthcoming with medical care and advice.

By noon, after an MRI scan, it was clear that she had sustained three minor (hairline) fractures in her lumbar spine (L1). The only prescription was complete bed rest for six weeks. The diagnosis was precise, the medical advice was sound, and by Wednesday night, we were back home with a structured recovery plan. What made this experience particularly memorable was not just the quality of medical care but also the ease with which it was provided.

1. **Immediate emergency care** was administered without delay.
2. **Accurate diagnostics** helped us understand the problem without unnecessary procedures.
3. **Right medical advice** ensured we weren't burdened with excessive treatments.
4. **Most importantly, it was cashless treatment**, thanks to a health insurance

SANDEEP SABHARWAL
Co-Founder, Sajeewan Life Pvt Ltd.

policy provided through my wife's employment.

The total bill for three days of hospitalization came to ₹46,000, out of which we only paid ₹5,000 for consumables such as adult diapers, underpads, hygiene products, and plastic utilities. The rest was covered by the insurance policy for which my wife had paid a **premium of ₹18,000 per year for a family of five.**

Usually, life's unfortunate events push us into deep reflection, but this positive experience made me wonder—

What will it take for every Indian family, all 144 crore fellow citizens, to have access to such a seamless medical assistance program?

This article is an attempt to break down the cost mathematics, drawing from my past experience formulating a rural medical assistance program in Anand, Gujarat, and estimating the overall requirements for India. We will analyze current healthcare practices, the challenges of conventional approaches, and explore a digitally-driven model that can be implemented within the next two to three years to provide **universal, equitable, and efficient health insurance coverage for all Indians.**

Learning from Krupa Arogya Suraksha: A Proven Model

In 2003, while working on deputation at Pramukhswami Medical College in Karamsad (Gujarat), I had the opportunity to design and implement an innovative healthcare initiative called *Krupa Arogya Suraksha*. The goal was simple yet ambitious: **to ensure that poor and marginalized communities could access quality healthcare without financial distress.**

At the time, the hospital had 520 beds and several underutilized medical facilities, including specialist consultation hours that were not being fully optimized. The question before us was—**how could we leverage these existing resources to provide healthcare access to the most vulnerable at minimal cost?**

To find a data-driven answer, we conducted a **morbidity survey covering 600 people**, ranging from **infants to 90-year-olds**, including men, women, persons with disabilities, and individuals suffering from diverse

ailments. The findings were striking:

- **Inpatient Treatment (IPT)** was required by **27 people per 1,000 population**
- **Outpatient Consultations (OPT)** were required by **40 people per 1,000 population**

Using these insights, we devised a **community-funded insurance model**, where **1,000 people contributed an average of ₹102 per year per person**, covering all expenses related to consultations, hospitalization (including food, medicine, and surgeries), and specialist treatments.

Thus, *Krupa Arogya Suraksha* was born—a **first-of-its-kind affordable medical program in India**. Families of five could access **unlimited medical assistance** for a mere ₹700–₹1,000 annually. Within three months, the program had 19,000 cardholders. Within a year, the number rose to **50,000+ subscribers**. The impact was so profound that then-Gujarat Chief Minister **Shri Narendra Modi ji** visited the program, followed later by Union Home Minister **L.K. Advani ji**.

Today, nearly two decades later, *Krupa Arogya Suraksha* has **75,000–80,000 active subscribers** and continues to thrive. The model's success raises a pertinent question—**if a small town like Karamsad could implement such a program, why can't India adopt a similar healthcare model on a national scale?**

Current Healthcare Challenges in India

India's healthcare landscape is fragmented, with significant gaps in accessibility and affordability:

- **High Out-of-Pocket Expenditure (OOPE):** Nearly **55% of total health expenditure** in India is paid out-of-pocket by individuals, pushing millions into poverty every year.
- **Limited Government Insurance Schemes:** While **Ayushman Bharat** covers hospitalization costs, it does not cover **outpatient consultations, diagnostics, medicines, and follow-ups**—which form a significant portion of healthcare expenses.
- **Urban-Rural Divide:** Quality healthcare remains largely **urban-centric**, with rural populations struggling to access specialist care.
- **Insurance Penetration:** Private insurance covers only a

small percentage of Indians, leaving **hundreds of millions vulnerable to catastrophic health expenses.**

A Roadmap for a National Health Insurance Program
The Mathematics of Replicating Krupa Arogya Suraksha Nationwide

To understand the feasibility of implementing a nationwide health insurance program based on the Krupa Arogya Suraksha model, let's break it down into simple calculations:

• **How many people need hospitalization?**

Based on our past morbidity survey, **27 out of every 1,000 people** required inpatient treatment annually.

Given India's **total population of 144 crores (1.44 billion)**, this means 38.88 million (3.88 crore) people would need hospital care each year.

• **How much does treatment cost?**

In 2003, the average cost of hospitalization—including doctor consultations, surgery, medicines, food, diagnostics, and follow-ups—was **₹1,42,000 for 27 people** (per 1,000 people).

That translates to **₹5,260 per person** in need of inpatient treatment.

• **Adjusting for inflation and cost escalation**

With rising medical expenses, technological advancements, and inflation, we estimate that today's costs would be approximately **4 times higher than in 2003.**

That brings the **per-person hospitalization cost to ₹22,720.**

• **What does this mean per 1,000 people?**

The total cost for hospitalization of 27 people in a population of 1,000 would now be **₹5,68,000 per year.**

If this expense is evenly distributed among all 1,000 people, each person would need to contribute ₹568 per year to ensure hospitalization coverage for those who need it.

• **Factoring in additional medical needs**

To ensure complete coverage—including outpatient consultations, additional medical conditions, and future healthcare challenges—let's round this up to **₹1,000 per**

person per year.

• **Total cost for the entire country**

If every Indian contributes **₹1,000 annually**, the total fund generated would be:

₹1,000 × 144 crore people = ₹1.44 lakh crores per year.

This amount could **fully cover medical care—including hospitalization, surgeries, medicines, and consultations—for all Indians**, offering the same level of healthcare my mother recently received. As per the Economic Survey 2024-25, India's Total Health Expenditure (THE) for the fiscal year 2021-22 was estimated at ₹9,04,461 crore, accounting for 3.8% of the Gross Domestic Product (GDP) and translating to ₹6,602 per capita at current prices.

pib.gov.in

For the fiscal year 2024-25, the budget allocation for the Department of Health & Family Welfare was ₹87,657 crore.

mohfw.gov.in

This figure represents the central government's budgeted expenditure on health and does not encompass the entire health expenditure in India, which includes state government spending, private sector expenditure, and out-of-pocket expenses by individuals.

Comprehensive data detailing the total health expenditure for the fiscal year 2024-25 is not yet available. Typically, such detailed analyses are conducted retrospectively and published in subsequent economic surveys or health accounts reports.

Bridging the Healthcare Gap: Can 6% of GDP Ensure Universal Coverage?

India currently spends **3.8% of its GDP on healthcare**, amounting to **₹9.5 lakh crore**. If this spending were increased to **₹1.44 lakh crore—roughly 6% of GDP—it could, in theory, provide comprehensive healthcare coverage for every citizen.** However, there's a fundamental problem: **accessibility.**

While financial allocation is crucial, it **alone cannot bridge the stark divide between urban and rural healthcare infrastructure.** The reality is that millions in remote

villages still struggle to reach a doctor, let alone receive specialized treatment. Even if the government commits to higher spending, **how will the most vulnerable—rural populations, the elderly, persons with disabilities, and women—actually access quality healthcare?**

Rethinking Healthcare Delivery

A new healthcare framework is needed—one that doesn't rely solely on **brick-and-mortar hospitals**, which could take decades to establish in every corner of the country. Instead, **technology and mobility** must become the backbone of healthcare expansion:

• **Telemedicine for Specialized OPD Consultations:** Digital healthcare services must be rapidly deployed to ensure that even **the most remote villages have access to specialists via teleconsultation.**

• **Enhanced Medical Transportation: Ambulance networks, mobile clinics, and patient transport solutions** must be strengthened to ensure people can reach healthcare facilities on time.

• **Upgrading Traditional & Alternative Healthcare:** **Ayurveda, Unani, and homeopathy clinics** exist in many rural areas but lack standardization. **Integrating them under strict quality measures** could improve rural health outcomes.

• **Mapping Healthcare Needs with Technology:** A **data-driven approach** is essential to identify **where healthcare services are lacking, which facilities need upgrades, and where new interventions should be placed.** AI and GIS mapping can help in **allocating resources effectively.**

• **Para-Medical Workforce Expansion:** Training more **healthcare professionals, community health workers, and paramedics** can ensure that primary care is **accessible at the grassroots level.**

A Financially Feasible Model?

It is easy to assume that **scaling up healthcare infrastructure will be prohibitively expensive**, but **mobile hospitals and flexible healthcare solutions** could make nationwide coverage **faster and cheaper than permanent hospitals.**

Consider **boat hospitals in Assam's Brahmaputra region,**

which bring healthcare directly to riverine communities. Why not replicate these model nationwide — introducing mobile health units in deserts, mountains, and tribal belts?

Mobile Hospitals: Taking Healthcare to the Last Mile

In a country as vast and diverse as India, **mobile hospitals have emerged as a game-changer in delivering healthcare to remote and underserved regions.** These hospitals, operating through **buses, vans, and even boats**, provide essential medical services in areas where permanent healthcare facilities are scarce. A remarkable example is the **boat hospitals on the Brahmaputra River in Assam**, operated by organizations like the **Centre for North East Studies and Policy Research (C-NES)**. These floating hospitals bring **doctors, diagnostics, maternity care, and even minor surgical procedures to riverine communities**, where access to healthcare is otherwise impossible. **Similar mobile health units, including train-based hospitals like the Lifeline Express, and bus-based clinics in states like Rajasthan, Maharashtra, and Tamil Nadu**, have proven that healthcare can be brought to the people rather than waiting for them to reach distant hospitals. **Expanding such models—especially in tribal, hilly, desert, and flood-prone areas—could revolutionize rural healthcare in India, making quality medical services accessible to millions.**

Where Are the Doctors?

Even if infrastructure is upgraded, **India still faces a doctor shortage, especially in rural areas. Why is that?** Perhaps the real bottleneck is **medical education itself**—the limited number of seats, the cost of training, and the reluctance of doctors to serve in rural postings. This is a deeper issue that deserves its own discussion.

For now, the question remains: Will increasing healthcare spending to 6% of GDP solve the problem? The answer is yes, but only if we rethink healthcare beyond hospitals and build a system that truly reaches every Indian.

Making India: Organic, Natural, and Profitable

Agriculture is the mother of all culture and is woven into the DNA of India. Farming is not merely an occupation here; it is a civilizational strength. The foremost question that may arise in the mind of the reader is that “Why should India strive to make its agriculture”- Organic, Natural and Profitable”? Because destiny of a nation is not only shaped in classrooms but also in its farm fields.

Feeding India, i.e a population of 1.4 billion, larger than the combined populations of the USA and Europe , requires sustainable and efficient agricultural practices. By 2050, food demand is projected to double, making it crucial to reform agriculture to reshape the nation's future.

From Deprivation to Abundance

In 1950-51, India's food grain production was 50.82 million tonnes. Thanks to the Green Revolution, it rose to 295.5 million tonnes in 2019-20 and 330.9 million tonnes in 2024-25 . This transformation from a "begging bowl" to a "surplus bowl" is unparalleled. However, the Green Revolution also led to excessive chemical use, mono-cropping, and ecological degradation and therefore a system compatible with India's ecological and cultural realities is needed.

Organic Farming – From a Niche Practice to a Movement

Organic farming, which avoids synthetic fertilizers and pesticides, offers an effective alternative. Government schemes like Paramparagat Krishi Vikas Yojana (PKVY), Mission Organic Value Chain Development for North-Eastern Region, and Integrated Nutrient Management for Organic Farming have promoted organic farming. Since 2015-16, 11.85 lakh ha have been brought under organic farming through PKVY. One of the notable examples of promoting organic farming is the YATRA- Farm Tourism venture, Assam which has successfully motivated about 500 farmers to take up organic farming. Farmers' participation in organic farming increased by incorporating farm tourism concept with organic farming to give more income to the farmers . Organic farming reduces chemical use, while natural farming goes a step further.

DR. A.V BHAVANI SHANKAR
Chief General Manager, NABARD

Natural Farming: Rebalancing Ecology

Natural farming restores balance among water, soil health, forest ecology, biodiversity, and indigenous seeds. NABARD's study “Organic farming in India: relevance, problems and constraints” shows farms with higher ecological balance earn ₹39,147 per hectare per month, nearly three times the national average . To rejuvenate 'life' around agriculture, NABARD's JIVA programme, launched in 2022, focuses on agro-ecological transformation, balancing ecology and economy. Clearly, ecology and economy are not adversaries; but two sides of the same coin.

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Profitable Farming Enriches 4P - People, Planet, Profit, and Prosperity

Agriculture employs 42.3% of India's workforce but contributes only 18.2% to GDP as per Economic Survey 2023-24 highlighting the urgent need to make farming more profitable. For profitability, collectivisation is a pre-requisite for which Farmer producer organisation (FPO) is one of vital the gateways to this transformation. The NABCONS Impact Evaluation study 2020-21 reveals that 11 NABARD-promoted FPOs have already generated revenues between ₹10 lakh and ₹2.26 crore . Further, there is a need to focus on targeted marketing of niche products like NABARD's promotion of Meliponiculture (stingless bee farming) in Kottayam, Kerala, popularized Dammar honey, which sells at ₹1,400/kg compared to ₹200/kg for regular honey. Bekeeping not only unlocks massive new income streams but also conserves biodiversity as Honeybees are an ecosystem engineer .

The Challenge: Bridging Gaps

Challenges include small landholdings, low productivity, climate vulnerability, price volatility, and post-harvest losses. Nearly 30-40% of India's total food production is wasted post-harvest as per “Study to Determine Post-Harvest Losses of Agri Produce in India” through NABCONS in 2022 . A vision that is local in touch but global in reach is needed.

The Vision: Making India - Organic, Natural, and Profitable

1. **Reduce Cost of Cultivation:** Promote low-input, diversified cropping systems and expand organic and natural farming models like NABARD's JIVA programme.
2. **Demonstration Farms and Exposure Visits:** Focus on practical demonstrations and exposure visits.
3. **Adopt Digital Agriculture:** Promote precision farming, satellite imagery, and data-driven advisories for efficient resource management. The Drone Didi scheme is a gamechanger.
4. **One District, One Model Farmer:** Create local champions of farming

5. **Aspirational Farmers Programmes:** Modelled on the Aspirational Districts concept to fast-track best practices dissemination.
6. **Transform Farmers into Agripreneurs:** Foster agri-startups like NABARD's Agri-business Incubation Centres (ABICs) to make farming an enterprise, not subsistence.
7. **Economic Survey 2023-24 -Press Release:** Press Information Bureau
8. Impact Evaluation Study (IES) 2020-21 Of NABARD Promoted FPOs - pub_22062306150099.pdf
9. NABARD Case Studies - नाबार्ड - राष्ट्रीय कृषि और ग्रामीण विकास बैंक Study to Determine Post-Harvest Losses of Agri Produce in India” through NABCONS in 2022 _annex_265_au2145_qhinz4.pdf
10. **Strengthen Collectivisation:** Scale FPOs to become Global Food Producer Organizations and link them to export markets through initiatives like NABARD's "Export Pathshala" model.
11. **Promote Off-Farm Development:** Boost Agro-processing industries, encourage rural crafts and secondary agriculture.
12. **Ease of Access to Organic and FPO Products:** Ensure easy access to organic and FPO products through ONDC platforms, kirana stores, and quick-commerce apps.

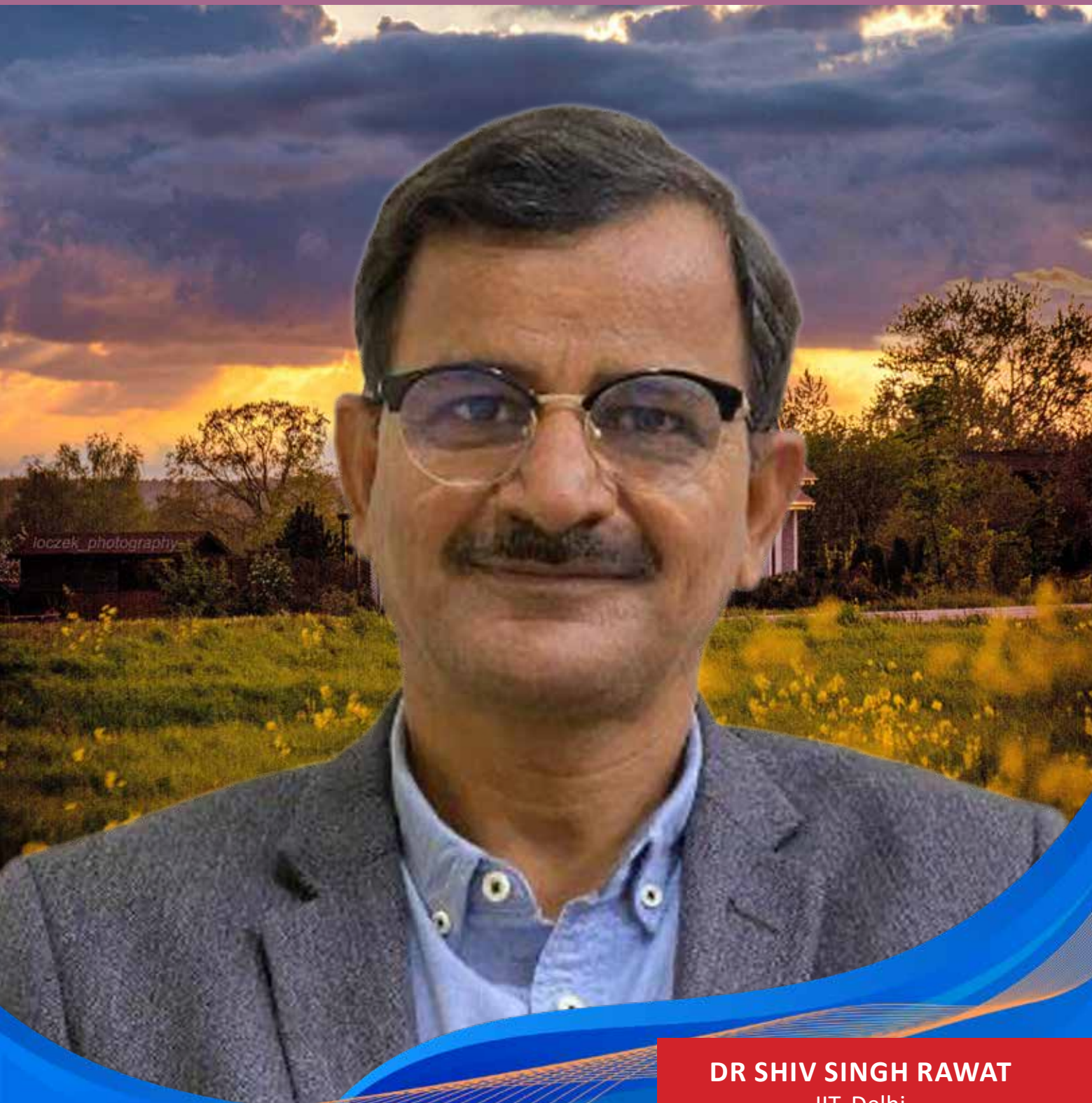
When farming becomes profitable and aspirational, India's youth will return to the fields with pride. The Economic Survey 2022-23 highlights that India now has 4.43 million organic farmers, the highest in the world and 59.1 lakh hectares under organic cultivation . But the journey has just begun. Making India Organic, Natural, and Profitable is not just a dream but a national imperative for building an Atmanirbhar Bharat and a Viksit Bharat. A future where farming thrives, farmers prosper, India's youth will return to the fields — not out of compulsion but with pride.

Jai Kisan, Jai Bharat!

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Government Must Prioritize Urban Flooding and Water Crisis in the Budget.



DR SHIV SINGH RAWAT
IIT, Delhi

Gurugram, the millennium city of promises and pitfalls; and Faridabad, a major industrial hub, are both grappling with severe water management issues. The twin challenges of urban flooding during monsoons and acute water scarcity during lean seasons have exacerbated the already fragile water infrastructure of both cities. A poor drainage system, unchecked urbanization, and the over-extraction of groundwater have led to a growing demand-supply gap in water availability. Gurugram faces a drinking water shortfall of 105 MLD (million liters per day), while Faridabad struggles with a deficit of 125 MLD. The recent report by the Central Ground Water Board (CGWB) provides an eye-opening report warning about the water crisis in Haryana.

The conventional approach of pumping floodwater into drains results in massive wastage of a valuable resource, underscoring the need for innovative and sustainable solutions, as adopted in countries like Israel and Singapore. If managed efficiently, floodwater could be stored and utilized to alleviate water shortages and replenish the depleting groundwater levels.

One of the promising approaches to tackling urban flooding and water scarcity is large-scale rainwater harvesting and underground water storage. Since urban areas lack the space to construct traditional reservoirs, the development of underground storage beneath existing infrastructure such as stadiums, parks, and playgrounds can significantly enhance rainwater conservation. An estimated 15,000 ML of rainwater storage capacity can be created in Gurugram and Faridabad at a cost of ₹100 Cr each, sustaining water needs for 4-5 months. Such initiatives would not only reduce urban flooding but also help bridge the water supply gap and traffic jams. A similar approach can be implemented in other urban areas of the state to meet water demand.

The other solutions proposed are the floodwater storage and groundwater recharge project to develop storage on 100 acres of government or leased land as a pilot initiative each in Faridabad and Gurugram. This project could store 15,000-20,000 ML of water at a cost of ₹40-50 Cr, raising the groundwater levels by two meters. Rejuvenating water bodies and improving aquifer

recharge mechanisms are crucial steps in addressing groundwater depletion. Shifting from single-pond revival to cluster-based rejuvenation (15-20 ponds per block) is essential. Additionally, large-scale robust rainwater harvesting systems (RRWHS) must be installed to meet daily water requirements. Setting up 550 RRWHS both at Gurgaon and Faridabad, at an estimated cost of ₹170 Cr, could help reduce dependency on groundwater and create a sustainable water supply model.

The tail stretch of the Budhiya Nala could be converted into a recharge channel to store excess Yamuna water, with the potential to recharge 25,000 ML annually at a cost of ₹35 Cr, ensuring a 100-day supply for the ranney wells of Faridabad.

Water pollution is another critical challenge for the state. This contaminated water, used for irrigation, is severely affecting crop health and has been linked to an increase in diseases such as cancer in several villages. To combat this, the Haryana government must invest in wastewater treatment technologies, drawing inspiration from global models such as those of Israel and Singapore. Dr. Rawat suggests implementing phyco-remediation, a nature-based technique using algae to purify water. The estimated annual budget required for treating 1,000 MLD of wastewater is around ₹60-70 Cr. If executed effectively, this initiative could provide cleaner water for irrigation and improve public health outcomes.

Another crucial measure to strengthen water security is large-scale forestation along the Yamuna River and other wastelands. Expanding green cover on barren lands and panchayat lands can help in groundwater retention, enhance biodiversity, and contribute to overall environmental sustainability.

To effectively implement these solutions, the Haryana government must allocate a dedicated budget of ₹500 Cr in the upcoming fiscal year to ensure long-term water sustainability, improve agricultural productivity, and safeguard the health and livelihoods of its people.

Prioritizing sustainability issues in aquaculture sector

Freshwater aquaculture is not only a viable rural enterprise in most parts of India but also an important component of blue economy and the food production system as well. Its contribution towards provision of human food having very high biological value, creation of livelihood options, conservation of endangered aquatic bioresources are becoming significant. Many of the technical aspects of aquaculture including year-round seed production in captivity, essential pond management measures, nutrition & dietetics, fish health monitoring have been more or less standardised and all these together contributed to a 10-fold increase in production over the past decades. Indian fisheries today (world's second best with about 18 mmt annually of which aquaculture production being of the order of 12mmt) The sector's potential in terms of changing socio-economic scenario is enormous and the key drivers are the resources themselves-both water and fish diversity. Freshwater aquaculture is the mainstay in India in terms of total quantity as well catering to the domestic food basket presently contributing to over 60% of the total fish production and is based mainly on cyprinids consisting of 3 major carp species and 3 species of exotic carps. The sector has been growing further by way of horizontal expansion and higher productivity per unit area with the available technology back up, financial investment/ credit support, entrepreneurship development and strategic planning. Such rapid strides in its development have also simultaneously brought several issues and problems to the forefront like inconsiderate

application of feeds/ fertilisers, unapproved chemicals / weedicides, anti-parasitic agents / anti-microbials / endocrine disrupting chemicals and xenobiotics in fish husbandry (affecting water and sediment quality) aimed at obtaining high yields per unit water area. Such



DR PRATAP MUKHOPADHYAY
Principal Scientist (Retd), ICAR- CIFA

a scenario raises justifiable concerns related to public health safety of harvested fish as human food and above all environmental sustainability thereby necessitating a pro-active approach to prioritize sustainable farming system that takes care of fish production without ignoring environmental factors and also giving due cognizance to the indigenous traditional knowledge while at the same time taking benefit of the available aquaculture technology packages. It is expected that if aquaculture production in India continues to maintain the much needed current growth rate then adoption of innovative approach based on ecological principles are mandatory. Long term sustainability and future aquaculture expansion should be aimed at development of farming system, which improves the overall efficiency of resource use and are based upon primary renewable resources. This will also have relevance in the context of reduced clean freshwater availability in the foreseeable future, emerging threat perceptions including natural resource degradation, climate change effects and new global trade regulations.

Precision feeding strategy in a sustainable aquaculture system :

In the process of healthy fish production from aquaculture, nothing can be more important than sound nutrition and adequate feeding. Feeding to near satiety can be achieved by a number of means provided there is close monitoring of the trophic activity and feeding behavior of cultured fishes. This will lead to homogeneous growth of all the fish species in a water body by decreasing competition for feed what is expected in a sustainable farming system. Therefore, a general understanding and assessment of the fish feeding behaviour (different from terrestrial animals) right from initial recognition till intake is of use. The practice should be to feed the fish and not water and to be precise, when fish needs and not when farmer can or have time. This will allow fish to grow well with maximum feed utilization efficiency. Feeding practice should be in tune with the biological rhythm. For example, catfishes prefer feeding towards the evening while carps feed only during day time. The frequency of feeding depends primarily on two factors- body size and water temperature since both

these factors affect the passage of feedstuff through the digestive tract. Rapid feed intake lessens its residual time in aqueous system thereby reducing chance of feed related water spoilage. The feed wastage in aquaculture is of common occurrence and happens mainly due to mismatch between culture system, feeding behaviour and nutritional physiology of the cultured species. Feed waste not only has a direct economic impact for the aquaculturist but also contributes to water pollution. Such a situation will have negative environmental impact and may have consequences on human health also. The logical steps may be (i) supply of the acceptable quality of the feed in tune with the voluntary feed intake (VFI). A number of environmental as well as intrinsic factors affect feed intake. Of the biological factors fish size, physiological stage and genotype are known to influence VFI (ii) such feeds having the required bioavailable nutrients and digestible energy are to be prepared in the proper form (chowmein type, small spherical/granular shape, flake type-floating) that may provide special physical properties like smoothness, water stability and correct feed particle/pellet size enough to be digestible by the fish species corresponding to the mouth opening to facilitate feeding in water. Devising a feeding strategy (feed sources, preparation and schedule) taking into account specific biological rhythm in order to reduce emission of metabolic waste products is thus vital. It may be required to maintain the dissolved oxygen content using the aerators after feeding or during unfavourable weather conditions in case there is oxygen depletion. Timing to start feeding the fish is important for achieving efficient feed conversion. Precise control of feed delivery is essential to optimise feed conversion and maximise return. Three major feeding devices to distribute feed for fish in aquaculture are in vogue. There are: hand-feeding (broadcasting), simple techniques like perforated feed bags attached to bamboo poles / cane trays hung from bamboo poles, mechanical feed applicator or demand feeder which fishes are capable of using well in pond conditions. A proper feeding strategy (in tune with the biological rhythm) is the one which increases feed efficiency, decreases the environmental load and maintains the body composition/profile of the

fish so -crucial from organoleptic point of view.

Sustainability through aquaculture diversification:

Despite the fact that number of indigenous and endemic freshwater fish species occurring in India is the highest among all nations and we are in possession of the vast resources and rich faunal biodiversity (with more than 10% of global fish diversity), the index of biodiversity being utilised for aquaculture is only too low again , out of this also 85% of production is contributed by three species of Indian major carps- catla, rohu and mrigal ,5% by air-breathing fishes and 10% by rest all species together. Thus carps continued to be the mainstay of Indian aquaculture even today. Species diversification is vital driven by market forces, reduced availability in the wild ,disease occurrence that nees to be addressed The former DG,ICAR ,Dr S Ayyappan suggested that a fifty species-based freshwater aquaculture should be aimed at as well as organic aquaculture. We have besides carps, unique species like catfishes ,murrels, perch, featherbacks, loaches ,eels ,cichlids ,number of shellfishes and a host of small indigenous fish species. In fact ,there are more than 600 freshwater fish species and propagation of even one sixth of this could help utilise the primary production for our benefit at no extra cost. During the sixties when the campaign of increasing the country's freshwater fish production began with a mission mode initiative, the first task was to remove or kill the existing small indigenous fishes in the ponds and tanks (terming them as fish of no importance in fisheries development) using a natural piscicide ,mohua oil cake (which acted initially as a fish poison but later became a manure contributing to growth of natural food organisms in the waterbody),followed by stocking with induced bred seeds of catla ,rohu mrigal ,grass carp, silver carp and common carp. It is true that in this process fish production was significantly raised within a year with lucrative economic returns and we continuously became the second best in the world but at the same time we lost the diversity. The same trend of culture , i.e., carp

polyculture system still continues.

Those smaller ones-always in high consumer demand (fish eaters prefer diversity of fish) regionally are being conserved separately in sanctuary type of ponds at individual or group levels mostly in panchayets/talukas like in rural Bengal . With the freshwater shortage, currently a burning issue and that there is a scope for better utilisation of thousands of ephemeral ponds and impoundments, swampy areas reclamation cost of which are very high and which are otherwise unsuitable for long duration carp culture but could be safely utilised for the farming of some of these air-breathing fishes and certain small fish species(most of these species are self-recruiting and thus one time stocking is enough) offering livelihood options for marginal village people became an eye opener .The idea of culturing them in cages installed even in large ponds and lakes only to have fish diversity in our daily diets was taken up Self-help groups(SHG) and several dedicated NGOs working across the county .It is nice that they realised the fact that diversity can lead to sustainability ,enhanced water productivity ,preserve the environment , maintain ecological balance and above all conserve indigenous biodiversity thereby profitability both in terms of economy and ecology..

There is a large amount of scientific literature on the merits of fish eating on human health (supply of animal protein of high biological value, reduction of cardio vascular ailments due to high levels of long chain n-3 PUFAs, supply of vitamins like cyanobalamine and important mineral elements like Ca, P, Zn, Iodine). Aquaculture thus has a major role in providing bases for better human health. It is also known that one can now tailor aquaculture product quality through proper application of nutritional principles. Adoption of aquatic biosecurity measures , stringent fish seed cerification ,integrated water management measures are now priorities at a time when there is a paradigm shift towards protein -based preferential food production is aimed at along with simultaneous least carbon and water footprint in order to fulfil the envisaged SDGs by 2030. .

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Sustainable Moringa Agriculture: A Pathway to Viksit Bharat by 2047



DR MAHARSHI
Visionary Moringa Maestro

Visual-1

India's journey toward Viksit Bharat—a developed, self-reliant nation by 2047—hinges on sustainable agriculture as a cornerstone of progress. Among the array of agricultural solutions, Moringa oleifera, dubbed the “miracle tree,” emerges as a game-changer. Rooted in Indian tradition yet poised for a climate-smart future, Moringa offers a blend of nutritional security, environmental resilience, and economic empowerment. By harnessing its potential, India can cultivate a sustainable, inclusive tomorrow.



Moringa's Climate-Smart Edge

V-2

India grapples with pressing challenges: feeding a growing population amid climate change, soil erosion, and water scarcity. Moringa rises to meet these demands. This drought-tolerant tree flourishes in degraded soils with minimal water and regenerates swiftly, making it a perfect fit for India's varied landscapes. Its deep roots stabilize soil, its leaves sequester carbon, and its low resource needs make it a climate-resilient

crop. Promoting Moringa on marginal lands can restore ecosystems while sustaining farmer livelihoods. For smallholders with limited access to fertile land, this hardy plant bridges the gap between productivity and sustainability, aligning agricultural growth with ecological health.



A Blueprint for a Circular Economy

V-3

Moringa's zero-waste potential embodies circular economy ideals. Every part of the tree—leaves, seeds, pods, roots, and bark—serves a purpose:

- Leaves, packed with vitamins and proteins, fuel nutraceuticals, school meals, and supplements.
- Seeds produce oil for cosmetics, biodiesel, and water purification.

benefits, including:



- Rich in vitamins and proteins
- Used in nutraceuticals, school meals, and health supplements
- Seeds yield oil used in cosmetics, biodiesel, and water purification
- Pods and stems ideal for animal feed and composting
- Roots and bark offer medicinal and natural dye properties

• Pods and stems enrich animal feed and compost.
• Roots and bark yield medicines and natural dyes. This versatility allows farmers and entrepreneurs to tap multiple revenue streams while minimizing waste. Localized processing units can amplify this impact, creating jobs, cutting transport costs, and keeping economic value within rural communities.

Empowering Rural Communities

V-4

A truly developed India must uplift its rural heartlands, especially small farmers and women. Moringa's low-cost cultivation and minimal inputs make it accessible to marginal farmers, offering diverse income sources—from fresh produce to value-added goods like teas, oils, and soaps. Women, in particular, can thrive in this ecosystem, managing nurseries, processing units, and marketing efforts. Strengthening women-led cooperatives, self-help groups (SHGs), and farmer-producer organizations (FPOs) can foster green jobs and gender equity, driving rural prosperity and sustainable livelihoods.



Biofuel for a Greener Future

V-5

Moringa's seeds yield oil that can be transformed into biodiesel—a renewable alternative to fossil fuels. As



India pursues its Net Zero by 2070 goal, Moringa-based biofuel could power rural transport and farm machinery, reducing diesel reliance and greenhouse gas emissions. This shift not only curbs pollution but also bolsters energy independence in remote areas, aligning with national sustainability targets.

Technology as a Force Multiplier

V-6

Integrating technology can supercharge Moringa's impact. IoT sensors can optimize irrigation, AI can predict crop diseases, and blockchain can ensure traceable, certified supply chains—boosting export potential and consumer confidence. India's AgriTech ecosystem and research hubs can innovate further, developing Moringa-based bio-packaging, pharmaceuticals, and more. This fusion of tradition and innovation can scale profitability while staying true to sustainability, sparking entrepreneurial growth in agriculture.

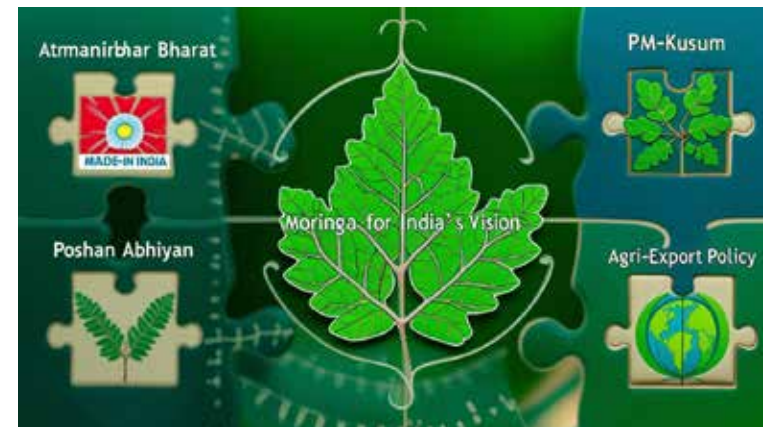


Aligning with National Goals

V-7

Moringa dovetails with India's flagship initiatives:

- **Atmanirbhar Bharat:** Fostering local production and self-reliance.
- **PM-KUSUM:** Replacing diesel with renewable energy sources.
- **POSHAN Abhiyan:** Tackling malnutrition with nutrient-dense Moringa.
- **Agri-Export Policy:** Meeting global demand for organic superfoods. Targeted policies—subsidies, minimum support prices (MSP), carbon credits, and export incentives—can unlock Moringa's full promise, weaving it into the fabric of India's development vision.



A Roadmap to 2047

V-8

Turning Moringa's potential into action requires a clear timeline:

- **By 2025:** Raise awareness and launch pilot projects in climate-stressed regions.
- **By 2035:** Expand value chains and integrate Moringa into nutrition and energy programs.
- **By 2047:** Establish Moringa as a bedrock of green growth, rural wealth, and India's climate leadership.

This phased approach can transform Moringa from a

niche crop into a national asset, delivering tangible impact by India's centennial independence celebration.



V-9

Moringa is more than a plant—it's a symbol of sustainability, resilience, and opportunity. By integrating Sustainable Moringa Agriculture into India's national development strategy, we can drive inclusive growth, ecological restoration, and green innovation. It offers a practical, scalable solution to nurture both "Jal, Jangal, Zameen" (water, forest, land) and "Jeevan aur Rozgaar" (life and livelihood). As we envision a Viksit Bharat by 2047, Moringa can lead the way—not just in healing the planet, but also in empowering its people. This holistic approach can help India achieve its sustainable development goals, creating a more resilient, equitable, and prosperous future for all.



Agriculture: The Backbone of a Viksit Bharat through Sustainable Practices.



DR. SYED ABUZAR
Head- Regulatory Affairs, APAC
Rovensa Net, Malaysia

अन्नादभवन्ति भूतानि, पर्जन्यादन्नसम्भवः।

यज्ञादभवति पर्जन्यो, यज्ञः कर्मसमुद्भवः॥

— श्रीमद्भगवद्गीता (अध्याय 3, श्लोक 14)

"Annādbhavanti bhūtāni, parjanyaḍannasambhavaḥ।

Yajñādbhavati parjanyo, yajñaḥ karmasamudbhavaḥ॥

— Śrīmadbhagavadgītā (Adhyāya 3, Shloka 14)

Long ago, India has acknowledged the backbone of agriculture as the foundation of both its economy and society. This vast, diversified land itself, while the nation strides towards this ambitious vision of a “Viksit Bharat-developed India”, agriculture stands as a major pillar towards holistic development: economic prosperity, social equity, environmental sustainability, and technological advancement. The dream could be achieved through sustainable practices of transformation in agricultural methods and ensuring that future generations will have access to all resources from which they derive benefits. This paper discusses how agriculture, aligned with sustainability, would propel India towards a future that is well balanced and inclusive.

The Cattering Role of Agriculture in the Development of the Nation

Agriculture, in fact, has been the lifeblood of India historically; has served more than 40% of the workforce and contributed around 17-18% of the GDP at the national level. It forms the backbone to the economy in ensuring food security, livelihoods for the rural masses, and preserving the culture. A “Viksit Bharat” was seen to alter the landscape of not just economics but also poverty alleviation, quality living, and empowerment of the disadvantaged, goals closely held within the agricultural space. Thus, agricultural modernization, improvement in productivity of farming, and equitable distribution of resources would enable rural economies to thrive, create a means of reducing the income divide, and help achieve a stable social order.

The fact is that agriculture is the greatest engine which may cause the industry to regenerate an agro-based industry, such as food processing, textiles, and biofuels, including more businesses, which relies heavily on the raw input

condition from agriculture. Strengthening agriculture, thus would take these industries up, triggering the employment multiplier and making way for infrastructure development. Without a vibrant agricultural base, prospering India would not be practically possible as a global economic powerhouse.

Need for Sustainable Practices

Agriculture is not merely a means of sustenance but a transformative force that can shape a “Viksit Bharat”. By adopting sustainable practices, India can achieve a harmonious blend of economic prosperity, social inclusion, and environmental health. The journey requires collective effort—from policymakers crafting enabling frameworks to farmers embracing innovation and consumers supporting local, sustainable produce. As the world looks to India for leadership in sustainable development, the agricultural sector stands ready to lead the charge. A greener, more equitable, and resilient agricultural landscape will not only fulfill the vision of a developed India but also inspire a global model for holistic growth. Through sustainable agriculture, Viksit Bharat can indeed become a reality—a testament to the power of harmonizing tradition with progress.

Sustainable Agriculture as a Catalyst for Holistic Development

1. Economic Resilience and Growth

Economically sustainable agriculture underpins the diversification of adrenaline production systems, urging the farmer to cultivate variegated crops — including millets, pulses, and horticultural products, which are climate adapted and have rising market demand. There are government-industry initiatives like the National Mission for Sustainable Agriculture (NMSA) that aim to promote organic farming clusters.

Farmers achieve cost efficiency through reduced reliance on chemical inputs and subsidies which place their incomes and rural economies in a position to promote local markets that support the overall economy.

2. Equity and Empowerment

The majority of India's agricultural workforce consists of small and marginal farmers, women, and tribal people. Such sustainable practices-jointly farming communities and cooperative models-enables these groups to obtain access to resources, training, and equitable markets. Programs such as Paramparagat Krishi Vikas Yojana (PKVY) endorse organic farming, which is labor intensive and capable of generating opportunities, particularly for women. Integrating the marginalized community into the agricultural value chain, India can thereby cure social inequalities-the very essence of Viksit Bharat.

3.Environmental sustainability

Through agro-forestry, conservation tillage, and integrated pest management, sustainable agriculture can decimate the environmental footprint of farming. Such practices are aimed at reducing greenhouse gas emissions, increasing carbon sequestration, and conserving biodiversity. For instance, the adoption of System of Rice Intensification (SRI) in states like Tamil Nadu and Odisha has shown remarkable water savings and yield improvements. By aligning itself with the global climate goals, India can project itself as a leader in sustainable development while rightfully savaging her natural capital.

4. Technological Innovations

This technology at the other end-the precision farming, drones for crop monitoring, and mobile apps for weather forecasts-augments the potential of sustainable practices. As states, the government's Digital Agriculture Mission, now is the time, to iron out the brush strokes that technology can present to each farmer in optimizing resource use based on data-driven decisions. The collection of startups and research institutes is also working on developing climate-resilient crop varieties, like the drought-tolerant maize and flood-resistant

rice, which work towards ensuring food security amidst climate change. This collaboration between tradition and innovation is blood for Viksit Bharat today and tomorrow.

Challenges and the Way Forward

Sustainable agriculture has many challenges that stand against its promises. Lack of awareness among the farmers, poor infrastructure, and unwillingness to change are some major spread among hurdles. One more hindrance is the considerable initial expenditure needed for organic certification or modern equipment. Solving these problems can be called joint efforts by government and private sector for subsidy, training programs, and easy credit. In addition, solution win through public-private partnerships should facilitate scaling the sustainable technologies.

Policy-backed support remains significant. A commitment to the future will be reflected, in encouraging eco-friendly practices, tightening norms on the use of chemicals, and developing rural infrastructure, in the scope of sustainable agriculture in the road map for Viksit Bharat. International partner also becomes a harvest of technical expertise and funds, positioning India as a global node for sustainable farming innovations.

Conclusion

However, agriculture is not only a means of livelihood, but also the transforming force that shapes a **Viksit Bharat**. The sustainable is possible only if it paces with prosperity, inclusion, and health. Whether through policy frameworks that enable or through farmers adopting innovation with consumers supporting local produce, everybody is on the course to action. Given that India is being watched for global leadership in sustainable development, so is the agricultural sector ready as it embarks upon transforming a greener, equal, and resilient agricultural landscape that will not only fulfill the vision of a developed India but will also serve as a model for global holistic advancement. **Sustainable agriculture will indeed make Viksit Bharat possible—proof of the possibility to harmonize tradition with progress.**

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Atma-nirbhar Krishi for Viksit Bharat 2047: Roadmap for Self-Reliance



As India marches confidently towards its centenary of independence in 2047, the vision of a **Viksit Bharat**—a developed, inclusive, and empowered nation—is becoming a shared national aspiration. At the heart of this transformation lies a sector that has fed the nation, employed millions and formed the cultural and economic backbone of India: **Agriculture or Krishi**. But for India to truly become a developed country by 2047, its agriculture must evolve. The mantra that will drive this change is "**Atma-nirbhar Krishi**" self-reliant agriculture. This vision is not just about achieving food security, but about empowering farmers, modernizing practices, protecting the environment and creating a robust, technology-enabled ecosystem that brings prosperity to rural India.

Meaning of Atma-nirbhar Krishi

Atma-nirbhar Krishi goes beyond the idea of self-sufficiency in food production. It envisions a system where Indian farmers have the **freedom, resources and confidence** to make independent decisions, access markets directly, adopt cutting-edge technologies, and respond to climate challenges effectively. It seeks to **liberate agriculture from systemic constraints**—like middlemen exploitation, information gaps, lack of infrastructure and unsustainable practices.

Why Agriculture Needs Transformation
Agriculture continues to employ **nearly 43% of India's workforce**, but contributes only about **15-18% to the GDP**. Despite several reforms and

PAWAN KUMAR

Chief General Manager, Patanjali
Organic Research Institute

green revolutions, small and marginal farmers—who make up over 85% of all farmers—still struggle with low productivity, poor market access and vulnerability to climate shocks.

If India is to become a developed nation by 2047, **agriculture must become more profitable, sustainable, and resilient**. This requires systemic transformation on several fronts—technology, education, infrastructure, environment and policy.

Pillars of Atma-nirbhar Krishi

1. Technology as a Catalyst

From **drones for crop monitoring to AI-powered advisory platforms**, technology is redefining the way we farm. Smart sensors, precision agriculture, mobile apps for mandi prices, and climate forecasts is already revolutionizing how farmers plan, grow, and sell. Agritech startups are already making waves—linking farmers directly to buyers, offering soil health diagnostics or even helping them access credit digitally.

Investing in **agricultural research, rural innovation hubs, and digital connectivity** is key to making such technologies accessible and affordable.

2. Strengthening Farmer Producer Organizations (FPOs)

Collectivizing farmers into FPOs empowers them with **bargaining power, economies of scale, and market access**. It helps reduce dependence on middlemen and enables farmers to access inputs, services and fair prices. Government support, training, and digital platforms can further amplify the impact of FPOs, especially in remote and tribal areas.

3. Infrastructure and Value Addition

A major pain point for farmers is post-harvest losses due to inadequate storage, transportation, and processing. Developing **cold chains, warehouses, rural food processing units**, and farm-to-fork supply chains can not only reduce waste but also generate rural employment and increase farmers' incomes.

Encouraging local processing and branding—such as millets, honey, spices, organic produce—can tap into domestic and global markets.

4. Natural and Sustainable Farming

India can lead the world in **climate-smart, eco-friendly agriculture**. Practices like **organic farming, Zero Budget Natural Farming (ZBNF)**, mixed cropping and agroforestry can reduce input costs and promote soil health, biodiversity and resilience.

Water-efficient techniques like **drip irrigation, rainwater harvesting, and Jal Shakti Abhiyan** initiatives are essential in the face of climate change.

5. Agri-Education, Youth Engagement and Knowledge sharing

Educating and skilling rural youth in modern agriculture, entrepreneurship, and digital tools will shape the next generation of farmers and agri-innovators. Revamping agricultural universities, setting up **rural innovation labs** and promoting startups and agribusiness can bridge the rural-urban divide. Knowledge sharing of best practices really motivates the farmer than anything else. More importantly, it can make farming aspirational again.

6. Inclusive Growth and Gender Empowerment

Women form the backbone of Indian agriculture, yet often remain invisible in policies and benefits. An Atma-nirbhar Krishi approach must be **gender-inclusive**, ensuring women farmers have access to land rights, credit, training and leadership roles in FPOs and cooperatives.

Similarly, integrating **tribal, dalit and landless communities** into value chains and decision-making structures is essential for equitable growth.

Goals for Atma-nirbhar Krishi 2047

By 2047, the Atma-nirbhar Krishi vision aims to achieve:

- **Zero hunger and nutrition security** for all citizens
- **Doubling of real farm incomes**, with reduced rural poverty
- **India as a global leader in agri-exports** of organic and high-value products
- **Widespread adoption of climate-resilient practices** and green farming
- Empowered rural communities that **drive the economy with pride and dignity**

Atma-nirbhar Krishi for Viksit Bharat 2047: A Shared Responsibility

Achieving the vision of Viksit Bharat is not just the job of farmers or governments. It requires the active participation of **researchers, entrepreneurs, policymakers, consumers** and civil society. Urban citizens can support by choosing **local, organic, and seasonal produce**, reducing food waste, and advocating for fair trade.

The spirit of **Atma-nirbhar Bharat** is about collective resilience and innovation. In agriculture, it means **liberating the potential of every farmer**, turning villages into engines of prosperity and ensuring that no Indian goes to bed hungry.

As we look ahead to 2047, let us also realize that the seeds of a developed India will be sown in its fields. If we empower our farmers today, we ensure a **Viksit Bharat tomorrow**—one that is just, green and truly Atma-nirbhar.

Agriculture: A Cornerstone of Holistic Development for a Viksit Bharat

Agriculture, the backbone of India's economy, is not merely a sector that feeds the population—it is a transformative force that holds the key to holistic development and the realization of a **Viksit Bharat** (Developed India). With over 54% of the Indian population engaged in agriculture and allied activities, the sector plays a vital role in ensuring food security, generating employment, enhancing rural livelihoods, and supporting inclusive economic growth.

In recent years, agriculture has undergone a paradigm shift, moving beyond traditional methods towards **sustainable, climate-resilient, and technology-driven practices**. This shift is critical in aligning the sector with the vision of Viksit Bharat by 2047—a future-ready India that is economically strong, socially inclusive, environmentally conscious, and globally competitive.



Fig 1. Role of Agriculture in Holistic Development

The Role of Agriculture in Holistic Development

Holistic development entails progress in multiple dimensions—economic, social, environmental, and technological. Agriculture contributes to each of these pillars:

1. Economic Empowerment

Agriculture contributes nearly 18-20% of India's Gross

Value Added (GVA). It provides livelihood to millions, especially in rural areas where alternative employment options are limited. Diversification into allied activities such as horticulture, dairy, poultry, beekeeping, and fisheries has helped enhance rural incomes. Initiatives like **PM-Kisan Samman Nidhi**, **Minimum Support Prices (MSP)**, and **e-NAM (National Agriculture Market)** have aimed at increasing farmers' income and integrating them into the national market system. Furthermore, the rise of **agribusiness startups**, **food processing units**, and **value-added products** is transforming agriculture from a subsistence activity to a profitable enterprise, opening up new job opportunities, especially for rural youth.

2. Social Inclusion and Gender Empowerment

Agriculture serves as a tool for **social inclusion**, reducing inequalities in rural and marginalized regions. Many government schemes now focus on **empowering women farmers**, who form nearly 33% of the agricultural workforce. SHGs (Self Help Groups), FPOs (Farmer Producer Organizations), and digital platforms are helping women access finance, training, and markets. The **PM-Formalisation of Micro Food Processing Enterprises (PM-FME) Scheme** and **Rural Livelihood Missions** have boosted local entrepreneurship, empowered communities and improving nutrition and well-being at the grassroots.

3. Environmental Sustainability

Agriculture's role in climate change mitigation is increasingly recognized. Sustainable practices like **organic farming**, **zero-budget natural farming (ZBNF)**, **crop rotation**, **integrated pest management**, and **precision irrigation** are being promoted to reduce the ecological footprint of agriculture. India is also pushing

for a **climate-smart agriculture** model under its **National Mission for Sustainable Agriculture (NMSA)** and state-level programs like **Rythu Bandhu** and **Mukhya Mantri Khet Suraksha Yojana**.



Fig 2.ESG Sustainability

4. Food and Nutritional Security

A developed nation must ensure that its citizens are not only well-fed but also well-nourished. Agriculture plays a crucial role in this by producing a diverse basket of cereals, pulses, fruits, vegetables, and dairy. With the increasing focus on **millets**—dubbed as **Shree Anna** and celebrated during the **International Year of Millets 2023**, India is promoting climate-resilient and nutrition-rich grains to combat lifestyle diseases and malnutrition. The **Public Distribution System (PDS)**, **Mid-Day Meal Scheme**, and **POSHAN Abhiyaan** also derive their strength from a robust agricultural production base.

New Developments Fueling Agricultural Transformation

Several recent developments highlight agriculture's evolving role in building a Viksit Bharat:

1. Digital Agriculture Mission

Launched in 2021, the **Digital Agriculture Mission** promotes the use of

emerging technologies like AI, blockchain, remote sensing, IoT, and drones. The **AgriStack** initiative aims to create a unified farmers' database for better targeting of services, subsidies, and credit.

2. Precision and Climate-Resilient Technologies

Companies and institutions are developing **drone-based crop monitoring**, **sensor-based irrigation systems**, and **weather-adaptive sowing advisories** to help farmers reduce input costs and increase resilience to climate shocks.

3. Natural Farming Promotion Scheme

Natural farming is being scaled up across India as a sustainable, chemical-free, and regenerative approach



DR VIJAYA TRIPATHI
R & D Head, Nutrelis Agro Foods



Fig 3. Digital Agriculture Mission

to agriculture. States like Andhra Pradesh and Himachal Pradesh are leading examples, showing how natural farming can increase farmers' profits while restoring soil and water health.

4. GATI Shakti & Infrastructure Push

The PM GATI Shakti initiative is investing in infrastructure development—roads, cold chains, rural markets—which is critical for reducing post-harvest losses and improving access to urban and international markets.

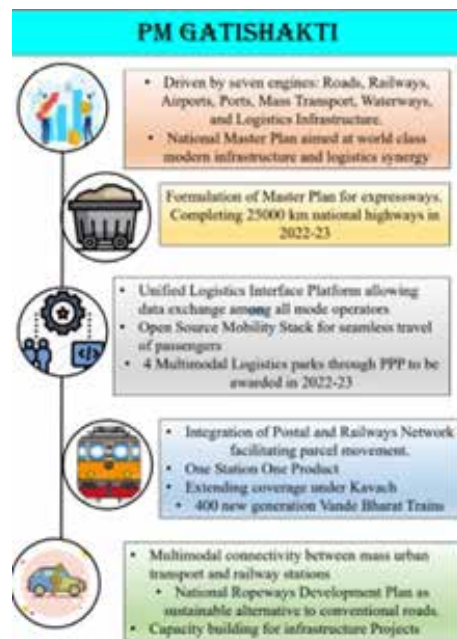


Fig 4. GATI Shakti

5. Agricultural Export Boost

India's agricultural exports crossed **\$50 billion in 2023**, with products like basmati rice, spices, marine goods, and organic produce leading the way. The government is targeting **\$100 billion** in agri-exports by 2030 under its **APEDA (Agricultural and Processed Food Products Export Development Authority)** initiatives.

The Road Ahead: Key Strategies for a Viksit Bharat

To fully leverage agriculture's potential for holistic development, India must focus on:

- **Agri-Education and Skill Development:** Empowering rural youth with modern agricultural skills and entrepreneurship training.



Fig 5. Agriculture Boost

- **Land and Water Reforms:** Promoting efficient use of land and water through watershed management, drip irrigation, and land consolidation.
- **Strengthening Farmer Producer Organizations (FPOs):** Enabling smallholders to gain collective bargaining power.
- **Access to Finance:** Expanding institutional credit and crop insurance coverage, especially for small and marginal farmers.
- **Research and Innovation:** Boosting public-private investment in agri-R&D for climate-resilient and high-yielding crop varieties.

Conclusion

Agriculture is much more than food production—it is a force for empowerment, equity, sustainability, and economic growth. As India marches toward its centenary of independence in 2047, agriculture will be at the heart of building a Viksit Bharat—one that is prosperous, inclusive, green, and resilient. By aligning agricultural practices with sustainability, technology, and inclusive growth models, India is not only securing the future of its farmers but also paving the way for a balanced and holistic development path that can serve as a model for the world.

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