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September 2023 **AGRICULTURE TODAY** 

# **DISTANCE TO DIGITISATION**

Addressing the nation from the ramparts of the Red Fort on the occasion of 77th Independence Day celebrations, Prime Minister Shri Narendra Modi underlined his desire to launch a scheme through which women in around 15,000 self-help groups (SHGs) would be trained to fly and repair drones. His inclination to popularise 'Drone Ki Udaan' indicates a new era in agriculture - one which will see agriculture march hand in hand with technology.

Agritech is hardly a new trend. The potential of the same has been in discussion for some time now. The rise of startups fanned the flare of agritech advent. From pre-harvest to marketing, agritech has solutions that would not only augment the efficiency but also ensure sustainability and accountability of the entire value chain. Not only are farmers but the consumers too gain from the agritech interventions in agriculture.

Judicious use of resources has always been a cause of concern in agriculture. Site specific management practices are non-existent in Indian agriculture. The application of digital tools to optimise the use of resources, carrying out surveillance of farms, transfer of targeted information to farmers, forecasting the incidence of disease and weather related anomalies have immense opportunities. However, the digitalization of agriculture has certain challenges to overcome. Issues such as investment, scattered landholdings, digital divide, language barriers and most importantly the skill set required for propagating and adopting the same have not yet been fully addressed.

The farmers in our country may not be able to invest in the technological interventions. However, the government can help them by subsidising the cost of technology integration in the farms. The solution towards popularising digital agriculture in India lies in collaboration. Private sector can play an

enabling role in this. Public private partnerships can hasten the rate of technology adoption. Incentivising the use of technology, community participatory approach and feminisation of technology can usher in an era of technology acceptance in routine farm jobs.

The distance to digitisation is small but the will required is enormous. Years ago digital payment was inconceivable in a country like India. But now, it has been effortlessly integrated into our lives. The same future is possible for agriculture. What is required, is a political will, and a desire to innovate.

In



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# **TECHNOLOGY IN AGRICULTURE Ensuring Food Security and Enhancing Farmer Prosperity**

n light of the world's burgeoning population, the role of technology has become indispensable for the future of agriculture. By the year 2050, the global population is projected to reach approximately 9.6 billion. This stark reality implies that farmers must augment their vields by 50 percent in order to meet the escalating demand. The urgency is even more pronounced in India, where diverse agroclimatic zones, millions of land holdings, and the intricate smallholder ecosystem underscore the need for technological advancements. The Indian agricultural sector, which has displayed robust growth with an average annual rate of 4.6 percent over the past six years, stands poised to rise to this challenge. Notably, agricultural exports have surged to an impressive \$50.2 billion in the fiscal year 2021-22.

In this context, modern agricultural technologies assume a pivotal role in addressing the imperative of producing more food on limited land while mitigating environmental impact. These technologies streamline essential processes such as planting, irrigation, and harvesting, culminating in heightened productivity with minimal environmental consequences. Precise resource management involving water, fertilizers, and crop protection inputs further attests to their efficacy in promoting sustainable practices.

#### Technology - A Transformative Force

The contemporary innovation of Artificial

About the **AUTHOR** Dr. K.C. Ravi **Chairman Crop Life India** and **Chief Sustainability Officer,** Syngenta India Pvt Ltd.



With over 1.72 crore farmers and 2.05 lakh traders registered on the e-NAM platform, integration with more than 1,000 grain markets across states and union territories has occurred seamlessly.

Intelligence (AI)-enabled sensors and transmitters empowers plants to communicate, articulating their needs and sensations. The Internet of Things (IoT) augments agricultural practices, ushering in an era of 'smart' farming through seamless integration of cutting-edge technologies. Sensors and transmitters play a pivotal role in monitoring vital aspects including soil and plant health, as well as greenhouse humidity levels. The data they yield facilitates the enhancement of growth conditions and overall efficiency. Furthermore, real-time insights pertaining to soil conditions, weather patterns, and crop health empower farmers to make informed decisions, optimizing their methodologies. By removing speculation and uncertainty from crop cultivation, technology serves as a trans-

formative force.

The advent of automated machinery, drones, and robots agricultural tasks such as augments seeding, spraying, and crop monitoring, thereby minimizing human error. Leveraging torical and cur-



rent data, technology aptly predicts disease outbreaks, pest infestations, and crop yields, thereby bolstering risk management strategies.

As technology catalyzes agricultural advancements akin to Industry 4.0, there emerges an opportune realm for publicprivate partnerships (PPP). The private sector, propelled by innovation in digitization and AI, is uniquely positioned to complement emerging technologies, facilitating their integration into the agricultural landscape. In tandem, the vast troves of generated data harbor the potential to revolutionize efficiency and yield optimization. By bolstering financial returns for farmers, these advancements positively impact their livelihoods, while also enabling predictive insights that minimize risk and waste. Notably, digital tools play an instrumental role in expediting the discovery of new molecules, consequently yielding the latest crop protection products. AI, satellite imagery, and drones collectively contribute to the assessment of crop yields, the surveillance of pests, weeds, and diseases, and the advancement of precision farming techniques.

#### **Government Intervention**

The convergence of AI and IoT with big data, sensors, drones, and computer imaging, bolstered by analytical tools, furIndia proudly stands as a beacon of comprehensive digital technology adoption, underscored by the India Digital Ecosystem of Agriculture (IDEA) framework.

nishes actionable insights that drive progress. The Government of India's Digital Agriculture Mission 2021-25 underscores the importance of projects predicated on technologies such as artificial intelligence, blockchain, remote sensing, GIS technology, drones, and robots to galvanize agricultural transformation.

India proudly stands as a beacon of comprehensive digital technology adoption, underscored by the India Digital Ecosystem of Agriculture (IDEA) framework. This pioneering framework lays the foundation for a federated farmers' database, linking publicly available data with digitized land records to foster innovative, technology-driven solutions. Empowering agriculture in India, this framework aligns with the overarching objective of amplifying farmers' income and enhancing the efficiency of the agriculture sector.

The National e-Governance Plan in Agriculture (NeGP-A) dispenses funds to states and union territories for projects that leverage modern technologies such as AI, Machine Learning, Robotics, Drones, Data Analytics, and Blockchain. Likewise, the 'Agriculture Infrastructure Fund,' as a central sector scheme, finances digital connectivity and optic fiber infrastructure investments. The Central Institute of Agricultural Engineering, Bhopal (ICAR-CIAE) has developed the Krishi Yantra App to bolster research, operations, and technology dissemination within the sphere of agricultural engineering.

The electronic National Agriculture Market (e-NAM) has substantially alleviated the challenges faced by smallholders. With over 1.72 crore farmers and 2.05 lakh traders registered on the e-NAM platform, integration with more than 1,000 grain markets across states and union territories has occurred seamlessly. The pervasiveness of the internet and smartphones promises to revolutionize the agricultural landscape, rendering the integration of smallholders into the digitally enabled system a necessity.

#### **Addressing Challenges**

However, a lack of awareness among the majority of small and marginal farmers poses a significant impediment. Capacity building emerges as an imperative aspect in achieving the envisioned objectives. While acknowledging the inevitability of a data-driven revolution in agriculture, it's crucial to recognize that the complexities inherent to the sector necessitate a multifaceted approach. Technology alone cannot be the panacea; instead, capacity building, particularly for under-educated small and medium farmers, forms a cornerstone for sustainable progress.

A salient observation made by the World Bank underscores the pivotal role of the digital revolution and the data it generates in shaping an efficient, environmentally sustainable, and equitable agriculture and food system. This paradigm has the potential to seamlessly connect the world's myriad farms with a global population of 8 billion consumers.

\*The expressed views by the author are strictly personal

# KRISHYAM **GENERATIVE ARTIFICIAL INTELLIGENCE FOR SMART AGRICULTURE**

griculture, the backbone of human civilization, has constantly evolved to meet the growing demands of a burgeoning global population. As we navigate an era of climate change, resource scarcity, and unpredictable weather patterns, innovative solutions are needed to ensure sustainable and efficient agricultural practices.

Generative Artificial Intelligence (AI) has emerged as a transformative tool that has disrupted many sectors and offers unprecedented potential to revolutionize farming and address critical challenges faced by the agriculture sector.

#### What is Generative AI?

Generative Artificial Intelligence, is an advanced technology that involves using algorithms and machine learning models to create new and original data based on patterns and examples from existing data. Unlike other AI techniques that focus on analyzing and interpreting existing data, generative AI aims to generate new content, such as images, text, audio, or even video, that is indistinguishable from human-created content.

Generative AI has gained significant attention and recognition for its ability to produce creative and realistic outputs across various domains. One of the key strengths of generative AI lies in its ability to understand and capture the underlying structure of the training data, allowing it to generate new data that adheres to those patterns. By leveraging large datasets,

generative AI models can learn complex relationships and generate highly realistic outputs that are often indistinguishable from human-created content.

It represents a groundbreaking advancement in the field of artificial intelligence. By enabling machines to generate new and original content, generative AI opens up a world of creative possibilities and practical applications across various industries. As technology continues to evolve, it is essential to explore its potential benefits while addressing the ethical considerations associated with its use.

#### Why Generative AI is important for Agriculture?

Generative AI is also finding applications in the field of agriculture, transforming farming practices and improving crop management. Here's how generative AI is being used in agriculture:

#### **Crop Yield Optimization**

Generative AI models analyze large datasets comprising soil composition, weather patterns, historical crop data, and other relevant factors. This allows farmers to make informed decisions regarding irrigation, fertilization, and crop selection to optimize yield. By leveraging generative AI, farmers can allocate resources efficiently, minimize wastage, and achieve higher productivity, ultimately enhancing profitability and food security.

#### **Disease and Pest Detection**

Generative AI helps in the early detection and identification of crop diseases and pest infestations. By analyzing sensor data, satellite imagery, and historical records. Al models can identify patterns and indicators of diseases or pests. This enables farmers to take timely preventive

The global generative AI market size is expected to reach USD 109.37 billion by 2030. The market is expected to expand at a CAGR of 35.6% from 2023 to 2030. Growing demand to modernize workflow across industries is expected to drive the demand for generative AI applications among industries.



#### About the **AUTHOR**

Mr Deepak Pareek, an agriculture strategist, has been honoured by World Economic Forum. He is a global influencer in the agriculture and technology domain being a regular speaker, moderator and evangelist

#### COMMENTARY

measures, such as targeted treatments or pest control strategies, minimizing crop damage and losses.

#### Synthetic Biology and Genetic Engineering

Generative AI assists in the design of synthetic DNA sequences and genetic circuits. AI models can analyze existing genetic data and generate novel sequences with desired characteristics. This capability helps researchers in genetic engineering applications such as developing crops with enhanced nutritional value, improved resistance to pests or diseases, and increased tolerance to drought or extreme temperatures. Generative AI speeds up the process of designing genetic constructs and reduces the need for time-consuming trial-and-error experiments.

#### Metabolic Engineering

Generative AI is employed in metabolic engineering, which involves modifying metabolic pathways in crops to enhance desirable traits. AI models can analyze complex metabolic networks and predict optimal genetic modifications to improve yield, quality, and resilience in crops. By simulating different metabolic scenarios, generative AI assists in identifying genetic targets for engineering specific biochemical pathways, leading to the production of valuable compounds, such as biopesticides, bionutrients, and biostimulants.

#### **Climate Adaptation**

Climate change poses challenges to agriculture, with unpredictable weather patterns and extreme conditions. Generative Al models can analyze climate data and provide insights into optimal planting times, suitable crop varieties, and appropriate cultivation techniques. By adapting to changing climatic conditions, farmers can mitigate risks, maintain crop productivity, and enhance resilience.

#### Soil Management

Generative AI can assist farmers in optimizing soil management practices. By analyzing soil composition data, AI models can recommend appropriate fertilization strategies, crop rotation plans and soil conservation measures. This helps in maintaining soil health, minimizing nutri-



By enabling machines to generate new and original content, generative AI opens up a world of creative possibilities and practical applications across various industries

ent depletion, and reducing the environmental impact of farming practices.

#### Crop Breeding and Genetic Improvement

Generative AI accelerates crop breeding processes by analyzing vast genetic datasets and simulating breeding scenarios. AI models can predict the performance of different crop varieties, identify desirable traits, and optimize breeding strategies. This expedites the development of improved cultivars that are more resistant to diseases, pests, and environmental stresses, contributing to enhanced agricultural productivity and sustainability.

#### Precision Farming

Generative AI plays a crucial role in precision agriculture by providing real-time insights for targeted resource management. By analyzing data from sensors, drones, and satellite imagery, AI models can identify variations in soil moisture, nutrient levels, or plant health within a field. Farmers can then precisely apply water, fertilizers, and other inputs only where needed, optimizing resource usage and minimizing environmental impact.

#### Virtual farming

Generative AI could be used to create virtual farms that can be used to test new crop varieties and farming practices without spending resources in the physical world. This would allow researchers and farmers to experiment with new ideas without having to risk their actual crops and only take to field that concept that has shown promise in the virtual world.

#### **Empowering Small-Marginal Farmers**

Generative AI has the potential to level the playing field for small-marginal farmers who often lack access to advanced agricultural technologies and expertise. By providing actionable insights and guidance, AI-powered platforms can empower farmers with knowledge and enable them to make informed decisions. This democratization of information enhances productivity, reduces dependence on traditional farming practices, and improves the economic viability of small farms.

#### Generative AI for More Sustainable Agriculture

Generative AI in agriculture offers immense potential to improve efficiency, sustainability, and productivity in farming practices. By harnessing the power of Generative AI-driven models, farmers can make data-driven decisions, adapt to changing conditions, and optimize resource allocation, ultimately contributing to a more sustainable and resilient agricultural sector.

As the world faces the complex challenges of feeding a growing population while safeguarding our planet, the need for transformative solutions in agriculture becomes increasingly crucial. Generative Al offers immense potential to revolutionize farming practices, optimize resource management, improve crop yields and quality, and enhance resilience to climate change. By embracing the power of generative AI, we can usher in a new era of sustainable agriculture, ensuring food security, environmental conservation, and the well-being of farmers and consumers alike. OBSER<u>VATION</u>

ost-Independence agriculture was the driver of the economy that contributed to more than half of the GDP. Today, our country is still the largest and most diversified food producer in the world. India is the second largest producer of wheat, rice, cotton, farmed fish, sheep & goat, meat, vegetables, fruits, and tea, and the top producer of pulses, milk, and spices. It is the primary livelihood of almost 55% of the Indian population, but productivity per unit of land is low, leaving farmers with low returns. Indian Agriculture can flourish and boost farmer livelihoods provided the

factors such as increasing yields, productivity improvement, and sustainability enhancement are addressed.

#### **Government Aid**

TRANSFORMING INDIAN

AGRICULTURE

Several schemes are introduced in the country to encourage farmers to adopt technologies like AI, Machine Learning, drones, data analytics, and blockchain in their farming methods. Small and marginal farmers are encouraged to adopt mechanization through Custom Hiring Centers located throughout the country. The electronic trading portal, e-NAM, as on July 3, 2023, had more than 1.75 crore farmers and 2.45 lakh traders registered. Funds from the PM KISAN scheme are transferred into the bank accounts of eligible farmers under the Direct Benefit Transfer mode.

Different apps are available on the Indian Council of Agriculture Research

The electronic trading portal, e-NAM, as on July 3, 2023, had more than 1.75 crore farmers and 2.45 lakh traders registered



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#### **OBSERVATION**

(ICAR) website that informs farmers on crops, horticulture, and marketing practices such as packaging, prices, weather, and other advisories. The government also provides crop-related advisories to registered farmers through SMS. The Meteorological Department (IMD) generates medium-range weather forecasts at district and block levels. The Meghdoot mobile app and social media such as WhatsApp help farmers to access weather alerts. The Radar Satellite-1 (RISAT-1A) enables applications in agriculture, predominantly paddy monitoring in the kharif season, mapping of water bodies, estimating crop damage severity levels, forest cover, etc. The SVAMITVA scheme maps land parcels in rural areas using drone technology giving rural people the right to document their residential properties.

#### **Startups & Private Projects**

Indian farmers are gradually turning towards conservation agriculture, which improves yields, saves water and energy, improves carbon sequestration, and reduces greenhouse gases. Farmers are encouraged to adopt various components in conservation agriculture in steps and modify the process to suit their skills and capital.

Agricultural startups are experimenting with gadgets to mimic agents that promote a conducive ecosystem. For example, the Polybee mimics the bees' function in pollination. The Polybee is an aerial drone that vibrates flower trusses releasing pollen that leads to the formation of fruits. Startups provide postharvest solutions such as digitizing the grains, which are available online for sale and farmers also can avail of a loan digitally. Laser land leveling (LLL) is another technique to improve the input efficiency of water and increase cultivated area, which is gaining importance in the states of Punjab and Harvana.

Some agri-tech startups are venturing into innovations in Climate Smart Agriculture technologies such as energy management, site-specific nutrient management, minimum tillage, stress-tolerant



#### The India Digital Ecosystem of Agriculture (IDEA) will serve as a foundation to build this federated farmers' database

cultivars, and crop diversification with location-specific recommendations, etc.

Precision agriculture is the management of farms through technology that identifies the utilization of precise amounts of inputs to increase average yields. A few apps help diagnose plant diseases, nutrient deficiencies and suggest treatment measures. Scientists, farmers, and plant experts are part of the online community ready to discuss issues related to plant health.

Smart equipment such as solar pumps, agriculture sensors, weather tracking technology, imaging technologies, GPS, and the Internet of Things save electricity, water, and assess fertilizer requirements and pesticide usage. Gadgets allow for real-time monitoring, expert advice, and prediction of crop health.

#### **Ease of Accessibility**

The government aims to bring all schemes and stakeholders on a single platform for ease of accessibility. In 2021, the Digital Agriculture Mission 2021–2025 was initiated to boost the sector to adopt technologies. A major intervention of the Ministry of Agriculture and Farmer Welfare is the implementation of Agri Stack, a digital foundation that will bring all stakeholders in agriculture on one platform. This huge integrated platform will significantly improve the agriculture value chain. The India Digital Ecosystem of Agriculture (IDEA) will serve as a foundation to build this federated farmers' database.

The effort will enable farmers in the country to have information on finance and agricultural inputs, localized and tailored early warning systems for disasters, easy access to apply for government schemes, affordable finance, private participation, ease of governance, and improve targeting of government benefits.

#### Challenges

Any solution in Indian agriculture must address productivity, reduction in costs, appropriate cropping decisions, and better prices for the produce for it to be relevant and successful. Most of the agritech platforms have morphed into e-commerce platforms as they have not been able to provide solutions for the farmers.

The big impediments are the lack of appropriate equipment and the cost of ownership. The laser land leveling technique is limited due to costs and land size. Small and marginal farms limit the use of machinery in terms of execution and affordability. Also, farmers require guidance in the selection of farm equipment. For instance, farmers in hilly terrains require machinery suited to their terrains. Lack of manpower, adequate skills, knowledge, and costs limit technology percolation into Indian agriculture.

#### Way forward

Implementation of digital technology will require the costs to be low, and encourage the use of portable equipment, renting and sharing platforms for agriculture tools and machinery, and support from government establishments.

Research institutes through local programs can reach out to farmers and help them understand the usage of digital technologies. New digital models can be location-specific, and suit region-specific farmer needs while addressing farmer partnerships, changing market demand, and consumer preferences that influence the supply chains in the market.

# *Peru and India must work together in the Agricultural Sector*

Dr. Teresa Stella Mera Gómez, the Vice Minister of Foreign Trade at the Ministry of Foreign Trade and Tourism of Peru, holds a clear view of what her priorities are in her new capacity. She is keen to foster collaboration of India and Peru in the agroindustry segment and also in addressing concerns of sustainability and environmental responsibility. In her interaction with Agriculture Today, she explores the nuances of foreign trade and Internationalization of Peruvian companies.

#### What are the key priorities and objectives of the Ministry of Foreign Trade in promoting Peru's exports and attracting foreign investments?

Peru has in place a National Export Plan for the period 2020 - 2025, under the Ministry of Foreign Trade that seeks a progressive and aggressive development of foreign trade of goods and services, through the joint effort of the public and private sector. Its general objective is to increase and diversify the Peruvian exportable offer and achieve a competitive insertion in international markets as well as facilitate foreign trade, seek efficiency in the international logistics chain, generate capacities for exporting companies to achieve internationalization and the consolidation of an export culture.

#### One of the critical issues in international trade is sustainability and environmental responsibility. How is the Ministry of Foreign Trade addressing these concerns while promoting economic growth through trade?

Our Ministry has implemented a strategy of Sustainable Culture, which seeks to promote and disseminate sustainable practices in the Peruvian export sector. Through constant articulation between the public and private sectors, academia and other actors in the foreign trade sec-

### We have 22 FTAs with 58 countries, which represent 83% of world GDP.

tor, the participation of companies in the implementation of concrete actions to address global challenges in terms of sustainability is encouraged. The work carried out has had a positive impact on important value chains such as coffee, cocoa, alpaca garments, native biodiversity products, manufactured products, among others.

### What are the opportunities that you see in India?

We do not compete in many of our export products and in those that both economies produce, there are different windows that allow us to export, especially when we talk about fresh products such as grapes, avocados and blueberries. It is a country that has a growing middle class, increased income and changes in consumption habits, which allows us to think that it represents a great opportunity for the export of many of our products.

### How can India and Peru work together in the field of agriculture?

Peru and India must work together in the agricultural sector since both countries share similar characteristics. Both countries have a huge genetic and climatic diversity. In this sense, it is necessary to approach the ICAR of India and the National Institute of Agrarian Innovation of Peru (INIA). However, not only these two institutions must collaborate; this work should also take place at the level of the Plant Protection Offices of both countries in order to exchange experiences in key areas such as the Integrated Pest Management.

In addition, collaboration must be done on the exchange of genetic material to obtain varieties with specific characteristics, and allow farmers in our countries to obtain better yields and guarantee food security.

#### As Vice Minister, what measures and policies do you plan to implement to support the growth and competitiveness of Peru's agricultural sector?

Agroindustry is one of the most important sectors in our total exports. In order to support the growth and increase the competitiveness of this sector, we work intensively to improve market access conditions through our trade agreements. In addition, we are working to improve agricultural productivity to meet the growing demand while maintaining environmentally sustainable practices; to strengthen our sanitary and phytosanitary systems; to support the internationalization of enterprises, especially of MSME in our regions, and the development of value chains with export potential.

For this purpose, we are strengthening the coordination of work among the productive sector with the Ministry of Agricultural Development, as well as the Ministry of Production. For example, we have launched a multisectoral strategy called "Productive Export Route", where the 3 ministries work together to provide support to farmers, producers and SMEs that want to start exporting, or are looking to reach new markets.

In addition, we have been implementing various measures to improve the capacities of our producers and businesses, in particular, to help them adopt sustainable practices and business models, in line with the new consumption and production trends. Regarding trade facilitation, we prioritize simplifying processes and making them digital, so the whole trade chain can reduce costs and time. We are also working to improve the transparency in logistical services.

We are focusing on work with small entrepreneurs, building their capacities in foreign trade matters, so they can better integrate in global and regional value chains.

#### How is the government supporting and facilitating SMEs' participation in international trade & how can you support us?

We need to improve and facilitate the participation of MSMEs in cross-border e-commerce and promote the adoption of sustainable business models in line with the new market demands.

We are also working in the internationalization of Peruvian companies, and for this we must work on several factors such as improving access to financing for exporters, through the Internationalization Support Program, which has recently completed its third call, and we hope to launch a new one this year. Likewise, we have been working to promote the digitalization of the processes of the international logistics chain, through the improvements and implementation of new services in the Single Window for Foreign Trade.

Regarding Peru's trade integration policy through trade agreements, it should be noted that this has been very positive for the country. We have 22 FTAs with 58 countries, which represent 83% of world GDP. 92% of Peruvian exports are covered by our free trade agreements, that essentially benefit MSMEs that export nontraditional goods.

In this context, it is important to continue diversifying the destination markets for our exports. For this, we seek to resume negotiation processes that were pending, such as the optimization of the Free Trade Agreement with China, the optimization of the trade agreement with Brazil and the negotiation with India.

#### What are some of the major challenges you have encountered in your role as Vice Minister of Foreign Trade, and how do you plan to address them moving forward?

After the pandemic, Peru has had to face disruptions due to political instability and climate shocks. In this context, we currently have the challenge of promoting the recovery of our economy, and especially supporting vulnerable groups and working with all the regions of the country, in order to generate inclusive and decentralized development.

For this, we are aware that from the public sector we must improve coordination among the different sectors and strengthen our institutions and governance, in order to improve the impact of our interventions as well as the efficiency in the use of resources.

In the case of my sector, which is foreign trade, we have been working in an articulated manner with other ministries as well with the private sector, in order to develop effective policy measures that can contribute to the development of our exports. We are focusing on work with small entrepreneurs, building their capacities in foreign trade matters, so they can better integrate in global and regional value chains.

# 2ND INDIA ANIMAL HEALTH SUMMIT

### **UNVEILING THE VITALITY OF MANAGEMENT AND POLICY FRAMEWORKS**



griculture Today organised the 2nd India Animal Health Summit at Holiday Inn, Aerocity, New Delhi on 26th July, 2023. The summit was organised in an effort to unify the different stakeholders of animal health sector on a single platform to discuss, evolve, measure and develop animal health strategies.

#### **INAUGURATION**

The inaugural function saw the participation of Dr Abhijeet Mitra, Animal Husbandry Commissioner, GOI; H. E David Pine, Hon'be High Commissioner, New Zealand; Dr J K Jena, DDG Fisheries and Animal Science, ICAR; Dr Tarun Sridhar, Former Secretary, Department of Animal Husbandry, GOI; Prof KML Pathak, Former Vice-Chancellor Deen Dayal Upadhyay University of Veterinary & Animal Sciences and Ms. Anjana Nair, Group Editor, Agriculture Today.

Dr. KML Pathak addressed the audience and welcomed everyone by giving a small insight of the 1st India Animal Health Summit. Dr. Pathak observed that after 2014 livestock sector has seen drastic changes due to in-

The National Commission on Agriculture (NAC) has recommended having one veterinarian for every 5,000 animals, but the ratio is almost 50% in most of the Indian states. numerable initiatives of Government Sector. Budget allocation for Livestock Health has increased, new programmes were initiated, vaccine production has increased, mobile veterinary units were introduced etc. which inturns led to the fast growth rate observed in animal husbandry sector.

Dr. Tarun Shridhar conveyed his thoughts regarding animal health by emphasizing on its correlation with human health. He also said that from pre-historical days animal heath was deemed important. In fact, World Health Organization was formed 24 years later to the formation of World Health Organization of Animal, which clearly shows how much importance to animal health was given.

Dr. JK Jena talked about the deficient areas in animal health. He noted that de-

#### REPORT



velopment and proper use of cost effective vaccines, with importance to capacity building and proficiency development has to be emphasized upon. It is usually said that an individual can't make any difference but the fact is difference start from an individual.

H. E David Pine observed that how two different countries are collaborating. He discussed New Zealand's Dairy Industry and how the country was excelling in its milk production and productivity.

The summit was inaugurated by lighting of the lamp. The audience included delegates, panelists, invited guest and many other dignitaries.

#### **PANEL DISCUSSIONS**

#### Session :1 Policies and Regulatory Ecosystem in Animal Health

The session was moderated with Dr. Tarun Shridhar, Former Secretary, DAHD, GOI. The panelists included speakers Dr Abhijit Mitra – Animal Husbandry Commissioner, Govt of India; Dr PK Uppal – Former Advisor, Govt of Punjab; Dr JK Jena, DDG (fisheries), ICAR and Mr. Navneet Dhand, Consultant, Mott Macdonald.

**Dr. Uppal** suggested that an apex body should be established for coordinating the four pillars -Risk assessment, management and communication; Modern Animal Health Framework; Biosecurity and Innovation and research along with adoption of modern animal health practices.

Dr. JK Jena put forward that technology

needs to be simple like sending messages from mobile with a unique Id which could be a mobile number and also like animal aadhar card.

Dr Dhand, advocated early detection of diseases and control of antibiotic usage. He also discussed about anti-microbial resistance and measures to counteract it.

#### Session-2: Animal Health for One Health Management

**Dr. Praveen Malik**, Former Animal Husbandry Commissioner, GOI & CEO Agrinnovate chaired the session. He set the session in motion by making complimentary remarks on Animal Health for One Health Management and introduced the panelists Dr. Stanley Fenwick, Technical lead for One Health & Global Health, Mott Macdonald; Dr. A Sahoo, Director ICAR-National Research Centre on Camel; Dr. Avinash Anand, Former CEO & MD, Uttarakhand Sheep & Wool Development Board and Dr. Arun Atrey, MD & CEO, Zenex.

**Dr. A Sahoo** pointed out that Implementation of one health needs collaboration of all the stakeholders. He pointed out that antimicrobial resistance was due to the misuse of antibiotics in animal health segment and urged that there should be an awareness about policies for proper use of antibiotics. Dr. A Sahoo opined that pastoralist should have animal health card while travelling as disease do transfer while travelling from one state to another. **Dr. Fenwick** stated that zoonotic diseases and animal diseases can be addressed by proper management. Animal health and management should be considered as same issue as human health. We look for animal health to cure human health. He also suggested that animals must be made climate resilient.

**Dr. Anand** observed that animal husbandry is an unorganized sector which needs to be organized into cooperative bodies. Sheep and Goat husbandry value chain reach upto export level. He addressed the initiatives introduced for dairy stakeholder's involvement in one health implementation. He also discussed about National Digital Livestock Mission which included farmer's aggregators and mobile vet van for 24X7.

**Dr. Atrey's** discussion was mostly centered on the myths surrounding antibiotics usage in animal health management. He pointed out that 75% antimicrobial resistance emerges from hospitals and rest 25% from humans in animals. In 2010 report it was observed that India uses 3% antibiotic and has 12% of livestock population of the world. He suggested to work in collaboration with researchers/scientists or veterinarians and should slowly move towards safer organic option.

#### Session-3 : Innovative Approach In Animal Health Delivery and Management

The session was chaired by Dr. GS Rajhoria, President, India Dairy Association. The

#### REPORT

panelists of the session were Mr. Aseem Rawat, Founder-Hetha; Ms. Shruti Sharma, Investment Specialist, Invest India; Dr. Naveen Kumar, Scientist-NRCE; Mr. Ravi Shiroor, Co-founder-Stellapps; Dr. B Sarvanan, President-Tamil Nadu State Veterinary Council.

**Mr. Rawat** introduced himself and his venture, Hetha which worked solely with Indigenous cows. He introduced his organization which had more than 1000 cows. He talked about his animal health management strategy and suggested animals should be tested for serious diseases.

**Dr. Kumar** focused his whole speech on vaccines and diseases. His discussion was centered on Lumpy skin disease and the vaccine he has developed. He said that people in other countries were looking towards Indian variant as it was cheaper compared to European variant, which costs around Rs 250 per dose. He stated that technology was never a problem rather the regulatory measures create problem. He also cleared the misconception surrounding vaccination.

**Ms. Sharma** recalled that 15 startups were given opportunities to give sales pitch to some knowledge sharing also.

Mr. Shiroor explored the opportunities of advanced technologies in animal health management. He expected the technologies to create an interface for the farmers who can find solutions to their problems in their

1. Academic Leadership	Dr NH Kelawala
2. Program Leadership	Dr Avinash Anand
3. Extension Leadership	Dr Ajit Singh Yadav
4. Innovation Leadership	Stellapps
5. Technology Leadership	Dr A Sahoo
6. Corporate Leadership	Zenex Animal Health
7. Best Company in Animal Pharma	AIMIL Pharmaceuticals Ltd
8. Best Company in Animal Feed	Kemin Industries South Asia P. Ltd
9. Bet Company in Vaccines	Venkateshwara Hatcheries Pvt Ltd
10. Best State in Animal Health Management	The State of Andhra Pradesh
11. Startup of the Year	Mooofarm
12. Young Scientist	Dr Naveen Kumar
13. Life Time Achievement	Sh Atul Chaturvedi

**INDIA ANIMAL HEALTH 2023 AWARDEES** 

#### own language.

**Dr. Sarvanan** introduced NAMO's VET (National Animal Mobile Operation Veterinary) scheme. In his presentation, he introduced the veterinary schemes and programmes in Tamil Nadu.

#### Session-4 : CEOs Panel on the Roadmap



#### for Making India a Global Power

The speakers included Mr. Neeraj Matiyani, India Head – Digital Native Business of AWS; Dr Sanjay Gavkare, Venkateshwara Hatcheries Pvt Ltd; Dr Bhushan Kumar Charpe, Group Product Manager, Dairy – AH, Provimi and Mr Sushanta Dey, Director – Marketing, Kemin Industries South Asia Pvt Ltd. The session was moderated by Prof KML Pathak, Former DDG(AS), ICAR & Ex VC DUVASU.

The discussions were centered on the potential of livestock and poultry in enhancing India's export market. It was a widely accepted fact that livestock sector is seeing an unprecedented growth and the panelists were of the united view that India has to tap into this. They agreed upon the fact that animal health becomes a defining point and we have to strengthen our animal health management strategies to make India a global power. Technology, farmer awareness, vaccination and proper use of antibiotics were also discussed.

#### AWARD CEREMONY

The award ceremony saw the participation of dignitaries like Prof KML Pathak, Shri Atul

Chaturvedi, and Shri JK Jena. Relevance of animal health in livestock production was stressed upon during the address. It was widely emphasized that health and production go hand in hand and various initiatives and programmes of government of India were discussed that mainly aimed to maintain livestock health and thus enhance its production which in turn has helped in raising Indian Economy. Winners of 2nd India Animal Health Awards 2023 were felicitated.

Shri Atul Chaturvedi stated that the three big agriculture commodities in terms of export were meat, fish and basmati. They contribute to foreign exchange. He stated that "Any farmer who invest in livestock never resorts to suicide".

The ceremony concluded in a celebrity note and by vote of thanks by Ms. Anjana Nair, Group Editor- Agriculture Today Group.

#### **ROAD MAP FOR ANIMAL HEALTH MANAGEMENT**

- Assessment management and communication,
- Modern animal health
- Biosecurity at farm level
- Innovation & research
- Collaboration of all the stakeholders
- Awareness about policies for proper use of antibiotics
- Animal health card for pastoralist
- Equal Importance to be accorded to animal health and human health management
- Enhancing climate resilience in animals
- Organizing animal husbandry into cooperative bodies
- Disease surveillance
- Development of technologies to create an interface for the farmers in disease detection

# A TRIBUTE TO A LEGEND

By PK Gadru

Yusuf Curmally passed away peacefully in Basel, Switzerland on 17th August 2023. It was a day of mourning for the Sandoz Agro family for Yusuf carried the Tricolor to global heights. He was amongst the founding fathers of the Sandoz Agro business in India. He rose from the position of an executive assistant to Managing Director of Sandoz to Head of Agro Division to Global Markets. Later he headed back to India as Managing

Director and Chairman the of same company before mergers to form Novartis/Syngenta. Yusuf Curmally was a legend who understood the global agro chemicals market and was well appreciated by his peers. He was also the 2nd Vice President of Pesticides Association of India under Vetran's Gobindjibhai Shroff and PP Singhal ji between 1969 and 1972. We all owe a huge gratitude to him. May the departed soul rest in peace.





#### **OVERVIEW**

# PIONEERING THE FUTURE OF INTEGRATED FARMING SYSTEMS

s the world faces the challenge of feeding an ever-increasing population while preserving the environment, the agricultural sector is searching for smart technological solutions. Smart agriculture incorporates various technologies, such as sensors, drones, satellite imagery, smartphones, blockchain, AI, and big data analytics etc. An integrated farming system (IFS) is an agricultural production system integrating two or more agricultural enterprises on the same farm. Smart agriculture and IFS are complementary technologies that can be used together to achieve even greater benefits. The future of farming systems depends mainly on adopting innovative, intelligent, and smart technologies. The agricultural sector's growth and progress are more critical to human survival than any other industry.

#### Convergence of Cutting-Edge Technologies

#### Smart Sensors in the Field

Smart agriculture operates at the intersection of big data, cloud, and IoT, providing farmers with precise information on vital parameters like soil moisture, temperature, and nutrient levels by strategically placing intelligent sensors in the fields. This datadriven decision-making is becoming a hallmark of modern farming systems, enabling farmers to make informed decisions based on this vast amount of data.

#### **Drones for Data Collection**

Agriculture drones offer farmers significant benefits, with high-quality cameras, GPS, navigation systems, sensors and programmable controllers. These UAVs can process and transform data into valuable information, enabling remote or automated control using agriculture software-controlled flight plans in their embedded system. These advanced



systems can perform tasks like crop health monitoring, fertilizer application, soil health scans, weather tracking and yield estimation while collecting and analyzing data.



#### About the **AUTHOR**

Dr. Sunil Kumar, Director ICAR- Indian Institute of Farming Systems Research Big Data, the life of new agriculture

Big data analytics tools are being developed to assist farmers in crop planting, irrigation, and pest management. These tools enable precision agriculture by analyzing soil conditions, crop health, and weather patterns, optimizing yields and reducing input costs. Additionally, they aid in crop forecasting, enabling better decision-making for planting, harvesting, and marketing.

#### Animal monitoring

Big data can help analyze animal health, feed intake, and movement patterns, identifying and addressing health problems early. M2M livestock solutions like FindMySheep enable global tracking of animals, while CattleEye uses overhead cameras and computer vision algorithms to monitor cattle health and activity remotely. Electrofishing and Marine Harvest use secure video surveillance to track fishery production and aid in fishing management.



#### Supply chain management

Big data analytics can track food product movement, ensuring safety and traceability of organic products. Blockchain technology reduces transaction costs and establishes financial security.

#### Weather Prediction

Data science significantly impacts weather forecasts by analyzing various weather patterns

#### Fertilizers Recommendation

Data science professionals can help farmers find the correct fertilizer quantity, addressing the global issue of fertilizer misuse by analyzing associated factors.

#### **Disease Detection and Pest Management**

Advanced algorithms in agriculture help predict pest invasion and disease spread, using nature's patterns and behaviour. Disease detection using drones and image processing and machine learning tools can identify infected area.

#### Adaptation to Climate Change

Big Data analysis can revolutionize farming by analyzing soil data to understand how soil can cope with climate change, releasing greenhouse gases and adapting to it.

#### Down on the Robotic-farm

Agricultural robots can work in various farming operations, including weed management, fruit picking and disease control. They use camera and image recognition technology to detect and remove weeds and learn to distinguish between weeds and crops based on leaf size, shape, and colour.



#### Smartphone

Low-cost mobile phones and data have revolutionized agricultural services, enabling farmers to access real-time weather, plant health monitoring, market information, and farming-related activities.

#### **Smart Irrigation Revolution**

Smart water systems, based on IoT technology, enable farmers to control water pumps, reducing travel and waste remotely.

#### Policy for Nurturing Growth

The Govt of India has implemented several initiatives to promote smart agricultural practices, including Digital India Initiatives,

#### The National Commission on Agriculture (NAC) has recommended having one veterinarian for every 5,000 animals, but the ratio is almost 50% in most of the Indian states.

Pradhan Mantri Kisan Samman Nidhi (PM-KISAN), Agriculture Infrastructure Fund (AIF), National e-Governance Plan in Agriculture (NeGP-A), National Agriculture Market (e-NAM), and subsidies for agricultural machinery and equipment. These initiatives aim to provide internet connectivity to rural areas, support small and marginal farmers in investing in modern agricultural practices and smart technologies and enhance service delivery and transparency in agriculture-related schemes and programs. The government also provides subsidies for various agricultural machinery and equipment, including smart farming tools like precision irrigation systems, drones, and smart sensors.

#### **Role of the Public Sector**

The public sector plays a crucial role in supporting smart agriculture integration through policies, regulations, and standards. It supports research and development, invests in infrastructure and facilitates training programs for farmers and workers. Governments also facilitate extension services to disseminate information to remote areas. Public institutions lead in data collection, quality assurance and sharing protocols, while open data initiatives foster innovation and collaboration in the private sector.

#### **Role of the Private Sector**

Private sector companies drive smart agriculture technology development, while large corporations invest in research and innovation to create tailored solutions for farmers. They manufacture and distribute smart agriculture equipment, sensors and monitoring devices, ensuring accessibility across regions. Private companies collaborate with farmers to integrate scalable, adaptable solutions, offer data analytics and insights, provide training and support services and strengthen agricultural value chains through technology-driven solutions. These companies also collaborate with buyers, processors, and retailers through digital platforms.

By collaborating and leveraging their respective strengths, the public and private sectors can drive the successful implementation of smart agriculture systems in integrated farming systems.

tête-à-tête with Anjana

# DIGITAL TECHNOLOGIES ARE PROMISING

Born and brought up in Kalri Jagir, a remote village in Karnal in Haryana and the one who walked away from a promising engineering education to pursue his passion for agriculture, Susheel Kumar is man of grit and determination. Battling all the odds and limitations of being a farm boy, Susheel today is the Managing Director and Country Head, Syngenta India Pvt. Ltd. He holds an MBA in Agribusiness Management from Symbiosis Institute of International Business and a bachelor's degree in Agriculture Operations and **Related Sciences from Chaudhary Charan Singh Haryana Agricultural** University. The rural urban divide and the intense desire to come up with farming solutions drove him more towards agriculture. Today in Syngenta, he works shoulder-to-shoulder with farmers to empower them by introducing cutting edge technologies. In a discussion with Anjana Nair, Group Editor, Agriculture Today, Susheel discusses about the scope of digital agriculture in India and its opportunities.

#### What is the scope of digital agriculture in India?

With the world's population growing, technology has become crucial for agriculture. We need to produce more food from limited resources. From autonomous robots to satellites and cutting-edge science to drones now, farmers around the world are deploying new technologies to help them work in smart and cost-effective ways.

At Syngenta, we are turning data into meaningful information that is powerful in the hands of our growers. Combined with farmers' deep knowledge of their land, our insights help farmers to run their operations more productively and cost efficiently, reduce their inputs, increase their profits and yields and ultimately enable more sustainable agriculture.

Modern agricultural technologies streamline processes like planting, irrigation, and harvesting, leading to higher productivity and reduced labour demands. It also enables precise management of resources such as water, fertilizers, and crop protection products. This minimizes waste and enhances crop yields. This is a unique moment in the history of agriculture.

#### Do you think farmers in India will accept modern technologies? How has your experience been?

As I said this is a unique moment in the history of agriculture. Over the past few years, the agro-industry has gone through a roller coaster ride, witnessing changes and advancements in farming approaches and techniques. Technologies have evolved, and sustained innovations prevail to increase yield and reduce costs.

We are working closely with all type of farmers across the country to help meet their challenges. As technology and communication systems are becoming robust, the adoption of smartphones is growing, the use of digital solutions is witnessing an uptick. Syngenta has been working with farmers for over 90 years,



tête-à-tête with Anjana

and we have witnessed a positive response from our farmers in almost all of our offerings. With Digital, we are working shoulder to shoulder with farmers to ensure they get the best value from us.

#### **Can you elaborate?**

Our CropWise Grower App has already

We had undertaken the Syngenta Drone Yatra which was a pan-India activity that covered over 17,000 kms, while providing Drone Spray Demonstrations to over 10,000 farmers.

garnered over 1.5 million downloads in less than a year as farmers use its features such as Crop Doctor - an Al/ ML based pest and disease recognition tool, Weather Alerts, Mandi Prices, Crop Calendar based on their farms and crop, farmer loan to procure Syngenta products, geo-tagging-based Farm Area Calculator, Spray Service Booking and many more. Cropwise Grower App has been beneficial for them in improving the quality of their yield, allowing them to procure better rates for their produce. With the farmers' usage patterns, we have noticed that farmers are using weather update feature the most, which has provided insights to us also in making our digital offerings better suited for farmers. With this, we have launched the new Crop Calendar feature which combines our offerings and personalizes the advisory based on the weather, location and others parameters of farmers.

We also took up an initiative to educate our farmers about the new technological advancements in agriculture such as Drone Sprays. We had undertaken the Syngenta Drone Yatra which was a pan-



tête-à-tête with Anjana

India activity that covered over 17,000 kms, while providing Drone Spray Demonstrations to over 10,000 farmers. Our initiative was attended by many government officials and dignitaries, including the Agricultural Ministers, Chief Ministers and many more. We experienced that there were many confusions, misconceptions and queries of farmers that need to be cleared. We have incorporated these learnings into our communication, as well as in this year's Drone Yatra in Haryana and Punjab, where we conducted an Independence Day special event for farmers in Punjab.

#### What are the digital products from Syngenta?

Syngenta thrives on R&D and innovative technology in crop protection and seeds to serve the farmers. We also adopt a number of tech-led Farmer Applications to provide them 24x7 assistance on crops, diseases, weather, pest, best agronomy and much more in regional languages. Our CropWise Grower App with Crop Doctor feature is helping thousands and thousands of farmers every day. It is available in 10 major languages. We also have worked on developing a unique biodiversity sensor which has been designed in collaboration with IIT Ropad in Punjab to study the behaviour of insects around farms, particularly bees and butterflies. The sensor runs on solar power and captures live data which can be used to study insect behaviour and decide on the field activities.

#### How has these digital products helped in maximising efficiency of Indian farms?

With our Digital offerings, we are aiming to help farmers optimize their resources better and maximize their outcomes. As a simple example, our Drone Spray services was launched last year, and this year we are introducing over 500 drones pan-India. Unlike traditional spray methods, drone sprays require up to 95% less water. Since its inception, 2643 acres



have been sprayed commercially so far using our Drone technology and our operations are active in seven states: Maharashtra, Punjab, Haryana, Madhya Pradesh, Andhra Pradesh, Telangana, and Karnataka.

Using the CropWise Grower App, farmers were able to detect pest and diseases on their crops sooner, and take remedial actions faster. Many farmers also made use of our Crop Calendar and followed our Crop advisory. Using our Personalized Crop Calendar, farmers can plan their entire crop, from land preparation to harvesting. They receive advisory about nutrition, crop protection and other inputs, leading to savings related to inputs costs and better management of farm soil. Since the launch of the Crop Calendar feature, almost 1L farmers have benefitted through improved quality of crop and safeguarding their crop through extreme weather conditions using advisory.

Are you planning for collaboration or are you in talks with any startups in digital agri space? In Feb 2023, Syngenta India Pvt Ltd partnered with IoTech, an agricultural Drone manufacturer and seller to provide a Drone Spray Service for growers in India. IoTech is currently working actively with Syngenta in endorsing Drone sprays by participating in various promotional activities including the recently conducted Syngenta Drone demonstration across India. IoTech is also actively working with Syngenta Foundation to create agrientrepreneurs for Drone spraying.

# What are the technologies in future that are promising in agriculture?

Technologies that hold the promise of promoting sustainability are blockchain technologies for food safety, controlled environmental agriculture (CEA) and biotechnology, along with 3D printing technology that allows the production of food products while saving both time and energy. With adequate and timely information at hand, even remotely-located rural farmers can adopt practices for sustainable and climate-smart agriculture that result in economic gains





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#### About CACL

Concept Agrotech Consultants is a professionally managed private limited company, providing a wide range of consulting services in agriculture sector. Launched as a private limited company in 1994, CACL has come a long way in providing knowledge-based services to the agri-business sector. A dedicated team of qualified professionals with requisite experience, field network and extensive database of people associated with agriculture at various functional levels, the company is capable of accomplishing any assignment successfully. Over thirty agribusiness clients today acknowledge the company's quality and reliability of services.

#### **BUSINESS SERVICES:**

- Research and Studies
- Business Consulting
- Data & Regulatory Services
- Agro Ventures
- FarmIQ IT Solutions

#### **FARM SERVICES:**

- AgroCert (GAP Certification)
- AgroSource (Produce Sourcing)
- FarmerConnect (Contract Farming)
- FarmSolutions (Farm Consultancy)
- Product Services (Marketing and Promotion)

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#### www.cacl.in

# **ENTREPRENEURSHIP IN AGRITECH** HARNESSING THE POTENTIAL OF INDIA'S AGRICULTURAL SECTOR

s per Economic Survey 2022-23, over the last four years, Agritech start-ups have raised approximately INR 6,600 crore from private equity investors, with an annual growth rate of more than 50%.

An EY report states by 2025, it is expected that the Indian agriculture sector will grow to a value of US\$24 billion. The sixth-largest food and grocery market in the world is in India, where 70% of sales are made through retail. This spurt in demand for Agri-Tech is largely expected to be driven by the emerging need for building a more resilient Agri-food valuechain, rapidly changing climate, rising income levels in rural and urban areas, increasing demand for food due to growing population.

Accordingly, the market is being driv-

en by the increasing use of innovative technologies such as Blockchain. machine learn-(ML), artifiing intelligence cial drones, (AI), geographic information systems (GIS). remote sensing technologies as well as the introduction of numerous e-farming applications.

One potential thematic area of Agritech is precision agriculture, which uses technology such as sensors, drones and data analytics to improve crop yields and reduce waste

**Key Areas for Investment Outlook** 

Agritech start-ups in India are focusing on several thematic areas. Agritech companies innovate and solve for livestock management, farm mechanisation, farm inputs, precision agriculture, farm analyt-

ics and agronomy advisory, post-harvest management, contract farming, market linkage and supply chain management

#### About the **AUTHOR**

AJAY KAKRA Managing Partner, JU Agri Innovation Ventures solutions, fintech facilities for credit and insurance, and quality management and traceability.

Pre-production players include Prosus-backed DeHaat, Info Edge-backed Gramophone, and JM Financial PEbacked BigHaat, while Production players include Omnivore-backed Krishify, India Quotient-backed BharatAgri, Northern Arc-backed Jai Kisan, Orios-backed Unnati, and Accel-backed Samunnati.

Lightrock-backed WayCool, Quona Capital-backed Arya, Omidyar-backed Bijak, Prosus-backed Vegrow, and Walmartbacked Ninjacart are among those in the post-production phase.

#### **Potential Thematic Areas**

One potential thematic area of Agritech is precision agriculture, which uses technology such as sensors, drones and data analytics to improve crop yields and reduce waste. This not only helps to increase food production and improve efficiency, but it also has the potential to help farmers adapt to the impacts of climate change by allowing them to better manage resources such as water and fertilizers.

Another potential thematic area is vertical farming and indoor agriculture, which uses technology to grow crops in controlled environments such as greenhouses and vertical farms. This can help to reduce the impact of extreme weather conditions on crop yields and improve food security in regions facing water scarcity.

#### Hurdles in AgriTech Implementation

In terms of financing, the cost of implementing Agritech solutions is a major barrier for many farmers, particularly smallholder farmers. There is a need for government policies and private sector investment to support the development and adoption of affordable and accessible Agritech solutions.

Rapid technological and infrastructure development has opened up a new dimension in which issues like hyper localization and fragmented supply chains can be addressed. The recent increase in mobile connectivity in India has also increased the potential to solve information distribution problems and provide verified market linkages on both the demand and supply sides.

#### Key Challenges for Start-up Founders and Fund-Raising Ability

One of the major challenges is the lack of access to funding. Agritech start-ups in India often struggle to raise initial funds from investors due to limited domain knowledge and lack of prior experience and exposure to the sector.

Additionally, Agritech start-ups face difficulties in scaling their operations due to seasonal and largely unorganised nature of the industry besides the lack of infrastructure and availability of skilled manpower in rural areas.

#### **Strategies of Receiving Funds**

Building a strong team and network: Having a team with relevant experience and a network of contacts in the industry can help to increase a start-up's credibility and chances of securing funding.

Showcasing proven solutions and results: Demonstrating that a start-up's solution has been tested and with proven results can help to increase the confidence of potential investors. This can be achieved by leveraging the various incubation and acceleration platforms started by the government or large corporates in the private sector.

Building partnerships: Building strategic partnerships with larger companies or organizations can help to increase a start-up's visibility and credibility and make it more attractive to potential investors.

Support of government policies: The Indian government's "Make in India" initiative and "ease of doing business" policy can help to promote the development



and adoption of Agritech in the country by encouraging innovation and investment.

#### **Digital Agri Entrepreneurship Ideas**

Most early stage startups are developing digitally enabled business models for creating a digital impression for their businesses. The digital enablement provides them with a strong Direct to Consumer (D2C) presence which creates a greater control over the consumers and provides relevant feedback for realigning their business to consumer demands and preferences. D2C marketing provides a jump start to the growing startups and helps it to gain quick brand visibility to compete with large established brands.

The other side of digitization is the adoption of AI enabled business models. Blockchain based agri tech startups can be a good example of the same. Blockchain enabled supply chain can provide a great deal of value addition to integrated businesses and can provide resilience to businesses in terms of tracking and traceability of produce from the origin, identifying rejected lots or batches for large export consignments to enable further loss of business and monitoring multiple level of suppliers for large brands.

Another use case for the digital technology can be case of drones in agriculture. Use of drones helps in reducing the cost of spraying and chemicals alongwith reducing the water consumption drastically. However, greater use of drones can be for crop analytics and predictive analysis for yield, pest infestation and overall crop health.

Lastly, digital initiatives in agriculture can be used in climate change analytics. Regenerative agricultural practices play a key role in mitigating the climate change risk. Further with proper capturing of data and systematic models, the carbon sequestered through regenerative agriculture can be leveraged to generate carbon credits for the farmers. This can augment their income and make the agricultural systems more remunerative.

#### **Future of Agritech**

The future of Agritech in India is promising, with the sector expected to continue to grow in the coming years. New technologies such as vertical farming, aquaculture, and agri-logistics are expected to gain traction and drive innovation in the sector. Farmers and entrepreneurs in India, as a highly entrepreneurial country, have the capability to develop systems that are self-sufficient, efficient, and sustainable. On-the-ground data from the supply and demand sides is critical for making informed and focused decisions. It is important for entrepreneurs, investors and the government to work together to harness the potential of Agritech to drive sustainable growth and development in the agricultural sector.

# SMART **SMART** AGRICULTURE DRIVING INNOVATION

mart agriculture has provided the agriculture industry with the framework to leverage advanced technologies like IoT, big data and the cloud to optimize operations from production to harvest and storage. With provisions for advanced analytics, monitoring, tracking, automation and forecast agility, smart agriculture is changing the agricultural landscape in India.

Agri-based tech-driven startups are helping farmers and other stakeholders in the supply chain to evolve and adapt to changing times. They are bringing the business mindset to the agricultural sector.

#### The Bustling Agritech Market

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The agritech market in India is forecasted to reach \$24.1 billion by 2025, which means it will be growing at a CAGR of 25% by 2025. This is fuelled by the agritech startups and the combined efforts of the government. There are approximately 450 agritech startups in India as of 2021 and this number is steadily growing. These focus on various sectors of agriculture such as supply chain management, farm management, market access, marketing, quality control, forecast, precision farming etc.

The government and the industry are realizing the potential the sector holds. In 2020 alone, Agritech companies in India raised approximately \$243 million in funding. This increased interest by the investors in the sector and its digitization marks the growth of smart agriculture in India. Technologies like remote sensing, Internet of Things (IoT) devices, satellite imaging, data analytics, vertical farming and hydroponics, crop management software, sustainable practices, market trend analysis etc., are being used to optimize and improve yield, farming practices, and reduce input costs.

#### Increasing the Efficiency of Agri Sector

Trends and techniques like these have incentivized and inspired agri-tech start-ups to offer disruptive scalable business solutions that can address the inefficiencies in the agricultural sector. From enhancing the adoption of sustainable cultivation practic-

About the AUTHOR Pushkar Limaye, Co-Founder and CTO at Carnot Technology



es to improving crop quality to re-designing the supply chain, agri-tech in 2023 aims to remove roadblocks in the entire production and distribution phase and increase efficiency.

The emergence of new disruptive ways to tweak the business models is helping the agri-value chain players to enhance production, productivity, and profitability.

#### **Innovative Interventions**

A major part of the agriculture value chain development is looking into innovative ways of linking producers to end users. Agritech is helping develop fully integrated value chains that enhance sales to companies or end users from independent farmers.

Agri-tech companies are also looking into better yield forecasting with the help of technology including sensors, drones, satellite imagery, soil condition, etc., to understand the yield holistically.

Besides this, an agri-tech startup has also identified a crucial community involved in agriculture and coined a term for them -Rental Entrepreneurs. This community of approximately 60 Lac entrepreneurs was earning their livelihood by renting. With a telematics system that offers insights like real-time tracking, precision measurement of rental work done in acres, fuel status etc., the agri-tech start-up built a one-stop solution for the multiple needs of REs.

In addition to this, start-ups are also focusing on reducing the bottlenecks in connectivity, the lack of traceability, etc., which often restrict the growth of agribusinesses. The scope for smart agriculture Technologies like remote sensing, Internet of Things (IoT) devices, satellite imaging, data analytics, vertical farming and hydroponics, crop management software, sustainable practices, market trend analysis etc., are being used to optimize and improve yield, farming practices, and reduce input costs.

is multifold as the agricultural sector is a complex system with multiple cogs.

#### Involvement of Public Sector

Initiatives by the government such as the Digital Agriculture Mission (DAM) 2021–2025 initiative are a great way to help agritech start-ups unlock new possibilities and identify the current gaps in the chain to increase food production and profitability.

Going forward, the sector needs enhanced public-private collaboration. The public and private sectors play distinct yet complementary roles in this sector. The public sector including government agencies and regulatory bodies set the framework for smart agriculture through policies, guidelines, and regulations. This includes providing incentives, subsidies, and grants to encourage farmers to adopt smart agriculture practices.

The public sector can invest in research and development of new technologies, improve existing practices, and address specific challenges the Indian agricultural sector faces. Besides this, investment in infrastructure development, such as rural connectivity and digitization, will also enhance the adoption of smart agriculture technologies.

#### Enhanced Private Sector Participation

The initiatives by public sector can be complemented by the private sector. Private companies and startups can drive technological innovation in smart agriculture. The private sector can also better adapt to responding to market demands by creating tailored solutions for farmers' needs. They can work on developing user-friendly applications, automated machinery, and services that improve productivity and efficiency. Private investors provide funding for research, development, and implementation of smart agriculture technologies. Besides this, the private sector can also help agribusinesses by facilitating services like market linkages, supply chain management, and access to credit, enhancing the overall value chain.

Smart agriculture with solutions that are specifically for India with its unique topographies, multiple languages, multiple crops, seasons and small landholding sizes can lead to a sustainable and successful transformation of the agricultural sector.

# Smart Agriculture SUSTAINABLE AGRICULTURE

he agriculture sector plays a very important role in the Indian economy because 56 per cent of the country's population is directly or indirectly dependent on agriculture. Moreover the contribution of agriculture to the country's gross domestic product is around 20 per cent. Agriculture salvaged Indian economy during the critical times of COVID-19.

Unfortunately Indian agriculture is significantly vulnerable to climate changes. Variability of monsoon sometimes affects the crop yield to the extent that Indian food security is challenged.

#### **The Changing Climate and Agriculture**

Between 1901 and 2022, temperatures in India have risen at the rate of 0.6 °C pushing the mean temperature to 25.1 °C. An agriculture expert survey apprehends that this rise in temperature may decrease the productivity of most of the Indian crops by 10% to 40% by the year 2100.

The major impact of climate change will be on rainfed or non-irrigated crops, which are cultivated in about 60% of the crop area. An increase of 0.5 °C in winter temperature is estimated to reduce the yield of rainfed wheat in India by 0.45 tonnes per hectare.

All the more, increasing natural disasters adds up the critical challenges to Indian agriculture The Government of India's Economic Survey (2018) estimated annual losses of US\$ 9–10 billion due to the adverse effects of climate change. In India, the effects of climate change could lead to a nationwide decline of up to nine percent in major crop yields between 2010 and 2039, which could worsen over time. Depending on the location and future climate scenario, the production loss could be up to 35% in rice, 20% in wheat, 50% in sorghum, 13% in barley, and 60% in maize.

#### **Towards Solutions**

Climate uncertainties have raised the need to adopt the concept of Climate Smart Agriculture (CSA) to mitigate the negative impacts of climate change on agricultural systems in India. Climate-smart agriculture is rooted in sustainable agriculture and rural development objectives which, if achieved, will contribute to achieving the Millennium Development Goals (MDGs) of reducing hunger and better environmental management.

About the AUTHOR Dr. Ravindra Pastor, CEO, EFASAL In India, the effects of climate change could lead to a nationwide decline of up to nine percent in major crop yields between 2010 and 2039, which could worsen over time According to a World Bank report, "The food security challenge will become more difficult, as the world will need to produce about 70% more food by 2050 to feed an estimated 9 billion people. The challenge is exacerbated by the extreme vulnerability of agriculture to climate change. The negative effects of climate change are already being felt in the form of rising temperatures, weather variability, shifts in agricultural ecosystem boundaries, invasive crops and pests, and more frequent extreme weather events. In the field, climate change is reducing crop yields, the nutritional quality of major cereals, and livestock productivity. Substantial investment in adaptation will be required to achieve increases in production and food quality to maintain current yields and meet demand."

#### **Smart Farming**

Smart farming refers to the application of modern information and communication technology (ICT) in agriculture. It promises to revolutionize the world of agriculture through the application of supported and driven solutions such as the Internet of Things (IoT), actuators and sensors, geopositioning systems, drones or unmanned aerial vehicles (UAVs), precision instruments, robotics, Big Data, Analytics etc.

Smart farming has real potential to deliver tangibly efficient and sustainable agricultural production through data-driven insights helping in calculated decisions and better resource management. From the farmer's perspective, smart farming will provide the farmer with the tools to make better decisions and more efficient operations and management.

#### **Government Schemes & Initiatives**

The government is promoting the adoption of smart farming methods through the use of technology and innovation in the agriculture sector in the country. The government is implementing a Digital Agriculture Mission (DAM) which includes India Digital Agriculture Ecosystem (IDEA), Farmer Database, Unified Farmer Service Interface (UFSI), Soil Health Scheme, Soil fertility and profile mapping scheme etc.

Central Government is also funding states on New Technology (NEGPA). Under the NEGPA program, funding is provided to state governments for digital agriculture projects using emerging technologies such as Artificial Intelligence and Machine Learning (AI/ML), the Internet of Things (IoT), Block chain etc.



Smart farming has real potential to deliver tangibly efficient and sustainable agricultural production through data-driven insights helping in calculated decisions and better resource management.

Government is also promoting schemes such as The Per Drop More Crop component of the Pradhan Mantri Krishi Sinchai Yojana (PMKSY-PDMC) aiming to enhance water use efficiency at the farm level through micro-irrigation technologies .Government is also reviving Mahalanobis National Crop Forecasting Center (MNCFC). Even drone technologies are being promoted & adopted. Government is supporting start-ups and agripreneurs to promote smart farming.

#### Third Green Revolution/ Agriculture 4.0 in India

Smart farming and IoT-driven agriculture

are paving the way for what can be called the Third Green Revolution or Agriculture 4.0. After the plant breeding and genetics revolutions, the third green revolution is taking over agriculture.

In future, smart farming revolution portends optimally efficient management of pesticide and fertilizer reducing overuse of chemicals and thus abuse of soil. IoT technologies will enable better food traceability, resulting in enhanced food safety. It would also be beneficial to the environment by promoting efficient use of water, or optimization of treatment and inputs. Therefore, smart farming has real potential to provide a more productive and sustainable form of agricultural production based on a more precise and resource-efficient approach. There is a need to emphasize the balanced use of chemical and organic agricultural inputs in smart ways of doing agriculture.

The new farms would finally realize the eternal dream of mankind. This will feed our population, which is expected to grow to 9.8 billion by 2050. A more sustainable and natural agriculture can play an important role in promoting environmental protection. **IN FOCUS** 

# SMART FARMING FOR AGRICULTURE 4.0

he precision agriculture market has gained tremendous impetus from the increased commercial viability of drone technologies. Drones will be supporting the farmers in a wide range of tasks from forecasting and planning to the actual cultivation of the crops in the forthcoming years. This will subsequently aid in supervising the fields to make sure that the crops grown are healthy. Additionally, the concepts of Agriculture 4.0 and advancements in the GPS technologies are poised to revolutionize the global precision farming market, which was worth \$5.2 billion at the end of 2018 and the revenue avenues are estimated to increase at a notable CAGR of 14% during the forecast period of 2019 to 2025.



About the **AUTHOR** Mihir Shah, CEO - AgriOwn Farmtech

#### **Data in Agriculture**

Higher in the atmosphere, Earth Operating Satellites (EOS) operated by government and private bodies hover over, monitoring soil conditions, health of vegetation and possible crop harming factors. IoT also enables farmers to connect with each other on a digital platform. With real time information from satellites and access to the latest research in agriculture, farmers can plan and alter their state of agriculture to maximize yield percentage. Since data are collected by smart agriculture sensors, soon increased demand from development of farm management in this sense is inevitable.

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In the future, the industry will need more precise, efficient, cost-effective, and

diversified key components such as sensors, control systems, robotics, autonomous vehicles, automated hardware, variable rate technology, motion detectors, button camera, and wearable devices. These data are used to track the state of the business in general as well as staff performance, equipment efficiency, crop vield and its health, livestock's behavioral pattern and so on. With new sensors, cameras and other devices, professionals can gain a holistic view of their farm and pinpoint actionable insights. This means farmers can foresee the production output and this allows them to plan for better distribution.

#### Agriculture 4.0

The agriculture sector is catching up as technology is changing the world. The introduction of automated farm equipment, drones, Internet of things (IoT) and sensors have changed the business of agriculture. This transformation is widely known as Agriculture 4.0.

Agriculture 4.0 considers the value chain side along with the demand side of the food-scarcity situations, by using the technology to address and improve the real needs of consumers and structure the value chain. Agriculture 4.0 has four major objectives that will place pressure on the agriculture industry to meet the demands of the future by taking into consideration of the aspects such as scarcity of natural resources, demographics, climate change and food wastage. Additionally, it will not be only dependent on fertilizers, pesticides and applying water across the field. Besides, the agricultural sector will rely on temperature and moisture sensors, robots, GPS and aerial technology in the upcoming years.

Drones can boost India's GDP by up to 1.5%, address challenges for the country's key agriculture sector.

#### General Trends that are Disrupting the Precision Agriculture Market Produce differently using New Techniques

Hydroponics, algae feedstock, desert agriculture, seawater farming, and sustainable packaging using bioplastics are the major changes that are observed as the latest techniques in Agriculture 4.0. These techniques are the enhanced versions of farming that is driving the growth of the precision agriculture market.

#### New Technologies are Bringing Food Production to the Consumers

The new technologies such as vertical and urban farming, genetic modification, and applying 3 D printing technology are augmenting the demand for precision agriculture. Considering genetic modification, the crop improvements with traditional techniques were used to grow drought-resistant wheat. However, genetic modification is needed to meet the demand for foods in the future.

Agriculture Drones are being Actively

Startup like AgriOwn Farmtech is working on pay per use model for Agriculture Drone services like spraying & crop health monitoring to help the small holders and marginal farmers of Gujarat & other geographies of India. With the PPP (public private partnership) model AgriOwn Farmtech is working with Gujarat Government & IFFCO to serve farmers with Drone & Nano Urea technologies to increase productivity and has served more than 11,000 farmers & 30,000 acreages across Gujarat state.

#### Employed

The global agriculture drones market size was valued at \$0.88 billion in 2020, and is projected to reach \$5.89 billion by 2030, registering a CAGR of 22.4% from 2021 to 2030. According to Frost and Sullivan, drone usage in India within the agriculture market will grow at 38.5% CAGR and reach \$121.43 million by 2030 and the adoption rate of drones will be 2% of the total agriculture machinery spending.

Drones can boost India's GDP by up to 1.5%, address challenges for the country's key agriculture sector. Application of drones in agriculture will provide employment opportunities, especially in small towns and rural areas for more than 5 lakh young people.

In order to promote the use of drone technology in agriculture, Department of Agriculture and Farmers Welfare (DA&FW) is providing financial assistance of 100% of the purchase cost of agriculture drone by institutes under Indian Council of Agricultural Research, Krishi Vigyan Kendras (KVKs), at 75% to FPO, at 50% to Farmers up to a maximum of Rs. 10 lakhs per drone.

It will be great boost and encouragement to the Indian DaaS (Drone as a Service) model Agritech startups where they will have help from Indian government on Service link benefit (S.L.I) like similar P.L.I scheme.

# **EXAMPLE 1** The formation of the series of t

One of the fastest-growing start-ups in the Agri-Tech sector and one of the very few companies providing end-to-end solutions & services to the farming community in India, DeHaat is currently operating in 12 Indian states with an extensive network of 12000 DeHaat Centers & 503 FPOs, serving 2 million farmers. In conversation with Agriculture Today, Mr Shashank Kumar discusses the digital structure in agriculture today and how DeHaat is helping farmers. Excerpts from the interview

#### Digital agriculture and smart tools have taken the agri discussions by storm. But how deep have they penetrated in the real world?

In the last 5-6 years, globally the overall grow of digital agriculture has been phenomenal. In India, every farmers' household has one smart phone. But again there exists a regional variation. For instance, in western India like Maharashtra and Gujarat, 65-70% farmers use smart phones. In eastern India, in states such as Bihar and West Bengal, it will be around 25-30%. Dehaat has been interacting with farmers through many interfaces. Our DeHAAT Centres, handling transaction of agri inputs, has observed that farmers are comfortable with using their smart phones for UPI transactions. I would say 25-30 % of farmers who buy inputs from DeHaat prefer UPI payments over conventional methods. It shows their inclination for digital tools.

Farmers also use smartphones for better price discovery, better information discovery and better crop advisory. Farmers growing cash crops like grapes, pomegranate and export varieties of potato are better inclined to use customised advisories in precision agriculture.

Among several agriculture stakehold-

We have 12000 DeHaat centers in rural India and 2 million farmers are transacting through them.

Shashank Kumar, CEO and Co-Founder, DeHaat. ers who participate in the value chain such as agri input retailer, local output aggregator, local MFI, arhatiya, we have seen 100% penetration of digital tools. They have become more efficient.

### What is the current trend of digital agriculture globally?

Average landholding size plays a major role in absorption of digital technology. Developed world therefore is well ahead of us in terms of acceptance and usage of digital technology. They are cruising ahead with Farm ERP, Insurance and measuring green house gas emissions. With the success of digital agriculture we will be able to bundle more and more services. In India, digital agriculture is not even 10% of total agriculture, whereas globally speaking it is 70-80%. In India most of agri innovators have tough time to monetise their services.

# How can digital agriculture increase the profitability of agriculture?

We have observed more than 50% increment in farmers' income because of the entire intervention of DeHaat. When they buy input from us and when they get customised advisories, they get better output and hence better price for their commodity. When they use our digital interfaces to buy or sell, there is elimination of middlemen and transparency in price. They make more money. Our free of charge customised advisories have helped them increase productivity and income.

# What are the emerging trends that are being witnessed in the agritech space?

Unmistakably drone is an emerging trend. Cost of drones is also coming down because of the enhanced scale of production. Drones are used for multiple purposes. They can be employed in mapping the farm and deployed for spraying after assessing the different stress levels and then spraying accordingly. This is becoming increasingly accepted as the rural areas are witnessing labour shortage and the new age farmer

#### We have observed more than 50% increment in farmers' income because of the intervention of DeHaat.

has started to identify drones as a suitable replacement.

In terms of cropping pattern there is a palpable shift towards horticulture crops in last few years. It is a high risk high return crop. Because of the availability of digital interventions, farmers are ready to take the risk.

Geotagging the land parcels, digitising farm boundaries, using satellite data for specific crop advisories are some other trends that have been observed. The same data is also being used for scoring for finance and insurance. Usage of digital agriculture interfaces and data to integrate financial services for farmers is picking up.

Besides that there is an awareness towards environment conservation among farmers. They know that over spraying of agrichemicals are harmful in longer run. There is an awareness and trend towards adopting climate smart agriculture practices.

#### Which are the specific areas where you would like to see more digital application?

Climate smart agriculture is an area where I would like to see more of digital intervention. Traceability is another



area. This will help the farm produce to go across border. The right package of practices can help the farmers to fetch better price for their product. Agri financing is another area.

### What are the challenges faced by agritech companies?

The primary challenge is the adoption of digital technology by farmers. The rate is still very low. The second challenge would be the data availability. If public and private data can come together on a single platform and there can be a collaboration. Creating a public digital infrastructure will be the right way to go.

Policy framework is another area where there are some challenges. It is generally volatile. Everyone is creating their own platforms rather than building up on their core competency. Everybody is reinventing the wheel.

#### What changes in policies do you want see at the government level to for perceptible changes in agritech expansion?

The government has done a tremendous job by helping digital innovators. Overall regulatory framework is designed in a tailor made way. For instance , if any digital interface talks about selling agri inputs to farmers in 20 districts in India, as per the current regulatory framework the platform will have to apply for 20 different licenses. The whole idea behind digital interface is transparency and scalability. Unfortunately, the current regulatory framework is not supportive of this.

## How DeHaat is showcasing the impact on ground?

Our vision is to maximise income for the agriculture household. We have evolved as a full stack platform offering complete end to end agri services to the farmer, from seed to market. We have 12000 DeHaat centers in rural India and 2 million farmers are transacting through them. We have improved the farmer income and helped the rural entrepreneur to evolve.

# EMPOWERING FARMERS IN THE DIGITAL AGE UNVEILING EMERGING TRENDS SHAPING THE AGRICULTURAL LANDSCAPE



Dr. Megha Upadhyay, Vice President; Ms. Priyanka Mallick, Managing Director, Dr Surbi Bansal – Assistant General Manager and Dr. Mukta Sirohi - Chief Operating Officer Q&Q Research Insights (LEFT TO RIGHT IN THE PICTURE)

n recent years, the agrarian landscape of India has been undergoing a transformative shift, fueled by the relentless march of digitalization. As the world's second-most populous country with a significant portion of its population engaged in agriculture, India's embrace of digital technology within the farming sector is not just a trend but a profound paradigm shift. Indian farmers are increasingly harnessing the power of digital tools to revolutionize their ageold practices. This surge in digitalization is not only enhancing productivity and efficiency but is also reshaping the entire agricultural ecosystem. In this article, we delve into the remarkable journey of how digitalization is on the rise among Indian farmers, exploring the transformative technologies and trends that are paving the way for a modern and tech-enabled agricultural sector.

#### Digitalization on The Rise Among Indian Farmers

This widespread adoption of smartphones within the agricultural community signifies a significant shift in how information is accessed, shared, and utilized in the farming sector. Research findings of Q&Q's Digital Farmer Panel covering 10000+ farmers revealed some startling insights –

9/10 farmers in Gujarat have smartphones. Other top states having smartphone penetration more than the national average are Punjab, Haryana, AP and Telangana.

■ More than 80% of farmers in the age group of 25-35 years have a

#### TREND ANALYSIS

smartphone. The younger generation of farmers leads the charge in embracing technology. This generational divide is becoming a driving force behind the infusion of modern tools into age-old farming practices.

■ The interplay between education levels and smartphone usage among farmers in India presents a compelling dimension that underscores the evolving dynamics of the agricultural sector. 70% of farmers who have high school and above education are more digitally active.

#### **App Usage Behavior of Farmers**

With smartphones becoming a common tool in their hands, farmers are navigating a new realm of possibilities. In this context, examining the app usage behavior of farmers unveils a captivating narrative of adaptation, innovation, and the fusion of age-old wisdom with cutting-edge tools.

The digital evolution of farming has witnessed a profound shift in the way farmers access and utilize information, with a substantial impact on their decision-making processes. Among the diverse array of apps available, a few have emerged as pivotal tools for farmers across the spectrum:

#### YouTube and Google

With over 50% of farmers with smartphones relying on platforms like YouTube and Google, a revolution in knowledge acquisition is underway. These platforms offer a treasure trove of agricultural tutorials, expert advice, and real-life experiences, catering to diverse agricultural needs. From mastering new techniques to troubleshooting challenges,



#### In the pursuit of precision farming, around 30% of farmers have embraced weather-related apps.

farmers find a wealth of information to bolster their practices. Videos of how to use chemicals is the most searched information on these apps.

#### Weather Apps

In the pursuit of precision farming, around 30% of farmers have embraced weatherrelated apps. These digital weather stations provide real-time forecasts, empowering farmers to synchronize their activities with nature's rhythms. Whether it's planning the optimal time for sowing, gauging the ideal conditions for pesticide application, or anticipating the perfect moment for harvesting, these apps revolutionize agricultural planning.

#### e-Commerce platforms

In an emerging trend, around 2-4% of



farmers are embracing e-commerce platforms for purchasing agrochemicals and seeds. This trend is mainly seen in Karnataka, AP and Maharashtra currently. While not yet widespread, this shift signifies a changing landscape where farmers are exploring online options to better understand products and compare prices.

#### **Digital Divide**

The digital transformation in agriculture is undeniable, yet it reveals glaring need gaps among farmers. While smartphones have become tools of empowerment, a significant divide exists. Many farmers, particularly in remote areas, lack access to technology and digital literacy. This gap inhibits their potential to benefit from apps, market insights, and online resources.

Furthermore, in sectors such as horticulture, where intricacies abound, growers are actively pursuing dependable avenues to secure loans and financial assistance tailored to their farming needs. Alongside this, the demand for apps facilitating the procurement of high-quality agricultural inputs is on the rise.

As these trends underscore, the fusion of digital platforms with agriculture is forging an era of unprecedented knowledge sharing and data-driven decision-making. In this marriage of technology and tradition, farmers are leveraging the digital realm to cultivate resilience, maximize yields, and navigate the complexities of a rapidly changing agricultural landscape.

# SMART CROP MANAGEMENT

About the **AUTHOR** Conrad Fernandes, PhD Vice President & General Manager, Asia-Pacific Operations, LI-COR Environmental of mankind's most challenging endeavours. The vagaries of climate, soil, market conditions, and regulations, require farmers to be entrepreneurs as well as cultivators. These challenges are exacerbated by climate change, water scarcity, global warming due to the increase in greenhouse gases in the atmosphere and geopolitical tensions. The amount of land available for agriculture is shrinking, as is the proportion of the workforce engaged in agriculture. Many of the solutions lie in the deployment of new technologies.

griculture has long been one

Smart Agriculture holds the promise of sustainable and productive farming using fewer inputs. DataBridge estimates the market for IoT in agriculture at almost \$14Bn in 2022, and projects it to double by 2030. Technology improvements will also play a role, with IoT and new advanced sensors moving Smart Agriculture to new levels. Combined, these technologies will enable site-specific management which can increase yields and deliver sustainability. Realizing these benefits will require coordinated effort by farmers, businesses and policy makers, with a crucial leadership role for Governments.

#### Site-Specific Management

As every farmer knows, no two fields are the same. Small differences in soil type, field micro-topography, and nutrient content make optimizing yields a site-specific challenge. The application of Precision Farming technologies at the site level promises better optimization of each specific location, while freeing the operator to manage the "big picture" of the farm.

"Smart farms" install a network of deployed sensors, all of which connect to in-field IoT telemetry devices that then send the data to fill crop models, resource management tools and even AI algorithms. Once the inputs are calculated, producers in the field are able to make real-time decisions around nutrient, chemical and water management that are actionable by people or automated processes.

Recent revolutions in sensor technology will enable far more precise diagnoses and responses. This has the potential to dramatically increase yields while reducing inputs and environmental impact. Site-specific management therefore holds the key to sustainable growth.

#### **Crop Health**

Many key indicators of crop health can be discerned visually or by remote-sensing technologies. But further increases in productivity require information internal to the plant. Academic researchers measure these parameters with research grade equipment. New low-cost highspeed sensors like LI-COR's LI-600 Porometer/Fluorometer allow direct measurement of stomatal conductance and chlorophyll fluorescence in seconds. Using such sensors, one person can make hundreds of measurements in a single day, providing deep insight into each plant's internal health. While this requires physical labor, it is highly leveraged labor: updated directly to the cloud, the data can be processed remotely and diagnoses provided to complete the Sense-Analyze-Respond loop. In this way, the needs of each specific site can be diagnosed and met.

#### Soil Health

Sensing soil respiration (the amount of carbon dioxide released from soil) allows analysis of soil organic matter and its decomposition, and estimation of soil microbial activities. These indicate how ef-



Smart Irrigation is an important and growing area of Smart Agriculture, whose success has been limited by the available sensing technology.

fectively the soil is converting organic nutrients to inorganic forms that plants can use. This data, potentially analyzed by Artificial Intelligence, can be used to provide precise regenerative agriculture prescriptions at the site level. Soil respiration may now be measured directly, precisely and remotely, using instruments like LI-COR's Trace Gas Analyzers and Smart Soil Chambers. These systems operate 24/7, providing data via IoT to the cloud and forming the Sense element of the Sense-Analyze-Respond mechanism.

#### Water Resources

Smart Irrigation is an important and growing area of Smart Agriculture, whose success has been limited by the available sensing technology. Automatic Weather Stations and Soil Moisture sensors provide valuable data, but still crops are over-irrigated. At the field level, water can be lost by surface runoff, deep infiltration and evapotranspiration (ET).

ET has been historically measured using algorithms and crop coefficients that match the field environment and can play a crucial role in smart irrigation practices. The main problem with this method, is that it is dependent on user entered data such as crop type, planting date and cutting dates.

LI-COR's new LI-710 ET sensor removes this barrier and measures the direct water usage of whatever crop it is placed above. It uses a simple SDI-12 connection and can be added to an existing weather station at low cost. Responding to that data will require widespread adoption of automatic irrigation systems, which are also becoming cheaper and easier to install. The combination of these technologies, integrated by IoT, holds the prospect of reducing water loss due to soil surface evaporation, surface runoff and deep infiltration from its current level of 500,000 Cubic Kilometers per year. This recovered water can be kept in the soil or in groundwater or freshwater, and used productively.

The implementation of these technologies holds great promise for addressing our food security and environmental challenges. This will require infusions of capital and technology, and cannot be implemented by farmers acting alone. Success will require partnership between policy makers, investors and practitioners, with high level leadership.

# DRONES - AS AGENTS OF CHANGE Towards sustainable agriculture

rones have become a crucial agent for the rapid transformation of the agriculture sector worldwide. And India is no exception to it. The adoption of drone technology is a key component of the Central government's mission of promoting digital agriculture to strengthen the farming sector. The central government has come up with inclusion of Drones under SMAM offering subsidy ranging 40% to 100% to various categories. Similarly, State governments too are adopting it with vigor as they are experimenting with drones in farming and promoting their use.

The gap that needs to be filled in terms of demand and quality is huge as the Indian agriculture lags in technology adoption. Crop failures, unpredictable weather conditions, pests and many other factors are affecting our agricultural production. Aging Indian farmers and direct exposure to agrochemicals are causing respiratory diseases and cancer.

#### **Drones for Safety**

Indian farmers at micro level and the agri-economy are struggling to cope up with these scenarios. Consumers often end up consuming food of higher pesticide residue and the soil, water, flora and fauna is also suffering due to the excesGovernment support and encouragement for drones are evident as the Prime Minister of India inaugurated India's biggest Drone Festival – Bharat Drone Mahotsav in May 2022 and PM KISAAN Sammelan in October 2022.

sive and indiscriminate pesticide use. But drones are ushering in a new era of precision. By harnessing the power of aerial data collection and automation, drones are reshaping the landscape of farming, offering increased efficiency, sustainability and productivity. All these while keeping the farmers and environment safe from direct exposure of chemical and least possible pollution of the ecosystem.

#### **Drone Technology for Agriculture**

With the advent of drone technology, the farmers can detect the crop failure in advance. They can take precautions to protect the crop from the weather fluctuations, detect and kill the pests before they destroy the crop. For example, instead of waiting for a pest to spread to thousand acres and then to use thousands of liters of pesticide all over, the agricultural intelligence using drones can identify the starting patch and prevent the spreading there by conserving resources and causing least disruption to ecology.

Drone coupled with AI can identity pest stress, water stress and nutrient stress in advance and can provide actionable insights to treat those in time. Even after detection, the drones can be used for precise application rather than blanket application leading to sustainable and remunerative food production while balancing ecology. Drones are thus reshaping agriculture through the implementation of precision farming techniques.

About the **AUTHOR** Prem Kumar Vislawath, Founder and CEO, Marut Drones

#### **Government Support for Drones**

Government support and encouragement for drones are evident as the Prime Minister of India inaugurated India's biggest Drone Festival – Bharat Drone Mahotsav in May 2022 and PM KISAAN Sammelan in October 2022.

Prime Minister called the use of drones a "milestone" for Indian agriculture and expressed confidence that it would create more opportunities. The Government of India has extended huge subsidies ranging from 40% to 100% for different agriculture-related instructors, farmer producer organizations (FPO) and custom hiring centers (CHC) for purchasing and promoting drones under SMAM for Kisan Drones. These drones are help-

The central government has come up with inclusion of Drones under SMAM offering subsidy ranging 40% to 100% to various categories



ful for government agencies also as they can be used for crop assessment of production estimates or to process farm insurance, digitization of land records, and can expedite claim processing and bring transparency.

On 26th January 2022, the Government of India released a certification scheme for agricultural drones, which states that one can now carry a payload that does not include chemicals or other liquids used in spraying drones. Such liquids may be sprayed by following applicable rules and regulations.

#### **Drone Production**

Drone production is also being encouraged under Central Government's Production Linked Incentive Scheme (PLI). Apart from that, in line with the emphasis in Foreign Trade Policy 2023 on facilitating export of high tech items including Drones, the DGFT liberalized the policy for export of Drones for civilian end uses from India.

Additionally, a contingency fund of Rs.6000/acre will also be set up for hiring Drones from Custom Hiring Centres (CHC). The subsidy and the contingency funds together will help the farmers access and adopt this extensive technology at an affordable price.

The Indian government granted the ICAR Institutions and other SAUs for the usage of drones for agricultural research activities. With this move, the government hopes to encourage budding researchers and entrepreneurs to look at budget-friendly drone solutions for more than 6.6 lakh Indian villages, making it accessible even in remote parts of India.

#### How can Drones help Indian Agriculture grow?

There are a few self-explanatory advantages of Drones in the agriculture sector, like crop monitoring, weather alerts to avoid crop wastage, fertilizer spraying, soil and field analysis and optimizing chemical usage. There are research happening behind the scenes to build the best mobility solutions in the agriculture sector by leveraging drone technology. A handful of government bodies and companies are involved in exploring these opportunities via drone technology for Indian farmers.

In the recent past, we have also witnessed many young innovators quitting their corporate jobs to venture into agriculture. This is a positive sign that the penetration or adaptation of the technology will be happen in a smooth way.

#### **The Future of Drones**

Building robust drones that are easy to maneuver is definitely a need, but the real deal lies in the algorithms or the applications that we develop around the usage of drones. The operation of drones should be extremely user friendly. In response to these challenges, researchers and companies are working to develop advanced drone technologies with longer flight times, robust weather resistance, and user-friendly interfaces. As these technologies continue to evolve, the scalability of drone-assisted agriculture will likely improve, making it accessible to a broader range of farmers.

# DATA DRIVEN AGRICULTURE

ndia's agricultural heritage blooms with abundant harvests and a vibrant tapestry of flavors, yet the poignant reality of India's farmers, battling hardships and fighting for their livelihoods, adds a sobering layer to this narrative. Yet, in the new India, there has been a gradual change in the agriculture sector with introduction of technology at various strata. Sustainable agriculture has become a critical need in our rapidly evolving world, where food security and environmental sustenance are essential challenges. As our country's population continues to grow, the demand for food will inevitably rise. Agriculture is the backbone of our national and global food system, but it faces numerous challenges in the 21st century, including climate change, population growth, and resource limitations. To ensure food security and meet the growing demand for agricultural products, it is crucial to optimize yields sustainably. Agritech companies play a pivotal role in revolutionizing the agricultural sector by leveraging innovative technologies to enhance productivity, efficiency, and sustainability.

#### **Power of Data in Agriculture**

Agritech companies are at the forefront of developing and implementing precision farming techniques, which involve the use of data-driven technologies to manage agricultural practices more efficiently. Through the deployment of sensors, drones, and satellite imagery, farmers can collect real-time data on soil conditions, crop health, and weather patterns. This information enables them to make informed decisions regarding irrigation, fertilization, and pest management, thereby optimizing yields while minimizing environmental impact. Agritech companies provide farmers with user-friendly platforms and software solutions to analyze and interpret the collected data, empowering them to make precise and timely adjustments to their farming practices.

Impact of Smart Irrigation Models India has faced impeding water crisis that has impacted agriculture drastically. Water scarcity is a significant challenge in agriculture, making efficient water management crucial for sustainable farming. Agritech companies develop and implement smart irrigation systems that utilize sensors, weather forecasts and soil moisture data to optimize water usage. These systems enable farmers to deliver the right amount of water at the right time, minimizing waste and conserving this precious resource. By avoiding over- or under-irrigation, smart irrigation systems help improve crop health, reduce water stress, and enhance overall yield.

#### **Applications of Remote Sensing**

Agritech companies are revolutionizing crop monitoring and management practices through the use of remote sensing technologies. Satellites and drones equipped with multispectral cameras can capture detailed information about plant health, growth patterns, and nutrient deficiencies. This data is then processed using machine learning algorithms to generate valuable insights for farmers. By identifying areas of the field that require attention, agritech solutions enable targeted interventions, such as precision application of fertilizers and pesticides. This approach minimizes input waste, reduces environmental contamination, and maximizes crop yield. Furthermore, agritech companies provide farmers with mobile applications and dashboards that offer real-time monitoring and alert, allowing proactive management of crops and timely responses to potential threats.

#### Boon of Integrated Pest Management

Globally around 20% - 40% global crop production is lost to pests. Thus, effective

#### About the **AUTHOR**

Dr. Darshan Rana, Chairman and MD, Erisha Agritech pest and disease management is crucial for ensuring healthy crops and optimal yields. Agritech companies are developing innovative solutions to address these challenges sustainably. Integrated Pest Management (IPM) techniques help identify pest and disease patterns, predict outbreaks, and recommend targeted interventions, reducing the reliance on broad-spectrum chemical pesticides. By utilizing data-driven insights, farmers can adopt more precise and environmentally friendly pest and disease control strategies, resulting in higher yields and reduced environmental impact.

"Without access to modern farming techniques or machinery, let alone science-based climate and weather data, farmer; livelihoods hinge precariously on a changing environment that they're struggling to understand." This statement by the U.S Agency for International Development highlights the ever- growing importance of marrying technology with agriculture. Agritech companies are driving a revolution in sustainable agriculture by harnessing the power of technology. The collaboration between agritech companies, farmers, and policymakers will be an essential element to ensure the widespread adoption of these technological advancements and promote sustainable practices

throughout the agricultural sector and help in building sustainable agriculture to optimize yield.

# CULTIVATING PROFIT WITH HYBRID MILLETS

aroja Devi, married at the age of 18 and with education till 10th grade, was a regular millet farmer who had been supporting her husband in farming ever since her family was divided.

A training programme organised by Corteva Agriscience changed her life. "During the programme, I learned about Pioneer's hybrid millet variety 86M94 and its benefits, which motivated me to try it out on my land. Seeing the potential of hybrid millet, I decided to plant the seeds on 20 acres of my 40-acre land. The results were astounding. I was able to achieve an additional yield of 13 mann per acre, resulting in a profit of Rs. 40,000. This extra income has given me and my family financial security, and I was able to pay for my daughter's coaching fees and my son's college fees. I am grateful for the training programme that opened up new opportunities for me and my fellow women farmers."

However, it took time for her to adapt to the new cultivation techniques and requirements of hybrid millets. But since she went to the Pioneer's meeting and saw that 86M94 millets giving more yield than others, she had decided to plant 86M94 millets in 20 acres. By being proactive, seeking guidance, and applying the knowledge gained from the training program, she was able to overcome the challenges associated with transitioning to planting hybrid millets. Besides the yields were also more.

The yield from her farm increased significantly compared to the previous year. The hybrid millets variety was resilient to drought and other environmental stress factors, resulting in a more productive crop. In terms of income, the hybrid millets variety gave her a better return on investment. "I was able to sell



The hybrid millets variety was resilient to drought and other environmental stress factors, resulting in a more productive crop.

the millets at a higher price in the market due to their quality and yield. Moreover, I didn't have to spend as much on pesticides and fertilizers as the hybrid variety had better resistance to pests and diseases. It not only increased my productivity and income but also made farming easier and more efficient."

She found hybrid millets to be more resistant to pests and diseases, resulting in a healthier and more robust crop. It requires less water and fertilizer, which can lead to significant cost savings. Another benefit of planting hybrid millets was that they have a higher yield potential than traditional millet crops which helped them to produce more millet with the same amount of land, leading to higher profits.

"I was able to achieve an additional yield of 13 mann per acre by planting Pioneer's Hybrid millet variety 86M94 on my land. This resulted in a profit of Rs. 40,000. I planted the hybrid millet seeds on 20 acres of my 40-acre land, which allowed me to earn a significant amount of money. Hybrid millet farming has been highly profitable for me. "

"The extra income has allowed me to fulfill my responsibilities towards my family. I have been able to pay for my daughter's coaching fees and support my son college fees, enabling them to receive a higher education and broaden their career prospects and pursue their dreams. Also, the higher profit has given me a sense of empowerment and independence. I am no longer solely dependent on external support. Instead, I have become self-reliant and have the ability to meet my own needs and aspirations."

She sells her millet harvest directly to traders in the local market. This allowed her to connect with potential buyers and negotiate the sale of the produce. Selling directly to traders in the market provided convenience and ensured a fair transaction for both parties involved.

She has solid future plans too. "In the future, I will keep planting high-yielding millet varieties and plan to expand my cultivation of hybrid millet by gradually increasing the area of land dedicated to its cultivation. With the proven profitability and positive impact it has had on my income, I am confident that scaling up the production of hybrid millet will bring further financial stability and prosperity to my family."

# **SMART URBAN FARMING**

mart urban farming deals with growing high value horticultural crops in urban and peri urban areas with the help of modern technologies. High value horticultural crops like vegetables, flowers, herbs and seedlings can be grown round the year or in off season under smart urban farming. It is being practised in open field, protected structures, roof top, balcony, kitchen garden and also inside closed room. It can be adopted with or without artificial light.

#### **Smart urban farming**

Smart urban farming involves lots of modern technologies mainly for efficient control and management of costly inputs like energy, water, seed, fertilizer and other chemicals. Value chain based efficient marketing system is the important component of Smart Urban Farming. These two important components of Smart Urban Farming are attracting youths and common citizens to adopt it on mass scale mainly in the big cities.

Simultaneously, this type of farming helps in growing safe food with one's own involvement in relatively small space, sometimes within home itself. It also helps in pollution control and facilitates supply of abundant oxygen and control many harmful gases by growing specialized plants. This is the main reason for massive adoption of Smart Urban Farming technology in the post covid era. Smart Urban Farming gives the opportunity to grow safe and high value horticultural crops for our own family and for the society. Many start ups related to different aspects of Smart Urban Farming are now flourishing in big cities.

#### Smart Urban Farming under Protected Cultivation Technology

Protected cultivation based smart urban farming offers several advantages to produce horticultural crops and their plant-

#### Modern technologies of Smart Urban Farming

- Protected Cultivation Technology
- Drip Irrigation and Fertigation
- Soilless Cultivation Technology
- Hydroponics, Aeroponics and Aquaponics
- ML, AI, Automation, Sensors, Controller and IoT
- Vertical Farming

The amount of post harvest losses in vegetables and cut flowers is very high (20-30%), which can be significantly reduced and productivity can be increased through protected cultivation technologies by taking the crops round the year.



IoT and Sensor Operated Greenhouse Smart Urban Farming at ICAR-IARI Pusa



#### About the **AUTHORS**

M. Hasan, Vinayak Paradkar and Pragya Balley Principal Scientist, Centre for Protected Cultivation Technology, ICAR IARI Pusa Delhi

#### **URBAN TRAILS**

ing materials of high quality and yields, through efficient land and resource utilization. Fruits, vegetable and flower crops normally accrue 4 to 8 times higher profits than other crops. This margin of profit can increase manifolds if some of these high value crops are grown under protected conditions, like greenhouses, net houses, tunnels, shade net etc.

These protected structures can be used for adopting smart urban farming based on either soil or soilless system in both single and multi lavers. The amount of post harvest losses in vegetables and cut flowers is very high (20-30%), which can be significantly reduced and productivity can be increased through protected cultivation technologies by taking the crops round the year. Protected cultivation has very high entrepreneurial value and profit maximization leading to local employment, social empowerment and respectability of the growers. Environmentally safe methodologies involving GAP and IPM tactics reduce the hazards lacing the high value products.

#### Machine Learning, Artificial Intelligence, Sensors and IoT in Urban Farming

Machine learning (ML), Internet of Things (IoT) and Artificial intelligence (AI) based automation have been the recent most successful approaches for controlling greenhouses and Urban farming models for maximizing the quality crop production of high value vegetables, flowers and seedlings and efficiently controlling the entire related business models. These recent techniques incorporate and integrate the human expertise, sensors, online and in-situ data, softwares and hardwares from different sources for the efficient management of all the related inputs and maximize the output in terms of both quality and quantity. The future of smart, efficient and precision agriculture is mainly based on automation linked with IoT and AI.

#### Government initiatives for Smart Urban Farming

Smart urban farming has great prospects for Indian agriculture. It is one of the potential technologies for doubling farmers' income. In the changing scenario of food habits and growing fad for green vegetaICAR-IARI Pusa Delhi is one of the lead institutes carrying research, education and training on different aspects of Smart Urban farming Technology including Soilless Vertical Hydroponics based Farming at Center for Protected Cultivation Technology. Indigenous infrastructure for Soilless, Hydroponics, Aeroponic, Multi layered vertical farming have been developed, installed and evaluated with significant achievements in Automation with sensors including IoT development. Technical Bulletins titled "Hydroponics Technology for Horticultural Crops" (TB-ICN:188/2018), Smart Urban Farming Technology (TB-ICN:270/2022- English) and (TB-ICN:H-195/2022-Hindi) have been published by ICAR-IARI for Technology dissemination related to Smart Urban farming.



Smart Urban Vertical farming Model being displayed at Kisan Mela 2022 ICAR IARI Pusa Delhi

bles, herbs and fruits, hydroponics technology is going to play a major role for sustainable and round the year production in urban and peri-urban areas. As this technology is capital intensive and requires technical knowhow, GOI has launched many schemes to promote this technology through different agencies

Ministry of Agriculture and farmers Welfare, GOI is providing funding (Up to 2 crore loan) to farmers under Agriculture Infrastructure Fund for Smart Urban Farming models like Vertical Farming, Soilless, Hydroponics and Aeroponics. such as Ministry of Agriculture & farmers Welfare, GOI; National Horticultural Board; National Horticultural Mission and Horticulture Mission for North East & Himalayan States

Credit linked projects relating to establishment of Commercial production units in protected conditions for Hydroponics cultivation are supported financially by National Horticultural Board. The details of the schemes are available through the link (www.nhb.gov.in). National Horticultural Mission and Horticulture Mission for North East & Himalayan States also indirectly support Hydroponics related projects through the protected cultivation initiatives. Farmers and entrepreneurs can avail these schemes as per the eligibility and suitability. Ministry of Agriculture and farmers Welfare, GOI is providing funding (Up to Rs. 2 Crore) to farmers under Agriculture Infrastructure Fund for Smart Urban Farming models like Vertical Farming, Soilless, Hydroponics and Aeroponics.

# CULTIVATING A FUTURE OF HIGHER YIELDS AND BETTER RETURNS

mart agriculture, also known as digital farming, is the application of cutting-edge technology and data-driven methodologies to improve agricultural production, efficiency, and sustainability. It involves the adoption of technologies such as Internet of Things (IoT), drones, sensors, satellite imagery, analysis of data using Artificial Intelligence (AI) and Machine learning (ML), among others for making better, more informed decisions to unlock value in the agriculture value chain.

Smart agriculture also helps to promote rural entrepreneurship, thereby fostering economic growth.

#### **Israel Example**

Israel spends around 5.4% of its GDP on research and development. In addition to the zeal for agtech innovation, there is also strong community support led

> About the **AUTHOR** Mr. Soumyak Biswas, Partner, BD0 India LLP



Applications such as KisanSuvidha have been developed to provide information to farmers on various factors such as weather, soil health, market conditions, prices, and address the issues of information asymmetry

by GrowingIL - a government initiative that aims to reshape Israeli agriculture through ground-breaking technologies.

The development of this ecosystem rests on four pillars – fostering a culture of knowledge-sharing through various events such as workshops, webinars, meetups, competitions, hackathons and conferences; creation of tools ranging from unique internet sites to pair startups with pilots to marketplaces, mentor programmes, and agtech investor maps; creating an environment for bringing the online community together via social media and newsletters, providing information on knowledge opportunities, job opportunities, investments; and lastly, connecting all the relevant players in Israel and abroad.

#### **Government of India Interventions**

Under National e-Governance Plan in Agriculture guidelines, funds are allocated to states/ union Territories to encourage and prioritise projects involving modern technologies such as Al/ ML, blockchain and others in agriculture.

Applications such as KisanSuvidha have been developed to provide information to farmers on various factors such as weather, soil health, market conditions, prices, and address the issues of information asymmetry. To tackle the issue of scale and market access, Gol has focused on collectivisation of farmers through self-help groups, farmer producer organisations and/ or companies, while rolling out E-NAM to enable fair price discovery for farmers across India. Gol is also in the process of chalking out the framework for the Digital Agriculture Mission where they are currently finetuning the India Digital Ecosystem of Agriculture (IDEA) report based on the inputs from various stakeholders and integrating the same with various databases related to schemes implemented by the Government.

#### Augmenting Adoption of Smart Agriculture

### Increase awareness about potential benefits of smart agriculture

Once the benefits of smart farming get demonstrated through pilot programmes, frequent awareness programmes and workshops at the village level, more farmers may join the bandwagon. Krishi Vigyan Kendras (KVKs) and various State Agriculture Universities may be mandated in this regard to raise the awareness of farmers.

#### Address infrastructure issues around connectivity

Stable internet connection is the backbone for successful implementation of smart agri practices. The BharatNet project, currently implemented by the Government, needs to be fast-tracked to implement the requisite infrastructure for better connectivity. Also, tariff rates need to be rationalised to ensure more farmers leverage this as a tool to adopt smart farming.

#### Incentivise accessibility of smartphones

Back-ended financial assistance through Kisan Credit Card (KCC) Scheme may be allowed to incentivise farmers who buy such devices. Also, applications for various Central and State Government Schemes, and subsequent approval and disbursal of such schemes may be introduced, leading to greater adoption and usage of smartphones.

#### Digitising farm and related data

Recently, the Government of Telangana and the Indian Institute of Science signed an agreement to create India's first AgRecently, the Government of Telangana and the Indian Institute of Science signed an agreement to create India's first Agricultural Data Exchange.

ricultural Data Exchange. Since agriculture is a state subject, it is important to give a nudge to the states to fast-track digitisation of farm data records. A part of support and other related assistance pertaining to the sector can be linked to the performance of the states. This may lead to healthy competition among the states in undertaking and completing such initiatives in a time-bound manner.

# Promote 'Indigenisation' through the National Research Foundation (NRF) Bill 2023

The Bill is aimed to establish NRF that will seed, grow and promote R&D and foster a culture of research and innovation in colleges, universities, research institutions, and R&D laboratories across India. It is important to dedicate a certain percentage of this fund to promoting research around farm equipment and machinery, given the imminent issues of labour shortage and the growing importance of mechanisation.

Foster a culture of rural entrepreneurship through Public-Private-Partnership (PPP) models

The custom hiring centres (CHCs) can provide requisite training for the farmers who otherwise would find it difficult to manoeuvre the machines and carry out their upkeep. Initial support in setting up new CHCs and scaling up existing CHCs may lead to local employment generation in rural areas.

#### Encourage startups in agritech space

The Government has already funded nearly 1138 start-ups through the Innovation and Agri-entrepreneurship Development Programme under the Rashtriya Krishi Vikas Yojana (RKVY) to promote innovation and application of AI, IoT, remote sensing, information and communication technology (ICT), GIS and blockchain in the agriculture sector. In the last budget, the Agriculture Accelerator Fund was announced to boost startups and increase digital infrastructure in rural areas to support agtech adoption. Modalities of the programmes need to be designed and quickly rolled out to encourage startups. Further, the current tax exemption of three years for startups can be increased for agtech-focused startups, given the long-term requirement to promote the adoption of such technology in India.



# A POWERFUL TOOL FOR WOMEN EXTENSION WORKERS

ndia has one of the most elaborate agricultural extension systems in the world, encompassing agriculture, horticulture, fisheries, animal husbandry and rural livelihoods. More than 300,000 extension workers, nearly 50% of whom are women, are the critical arteries connecting farmers to public systems as they support them with valuable information and services. Artificial Intelligence can significantly enhance the effectiveness and productivity of these extension workers.

One of the significant challenges women extension workers face in India is the lack of access to timely and accurate information. Al-based systems can offer unique opportunities for women extension workers to amplify their impact and drive holistic development across rural India.

#### Al's Potential in Tailoring Solutions for Local Contexts

Artificial Intelligence, often hailed as the

fourth industrial revolution, can process vast amounts of data from various sources, analyze patterns and generate real-time insights to address the challenges farmers face. Weather predictions, disease detection, crop yield estimation and soil health assessments are just a few areas in which AI can offer invaluable support. By harnessing AI-powered solutions, women agriculture extension workers can augment their roles to provide farmers with real-time information and tailored recommendations. This

#### About the **AUTHORS**

Ravi Shankar Sharma, Director – Programs and Oorna Mukherjee, Lead Communications Coordinator, Digital Green Al-based systems can offer unique opportunities for women extension workers to amplify their impact and drive holistic development across rural India.



#### WOMEN EMPOWERMENT

strengthens their impact and enhances farmers' resilience against uncertainties, fostering inclusive growth within our agrarian communities.

#### AI in Crop Diagnosis

Al can also enable remote monitoring and diagnosis of crops, saving the extension workers valuable time and effort. Drones equipped with AI-powered cameras and sensors can easily capture high-resolution images of agricultural fields and detect signs of pest infestations, nutrient deficiencies, disease outbreaks, and other crucial parameters. These images, analyzed by AI algorithms, can identify the existing problems and the susceptibility of different areas within a field to various environmental risks and suggest appropriate solutions that help in risk mitigation. With this technology, extension workers can remotely diagnose issues, allowing them to prioritize their visits to the fields and cover larger areas to assist more farmers. This also enables them to provide data-driven recommendations, saving valuable resources.

#### **Communication Expert**

Al can help women extension workers overcome language barriers and enhance their effectiveness in communicating with farmers. Language translations, speech-to-text or text-to-speech facilities, voice assistants and more tools powered by Al can enable extension workers to convey essential information accurately and build trust. This is particularly beneficial in multilingual and multicultural farming communities in remote areas, where communication barriers often pose significant challenges in reaching the last mile.

#### **Capacity Building**

Al provides a digital platform for personalized training and capacity-building programs. Al algorithms can analyze individual learning patterns and preferences, creating customized training modules for each frontline extension worker. This way, extension workers can access training materials and resources anytime and anywhere while providing instant feedback and assessments to gauge the progress and proficiency of the workers.



#### Al algorithms can analyze individual learning patterns and preferences, creating customized training modules for each frontline extension worker.

#### Networking

To narrow the information divide, AI solutions can empower women extension workers by offering a platform for knowledge exchange and networking. Online communities and forums powered by AI can connect extension workers across various regions enabling them to share experiences, best practices and innovative solutions. This collaboration fosters a supportive environment, fostering professional growth and development of women extension workers in agriculture.

#### Challenges and the Road Ahead Equitable Technology Access

While the integration of AI into agriculture holds immense promise for revolutionizing farming practices, enhancing productivity and promoting sustainability, challenges such as the digital divide, data privacy, and the need for skill upgradation cannot be ignored. As the agriculture sector seeks to harness the potential of AI, it must address these hurdles and ensure equitable access to technology and training for extension workers, particularly women who face other societal barriers.

Building Infrastructure and Collaboration Addressing the digital divide issues requires infrastructural development, including the expansion of internet connectivity and affordable devices. Bridging this gap and ensuring the successful adoption of Al-powered technologies requires training programs and user-friendly interfaces so farmers and grassroots-level extension agents can reap the benefits.

Moreover, as the agricultural sector generates vast amounts of data, ensuring the quality, reliability, and privacy of this data is crucial. Secure, open-source datasharing platforms can protect sensitive information while enabling ecosystem players to share data for collective benefits. The convergence of governments, technology developers, research & innovation institutions, and NGOs can enable the pooling of resources and expertise to ensure Al benefits reach farmers.

#### Driving Force for a Prosperous Agricultural Sector

In the evolving landscape of Indian agriculture, where tradition intersects with innovation, the synergy between AI and women agriculture extension workers paints a promising picture of progress. By leveraging AI-powered systems, these extension workers can access relevant information, remotely diagnose crops, overcome language barriers, receive personalized training, and collaborate with multiple players in the ecosystem. These advancements hold the power to amplify the impact of their work, revolutionize farming practices, and foster sustainable development and food security. As AI continues its ascent, it is imperative to recognize the crucial role of women and equip them with the training and tools that elevate their influence. The convergence of emerging technology and human expertise is not just a possibility but the driving force behind a more prosperous and sustainable agricultural sector in India.

# SMART PRECISION MODELS FOR Rice Crop Management

agriculture odern facing tremendous challenges like climate change, urbanisation. soil erosion and biodiversity loss and changing tastes of consumers in food and concerns about how it is produced. Estimating the future climate and planning management practices according to the changing climate is one of the key factors in increasing productivity. Indian agriculture needs a technological revolution to address the challenges in crop production and to meet the food requirement of an ever growing population.

#### Agriculture 5.0

Current advances in ICT are making smart farms with the concept of Precision Agriculture i.e. applying the right inputs at the right time in the right place. Remote Sensing and Proximity Sensing drives Agriculture 4.0 and generates a large amount of valuable precise information. The Next Era is Agriculture 5.0 i.e. Artificial Intelligent platforms with machine/deep learning algorithms analyse this big volume of data to help farmers by giving



Remote Sensing and Proximity Sensing drives Agriculture 4.0 and generates a large amount of valuable precise information.

intelligent decisions providing detailed information on soil, crop status, and environmental conditions to allow precise applications of phytosanitary products, resulting in reduced use of herbicides and pesticides, improved water use efficiency and increased crop yield.

Nowadays mobiles are widely used by farmers and internet connectivity is also available to farmers with reasonable prices. Technologies now moved from web to mobile with advanced Artificial Intelligence(AI) capabilities, wherein Computers can learn much the same way as we humans do. It is the incredible explosion in data that has allowed AI to advance so quickly over the last couple of



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#### **CROP SPECIFIC**

years. More data in Al system has quicker learning process and the more accurate it becomes. Coupling both of the above, there is a need of developing adoptable and acceptable tools to farmers in real time decision making with the advent of intelligent technologies

#### Smart Rice Management platforms

Rice is the major food crop in India and is grown in diversified environments. Management levels and production constraints vary spatially and temporally in these environments. Smart Rice Management platforms are needed to support farmers in quality decisions throughout the crop growing period to improve crop productivity with maximum returns.

A Spatial Rice Decision Support System (SRDSS) has been developed by integrating with crop growth (Oryza2000) model with remote sensing (RS) and GIS layers to choose the best crop growing period with optimum management practices to achieve maximum yield at pixel/polygon level. This is further refined by integrating with Wireless Weather Station fabricated at ICAR-IIRR.

#### **Rice Expert System**

Rice Expert System has been developed to diagnose pests/diseases and recommend advisories using an AI rule based system (http://riceexpert.in). This system also facilitates the released rice varieties recommended for different traits for different rice growing regions.

#### **Rice IPM App**

A Rice IPM mobile app has been developed in Telugu, English and Hindi languages covering 11 major insect pests, 10 diseases and 18 weed species as well as nutrient deficiencies for identification of pests with symptoms of damage (both text and image) and recommended management practices.

#### Aavishkar- Al based mobile app

Aavishkar- AI based mobile app has been developed to detect rice pests and





generate advisories in text and voice mode through a click of the camera on the symptom (https://www.icar-iirr.org).

#### **IIRR Portals**

IIRR seed portal (https://www.iirrseedportal.in) has been developed to facilitate online procurement of quality seeds of improved rice varieties developed at IIRR.

IIRR Geoportal(http://www.iirrgeoportal.in ) visualises geospatial layers of Rice crop majorly covering pest and disease distribution maps along with Rice Area and Productivity layers.

A prediction model was developed for forecasting rice gall midge and yellow stem borer populations using count time series and Artificial Intelligence (AI) based machine learning approaches. The two stage spatiotemporal models were developed to forecast the rice yields Technologies now moved from web to mobile with advanced Artificial Intelligence(AI) capabilities, wherein Computers can learn much the same way as we humans do.

of 13 13 districts of Andhra Pradesh. Additionally, we have created AI based interrupted time series models to evaluate the impact of covid-19 lockdown imposed by Government of India on rice prices.

Rice pest pheno-forecast portal is in pipeline wherein AI based weather forecasting models were developed and Accumulated Degree Days and Pheno-forecast were Pest derived and recommended advisories will be generated. Robust multi-trait multi environmental (MTME) genomic prediction models were developed for genomic selection in Rice and the developed models were also validated in different populations of Rice crop.

The above models get trained with the real-time data acquired and the intelligence modules for crop advisories will be improved from time to time automatically. The cloud platform integrates all the AI modules so that farmers get the benefits without much hassle.

# EFFECTIVE INTERVENTIO

Founded in 2005, OmniActive has been consistently delivering innovative, scientifically validated, and nature-based ingredients to the evolving natural products industry. With Sanjay Mariwala at the helm of the affairs, OmniActive has bloomed over three continents with more than 400 employees. In an interaction with Vinita Singh, Senior Manager, Agriculture Today, Mr Mariwala discusses his journey and the significance of nutraceutical companies. **Excerpts from the interview:** 

AGRICULTURE TODAY September 2023

#### How did you arrive at OmniActive?

My earlier involvement was in my family's food industry. Despite family expectations, I found it uninteresting and eventually, the business became unprofitable, leading to its sale. Seeking to be an entrepreneur in a field of my own choice, I identified agriculture and agribusiness as my areas of interest. Drawing from my understanding of agricultural commodities and value-added products, I explored ways to leverage this expertise for profitability and sustainability. After considering options like personal care and healthcare, I recognized India's potential to establish a unique brand in the healthcare sector.

Although you've been in business since 2015, your primary market remains the US. Given the limited awareness of nutraceuticals among Indian consumers despite your long tenure, what specific policy interventions do you believe could accelerate the nutraceutical market in India?

Effective policy interventions should involve close government scrutiny of the nutraceutical industry, acknowledging its emergence as a cutting-edge market. It is vital to create a dedicated department for nutraceuticals, recognizing its potential. Collaborative efforts from Ministries of Agriculture, Commerce, Ayush, NITI Aayog, Health, FSSAI, and Food Processing Industry would amplify awareness and drive growth within the Indian market.

#### Could you provide insights into the current market share of the nutraceutical industry?

Our presence is dominant in the global marigold market. We've achieved substantial recognition in the US market and are actively working towards replicating this success globally.

#### What are the challenges that you've encountered thus far in the Indian market?

Our interactions with farmers have generally been positive and cooperative. However,



substantial challenges have arisen from government policies. Our efforts have focused on advocating for three key interventions: establishing a dedicated department for nutraceuticals, promoting participation within this sector, addressing Acts that may be detrimental like the National Biodiversity Act, introducing Production-Linked Incentives (PLI), and refining the classification of nutraceutical products.

### How do farmers generally view contract farming arrangements?

In North India, particularly in states like Punjab, Haryana and Uttar Pradesh, farmers are accustomed to cultivating staple crops such as wheat and rice due to Minimum Support Price (MSP) programs. Conversely, in our contract farming initiatives for marigold, we predominantly collaborate with South Indian farmers. These farmers are accustomed to multiple cropping practices, making the engagement smoother. Yields have improved over time, from 1-3 tonnes per acre initially to 5-6 tonnes per acre with improved varieties.

### What are your forthcoming plans for the next decade?

Our strategic focus involves expanding the range of nutraceutical products utilizing crops like marigold and paprika.

How are you ensuring environmental sustainability and bolstering farmers' income through your

#### initiatives?

Given the pressing issue of climate change, we've introduced crop insurance to safeguard farmers against financial losses. We prioritize Good Agricultural Practices (GAP) through training, minimize plastic usage during production, and advocate for protected cultivation methods.

### What are your initiatives to empower women farmers?

Our CSR initiatives allocate 2% of revenue effectively. Addressing the prevalent iron deficiency among women in Karnataka, we regularly distribute iron supplements to mitigate this issue. We also organize eye care camps, providing essential treatment for various eye-related concerns.

### What emerging trends are shaping the nutraceutical industry?

Consumer preferences play a pivotal role in industry trends. A growing preference for natural products and a tendency to support socially and environmentally responsible companies are the major driving forces.

#### What motivated the shift towards domestic development of hybrid seeds, as opposed to heavy reliance on imports?

Dependency on a single source or country for seeds presents significant challenges in seed development. Ensuring the success and continuity of our efforts led to the realization that self-reliance, as emphasized by Aatmanirbhar Bharat, is crucial for both our country's stability and growth.

#### **OPINION**

# **'THE FOREST CONSERVATION (AMENDMENT) BILL 2023' WHAT IT MEANS TO TREE GROWERS**

he recently passed Forest (Conservation) Amendment Bill. 2023, in the Lok Sabha has introduced significant revisions to the Forest Conservation Act of 1980, eliciting substantial criticism. The principal point of contention centers on the updated legal definition of a forest, which now encompasses lands previously declared as forests under past acts such as the Indian Forest Act (IFA) of 1927 or any other contemporary legislation after October 25, 1980, along with those documented in official government records. However, it is essential to recognize that the new forest definition does not exclude ecologically significant lands that were previously not classified as forests. Instead, the responsibility now falls upon state governments, as the IFA of 1927 originally grants state governments the authority to classify and designate any government-owned or proprietary land as a 'Reserve forest', 'Village forest', or 'Protected forest'. Consequently, rather than criticizing the bill, state governments should conduct thorough surveys and officially designate all ecologically important lands within their respective territories as forests under the purview of the IFA of 1927. The amendments also aim to remove constraints in vital infrastructure development for national security and livelihood opportunities near forests.



#### Implications of Forest Conservation (Amendment) Bill for Tree Growers

#### Solution to Land Disputes

For the first time, besides conservation, the emphasis has been given to 'Samvardhan' which literally means promotion of afforestation. Firstly, these amendments intended to resolve numerous land disputes concerning public access to rail lines or road forests. As per a study by the Centre for Policy Research, land dispute accounts the largest set of cases. The proposed amendments exclude the forest lands alongside railways or public roads maintained by the govern-



#### About the **AUTHORS**



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ment, as long as they are used for providing access to habitation, rail, or roadside amenities within a maximum size of 0.10 ha.

#### **Encouragement to Private Forestry**

Secondly, the bill encourages tree plantations on private lands and non-traditional forest areas, aiming to increase overall tree cover. This allows farmers to freely plant trees without the worry of their agroforestry land being classified as forest land. This will help in encouraging private forestry. As a result, the gradual rise in tree coverage will also act as a carbon sink, aligning with India's ambition to achieve 'net-zero' carbon emissions by 2070. However, meeting climate goals necessitates the establishment of agroforestry business models.

#### **Relaxation in Forest Activities**

Thirdly, Silviculture, including regeneration activities, is now legally considered as forest activity. This will increase the supply of timber and also pave the way for the restoration of degraded forest lands. Further, surveys and investigations in forest areas will no longer be considered non-forestry activities, as they are temporary and have minimal impact on land use. The exceptions granted to forest management empower both central

#### **OPINION**

Manufacturing & sale of Animal Feed and Feed supplements in India are not well regulated; BIS standards & specifications are prescribed for compounded animal feed & mineral mixtures. For import of Animal Feed Supplement / Feed additive products in India, DAHD is the competent authority that issues approved list of Feed Supplements / Additives. There have been on-going discussions at FSSAI & DAHD along with other stakeholders for creation of separate regulations for Animal Feed and Feed Supplements.

and state governments to facilitate easier forest administration. The Bill also grants the Central Government the authority to issue implementation directives.

### Lot more to do for promoting agroforestry

The implementation of these laws encourages agroforestry and plantation cultivation on non-forest lands, offering enduring environmental and economic benefits, including soil conservation, carbon sequestration, and biodiversity protection. Studies worldwide, including in India, show higher returns in agroforestry systems, emphasizing their productivity and favorable cost-benefit ratios.

However, the harvesting of different tree species on private land remains still tightly regulated. Moreover, the governance of interstate and inter-district transportation of forest produce needs to be made smoother and more accessible.

States such as Rajasthan, Kerala, Chhattisgarh, Bihar, Sikkim, Uttarakhand, Mizoram, and Arunachal Pradesh strictly prohibit the felling of any relatively abundant The implementation of these laws encourages agroforestry and plantation cultivation on non-forest lands, offering enduring environmental and economic benefits, including soil conservation, carbon sequestration, and biodiversity protection

tree species outside forests. Unfortunately, the policy of tight regulations has led to a sense of demotivation among farmers, resulting in many of them abandoning agroforestry practices.

#### National Transit Pass (NTP) System

To address these issues and create a conducive environment for agroforestry, the Government of India has introduced the National Transit Pass (NTP) System



Area under Tree outside forests (TOF) and number trees free from felling permission (FP) on private lands in various states for seamless issuance of transit passes (https://ntps.nic.in/Index.aspx). However, the success of this system depends on raising awareness among tree growers. Presently, only a few states are participating in issuing the transit pass, and the number of applications received for NTP remains disappointingly low, with less than eight thousand applications received to date

#### **Trees Outside Forest India**

In a promising development, the Ministry of Environment, Forest and Climate Change, Government of India, in collaboration with funding support from USAID, has launched a project called Trees Outside Forest India. This initiative aims to create an enabling environment for promoting trees outside forest areas. The project is being implemented in seven states, and the International Center for Research in Agroforestry is leading the implementation, with six other organizations partnering in this endeavor. The success of such projects and initiatives in these seven states should serve as a model to be replicated in the remaining states across the country.

#### The challenge and Way forward

One major issue is it is very difficult to identify whether the timber coming to market is from sustainable source or not. The lack of sufficient human resources for the effective implementation of programs is another constraint. The block chain technology and digitalization can help identify sustainable sources by assigning unique digital identifiers to harvested trees. A robust marketing system and standardized certification and processing industries are also vital for successful implementation.

The amendment put forward in the Bill, approved by the Lok Sabha, aims to rejuvenate the essence of the Act concerning the preservation and growth of forests. These modifications will serve as a significant step towards improving forest productivity, promoting plantations beyond forest areas, and reinforcing regulatory measures, all while addressing the livelihood aspirations of local communities.

\*Views expressed are personal



# **SAAS-BASED AGRI STARTUPS** FUELING INDIA'S AGRIPRENEURSHIP WAVE

iven that more than 80% of the farmers in India are small and marginal, the business model tested in developed countries cannot be simply replicated in India. SaaS startups in the agriculture sector have been leveraging technology to address India-centric challenges, increase efficiency, and drive innovation. According to an EY report, the market potential is poised to reach US\$ 24 billion by 2025.

The SaaS startups are fuelling the agriculture industry by providing farmers with data-driven

> Dr. Sat Kumar Tomer, Founder, CEO, Satyukt Analytics

insights, automation tools, and improved decision-making capabilities. By leveraging technologies such as IoT, AI, data analytics and remote sensing, these startups are helping to increase productivity, reduce resource wastage, enhance sustainability, and ultimately contribute to the overall growth and advancement of the agriculture sector.

#### **Challenges of Agriculture**

India is a country with varied climatic conditions and soil types. Agriculture has been a vital sector of the Indian economy. However, there are many challenges and uncertainties such as imbalances in the use of nutrients, pests and diseases, and extreme weather events.

The ratio of nitrogen is significantly higher compared to the recommended



dosages, while other nutrients are applied in relatively lower quantities. According to the Fertiliser Production and Consumption 2021-22 report, the ratio of NPK use was 7.7:3.1:1 during 2021-22 against the standard practices of a ratio of 4:2:1. In a Centre for Science and Environment study, the ratio was found to be as high as 31.4:8:1 in the state of Punjab.

Sometimes crops are completely wiped out due to the sudden attack of pests or unseasonal weather events. Irrigation water use efficiency in India is only 38% compared to the developed countries having in the range of 50 - 60%, according to the National Water Mission.

#### **Targeted Approach**

Data-driven precision agriculture represents a shift from traditional uniform farming practices to a more targeted and efficient approach, driven by accurate and actionable data. It involves applying the right agriculture input at the right time and right place.

#### **IOT in Agriculture**

There are various types of data driven precision agriculture platforms available such as IoT sensors, drones and satellite remote sensing. IoT sensors gather several variables about the soil and environment from a farm enabling real-time monitoring and analysis to take timely actions. However, these sensors have limitations such as capturing only local inData-driven precision agriculture represents a shift from traditional uniform farming practices to a more targeted and efficient approach, driven by accurate and actionable data.

Satellite remote sensing is able to precisely monitor soil nutrients, organic carbon and moisture, and track the health of crops at an affordable cost for small and marginal farmers.

formation, data security issues, extreme weather conditions, such as extreme temperatures or humidity, which can affect the durability and functionality of IoT sensors. All these factors coupled with high capital expenditures and maintenance costs make it unaffordable to most of the farmers in India.

#### **Drone Challenges**

The drone offers a collection of highresolution images for effective scouting. However, these advantages are counterbalanced by the drawbacks such as the need for physical presence on the farm, high cost making them unaffordable for many farmers, and limited data scope (unable to capture soil nutrients and weather conditions). Additionally, their coverage is limited and may not suit large-scale agricultural operations. While current infrastructure remains underdeveloped, there is optimism for improvement. Despite limited penetration currently the new policy offers a hope for broader outreach to more farmers.

#### Satellite Remote Sensing Technology

After the availability of higher-resolution images from international space agencies, Satellite remote sensing technology is gaining ground for farms. Satellite remote sensing is able to precisely monitor soil nutrients, organic carbon and moisture, and track the health of crops at an affordable cost for small and marginal farmers. Further, satellite remote sensing provides historical data to track the history of a farm to gain insight into the risk associated with a farm. It enables large-scale monitoring, provides near real-time data, does not require physical intervention, and allows information to be accessed remotely with global coverage. Satellite remote sensing technology looks like a promising technology for large numbers of small and marginal farmers to access precision agriculture so far not accessible to them.

# ICFA'S DEVELOPMENT MEET ON AGRICULTURE FOR NER

Hotel Taj, Guwahati | 25th July, 2023



CFA hosted Development Meet on Agriculture for NER at Hotel Taj, Guwahati on 25th July which was joined by 50 plus CEOs, State officials, heads of institutions and Startups.

Chaired by the Secretary, North Eastern Council, Mr. Moses Chalai, IAS, the meet recommended launch of Commodity Boards for Bamboo, Pineapples and Organic Foods, establishing integrated GI system for all NE products, FPOs-industry partnership and agri Startups support program and creation of a business and investment forum for NER.

The meeting started with welcome note by Mr. PL Thanga, IAS (Retd), ICFA Chair for NER. He shared his thoughts by stating that India is one of the largest producers of pineapple. He noted that people from Maharashtra to Kerala are coming in forefront and are now becoming leading entrepreneurs. He also discussed about incubation center, market intervention in pineapple production.

#### FPOs to be strengthened

Mr. Pankaj Pathak, ICFA Advisor for NER emphasized on the importance of this meeting and reminded everyone that the base concern of world is agriculture. He talked about the potential of Pineapple in NER region. "Assam and its neighbouring states have two best varieties –Kew which is used for processing purpose and queen for table purpose. Inspite of India being 6th largest producer of pineapple, the presence in global market is very less, "he noted. He was of the view that assistance to the FPOs; especially educating them can be done. Assam being an organic state, there is a vast scope, he observed.

Mr. Pankaj Pathak said that for the longest time, everyone's vision was to increase the price of the product, for example Thailand is the biggest exporter of pineapple and black pepper and they are competing on price. The farmer's income can be increased by increase in price, reduction in cost with increase in volume. In NE there is no issue of land holding. Farmers can move from one acre to two acre in the same price. And the focus should be done by farmers and higher authorities.

#### **REGIONAL FOCUS**



#### Underfinancing and Low Insurance Coverage

Mr. Naveen Dhingra, CGM, NABARD said that development needs in north eastern region means the development has to take place or its benefits has to meet rural and agriculture sector. He shared some data to understand the problem statements that are being addressed in state of Assam or North-East. "Around 85% of people are dependent on agriculture. Out of 40 lakh hectares of land, roughly 15 lakh ha is irrigated and rest is unirrigated. Out of 29 lakh household in Assam, only 11 lakhs are provided with Kisan Credit Card (KCC). 7.5 lakh of them active KCC and in rest no transactions have been done, "he pointed out. He noted that there is a lot of underfinancing in these regions which means people are not getting adequate funding for taking up the cultivation. Mr. Dhingra brought to the attention the low productivity of paddy crops in Assam, despite it being the major crop. "The productivity level is less than 30% as compared to all India productivity level of paddy. Only 3000 farmers in Assam have crop insurance coverage," he said.

Further he discussed about few advantages that northeast region have. He mentioned that many NER states were organic and has large production of bamboo. He suggested that it can create an effective value chain as it has export potential and can make products from bamboo. Assam is also known for its handloom and handicrafts as it has the largest



rural community. He also suggested that the North East can also be projected as species area. Floriculture board can be established and tourism sector can be also encouraged there.

"The basic work of NGO's is to spread knowledge so that the people can take benefit from it. NABARD has different pilots, under which creates awareness. Once the programme is successful, it is multiplied and taken care by NGOs," he said.

#### Information, Awareness and Facilitation

Mr. MJ Khan, Chairman, Indian Chamber of Food and Agriculture stated that few suggestions which can be used in formalizing actions for example information, awareness, and facilitation. Comprehensive campaign both in physical and digital format can be organized for each available opportunity. He asked everyone that instead of stating about problems, we should discuss the problems and also the crops and its productiveness is important.

#### **Creating Awareness**

Dr. Madhulika, Invest India head for NER mentioned the challenges while working with FPOs. She pointed out that the primary processing is lacking and it creates difficulty in investing in upstream. She also suggested few solutions like proper export guidance and creating an entire supply chain for products/crops. She also recommended that awareness must be created among farmers regarding the market and crop rotation.

Mr. Subhash Bhattacharjee, Advisor of Patanjali suggested four points for bringing the policy alignment for the development of agri-horticulture. He suggested public private partnership in processing sector, Gl crop for better value, formation of millet value chain and lastly, reinventing some new thing for tea growers.

Dr. Kushalin Sarma, Executive Member DTDF of DRDO, Ministry of Defence was of the view that the academic institutions and research bodies, government and state government mechanisms of all 7 states should come forward and teach rural people. He also noted the lack of connect between the people and government sectors. Mr. Nitin advised for centralizing the GI, He also suggested an investor connection like shark tank where startups can pitch their ideas.

Dr. R. Sudhakaran, Head Regulator Affairs (Agri inputs), INERA Cropscience mentioned about the opportunities existing for the farmers, producers, exporters and FPOs. He said that crop insurance and advisory are provided to them. Mr. Bharat Goswami, Regional Manager of DS Group pointed out the opportunity for Arecanut farmers in Assam in the production of pan masala as currently good quality ones are not used.

Ms. Angela Nar, Director of Responsenet Development Services informed about the 300 farmers initiative which was the first pilot that was started in April with the challenge of information dissemination on the ground and capacity building among the farmers. She further suggested that the institutions and government bodies should focus on educating farmers. "Every state government of north east region should come together and provide more platforms like naturally organic, products of the region, etc. Small initiative platform for startups to get investors can also be thought about," she added.

#### **Leveraging FPOs**

Mr.Raja Gohain, Founder of Ryan Farms



LLP advocated a common platform between FPOs. "FPOs mostly are seen working in isolation. FPO to FPO business trading, intra trading business between FPOs can be introduced," he suggested.

Dr. Geetima Das Krishnan, Head-North East Desk, Invest India, Gol said that list of FPOs can be shared so that the funding of regarding that can be done just like the funding in agri allied sectors & tea garden is going on.

Mr. Saurabh Srivastava, Marketing Coordinator of Agriculture Department, Government of Assam stated that for long term solution is proper education which should be provided at school and college level and in banking sector. "Since in NE people are not paying loan, it gets difficult to give loan to change the scenario of agri". He was of the view that agriculture must be looked up as an industry.

#### Communication, Coordination and Logistics

Mr. Mintu Handique, General Manager CSR, Numaligarh Refinery Limited suggested that a WhatsApp group where all the VCs are directed to give report on daily basis. He further added that there is a lot of scope for NE products, but the buyer should be found. "The department has opened around 30 entries. Through that direct export can be done and one can become registered exporter", he mentioned.

Mr. Pritha Purkayastha, AVP, Axis Bank discussed about logistics improvement. "Protection gap and insurance should also be provided" he opined.

Prof CP Suresh, Head, Department of Horticulture, North-Eastern Hill Univer-

sity noted that production of pineapples and oranges have been decreasing for the past 3 years. He also advocated for sustainable tourism.

Mr. Abhijit Sharma, Mission Director, School of Livelihood and Rural Development talked about how climatic change has been affecting Meghalaya now. "The production of oranges has been reduced. So through other ways farmers can earn like from carbon funding, renewable energy, socio-forestry, forest produce using the innovative ways for increasing the farmers income and not going for extensive or over-exploitation of resources", he suggested.

Dr. R Murugesan, Director of National Institute of Rural Development felt that the capacity building is missing and FPO cells needs to be created to directly connect.

#### **Concluding Remarks**

Dr. MJ Khan thanked everyone for their valuable suggestion. He also thanked Mr. Moses for giving his valuable time, Dr. Thanga for being the constant source of inspiration and to be involved in this region and Mr. Naveen for meaningful intervention and adding value to the different speakers what they share.

The concluding remarks by Mr. Moses Chalai, IAS, Secretary of North Eastern Council mentioned about the many stakeholders who were at work. He noted that the challenge is how to bring everyone to work together. "Even nowadays, it is a bit tough to become an entrepreneur. Even if we look into the market, a single family is covering and contributing 2-3 different varieties of crop," he noted. Further, he also mentioned pineapple and turmeric and its market value in concluding speech.

### Road Map For Development of NER

- Strengthening FPOs
- Creating an effective value chain for Bamboo products
- Promoting Handloom and Handcrafts
- Establishment of Floriculture Board
- Promotion of Sustainable Tourism
- Comprehensive campaign both in physical and digital format
- · Providing proper export guidance
- Establishing an entire supply chain for products/crops.
- Awareness among farmers regarding the market and crop rotation.
- Policy alignment for the development of agri-horticulture
- GI training of horticulture crops
- Formation of millet value chain in North- Eastern states.
- Creating Investor Connection
  Programmes like Shark Tank
- Providing more platforms like naturally organic, products of the region, etc.
- Creation of a common platform between FPOs for information sharing and intra trading business
- Expanding and Strengthening logistics
- Increasing farmer incomes through carbon funding, renewable energy, socio-forestry and marketing forest produce using innovative ways
- Public private partnership in processing sector
- Popularizing Crop Insurance
- Creating Awareness on different financial schemes for farmers



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