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Sustainable Agricultural Mechanization

The Way Forward

Smallholder farmers are the main producers of world's food. To feed the growing population, they will have to increase production by up to 100 percent by 2050. This must be achieved while preserving natural resources and that is why Sustainable Agricultural Mechanization will be fundamental to the process.

Sustainable Mechanization is climate-smart, environmentally benign and essentially means 'no-till conservation agriculture', which requires specific mechanization inputs. Principally, these are seeders and planters capable of penetrating soil surface vegetative cover to deposit seed and fertilizer at the required depth and spacing. Also, equipment for management of cover crops and weeds. Mechanization is required not only for crop production, but also for processing and along the entire value chain.

Mechanization inputs are usually expensive, hence require specialist service provision. This will need collaboration from both the private and public sectors and will involve public-private partnerships to be developed in one form or another.

Access to mechanization by smallholder farmers is a challenge that needs to be addressed promptly for higher productivity of labour and land. This will require an environment conducive to enthusiastic and profitable private sector participation. Local manufacture of locally adaptable mechanization inputs should be encouraged and facilitated. The conservation of natural capital (especially soil, water and forests) requires renewed focus on sustainable land management. Supply chains for sustainable mechanization options need to be strengthened to encourage increased demand.

Because of rural-urban migration and the impact of pandemic diseases, female-headed farm families are becoming more prevalent across the globe. Improving women's access to farm power through the provision of suitably designed equipment needs to be addressed by the stakeholders in the farm power provision supply chains.

Consideration of the entire value chain can help in avoiding the build-up of bottlenecks in the value addition process. Participatory technology development should involve partnerships between manufacturers, researchers and user groups. Let us move towards building this synergy.

We feel pleased in hosting the first **ATG Farm Tech Summit** and fourth edition of **Apollo Farm Power Awards 2022**.

Happy Reading...

Mamta





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MR RAM KAUNDINYA



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MECHANIZATION FOR MODERNIZATION

Agricultural mechanization is very relevant for Indian agriculture. The farmers too are recognizing it. The farm equipment market in India estimated at USD 8.8 billion in 2017 is now expected to reach USD 12.5 billion by 2022.

It is a known fact that farm mechanization reduces the cost of cultivation and increases productivity. Use of improved implements has potential to increase productivity up to 30 per cent and reduce the cost of cultivation up to 20 per cent. It can also be the answer for increasing agriculture exports, addressing labour shortage, and encouraging judicious use of farm inputs.

Indian conditions have not been an easy terrain for the agricultural machines. Fragmented land holdings, strained spending capacity of small and marginal farmers, pricier farm technology, subsistence agriculture and diverse geographical conditions have perennially impeded the growth of farm mechanization in India. But relevant schemes like Sub Mission on Agricultural Mechanization (SMAM) launched in the year 2014-15 has tremendously improved the access of agricultural machines and equipment to Indian farmers. Custom hiring centers established in the country has assisted farmers in procurement of various agricultural machinery and equipment. During 2020-21 alone, 9432 CHC were established under the SMAM scheme.

Looking at the future, I see immense scope in this field. Apart from the government interventions, many start ups can evolve models that can propagate farm machines and assist farmers in choosing the equipment appropriate for his farming needs. Research and development can be focussed on developing

need-based and regionally differentiated machinery. Tractor penetration has increased from one per 150 hectares to one per 30 hectares.

However, such an increase in penetration has not been seen in other segments of farm equipment. As per-capita land holding of Indian Farmers is decreasing, small farm machineries / implements (individually operated) need to be promoted. Youth can be specifically trained and financially supported (credit linked back-end subsidy) to set up CHCs. Agriculture is evolving. The needs of farms are changing. As women form a formidable part of Indian agriculture, India should be looking at developing gender sensitive equipment and may be train a women force in agri mechanization. Custom hiring models and Agriculture Machinery Banks have also been suggested to mechanize Indian agriculture.





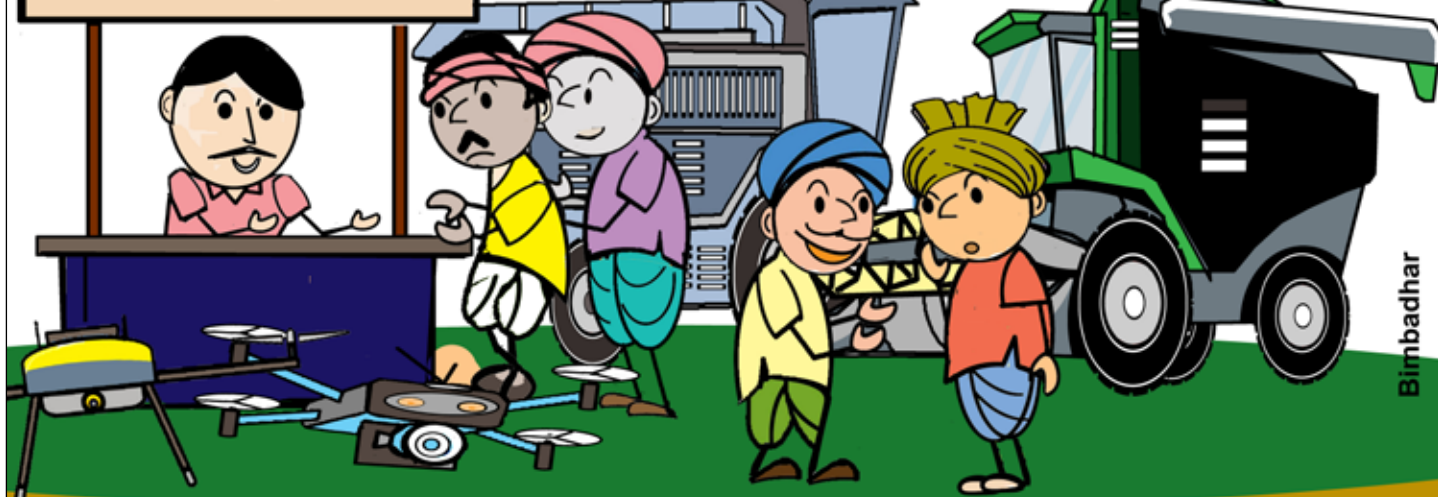
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RAJNI SHALEEN CHOPRA

TWO MAJOR UPCOMING INITIATIVES OF ICFA SHALL HONOUR GRASSROOTS VISIONARIES

Two upcoming initiatives by the Indian Chamber of Food and Agriculture (ICFA) will play a major role in encouraging and strengthening the work happening at the grassroots level in the agriculture sector.

One is the First India FPOs Summit 2022, being organized on November 11 at PUSA Campus in New Delhi. The second is the First India ACABC Summit 2022.

Celebrating the best Farmer Producer Organisations (FPOs) in the country is a wonderful initiative indeed. Following the thrust provided by the Centre, creditable work has happened in the direction of mobilizing small farmers into FPOs.

Farmers face tremendous challenges in growing, harvesting and marketing their produce due to lack of economic strength. The feedback from more and more states is revealing that by mobilizing as FPOs, groups of small farmers have become influential market forces. They are now significantly able to improve their incomes by developing the agriculture value chain.

The initiative taken by ICFA to recognize and honour the best FPOs shall encourage and support those farmers who have been able to collectively address the challenges of access to technology, quality seed, fertilizers and pesticides including requisite finances.

FPOs across many states are now collectively ensuring better access to technology, input, finance and market for faster enhancement of their income. First India FPOs Summit 2022 will honour the visionaries of the grassroots who came together for the collectivization of small, marginal and landless farmers in order to give them strength to deal with such challenges.

Simultaneously, ICFA is hosting the first national level convention of more than 1000 Agri-Clinic and Agribusiness Centres (ACABCs) on Nov 10, during the AgroWorld 2022.

Agri-Clinic and Agribusiness Centers, spread across the country, are amongst the largest institutional systems in agri space in the country. Over the past many years, there has been much focus on the three other institutions – Cooperatives, FPOs and Agri Startups. All these years, the platform of ACABCs has remained largely unexplored by the industry and institutions for collaboration and partnerships.

These awards and accolades are given after adjudication by a competent jury. The initiative taken by ICFA shall award the meritorious performers in these respective sectors.



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NEEDED: SUSTAINABLE GROWTH OF FARM MACHINERY

Is India's farm mechanisation industry well positioned to make us Atma Nirbar in food production?

Raising agricultural productivity and income per acre are the main growth indicators for Indian farmers. Promotion of new farm technologies is one of the most important factors for growth

in agri productivity, with several studies suggesting a direct correlation between increased yield and farm mechanisation.

Tractorised, Not Mechanised

India is the largest tractor market in the world, with growth in overall mechanisation of its farmlands. Are agricultural technologies accessible and affordable for the small landholders in India – 80 pc of our farmers? No.

India is tractorised, but not mechanised, with far lower levels of non-tractor farm equipment or farm machinery penetration compared to developed countries.

For long, several local and

unorganised non-tractor farm equipment manufacturers have developed low-cost farm equipment driving affordable mechanisation beyond tractors. However, this was done without considering the quality, serviceability and design. Due to this, low-cost farm equipment is prone to break downs and results in lower yields.

Like tractors, sustainable growth of overall farm mechanisation requires sustainable manufacturing of farm machinery. This is also in context of diminishing agricultural labour. Farm machinery needs to be Made In India, as per the clarion call of the PM for Atmanirbhar Bharat. It is important for the country to encourage innovation, local R&D and develop world-class infrastructure, while

About the AUTHOR

Mr Hemant Sikka is the President of the Farm Equipment Sector (FES) and a Member of the Group Executive Board at Mahindra & Mahindra Ltd. (M&M). He oversees Mahindra Powerol, the Genset and Industrial Engines Business & Mahindra 2 Wheelers division. He also serves on the boards of several Mahindra Group companies in India and overseas. Mr Sikka is also President of Tractor & Mechanization Association (TMA) of India



enhancing skill development for sustainable growth of farm machinery.

To do so, the Indian government can support in the following ways.

Restrict Import Of Farm Machinery

For India to roll-out Made in India farm machinery, we need restrictions on importing farm machinery into the country. Import data shows that in eleven months of F'21 (April 2020 to February 2021), the value of farm machinery imported was around ₹ 1185 crore compared to Rs 477 crore in FY 2018, i.e. 148% growth in three years. In F'21, 63% by value of imported farm machinery came from China, making China based manufacturers significant beneficiaries of the SMAM (Sub-Mission on Agricultural Mechanism) scheme.

Fully imported products dominate two categories of farm machinery – crawler type combine harvesters and rice transplanters, both of which are major beneficiaries of SMAM. In F'21 around 70% of crawler type combines harvesters sold in India were imported. About 60-70 pc rice transplanters were imported. Global manufacturers were major beneficiaries in both categories

Policy On Emission Norms

Prudent emission norms in tractors and farm machinery encourage adoption of farm machinery. Progressive, prudent and well-spaced out emission norms for agri equipment are the need of the hour.

Complex Tractor Technology

As the tractor becomes technologically more complex, serviceability will be another key issue, with local repair workshops in villages not being equipped to service and repair these complex systems. This could lead to longer service intervals, higher cost of service and delays in readying critical equipment for use in farmlands.

Subsidy by State Governments

The government's support for agri machinery makes newer technology adoption easier for farmers. Government bod-

GLOBAL CENTRES OF EXCELLENCE

Japan – Lightweight tractors & Rice Machinery Value Chain

Finland – Harvester & Forest Machinery

Turkey – Farm Implements

To Make in India, Mahindra will soon launch its first dedicated Farm Machinery plant in Pithampur, MP. Through this plant, Mahindra will introduce a range of farm machinery, made for India, in India and at Indian prices.

To further making farming affordable, Mahindra has also rolled out Krish-e, its' new business vertical that provides technology driven services that are progressive, affordable, and accessible to farmers.

These include agronomy advisory, access to advanced farm equipment rentals and new-age precision farming solutions, through Krish-e centres and digitally across the complete crop cycle, all focused on bringing down the overall cost of farming and improving crop output and consequently the farmer's income.



ies must ensure uniform and timely subsidy disbursement through DBT to help farmers leverage subsidies effectively.

Registration Tax and Insurance of Tractors/FM

Various state governments levy several type charges at the time of registration of a tractor or farm machinery, like hefty RTO taxes, renewal charges, tractor fitness charges, inspection charges, smart card charges, number plate charges etc. at the time of registering a tractor. In some states the cost even goes up by as

much as Rs. 30,000 - 50,000, which is a very high price for a farmer to pay.

A Pan India uniform policy will be highly beneficial for the industry.

Mahindra's Mechanisation Push

Mahindra has a large role to play in the mechanisation of India's farmlands, bound by the purpose of 'Transform Farming & Enrich Lives'. As the world's largest tractor manufacturer by volumes, the company aims to deliver prosperity on farmlands through pioneering technologies for farmers across the world to enable them to rise.

With a presence in over 50 countries, Mahindra has a strong tractor portfolio and are very bullish about the introduction of farm machinery beyond tractors and aim to grow substantially in the next five years. With this Mahindra has a very strong pipeline of farm machinery and have been introducing three to four new products each year, for a complete range of products and solutions as part of its Farm Machinery portfolio, based on having established three global technology Centers of Excellence, through acquisitions over the last couple of years.

These centres will allow Mahindra to bring back and adapt technologies relevant for the Indian market, with the idea of taking technologies used in large land holding farms around the world and making them affordable and accessible to small land holding farmers.



Mr Sikka enjoys sports and watching movies in his leisure hours

2022 - FOURTH EDITION OF apollo FARM POWER AWARDS

Recognizing merit and high quality in the farm power equipment industry

In a national first, Apollo Tyres & ICFA instituted the Apollo Farm Power Awards in 2019 to recognize excellence in farm power industry.

The Apollo Farm Power Awards were instituted with the vision to recognize excellence in farm power industry and reward research and development in this sector. November 2019 featured the inaugural edition of these prestigious awards. The Apollo Farm Power awards were given away in a glittering ceremony during World AgTech Congress.

The initiative was taken up to recognize the efforts of the farm mechanization industry and bring them all on a common platform to counter such future challenges jointly.

Tractor is the main source of farm power across the world. The Indian Tractor Industry has grown four-fold in the last 20 years to become world's largest tractor producing country,

helping to improve farm productivity through mechanization. Partnering with ICFA, Apollo Tyres group initiated a unique approach to reward research and development in this sector.

The eminent panelists discussed the challenges ahead for the growth of small and marginal farmers, frequent climate changes, agriculture labour shortage with male workforce shifting in urban areas. Members also discussed the innovations needed in mechanization to meet the demand for changing cropping pattern, and the challenges caused by decreasing water table across diverse agro climatic zones.

2019: First Edition Of Apollo Farm Power Awards

The 18 awards were divided in 11 categories. The awards were won by 11 leading tractor manufacturers and three Self Power tools developers for exemplary contribution in the

development of new models, with technological integration to take care of the growing demands in agriculture mechanization.

Individual products and brands were selected by the eminent jury panel chaired by Dr Punjab Singh (President NAAS), members from CFMTTI, ICAR and Farmer Opinion leaders based on multiple important aspects like performance, technical specification, and the versatile nature and choice of farmers considering distribution channels support and services.

2020: Second Edition Of Apollo Farm Power Awards

In 2020, Agriculture Today Group organized the second edition of Apollo Farm Power Awards.

The second edition of the Apollo Farm Power Awards was organized virtually by the Agriculture Today Group. Union Minister of Agriculture and Farmers Welfare Shri Narendra Singh Tomar was the chief guest at the award ceremony. He awarded winners in 20 categories of tractors and diversified farm power equipment and the best innovations and launches in the sector. The Sonalika Group won the award for the fastest growing brand in farm power.

Dr Ashok Dalwai, CEO, NRAA and Chairman, DFI Empowered Body, Ministry of Agriculture, GOI, was the Guest of Honour at the award ceremony. Those who spoke on the occasion included Dr Dalwai; Mr T R Kesavan, President of Tractors Manufacturers Association (TMA); Dr MJ Khan, Chairman, Indian Chamber of Food and





Agriculture (ICFA) and Ms Mamta Jain, CEO and Editor of the Agriculture Today Group.

The award session was followed by a panel discussion on 'Mechanising Indian Farms for Efficiency And Precision'. Later, awards were presented for excellence in diverse categories of agriculture mechanization.

2021: Third Edition Of Apollo Farm Power Awards

In 2021, Apollo Tyres and The Agriculture Today Group organized the third edition of Apollo Farm Power Awards. Those who spoke on the occasion included Dr Ashok Dalwai, CEO NRAA and Chairman, Committee on DFI; Mr TR Kesavan, President TAFE Ltd; Mr Sandeep Mathur, Head OEM and Institutional Business, Apollo Tyres; Dr MJ Khan, Chairman Indian Chamber of Food and Agriculture and President of the Agriculture Today Group; and Ms Mamta Jain, CEO and Editor of the Agriculture Today Group.

The award session was followed by a panel discussion on 'Mechanising Indian Farms for Efficiency And Precision'. Later, awards were presented for excellence in diverse categories of agriculture mechanisation.

2022: Fourth Edition Of Apollo Farm Power Awards

The Agriculture Today Group and Apollo Tyres continue the glorious tradition this year by hosting the third edition of the Apollo Farm Power Awards.





AGRICULTURAL MECHANIZATION

Agricultural robotics, sensor technology, and artificial intelligence will have to be integral components of new agricultural mechanization

COURSE CORRECTIONS WE NEED

Crop productivity has reached a plateau during last couple of years. New generation youth farmers are looking for alternative employment opportunities. New agriculture demands mechanized automated and smart options for improving precision and timeliness. These make production and post-production farm operations more comfortable, safe and economically feasible.

This article highlights course corrections at farm mechanization delivery points.

Achievements, Impact

The overall farm mechanization level of the country is about 47% which is lower as compared to that of other developing countries such as China (59.5%) and Brazil (75%). We have to reach power

consumption more than 4.00 kW ha⁻¹ by 2030 to reach the level of the most mechanized countries by 2047.

There are tangible socio-economic benefits of various mechanization and post-harvest technologies for farmers and other stakeholders. Numerous tools, techniques, process protocols, products to contain post-harvest losses and policy decisions have saved more than 30 million tons of food grains. Concepts of agro-processing and custom hiring centres have well been taken.

AICRP-PHET established about 300 agro-processing centres throughout country and provided direct and indirect employment to 4-6 and 10 peoples

About the AUTHOR

Dr SN Jha is DDG Agricultural Engineering, ICAR & President, Indian Society of Agricultural Engineers





addition, cold chain etc. Similarly, National Food Security Mission (NFSM) scheme, *Rastriya Krishi Vikash Yojana*, sub-mission of Agricultural mechanization, *Pradhan mantra Krishi Sichai Yojana*, Rural Agricultural Infrastructure development etc. are having almost 100 % engineering work at Panchayat, block, district and state levels.

per unit respectively in production catchment itself. The concept is being implemented through various schemes of the government.

India has now become self-reliant in post-harvest machinery and technology of cotton, jute and allied fibres. India exports the ginning machinery to the tune of Rs. 300 crores per year. The share of jute diversified products has increased many folds in last five years. Small and medium lac processing plants and different value-added products are providing livelihood support effectively to various stakeholders in lac producing states of the country.

Aspirations

The new agriculture structure for improving productivity and sustainability includes adoption of new age tools of information technology that leads to improved precision and automation using sensors, robotics and AI for quality production and postharvest operations.

Aspirations of carbon emission neutral country by 2070, major food supplier to world and safe nutritive foods production system mostly be unaffected in any order of the world are our aspirations by 2047.

Agricultural robotics, sensor technology, and artificial intelligence will have to be integral components of new agricultural mechanization. Research and developments on robotics and AI using Internet of things need focused attention to meet the aspirations of youths, majority of whom want to be CEO of startup companies' of smart farming than becoming progressive farmers. Speed and skill with certain course corrections are needed at all levels.

Delivery Points' Course Correction

Focus of the Indian agriculture needs pragmatic shift from production oriented agriculture to profit making ventures with automation, IoT and remotely controlled farm, both in pre- and post-production activities, in the centre. Skill development needs speed for which several institutions and centres of excellence such as National Institute of Agricultural Robotics and AI, Agri-electronic manufacturing hubs for accelerated manpower development shall be better sooner than later.

Government of India is putting all efforts to accelerate the farm outputs in both production and profit making supporting by launching several schemes. Some of them are Mission for Integrated Development of Horticulture (MIDH) comprising construction of proper fencing, net house, hi-tech green house, pump house, irrigation facilities (drip, sprinkler), water storage tank, creation of infrastructure like drying platforms, storage bins, packaging units and related equipment, construction of green houses, shade net house, plastic mulching, and plastic tunnels, anti-bird/hail nets, horticulture mechanization, integrated post-harvest management infrastructure, processing and value

Engineering Knowledge Needed

Many works in MNREGA require engineering knowledge for perfection. The present delivery points block agriculture officer, district agriculture level officers and Director agriculture at the state levels. Majority of them are hardly trained in these engineering oriented work. Implementation of these schemes isn't at the optimum level.

Perhaps except Madhya Pradesh and Tamil Nadu, no any other state has deployed the most suited manpower for mechanization/engineering oriented work. There is hardly any trained manpower is available at panchayat, block and district levels to guide and help farmers/entrepreneurs in procurement, commissioning, repair and maintenance of agricultural machinery, irrigation and soil/watershed management gadgets and post-harvest processing and value addition plant.

Since Agriculture is a state subject, each state has to strengthen its weak delivery points by employing agricultural engineers which is a single professional degree that can handle all these aspects, i.e. agriculture as well as engineering. After employment of such engineers, monitoring mechanism at state level by establishing Directorate of Agricultural Engineering is the must, other-wise employed engineers in field as being hired by some state shall also not bear fruits to its full potential. Therefore, there is an urgent need of policy decision for establishing Directorate of Agricultural Engineering in each state and employment of Agricultural Engineers at Panchayat, block and district levels for speedy development of Indian Smart Agriculture.

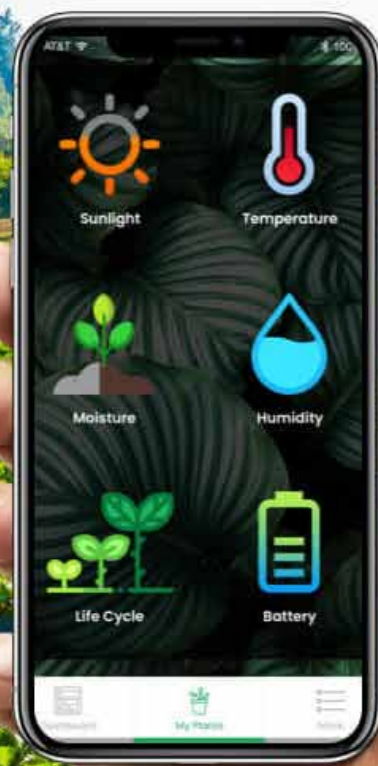


**fun
FACT**

Dr Jha enjoys old Hindi film songs,
reading and writing

SMART FARMING

ADOPTION OF FARM MECHANIZATION SHALL STEADILY INCREASE



Given the agricultural worker scarcity and the launch of several Government programs, adoption of farm mechanization is going to increase in future.

The average farm power availability needs to be improved to a minimum of 3.5 KW/ha by 2024 to assure timeliness and quality in field operations and to undertake heavy field operations like sub-soiling, deep ploughing, chiseling, etc.

Currently, India is one of leading country in the world for the manufacture of tractor, agricultural implements and equipment. The range of equipment includes land development machinery, field preparation equipment, plant protection machines, harvesting and threshing equipment, irrigation and drainage pumps, sprinkler systems, dairy and agro-processing equipment etc. India is exporting these implements to various countries including USA and countries in Africa and Asia continents.

Precision Farming

The world is now the edge of the third

modern farming revolution and precision farming is becoming an important part of it. Due to scientific progression, genetically modified newer sets of crops that are pest resistant and need less water were introduced, leaving each farmer able to feed 155 people. Advanced analytical capabilities and constantly improving IOT (Internet of things) capabilities, like precision agriculture drones, will be key elements in the third revolution.

In developing economies, 32% of food losses occur during food production as analyzed by McKinsey on FAO data.

Sensors, robots and drones are expensive, have high maintenance, and require technically trained labour to operate. A variety of sensors are required for collecting data on different parameters, which need to be analyzed separately, hence driving operational costs higher

Conventional farming practices are area-centric. There is a general set of crops cultivated throughout an area. All the farmers in that area follow the same procedures with respect to the sowing, nourishing, irrigation, and harvesting period. These practices result in unpredictability, overuse of resources, and uncontrolled waste production.

Since details of areas in a single farm can be traced, precision farming benefits farmers in several ways. A refined set of cultivation practices and choice of crops is based on suitability of land, elimination of volatility and risk, waste management, reduction in production costs, minimum environmental impact, optimized use of fertilizers, water management.

Global Technology Boom

Connected tractors are advanced agricultural tractors that use sensors, control units, hardware, display, and other IOT systems to connect over the Internet and facilitate remote monitoring of the operations by farmers. These tractors use on-board application and intelligent connected solutions to conduct farming operations more effectively.

Emerging trends such as Smart

Farming and advent of IOT sensors and rise in affordability among farmers has boosted the demand for technologically advanced farm equipment. The use of IOT in tractors for data management, remote display of tractor operation, and autonomous undertaking of harvesting, seeding, and planting is projected to drive the connected tractors market.

Rise in Demand for Connected Tractors

Connected tractors effectively undertake farming actions to enhance farming operations. These tractors have sensors to analyze soil compaction, calculate seeding distance, and make precise turns on fields for minimal gaps and overlap. Demand for higher yield output has been increasing at the expense of small available arable land, the connected tractors helps effectively use the farm space and thus is expected to gain high preference.

The Future of Agriculture

Precision farming and modern farming focus on reducing production cost and wastage, as it is tailored to the needs of each plot. It centers on data collection and analysis of farm plots which comprises sensors, drones, and robots for recording the data, and software as a service can be used to adapt to precision farming systems.

Although IOT is still at a nascent stage, the governments of agriculture-dominant economies do invest in other cutting-edge technologies like artificial intelligence and machine learning (AI/ML) to make smarter agriculture solutions. In countries like India, the implementation of IOT in agriculture has its own set of unique benefits and challenges.

Firstly, the farmers fear upgrading



various sizes of farms.

Sustainable Digitalization of Agriculture

The recent rapid digitalization has reduced the exhaustive paperwork in most private and public sector organizations and for also reduced the manual work. United Nations projects that by the year 2050 the population of the world will be 9.7 Billion. With the relevance of over 60% of the world population relying on agriculture for food, the pressure to increase crop production to meet demands doesn't seem to ease. Coupled with climate change, which is leading to the rise in global temperatures, levels of greenhouse gases, and frequency of extreme weather events like droughts and floods, along with increasing labor costs, high production costs, and unpredictability, poses a major challenge to the future of agriculture. Hence, the goal is to increase productivity through farm mechanization in a sustainable way.

About the AUTHOR

Mr Ashok Anantharaman is COO Action Construction Equipment Ltd, Faridabad

Dr Rajendra Paroda, FTSE Global Agriculture Authority, Elected As ATSE Fellow

Dr Rajendra Paroda, Chair, Trust For Advancement Of Agricultural Sciences (TAAS), New Delhi, India, has been elected as an ATSE Fellow. ATSE is Australia's foremost impact network for leading applied scientists, technologists and engineers.

About Dr Paroda

Dr Rajendra Paroda is an acclaimed agricultural scientist specializing in plant genetics and breeding. His contributions to plant breeding and genetic resource management are globally recognized and include establishing the first modern national gene bank in India.

As Secretary, Department of Agricultural Research and Education, he modernized India's agricultural research system, creating more than 30 new research institutes. The resultant innovations doubled India's food grain production from 130 million tonnes to 1980 to 260 million tonnes in 2011 – underpinning food security for a rapidly growing population.



ATSE

Outstanding Contributions

Dr Paroda's outstanding contributions have strengthened agricultural research and innovations internationally, particularly in Asia and the developing world. He established and led key international bodies including the Global Forum on Agricultural Research (GFAR) and the Asia Pacific Association of Agricultural Research Institutions (APAARI).

Dr Paroda has a long association with Australian scientists and organizations including CSIRO. He served on the Advisory Council of the Australian Centre for International Agricultural Research.



We cordially invite you to join us for
**The Apollo Tyres
Farm Power Awards**
to reward excellence in the
farm power industry and to
recognise the leaders
paving the way forward through their
research and development in the field.

Date: 17 November 2022, Time: 4 PM

Venue: La Meridien, New Delhi

PROF GAJENDRA SINGH

The Teacher Professor

A renowned academician, a visionary and an excellent teacher, Dr Gajendra Singh has helmed some of the coveted institutes of agricultural research and education in India and abroad. A person with humble beginnings, Dr Singh went on to become a respected educator and an able administrator.

Precious Childhood

Born in Bhogpur village to farmer parents, Smt Bhuro Devi and Shri Sardar Singh, Gajendra Singh was an enthusiastic child. Bhogpur was a self-sufficient small village of about 40 farming families, approximately 6 km from Khurja (Post office and Tehsil) in Bulandshahr District in western Uttar Pradesh. Gajendra Singh had a very fulfilling and happy childhood.

Playing hide and seek, kabaddi, gilli danda, kanche, climbing trees to steal mango and guava from orchards, falling from Jamun tree, jumping from the bridge and bathing in canal, grazing animals, riding on buffalo back, chasing away wild animals, mainly cows and bulls from the village were his favourite past times. Gajendra Singh attended Primary School in the adjoining Sikri village and completed High School and Intermediate from Khurja.

"My Tauji took me to a Primary School in Sikri village as there wasn't any school in my village. I looked too young and the Headmaster informed that the school did not admit children below 6 years of age. To that my Tauji replied that Gajendra has turned 6 years today. Thus 3rd August 1944 became my offi-



cial birthday,” remembers Dr Singh.

In Class 4, he moved to Government Model School in Khurja town. He completed high school from SMJEC Inter College in 1960 and intermediate from NREC College Khurja in 1962.” I was the first student from my village to take science stream in High School. Only one student had passed high school from my village before me”.

Choosing Agriculture

Gajendra Singh wanted to be an engineer. He joined G B Pant University of Agriculture and Technology, Pantnagar (formerly U.P. Agricultural University). “The scheme ‘Earn while you learn’ lured me into the college. I had secured admission in University of Roorkee. But I could not join as my family was poor and couldn’t afford my education there. But I made the best of my situation. I put my heart and soul into my studies, enjoying every bit of it. In ploughing competition at Pantnagar for bullock drawn plough I secured the first position. With practice of chasing away wild animals in my village, I became a long distance runner and stood first in the 3-mile race at Pantnagar University”.

Mr Singh received his Master’s degree from the Rutgers - The State University of New Jersey, USA in 1968 and Ph.D. from the University of California, Davis in 1973.

Illustrious Career

Dr Gajendra Singh returned to India and joined his alma mater, G B Pant University of Agriculture & Technology, Pantnagar where he worked as Associate Professor of Agricultural Engineering

tête-à-tête with *Anjana*



Prof Singh served the Indian Council of Agricultural Research (ICAR), New Delhi as Deputy Director General (Engineering) from December 1994 to December 1997

from 1973 to 1975. In 1975, he joined the Asian Institute of Technology (AIT) as Assistant Professor and in 1978, he was promoted to Associate Professor and in 1984 to full Professor. Later on, he served as Chairman of the Agricultural & Food Engineering Division of AIT. He served on the faculty of the Rutgers University, New Jersey, from November 1984 to July 1986 and was awarded tenure.

During September 1986 to September



Dr Gajendra Singh was also consultant for many reputed organizations such as Asian Development Bank (ADB); the United Nations Development Programme (UNDP); Food and Agriculture Organization (FAO) of the UN; United Nations Industrial Development Organization (UNIDO); European Union (EU); United Nations Economic and Social Commission for Asia and Pacific (UNESCAP); International Crops Research Institute for Semi Arid Tropics (ICRISAT); and International Rice Research Institute (IRRI). Presently he is associated as consultant with Food and Agriculture Organization (FAO) and UNIDO of the United Nations: Agricultural Mechanization in developing countries, mainly in Asia and Africa; Center for Sustainable Agricultural Mechanization (CSAM) of UNESCAP; RMSI on Climate Change on World Bank funded projects.



Prof Singh served as the first Vice Chancellor of Doon University, Dehradun during 2005-08, and built the university with an able team

the management of six ICAR research institutes and for policy and planning of research and education in agricultural engineering, fibre technology and agricultural statistics at national level. He was also the in-charge of developing the Agricultural Research Information System (ARIS) Network linking state agricultural universities and ICAR research institutes.

He was also Coordinator, AASE Program; Adjunct Professor of Agricultural Engineering, Indian Agricultural Research Institute (IARI); Chair of the Science Committee of "Appropriate Scale Mechanization Consortium for Sustainable Intensification in Asian and African countries" funded by USAID.

Prof. Singh served as the first Vice Chancellor of Doon University, Dehradun during 2005-08. He was responsible for the design and development of physical infrastructure from scratch, development of academic structure including draft statutes, rules and regulations and recruitment of faculty and staff. For curriculum development he organized brain storming session for each school with leading experts from all over the country.

Research Interests

Prof. Singh's areas of research are Agricultural engineering, mechanization, sustainable development and climate change. He has worked on a number of sponsored research projects funded by USAID, IDRC of Canada, the Netherlands Government, Royal Thai Government, ICIMOD, GRID-UNEP and CDG-SEAPO.



ber 1988, Prof. Singh served as the Vice President for Academic Affairs of AIT. He was responsible for overall academic planning and administration including appointments and promotion of faculty and senior staff, allocation of financial resources and human resources development. He did the ground work for the establishment of the School of Management, and programs in Telecommunications and Biotechnology. He served as Professor up to 2004 and as Dean, AIT Extension during 2001-2004.

Prof. Singh served the Indian Council of Agricultural Research (ICAR), New Delhi as Deputy Director General (Engineering) from December 1994 to December 1997. He was responsible for

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HONOURS AND RECOGNITION

- John Gilmore Award, University of California, Davis, 1970
- American Society of Agricultural Engineers Kishida International Award, 1990
- Emil Mrak International Award, University of California at Davis, 1991
- Gold Medal, Indian Society of Agricultural Engineers, 1994
- American Society of Agricultural & Biological Engineers Massey Ferguson Educational Gold Medal, 2006
- Eminent Engineer Award, The Institution of Engineers (India), 2009
- Life Time Achievement Award, G B Pant University of Agriculture & Technology, Pantnagar, 2018

Prof. Singh has more than 200 publications to his credit including papers in journals and presented more than 200 papers at national and international meetings and conferences. He has supervised 17 doctoral candidates and 79 masters' students from all over Asia.

Prof. Singh is also Fellow of National Academy of Agricultural Sciences

(NAAS-India), International Commission of Agricultural Engineering (CIGR), American Society of Agricultural and Biological Engineers (ASABE), Indian Society of Agricultural Engineers (ISAE), Institution of Engineers (India), and Soil Conservation Society of India.

For his contribution to the Agricultural Engineering profession, ISAE es-

tablished Prof Gajendra Singh Education Gold Medal in 2020.

Dr Gajendra Singh has been deeply inspired by his teachers. "Professor Mark E Singley, my MS advisor at the Rutgers University and Professor William J Chancellor, my PhD advisor at the University of California always treated me as a partner or colleague and not as a student during my research years." His deep passion for the subject and his interest in passing on the power of knowledge to his students was probably fired by the excellent support that he received from his teachers. He treasures his achievement as a teacher more than any accolades. "I am known as teacher 'Professor'. I have been honoured by the highest award, the 'Massey Ferguson Gold Medal for Education' by the American society of Agricultural & Biological Engineers (ASABE)."

WORLD FOOD DAY 2022

LEAVE NO ONE BEHIND

Food and Agriculture Organization (FAO) was founded by the United Nations on 16th October 1945. This day is commemorated as World Food Day.

FAO leads global efforts to conquer hunger and promote nutrition & food security. Its motto is "Let there be bread" ("fiat panis" in Latin).

Targets

- i) Eliminate hunger, food insecurity and malnutrition
- ii) Make agriculture more productive and sustainable,
- iii) Reduce rural poverty
- iv) Ensure inclusive and efficient agriculture, and food systems
- v) Protect livelihoods from disaster

The SGG 2030 Agenda is in synch with these mandates, when it comes to Agriculture. SDG 1 aims at removal of poverty.

S D G

2 targets to achieve

zero hunger. SDG

3 calls upon realization of total health and



well being.

Health is predicated upon nutritive consumption. Balanced & nutritive diet build immunity and offer needed resistance against external health challenges.

The theme for 2022 celebrations is: "Leave NO ONE Behind". This theme is in recognition of the unfortunate status of global nutrition & health standards. Malnourishment and under-nutrition continue to grip a large percentage of the global population.

Undernutrition refers to insufficient intake of energy and nutrition necessary for

A paradigm shift from production-centric agriculture to Integrated food systems is critical. Food system is a complex of production, processing, storage, transportation, distribution and retail which ensures efficient connect between farm-gates and consumption centres. The world, and more so Asian and African countries, are yet to give due importance to post harvest management



About the AUTHOR

Dr Ashok Dalwai is CEO, National Rainfed Area Authority (NRAA), Ministry of Agriculture and Farmers' Welfare



growth and health. Malnourishment is more expansive. It means all nature of deviations from adequate and optimal nutritional status, inclusive of energy, under-nutrition and over-nutrition.

Evaluating the global nutrition status on the anvil of these definitions, the challenges of 21st century are elephantine in magnitude & complexity.

Report Of Global Panel on Agriculture and Food Systems

As per the Report of the Global Panel on Agriculture and Food Systems for Nutrition, 2015:

i) The world has made substantial progress in reducing hunger and under-nutrition. Relatively, there is lesser suffering, lower mortality rates and improved life chances.

ii) Notwithstanding these gains however, malnutrition in all its forms currently affects one in three people worldwide, far beyond the 800 million (approx.) who experience hunger on a daily basis.

This implies the high intensity of hidden hunger compared to hunger per se.

There is stunted and wasted growth on account of which 45 percent of 16, 000 daily deaths of children below 5 years of age are attributed to under-nutrition and suboptimal breastfeeding at the global level.

Prevalence rates of overweight, obesity and diet-related chronic diseases such as

diabetes and hypertension are gaining currency and, most rapidly in low- and middle-income countries.

More than 2 billion people lack vital micro-nutrients, which affects their health and life expectancy.

Re-Orienting Global Production System

The world in its eagerness to conquer visible hunger has been producing more of calories-centric cereals at the neglect of proteins, fats, vitamins & minerals. A new matrix of diversified production that includes millets within the cereals, pulses, fruits, vegetables, dairy, livestock, and fish is the urgent calling.

A paradigm shift from production-centric agriculture to Integrated Food Systems is critical. Food system is a complex of production, processing, storage, transportation, distribution and retail which ensures efficient connect between farm-gates and consumption centres. The world, and more so Asian and African countries, are yet to give due importance to post harvest management.

Food Loss And Waste

Food loss and waste is a threat, as it is resulting in decomposition of produced food up to an extent of 30 percent and, generating green house gases in consequence. Every grain saved is a grain produced and, we

need to remember this. This will minimize the charge on resource use and ecology at large.

Given the challenges emanating from climate change and growing population, new technology that is sustainably intensive (SI) brooks no delay. Science has no limitations to expansion of its frontiers. It needs to be deployed on the understanding of contemporary and future challenges and associated demands. Science cannot be unhinged from sociological and philosophical framework. As Einstein said, "Science without philosophy is blind and, philosophy without science is lame".

We Need New Science Today In Agriculture

Today's Science will become tomorrow's technology. Tomorrow's Technology will become day-after-tomorrow's innovation. On this day, we need to bring the arclights on the following:

- i) Nutrition-led production
- ii) Sustainable intensification of production
- iii) Global food systems based on

harmony between public policy (that ensures availability, accessibility, affordability and awareness) and private-corporate sector (that is socially sensitive and not driven merely by profit-interests).

Finally, the theme "Leave NO ONE Behind" entails that we adopt the principles based on three pillars of Economy, Equity and Ecology.

MAXIMIZING MILLETS



NITI Aayog's and United Nations World Food Programme's Mapping & Exchange of Good Practices (MEGP) Initiative Mainstreams Millets in Asian and African Countries

The problem of poor nutrition and food insecurity persists, despite growth in global food production, supply and distribution. Climate change further poses a risk to nutrition and food security, as agriculture has always been climate dependent. The sector has become even more vulnerable in current times where varied weather patterns

are observed. As the global temperature continues to rise and distort weather patterns, extreme events are predicted to be more frequent in the future. These events are hampering food and nutrition security of millions of vulnerable populations, especially smallholder farmers. It is in this context, millets, often termed as 'nutri-cereals', contribute substantially to food and nutrition security. They are poised to be the crops of the future, being a climate-smart crop.

Despite the vast potential of millets to expand dietary diversity, its cultivation

and consumption are witnessing a sharp decline in our country, owing to demand and supply-side constraints. The per capita consumption of millets fell drastically from 32.9 kgs to 4.2 kgs from 1962- to 2010 (Source: Assessing Millets and Sorghum Consumption Behavior in Urban India: A Large-Scale Survey, 2021).

Factors That Impact Demand

Some of the responsible demand-side factors include (Source: Millets Value Chain for Nutritional Security: A Replicable Success Model from India (2016)):

1. Increasing urbanization and per capita incomes are changing consumer tastes and preferences
2. Poor social status and inconvenience/

About the AUTHORS

◀ **Dr Neelam Patel is Senior Adviser, Agriculture & Allied Sectors Vertical, NITI Aayog.**

Dr Saloni Bhutani is with the Agriculture & Allied Sectors Vertical, NITI Aayog ▶



- lack of traditional knowledge to prepare millets (especially sorghum)
3. Lower shelf life of milled grains
 4. Rice and wheat are included at a larger scale in PDS
 5. Millets haven't been uniformly included in PDS

Factors That Impact Supply

1. Lack of industrial demand for value-added millet products discourages farmers from cultivating millets
2. Low profitability— low remuneration for millets vis-à-vis competing crops
3. Green Revolution has favored the production of rice and wheat, including output price incentives and input subsidies
4. Lack of access to quality seeds
5. Inadequate infrastructure such as processing technologies, unique milling equipment, etc. to address total value chain

NITI Aayog, Government of India in collaboration with United Nations World Food Programme (WFP), India has launched the MEGP Initiative, which aims to map and exchange the best practices for millets mainstreaming in Asia and Africa. The initiative supports documentation of good practices and lessons learnt. It presents an opportunity of experience sharing amongst Asian and African developing countries. A compendium of good practices is targeted to make it easier for the government, both in India as well as abroad, to better understand what it entails, and trigger informed decisions if they wish to scale up/replicate this idea. It will unlock various South-South Cooperation (SSC) & South-South & Triangular Cooperation (SSTC) pathways and shall offer a policy choice of mutual collaboration through study visits, expert deployment, demonstration sites, peer coaching networks, technology and/or knowledge transfer, and policy dialogues.

Categories

Millet stakeholders in Asia and Africa can submit their good practices in millets mainstreaming in three categories:



1. Millet value chain (production, storage & transportation, processing, packaging & branding, distribution & consumption)
2. Mainstreaming dimensions (institutional commitment & coordination, multi-stakeholder partnership, sustainable and innovative financing, gender & inclusion, and enabling environment for safety nets inclusion)
3. Millet recipes to enhance the knowledge on the cooking method and develop diversified millet recipes that could be included in the daily diet in both urban and rural areas.

php by 18th Oct, 2022, and avail benefits such as:

- Access to bridge initiatives like back-supporting millet startups
- Access to regional platforms for learning dissemination
- Access to networking platforms, including donors, innovation labs, research institutes, government departments etc.
- Linkages with government departments for potential scale-up
- Publication support

The MEGP Initiative will bring together a publication of good practices, which will provide a learning and dissemination platform for all eligible entries. Some of the selected entries will also be shortlisted for further support, including invitation to the regional conference in November, 2022. Mentorship support will be provided by a range of experts to the winners and they will be further linked to key stakeholders including donors, research institutes, private sector and Government Departments for potential scale-up. Entries will be judged on parameters such as: (i) Innovation (novelty of the solution), (ii) Practicality (ability to address significant current or emerging need), (iii) Gender & Inclusion (ability to reach the last mile, the most marginalized and the excluded, particularly women) (iv) Impact Generated (potential to improve outcomes at scale) (v) Sustainability (potential for scale-up and alignment with the public/private systems).

For any queries or support with the application submission, write to/ call at pranay.sinha@wfp.org (+91-8789529566) or saloni.bhut@niti.gov.in (+91-8297243051)

Aim/Eligibility/Benefits

The initiative aims to capture forgotten practices (particularly the traditional and indigenous community practices) associated with millets and motivate practitioners, organizations and individuals to work for the revival of such practices. Organizations and practitioners from government or non-government organizations, multilaterals or FPOs/SHGs/PACS/Cooperatives and private sector/startups from Asia and Africa can submit their case stories on the web-portal <https://agri.niti.gov.in/MEGP2022/index>.



Dr Neelam is fond of gardening

SMART FARMING

CHANGING DYNAMICS OF AGRICULTURAL MECHANIZATION

Our country has the appropriate climatic conditions and the rich fertile land, which provides huge potential to become one of the leading producers of various agriculture products. With the adoption of advance agricultural technologies and tech-driven methods, we have huge potential to improve productivity. With the advent of smart farming, which uses modern information and communication technologies to increase the quantity and quality of products while optimizing the human labor required, we have a huge potential to look at agriculture in a new light. We

To adopt such smart farming technologies with modern agri mechanization for labor intensive activities can revolutionize agriculture, improving lives and livelihood of the farming community. This will also require the government subsidies to be focused on promoting such revolutionary smart farming technologies

have a strong market for tractors, which basically are the prime movers for most land preparation implements. The issue here is that although we have mechanized most of the land preparation activity, but there is a lot more to be done on agriculture mechanization. There are abundant opportunities for mechanizing other farm activities to boost productivity namely – transplanting, precision planting, crop protection and harvesting.

Impact On All Facets Of Farming

The level and appropriate selection of agricultural machinery and smart farming technologies will have a direct impact on timeliness of farm operations and productivity, which will enhance farming income and quality of rural life.

Unless we take a holistic view of mechanizing the complete farm operations, the target to be the largest producer of grains maybe difficult to achieve. India has the largest land area under rice cultivation in the world, but we are number two as far the rice production is concerned. The need is to increase farm yields by looking at mechanization of complete crop cycle and not just land preparation.

Smart Farming

We still have activities like rice transplanting, spraying, crop harvesting which is still dependent on manual labor. The uniformity of farming activity cannot be assured with the use of farm labor, which leads to uneven cropping and plant growth. Even crop protection done using hand held sprayers or tractor mounted sprayers have their own limitations. The manual spraying activity has limited and uneven coverage which adversely affects





yield. On one side the tractor mounted sprayers have limitation in entering the field. There has been new technologies available across the world like high clearance sprayers and drones, which can handle the spraying activity in a much more effective and efficient manner. This added with smart farming technologies like IoT which connects machines through sensors integrated on farms to make farming processes data-driven and automated. This can optimize farming as IoT devices installed on a farm can collect and process data that enables farmers to react quickly to emerging issues and changes in ambient conditions. IoT-based smart farming doesn't only target large-scale farming operations; it can add value to emerging trends in agriculture like organic farming. The adoption of such world class technologies requires government and industry intervention.

Potential To Revolutionize Agriculture

The cost of manual labour is going up with rural employment guarantee schemes and increasing urbanization, which will

not only impact the cost of farming, but also the timely availability of labor during the critical season requirement. Here again Smart farming will help to manage farms using modern Information and communication technologies to increase the quantity and quality of products while optimizing the human labor required.

Hence there is a need to adopt such smart farming technologies with modern agri mechanization for labor intensive activities can revolutionize agriculture to the next level improving lives and livelihood of the farming community. This will also require the government subsidies to be focused on promoting such revolutionary smart farming technologies.

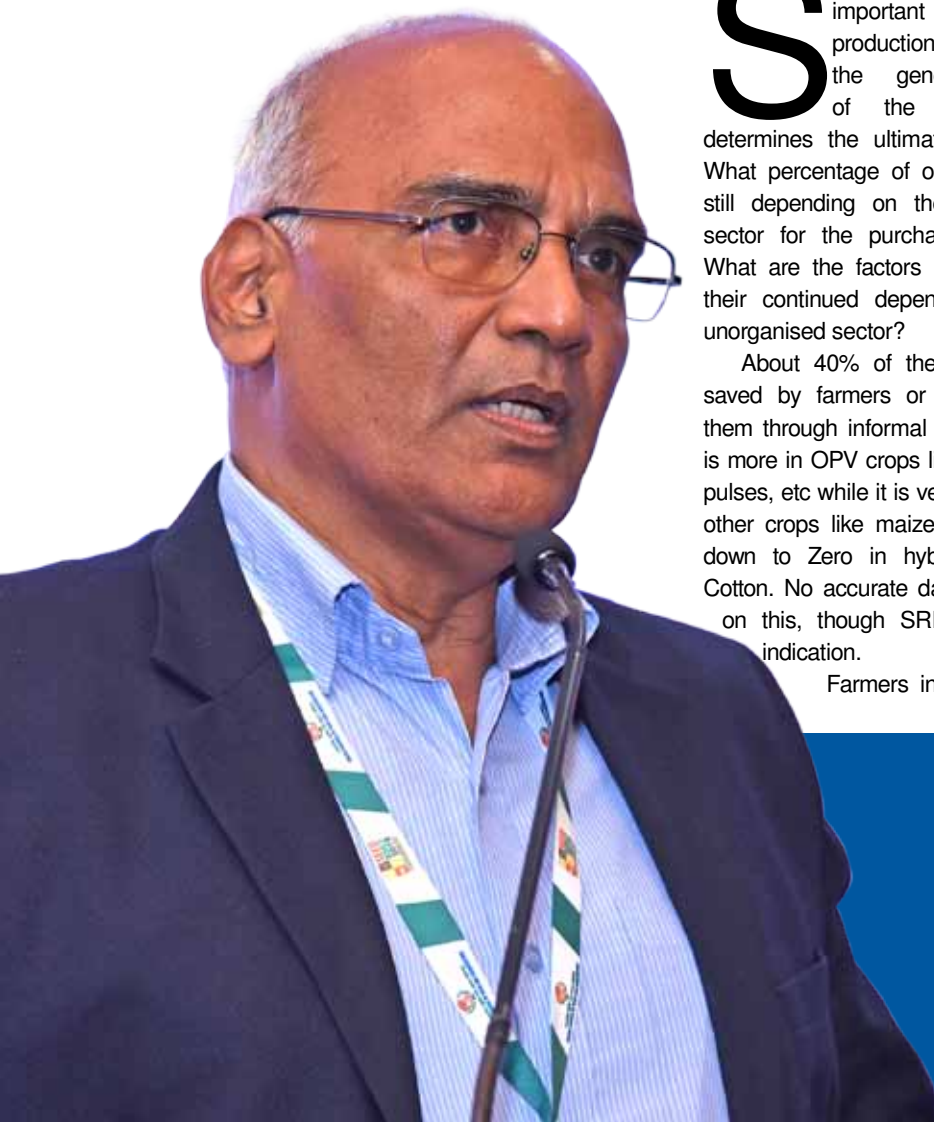
About the AUTHOR

Mr GS Grewal is Executive Director, KUBOTA. He excels in Sales & Marketing, Channel Development, Customer support & Logistics





THE FOUNT OF LIFE



Seed is the single most important input in crop production. It carries the genetic potential of the variety and determines the ultimate productivity. What percentage of our farmers are still depending on the unorganised sector for the purchase of seeds? What are the factors responsible for their continued dependence on the unorganised sector?

About 40% of the seed is now saved by farmers or purchased by them through informal channels. This is more in OPV crops like wheat, rice, pulses, etc while it is very low in some other crops like maize, even coming down to Zero in hybrid crops like Cotton. No accurate data is available on this, though SRR gives some indication.

Farmers in remote areas

Given the multiple challenges in agriculture, diversity of germplasm can offer solutions that can be enabled by technology. Extensive collaborative effort between private and public sector is required. Industry needs to work with state governments focusing on state and region-specific crops

About the **AUTHOR**

Mr Ram Kaundinya
Director General





6th AGM of Federation of Seed Industry of India (FSII) at New Delhi.

All states have a seed strategy, but most do not implement it aggressively or tweak it to suit different crops and ever emerging new challenges

are more dependent on the unorganised sector for seed procurement. The seed distribution network of NSC and other government agencies is sparse and inadequate. Although private seed industry network is quite extensive there are remote sectors where branded seed is not available due to logistics. Prices or lack of awareness impacts the demand and the expectations from each other.

There is some misinformation regarding branded seeds requiring more inputs of fertilizer and crop protection chemicals for better yields as compared to un-branded seeds, or seeds at Jetty from buying them.

Lack of awareness about the quality offered by the branded seeds and pricing are also factors that lead to thriving unbranded seeds.

The promise of unregulated illegal traits is another reason that farmers risk opting for unbranded seeds with no assurance of genetics or quality.

A clear seed strategy is needed in order to plan programmes and projects in the seed sector and to attract investment. Do most Indian states have a sound seed strategy to make this possible?

All states have a seed strategy, but most do not implement it aggressively or tweak it to suit different crops and ever emerging new challenges. The strategies are usually short-term, farmer centric and do not take a long-term view on sustainability and environment. A few States can be mentioned for having a sound strategy are Punjab and Telangana. The seed strategy needs to be taken balanced view of farmer, environment, national & international market status and consumer demand.

Access To Quality Seeds

Increasing agricultural productivity remains India's challenge. Hybrid seeds and GM seeds address this, yet India is still reluctant to embrace new seed technology. What will be the policy direction of India's seed sector?

Given the multiple challenges in agriculture, diversity of germplasm can offer solutions that can be enabled by technology. Reluctance of farmers to embrace technology is due to lack of awareness and negative propaganda against technology. This can be countered by persistent information campaign and giving farmers' field demonstrations. Though this is done at some level but more extensive collaborative effort between private and public sector is required. Industry needs to work with State governments focussing on State and region-specific crops.

In the event of wide promotion of natural farming, how will you ensure seed access to the farmers during the peak season?

Natural farming is a long way from wide adoption as it is still being researched. It will be best suited for niche crops adapted to specific environments. The process will not be able to support food production for a growing country like ours. As a matter of fact, given the changing climate, climate resilient varieties developed using the latest technology might be best suited for natural farming method of cultivation.



AI AND AUTOMATION IN AGRICULTURE

Indian agriculture is witnessing many challenges.

1. Continuous land degradation because of intensive cultivation and overuse of agro-chemicals, fertilisers, pesticides and herbicides.
2. The already serious stress on India's water resources is worsening with each passing year.
3. Climate change is resulting into unpredictable weather events that is affecting cropping pattern and increasing risks of crop damage.
4. In most of the crops, increase in productivity has been accompanied by an increase in average cost of production effecting earnings of the farmers.

There is a need of 'efficient growth', so that any increase in productivity is associated with a reduction in the average cost of production. Automation and Artificial Intelligence (AI) technologies promise solutions to these challenges. AI-powered solutions will not only enable farmers to improve efficiencies, but they will also improve quantity, quality and ensure faster go-to-market for crops.

Key AI Solutions that can be used for Indian Agriculture:

Crop and Soil Monitoring

Micro and macronutrients in the soil are critical factors for crop health and both the quantity and quality of yield. It's vital to understand interactions between crop growth and the environment in order to make adjustments for improved crop health.

Traditionally soil quality and crop health were determined by human observation and judgment or with the help of soil testing labs.

These methods are less accurate and are not on real time basis.

Instead, we can now use drones (UAVs) to capture aerial image data and process it for intelligent monitoring of crop and soil conditions.

Visual sensing AI can analyze and interpret this data to:

- Characterize soil texture and soil organic matter
- Track crop health
- Make accurate yield predictions
- Detect crop malnutrition

AI models can inform farmers of specific problem areas so that they can take immediate action.

Observing Crop Maturity

Manual observation of crop growth stages is labour-intensive and inaccurate. Visual data points can be processed using AI to accurately identify crop growth stages and guide farmers on best time to harvest crops, fruits and vegetables bringing in ease of farming and better productivity.

Insect and Plant Disease Detection and control

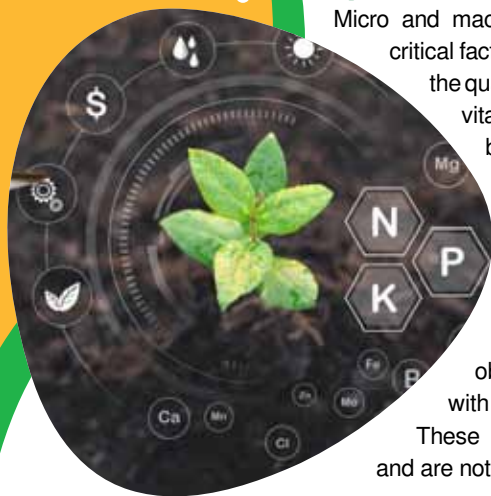
Using image recognition technology based on Deep Learning, we can now automate detection of plant diseases and pests. This works using Image Classification, Detection and Image Segmentation methods to build models that can monitor plant health.

■ UAVs (Drones) equipped with computer vision AI make it possible to automate spraying of pesticides or fertilizer uniformly across a field.

■ With real-time recognition of target spraying areas, UAV sprayers are able to operate with high precision both in terms of the area and amount to be sprayed.

■ Many technology companies have developed robots, which use computer vision and artificial intelligence to monitor and precisely spray on weeds. These intelligent AI sprayers can drastically reduce the number of chemicals used in the fields

■ Computer vision algorithms when



combined with Machine Learning to build robots can perform automatic weeding, thus saving on labour and reducing the need for herbicides.

Livestock Health Monitoring

Animals are another major component of our agriculture systems, and they tend to need a bit more tracking than plants. The cattle can be tracked and monitored remotely and in real-time so that farmers can be notified as soon as a problem is observed. This can help in counting animals, detect diseases, identify change in behaviour, tracking health of animals and so on.

Produce Grading and Sorting

AI computer vision can continue to help farmers even once the crops have been harvested.

■ Just as they are able to spot defects, disease, and pests in plants, imaging algorithms can also be used to sort “good” produce from the defective or just plain ugly.

■ By inspecting fruit and vegetables for size, shape, colour, and volume, computer vision can automate the sorting and grading process with accuracy rates and speed much higher than even a trained professional.

Predicting the Best Time to Sow

The difference between a profitable year and a failed harvest is just the timely information on a simple data point of timing of sowing the seed. To combat this, analytics tool can be used to arrive at a precise date for sowing the seeds to obtain maximum yield.

Weather forecast can help the farmers plan their better and take necessary precautions to protect their crops.

Crop Yield Predictions and Price Forecasts

For farmers, a big worry is the price fluctuation of the crop. Due to unstable prices, farmers are never able to plan a definite production pattern. This problem is highly prevalent in perishable crops that have very limited shelf time.

About the AUTHOR

Mr Bimal Kumar is Director Special Projects, Agriculture, CNH Industrial. He has more than years of professional experience in Strategy, Business Planning, Sales, Marketing and Process Reengineering in Tractors and Farm Machinery Industry.

Satellite imagery and weather data can be used to assess the acreage and monitor crop health on a real-time basis. With the help of technologies like Big Data, AI and Machine Learning, companies can estimate the output and yield, and forecast prices. They can guide the farmers and governments on the future price patterns, demand level, type of crop to sow for maximum benefit.

While AI promises quick wins for Indian agriculture, farm automation may take some time. This is because of the high costs and availability of required infrastructure, resources and technology. Another challenge is that farmers even in developed countries take time to fully trust the automated machines and so adoption is slow. Another hurdle on the way to the advancement of AI on the farm is battery power and availability of electricity.

AI is not intended to replace farmers knowledge but to complement and challenge the way decisions are made and improve farming practices.

**fun
FACT**



Mr Bimal Kumar is fond of art and craft, reading non-fiction books and writing articles



Mechanisation of Agriculture is the only Future of Better life

Hydraulic Reversible
Plough Opal 080E

Power Harrow Perlite 5

Tyne / Roto Cultivator
Achat 70

Hydraulic Reversible
Plough Opal 090E

Mulcher / Shredder
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PRIORITIZING FARM POWER

CENTRAL FARM MACHINERY TRAINING AND TESTING INSTITUTE, BUDNI



Dr PK Pandey, Director, Budni



Dr AK Upadhyay, Training Head, Budni

Indian agriculture has come a long way from hand held ploughs. Today farmers are comfortable with farm machines and equipment. These machines have come to play a pivotal role in crop production, and its handling, transportation, processing and preservation. The country has systematically introduced agricultural mechanization into the Indian fields through many schemes with the help of supporting institutes.

The relevance of the agricultural machines dawned on the country many decades ago and that is when the government decided to import farm equipment in the First Five Year Plan period. Simultaneously, for promoting the use of machines, the Government established the "Agricultural Machinery Utilization Training Centre" in 1955 at Budni, Madhya Pradesh).

Agricultural Mechanization through Budni

The objective of establishing the Budni Centre was to train the prospective farmers on proper use, maintenance and

up-keep of farm machines. Subsequently, considering the imperativeness of the indigenous manufacture of farm machines/equipment, in 1959, a testing wing was added to the Centre; primarily with a view to ascertain the suitability of agricultural machines/equipment to the agro-climatic conditions of the country. The Centre was renamed 'Tractor Training and Testing Station'. In the year 1983, the Tractor Training and Testing Station was

upgraded and renamed 'Central Farm Machinery Training and Testing Institute'. Viewing the importance of the testing of farm machines and training on various aspects of farm machinery, and to cope-up with the increased demand of trained manpower in the field of agricultural mechanization, three more Institutes were set up at Hissar (Haryana), Anantapur (Andhra Pradesh) and Biswanath Chariali (Assam) in the year 1963, 1983 and 1990 respectively.

Over a period of 5 decades, with the growth of indigenous production of tractors and farm equipment, the Institute has developed the necessary expertise and infrastructure and has attained International Standards in the field of farm machinery training and testing and is well recognized amongst leading testing organizations in the world. The

**CFMT&TI
has trained 3002
trainees during 2020-
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upto 72058**

Institute has accreditation of Organization for Economic Co-operation & Development (OECD), Paris which has helped in export promotion of Indian Tractors.

Testing Activities

The institute undertakes testing of farm machines and thereby create awareness on judicious use of available farm inputs such as seed, water, fertilizer, pesticides, agricultural machinery and power. The institute is also involved in the transfer of scientifically proven technology from lab to land through demonstrations of newly developed-high-tech machinery in the farmers' fields. This has helped in improving the socio-economic condition of the rural youth by generating employment opportunities. They also have improved the socio-economic status of the women farmers by creating awareness about gender friendly tools.

CFMT&TI has trained 3002 trainees during 2020-21. Of these 38.54 % were women trainees. Total number of trainees trained since inception has reached upto 72058. The institute undertook Skill Development Training Programmes for migrant labourers under Atma Nirbhar Bharat Abhiyan during COVID-19 pandemic and imparted training to 856 migrant labourers during the year. This aims to mitigate the problems of labourers migrated due to Covid - 19 pandemic. Encouraged with the success of the programme, the ministry has decided to include this programme in its operational guidelines of Sub-Mission on Agricultural Mechanization (SMAM).

Infrastructure

Apart from the machinery and equipment available in the training wing, the institute is well reinforced with demonstration and training lab. There are three hostels, including one for women trainees, in the institute. The hostel can accommodate about 300 trainees where accommodation is free.

There is a well maintained Library in



the campus for the benefit of trainees and staff members. Library has a good collection of over 22,000 books, test reports, machine manuals and other documents on Agricultural machinery and allied subjects. There is open source integrated library management software, 'Koha version 20.05.05' installed as a component of library automation. One can access to the library's collection through online Public Access Catalogue (OPAC). Library is also engaged with some other tasks such as providing/dissemination of information, as well as digitization of Test Reports, manuals and other documents etc. Apart from this there is a dispensary and gymnasium.

Testing Activities

CFMT&TI conducts testing on agricultural tractors with a view to assess their Functional Suitability and Performance characteristics. The published test results thereafter would help the farmers and other prospective purchasers in determining the Comparative Performance of tractors available in the market so that they may select a suitable tractor from the market. Their tests act as a guide for financial institutions in recommending financial assistance to the farmers. CFMT&TI's testing activities also

promote export of agricultural tractors, through testing in accordance with International Standards/ OECD standards.

They conduct testing of tractors/ combine harvesters/ power tillers for issuance of road worthiness certificate under the provisions of Central Motor Vehicle Rules (CMVR). The institute also assist Bureau of Indian Standards in the formulation of various codes / standards on agricultural implements and machines. They also test to ensure quality through 'Batch Testing' programmes and also assist the manufacturers in the product improvement.

Farmers, researchers, manufacturers among others, have been beneficiaries of the institute. This is the only institute authorized by GOI for undertaking testing activities on agricultural tractors. Whenever a new tractor enters the market, it is first tested at Budni in Madhya Pradesh. It can be launched in the market only after receiving the OK report from here. Tractor companies have to register their tractors with this institute in Budni to get them tested. Earlier this process used to take nine months, which has now been reduced to just two and a half months. These instructions came into effect from August 15, 2022.

MECHANIZATION & AUTOMATION

KEY TO ATTRACT YOUTH TO AGRICULTURE

Digital Agriculture leverages the smart use of data. It involves the processes of data creation and analysis, decision making, and implementation through management interventions. These processes are becoming increasingly computational, data-intensive, real-time, and precise.

The main Digital Agriculture tools that exist today include cross cutting technologies such as sensors and controllers and computational decision tools. Field-based activities are also enabled by technologies such as geo-locationing, communication (cellular, broadband, and others), geographical information systems (GIS), yield monitors, precision soil sampling, proximal and remote sensing, unmanned aerial vehicles, variable rate technologies

and auto-steer, guidance, and robotics.

Livestock-Specific Technologies

Livestock-specific technologies include radio frequency identification, automatic milking systems and electronic feeding systems, among many others. There is an immediate need for the agricultural sector to adopt cutting edge digital and precision agriculture technologies to improve input use efficiency and enhance farmers' profitability by increasing productivity, reducing cost of cultivation and adding value to farm produce.

Drone Age

Drones can revolutionize the farming industry through need-based precise and variable input application leading to input saving, timeliness, reduction in cultivation cost

and ensuring farmers' safety from direct exposure to chemicals. Drones can be used for targeted input application, timely diagnosis of nutrient deficiency, crop health monitoring, rapid assessment of crop yield and crop losses.

Drones can fly at low height (1m-3 m) over the crop canopy. This makes them suitable for spraying of crop protection chemicals as well as nutrients. This is more adoptable compared to aerial spray. Unlike ground spraying, spraying through drones can be carried out when field conditions prevent movement of wheeled vehicles. It enables the timeliness of spray treatments without inflicting soil compaction.

Drone based application in agricultural production system also saves input cost and environment. Due to these associated advantages, the use of drones in agriculture has increased sharply in



recent years worldwide for soil and field analysis, mapping and animal detection, and irrigation, crop spraying and planting.

Drone technology has the potential to not only reduce the quantity of the inputs like pesticide, crop nutrients but also save environment and farmers from harmful exposure. It can effectively be used for timely spraying of crop inputs with minimum labour requirements. Drone is also helpful for spraying of crop nutrients and pesticides in hilly regions wherein it is difficult for other farm equipment to reach.

Many startups, industries, SAUs and research institutions have started working on drone to harvest its potential in agriculture including soil and crop nutrient spraying. As the DGCA guidelines are available now, many companies have registered their products on Digital Sky Platform including agriculture drone.

Lack Of Standard Guidelines

Lack of standard guidelines for use of drone in agriculture has been a bottleneck in popularizing drone based technologies in India. As the drones are being increasingly used for several agricultural operations, it was essential to develop Standard Operating Procedures (SOPs) that can facilitate application of different types of crop soil and crop nutrients using drones; and harness their potential for successful adoption of soil and crop nutrient spraying.

The SOP for use of drone application

for crop protection in agricultural, forestry, non-cropped areas, etc. was released by Ministry of Agriculture and Farmers Welfare (MoA&FW, GoI) in December 2021. This SOP will render guidance to the stakeholders involved in undertaking safe and effective control of pest and diseases by drone-based application.

Not only drone, use of AI in agriculture is also emerging especially in three major categories -agricultural robotics, soil and crop monitoring, and predictive analytics. In many developed countries, farmers are using AI technologies for sowing seeds using drones, soil mapping, and commodity pricing. AI helps bring down the operational costs in farms, by reducing dependence on manual labor and allows agronomic expertise to make data-driven decisions.

In India, work on use of AI and robotics for agriculture is at early stage and needs extensive field evaluation for reaping the real benefits of advance technology. Blockchain technology will be a major focus in the coming days. It is possible to have real-time monitoring of supply chain leveraging blockchain, and there will be more transparency in agricultural transactions. It is vital for both farmers as well as consumers, it allows farmers to negotiate better prices throughout the supply chain while enabling consumers to have confidence in the knowledge of precisely from where the produce they buy comes.

It is an essential aspect when

considering the growing lack of trust in the sourcing of produce sold in markets. As our population continues to grow, our agricultural methods must grow with it. It is time to take advantage of the technology we have at our disposal to put food on our table and create sigh of relief for our farmers.

Monumental Progress

In fact, mechanization and automation has been top 20 inventions of 20th century. India has made a monumental progress in this respect. With the great efforts of research institutions, vibrant industry and very conducive government policies , agriculture as a whole and mechanization in particular has grown exponentially in the country. We are holding first or second positions in the world in production of most of the agriculture and allied commodities. We are number one in tractor production in the world.

The challenge before agriculture is to attract educated youth in agriculture. Mechanization has brought social engineering changes in agricultural entrepreneurship and given great social status by removal of drudgery, saving lots of time, bring in precision and efficiency and enhancing income of the farmers. Digital tools of mechanization and automation of operations will attract young talented youths, CEOs of startups, professional engaged in NGOs and FPOs towards agriculture which will finally lead to dream agriculture of India 2047.



About the AUTHORS

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MAKING AGRICULTURE NEXT DECADE READY

INNOVATIONS DRIVEN BY MECHANISATION, AUTOMATION, DIGITISATION & AI

Automation, digitisation & artificial intelligence has been impacting every aspect of our modern life. AI systems are helping to improve the overall harvest quality and accuracy – known as precision agriculture. The technologies which are AI-based help to face the challenges like the increasing crop yield, making optimum use of irrigation, soil content sensing, crop-monitoring etc through data based information and predictions for the farmers.

Initiatives by Shrachi Agrimech

Shrachi Agrimech, with more than 30 years of experience, provides a wide range of crop-based agro-machinery equipment like power tiller, weeder, reaper, and mechanised garden tools which include brush cutters and chainsaws. Shrachi Agrimech is recognised as one of the leading power weeder company in India. For more than three decades Shrachi Agrimech has been catering to the requirements of small and marginal farmers in India, thereby contributing towards increased farm productivity and rapid mechanisation in the agrarian sector.

Shrachi FarMeter – Award Winning GPS-Based Weeder Tracking Kit

Shrachi FarMeter is our first step towards our mission towards making modern information technology more usable to our farmers, leading to better

productivity and increased farmer income.

We at Shrachi are always focused on bringing to the farmers, technologies that will help them to increase productivity, leading to sustainable farmer income. With this vision, we have recently launched Shrachi FarMeter, an award-winning, GPS-based tracking device for the Power Weeder industry. This is a first-of-its-kind device for the Power Weeder industry across the country. This is a simple device which is easy to install and use. All data captured can be easily tracked on a mobile phone using a simple Android app. We have seen such developments for tractors, but bringing the advantage of GPS tracking to small farmers was our motivation behind this project.

Farmers and rental entrepreneurs face a lot of difficulties due to a lack of transparency, no accurate area measurement and no proper record keeping & accounting. Shrachi FarMeter will help farmers optimise their operations by giving them the features like live tracking of their weeder, AI-based analysis of farming & non-farming activity, accurate area measurement, geo-fencing as well as accounting records for 6 months. This will not only help in custom hiring but will play a major role in the overall growth of the sector in the steps mentioned below:

- Shrachi FarMeter will help power weeder owners to give their weeder on rent and not worry about any loss. Transparency in operation with on-demand/ live data is giving

About the AUTHOR

Mr Sumit Jalan is COO, Shrachi Agrimech. Under his leadership Shrachi Agrimech has seen major achievements and many milestones. Mr Jalan is also the youngest Working Secretary of the 'Power Tiller Association of India' since 2019.



more confidence to farmers to rent their machines without worrying about loss.

- The activity of the operator can be easily monitored by the buyer and seller of the service.

- The owner is now more confident to increase his fleet of weeders to maximise his business.

- Similarly, farmers hiring the weeder are also getting proper pricing and paying for their exact use, leading to optimised agricultural income.

- This is leading to a new confidence in Custom Hiring which translates into more farm power per hectare, contributing substantially to the growth of farm mechanization in the country

Now taking into account the huge population of small and marginal farmers who are the principal beneficiaries, the sheer size of its impact is remarkable. Shrachi FarMeter has been awarded the AMMA Innovation Award 2022 by Agricultural Machinery Manufacturer's Association (AMMA – India), acknowledging its potential and impact.

Shrachi Agro Drones

Aptly recognised by our government, this is a focus sector now, seeing multiple new players, with innovative solutions for the agricultural sector.

We, at Shrachi, are expanding our business in the field of smart agriculture and are collaborating with different organizations to offer Shrachi agricultural

Shrachi FarMeter will help power weeder owners to give their weeder on rent and not worry about any loss. Transparency in operation with on-demand/live data is highly reassuring for farmers

drones that will specifically help small & marginal farmers to reap the maximum benefits of this technology.

Shrachi 8D6 Plus – Innovative Power Weeder

For Shrachi, understanding and learning the requirements of small & marginal farmers, across various geographies in India, has been a continuous process. Shrachi Agrimech has made significant growth in the Power Weeder segment through a wide range of weeders of various capacities and fuel types. It has been implementing this knowledge in developing weeders and applications that will benefit the targeted users. Shrachi Agrimech has in its way been innovative in its area of operation, especially in paddy farming.

8D6 Plus is one of its kind power

weeders which provide multiple innovative solutions. Apart from the high-power engine, this weeder is equipped with integrated Rotary Weeding Unit and Ditching Unit with dual-mode rotary movement in clockwise & anti-clockwise directions. Usage of just one Agricultural Machinery i.e.; Shrachi 8D6 Plus weeder with its wide range of attachments can be used for Crop Monitoring, Wetland & Dry Land Tilling and Levelling, Paddling, Transplanting, Weeding, Spraying, Reaping, Threshing to generating stable farmers income and satisfaction.

New innovations in agro-tech, data driven approach are making it even easier for agricultural service providers to curate their offerings to the specific requirements of small and marginal farmers and thus help in creating a balanced and a rapid development of farm mechanisation.



Mr. Jalan is a sports enthusiast with interest in Cricket, Badminton, Pool etc. As a cricketer, he has represented his college and office in various tournaments

SMART AGRICULTURAL MECHANIZATION IN INDIA



Indian agriculture is highly labour intensive whereas smart agriculture is all about machines and technologies. Smart agricultural mechanization includes application of sensors, controllers, Internet of Things (IoT), AI and robotics in agriculture. Research work in the areas of precision agriculture, digital farming, precision irrigation, AI powered machinery, user friendly mobile applications, etc. has gained momentum during the last decade. Research

Agriculture is expected to be dominated by precision and cloud based data and supported by advanced infrastructure like smart tractors, unmanned aerial vehicles, wireless technology and unmanned autonomous vehicles for multi-purpose field works

institutes of ICAR, SAUs, IITs, NITs and other private organizations have been involved in development of technologies based on precision agriculture (PA), digital agriculture (DA) and AI through different projects such as the National Agricultural Innovation Project (NAIP), Consortia Research Platform on Farm Mechanization and Precision Farming (CRP on FMPF), AICRP on Farm Implements and Machinery, NAHEP etc.

Precision Agricultural Technologies

These institutes are applying modern tools and techniques for application of sensors and robotics in planting, rice transplanting, weeding, spraying, drone-based spraying with the help of IoT and AI, etc. A few potential precision agricultural technologies such as ground speed sensor based fixed rate seed cum fertilizer drill, low cost SPAD meter, spectral reflectance (NDVI) based fertilizer applicator, uniform rate sprayer, real time soil moisture based sprinkler irrigation system, automatic irrigation system for rice, automatic yield monitor

About the AUTHOR

Dr CR Mehta is Director, ICAR Central Institute of Agricultural Engineering, Bhopal. Under his leadership, ICAR-CIAE Bhopal was awarded the Sardar Patel Outstanding ICAR Institution Award 2020. Dr Mehta can be contacted at director.ciae@icar.gov.in



for indigenous combine harvesters etc. have been developed and tested at ICAR-CIAE, Bhopal.

The institute has also developed sensor based control and monitoring system for grain storage and modular storage structures for onions and potatoes with encouraging results. The sensor based grain storage system measures environment parameters such as temperature, RH, and CO₂ in the bulk or bag storage system and generates an automatic alert during infestation of grains by pests and insects.

An ultrasonic sensor based spraying system, sensor-based system for sugarcane bud cutting and planting, tractor-implement monitoring system, automatic depth and draft control for fuel economy and image based herbicide applicator have been developed and tested at IIT, Kharagpur. The percentage saving of chemical by tractor operated ultrasonic sensor-based pomegranate sprayer was 25-30% and 45-50% with turbo nozzles and hollow cone nozzles, respectively as compared to whole field spraying system.

Large Scale Adoption Lacking

Punjab Agricultural University (PAU), Ludhiana has developed an optical sensor (Yara) based fertilizer application system, an automatic EC and pH mapping system and a batch type yield monitoring system for indigenous combine harvesters. The results of these precision technologies are encouraging. However, their adoption on large scale is lacking due to high cost of these machinery.

Farmers in India have started using tractor operated laser guided land leveller and mobile phone-based remote control water flow pumps, resulting in significant water savings and overall cost reduction. Innovative spraying equipment such as air assisted sprayers, ULV sprayers, ultrasonic sensor based sprayers, canopy sprayers and electrostatic sprayer are being developed and can improve the efficacy of spray. These equipment will reduce the application



rate as well as number of sprays in field and horticultural crops, thereby, reducing the pesticide requirement and pollution of soil and ground water.

Way Forward

The emerging smart agriculture mechanization combines precision farm management tools (GPS/GNSS, DSS, VRT), end user applications (apps, mobiles, machines, Agri-bots) and data solutions (data IoT, information, tech empowered tools). These technologies not only make agriculture machinery smart and efficient but also help in saving inputs such as seeds, fertilizers, chemicals, water and energy and make agriculture more sustainable. The following strategies will not only enable farmers to do more with less but also help to improve quality and ensure faster go-to-market for crops.

- * Establishment of an interactive digital platform to allow farmers full access to information and technology databases, expert systems and DSS for web based agro-advisory, skill development, machinery management and financial assistance.

- * Promotion of an app-based farmer-to-farmer aggregation platform, which bridges the demand and supply gap of machinery or equipment by connecting owners of tractors and farming equipment with those who require their services.

- * Promotion of digital farming and precision agriculture technologies through research & development and financial assistance.

- * The hardware/technology must be portable, affordable and plug and play type for better success in India.

- * Need for increased application of smart agriculture and digital farming with involvement of private sector for farm mechanization.

In future, agriculture is expected to be dominated by precision and cloud based data and supported by advanced infrastructure like smart tractors, unmanned aerial vehicles, wireless technology and unmanned autonomous vehicles for multi-purpose field works. There is need to simplify these technologies to rudimentary levels and make them cost-effective for maximum acceptance by the farming community.



NEW AGE TECH

TRANSFORMING FARM PRODUCTIVITY

New age technology innovations and customized products across the globe



The pace of transformation in farm machinery industry has taken a quantum leap in India, with first wave of Covid-19 being the inflection point. The agri industry fought ferociously to record an unprecedented year in tractor sales. Labour shortage forced farmers to evaluate new ways to step up farm productivity. The tractor market is rapidly becoming organised, and it is high time that farm mechanisation looks beyond pure tractorization.

It is crucial to embrace new age technologies that can simplify the multitude of fragmented supply chains characterising Indian agribusiness. Being India's No1 tractor export brand, ITL understands world agri markets well and manufactures 1,000+ tractor variants and 70+ implements. We remain committed to harness new age technologies and customising them as per regional requirements of farmers to ensure a prosperous future for them.

Technology Penetration In Agriculture

Country farmers have been fast adopting higher HP tractors and advanced implements over the past decade. Thanks to rising digitalisation wave, farmers today are

About the AUTHOR

Mr Raman Mittal is Joint Managing Director at International Tractors Limited (Sonalika & Solis). His endeavour to provide a holistic package to farmers has led the brand to gain the trust of more than 14 lakh farmers in over 140 countries

INCREASED CONSOLIDATION, COLLABORATION

- Enhancing the productivity and output of the agri sector will heavily need a significant degree of consolidation and collaborations among stakeholders. New Age technologies such as machine learning, mobility & cloud computing, remote sensing & big data, artificial intelligence, block chain are technologies that modernising operations and simplifying complex agri value chains. These are at a nascent stage in India.
- Fast emerging agri tech start-ups have harnessed emerging technologies' potential while supporting farmers to achieve better scale and sustainability. While we keep consolidating our position as the top exports brand from India, one of the oldest industry in the form of agriculture must also look at enhanced partnerships among central and state governments, agri universities, cooperatives, research institutions, investors, farmer producer organisations (FPOs) as well as embrace the rise of Indian agri startups.
- Over 1,000+ of these innovation-led startups have also been emerging as important catalysts that will make agri ecosystem capable of catering to increasing demand. A more cohesive environment among manufacturers and such startups will increase farm productivity and address critical issues such as insufficient quality of agri inputs, missing guidance during critical crop-growth stages, produce distribution as well as role of different intermediaries.

more informed but there is still a significant gap due to lack of knowledge and limited access to information, over advanced technologies. Every intervention and invention in the agriculture sector should focus on two aspects - reduce production costs for farmers and cut down losses in the agri and food supply chain.

Special attention needs to be given to small holding farmers and marginal holding farmers which constitute over 80% in India. An efficient amalgamation of technology, public/private investments that are matched with market interests are of paramount importance to build more efficiencies in the sector.

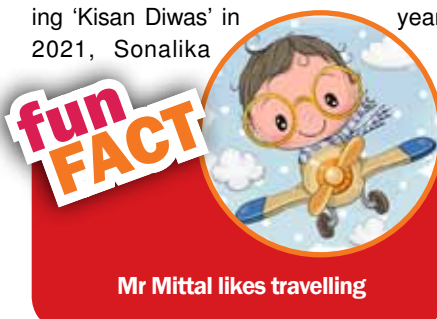
People-Progress-Technology

'People-Progress-Technology' together are poised to spearhead data-driven precision farming to generate sustainable profits. ITL has always been at the forefront of innovation and continues to offer best in class technology to the farmers across the globe, especially Europe and USA. We have always kept farmers at the front and centre of any new development – be it product or service – and fully powered by advanced technologies that ensure people continue to progress towards a prosperous

future. Our premium tractors – Tiger series & Sikander series – have been winning hearts across the country. We have kept our approach focussed on the futuristic technologies as well for long time.

Tiger Electric - Back in December 2020, Sonalika Tractors unleashed a new era of agri innovation by launching the Tiger Electric tractor - India's first field ready electric tractor which ensures 100% torque at 100% times. With Tiger Electric, we bridged the gap between concept and being field-ready, while keeping pace with global benchmarks in farm mechanisation technology. It is built on the proven tractor platform of Sonalika to guarantee farmer friendliness and remain easy to use as we progress towards an emission-free, greener tomorrow.

Tiger DI 75 CRDs - Commemorating 'Kisan Diwas' in 2021, Sonalika



Tractors launched its most advanced Tiger DI 75 4WD tractor with superior CRDs (Common Rail Diesel System) technology. It boasts of premium technologies such as Sonalika's legendary powerful engine, 12+12 shuttle tech transmission and 5G hydraulic control system and company R&D experts have developed CRDs technology to deliver up to 10% higher fuel efficiency for affordable farming. CRDs technology will also support Sonalika Tractors to comply with the upcoming Trem Stage IV emission norms in future.

Sonalika Samrat Harvester – the most advanced and self-propelled combine harvester by Sonalika is fully equipped with next-gen technologies. It reduces tedious labour tasks during harvesting season. It is economical, leading to savings for farmers. It is manufactured at the new high tech facility at Amb, Himachal Pradesh, set up with an investment of Rs 200 crores to roll out advanced quality harvesters. It is designed with CED (Cathode Electric Deposition) paint process that involves 14-stage treatment process to ensure rust-free and longer period of harvester's performance.

Mobile app based crop advisory, rental services in farm machinery, livestock sensors have made a headway into the sector. ITL also launched its 'Sonalika Agro Solutions' app for Tractor and implement rentals to help farmers.

The Transformation

Farm mechanisation is destined to transform the way how an average Indian farmer operates. This massive change depends on how all stakeholders blend to create an appropriate policy framework, financing mechanism and technology. The herculean task is to identify ways that encourage SHF (Small Holding Farmers) and MHF (Marginal Holding Farmers) to adopt mechanised farming techniques. Policy interventions are happening at an unprecedented scale. The country needs farm mechanisation which stands regionally different tuned as per demands. The challenge is to leverage farm mechanisation for increased farm productivity and identify ways to include SHF and MHF to adopt mechanised farming.

DIGITAL REVOLUTION IN AGRICULTURE

With increasing urbanization and the contagious depletion of natural resources, including fragmentation of land holdings, a paradigm shift in farmer's perception is inevitable from production to productivity and profitability. To feed the current 7.8 billion global population with an average growth rate of 1.09% (2015-20) under changing climate scenario, a transformation in agriculture from traditional to technology led precision farming is presently needed. The current situation is likely to be aggravated by 2050 to meet the likely requirement of 9.8 billion people globally. In the current technology-based era, the concept of big data encompassing the bulk collection of scattered information including the soil architecture, weather forecast, climate change, nutrient recommendation, protection strategy and crop mapping shall be of great significance.

India and Digital Agriculture

While India has made significant progress in technological development in the field of agriculture, productivity

Presently, agriculture is passing through a fourth revolution facilitated mainly by the advances in information and communication technologies

of land and labour remains low in term of world standard. Unless technological advancements are achieved, almost in an unbroken chain, even maintaining the present food consumption level in future would be difficult and further improvement would provide a major challenge. In the present situation, a new direction can be given to agricultural research only by bringing about a perceptible change in the crop based farming system for integrated development.

Big data, remote sensing and artificial intelligence are still at a novel stage in India compared to other

developed countries. Technological developments such as machines for tillage and harvesting, controlled irrigation, fertilizers, pesticides, crop breeding, genetics research, biotechnological tools for trait improvement have evolved modern farming.

Presently, agriculture can be considered to be passing through a fourth revolution facilitated mainly by the advances in information and communication technologies. Emerging technologies,



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The main role and application of big data in smart farming is to ensure in minimum cost gaining higher profit as well as sustainability

such as remote sensing, Internet of Things (IoT), Big data analysis, development of unmanned aerial vehicles (UAV) and artificial intelligence (AI) are promising tools being utilized to optimize agricultural operations and aimed to enhance production and reduce inputs as well as yield losses.

Low Cost, High Profit, Sustainability

Big Data and Smart agriculture both are relatively a new concept of agriculture. Precision agriculture concept is extended through smart agriculture based on big data information analysis. The main role and application of big data in smart farming is to ensure in minimum cost and higher profit as well as sustainability. The use of artificial intelligence, sensors and smart machines in agriculture has brought agriculture to the top of the digital revolution in the modern era. Data in agriculture is a collection of various type of

soil mapping containing information related to their physical and chemical properties, weather, pest management practices, etc. Because of all this information, in any adverse weather or disease eruption situation(s), the farmers are warned in advance, thus, reducing their sufferings.

Way Forward

With the advancement and development in Big data, Remote Sensing and Artificial Intelligence techniques, real-time satel-

lite remote sensing systems can evolve. Technology transfer from research centers to commercial agribusiness industries with greater emphasis can be a boon to both the society and agriculture.

Presently, the available thermal cameras are mainly designed for non-agricultural uses, such as buildings and machinery inspection, which can also be used by farmers for improving irrigation scheduling under limited water availability. Decision support systems can be developed and such systems can form the main link to convert the spatial data collected into detailed management recommendations at the farmer's level.

Decision support systems have the potential that will add value to remote sensing data for the farmers. By encouraging agricultural information technology (IT), companies entering the marketplace, the cost of remote sensing data and other systems associated with precision agriculture are likely to come down in line with the benefits received.

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FACT**



Dr Arvind likes to share innovative experiences, practice yoga and meditation

DIGITAL AGRICULTURE

DELIVERING VALUE TO SMALL, MARGINAL FARMERS

It is harvest season in Mayurbhanj, Odisha. The October sun warms up the huge piles of pumpkins drying out in the backyards of farmers. Arati Mohanta, a Community Resource Person of Mrugasuni Farmer Producer Organisation is anxious about finding the right buyer for the pumpkins, on time. She is armed with an application called Kisan Diary Enterprise (KDE) that has data on the availability of pumpkins, including some photographs. In the earlier times, it was difficult to get this information and thus challenging to connect to buyers, however now, on meeting a potential buyer, she shares key data on the availability and quantity of produce using KDE dashboard easily. Buyer was satisfied with the information and closed a deal for 4147 quintals of pumpkin, the largest deal the FPO has done so far for their 311 members. Technology is changing the way agriculture business is conducted in India, for good.



Powered by the exponential rate of mobile penetration digital technology is driving agriculture business across In-

dia. The government is assisting in the rapid development of an enabling digital eco-system in India. Initiatives to this end

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include the Digital Agriculture Mission (2021–25), IDEA Stack, PPP in Digital Agriculture, etc. This is also demonstrated by private investments, which totaled USD 889 million in 2021, or a staggering 90%, being made in the agriculture and food sector.

On the other hand, farmers are adopting these digital services at an accelerated pace. According to a 2018 estimate, the top 30 agriculture apps have been downloaded about 50 lakh times, a figure that is likely to have grown manifold since then. With both mobile data use and digital literacy poised to grow further, these are rainy days for the agriculture sector in India.

Digital Technology Solutions

From simple videos in social media platforms like youtube and instagram that offer audio-visual advisories to high-end blockchain and Artificial Intelligence technologies that offers transparency and value creation- a vast array of solutions are available for the farmers. About 15 years ago, Digital Green introduced the community video approach that transformed the way agri extension systems worked. Today, the same approach has been adopted and scaled by governments in Bihar, Jharkhand, Andhra Pradesh, Jharkhand, and Telangana, serving about 2 million farmers through a network of upskilled front-line workers.

Drones that capture real-time data on the crop (such as growth, health, and pest spread) and enable precise input application are made possible by precision technologies from geospatial imagery, which offers high-resolution images (with rich information on topography, soil, field history & timelines, and yield estimation) to advance crop management. In addition to enabling farmers to receive individualised advice on topics like climate-smart agriculture and opening up market opportunities, the full spectrum of these technologies also enables service-providing industries like commodities and insurance to make data-driven decisions. Then there are companies like Krishi Tantra, which

The Data Way Forward

The data repositories cited above are treasure boxes to advance agriculture and food systems in India. However, there are two key considerations to finding the key to them.

a. Need for continuous enrichment of data. One of the critical challenges the sector is facing today is data collection & the cost of data. FPOs can play a big role in data enrichment as they are business units for farmers and by farmers. Therefore data collected and maintained by FPOs builds ownership, strengthens agency and ensures informed consent. A network of decentralised and distributed FPO level data systems can power the future of digital agriculture in India.

b. Need for secure and trusted data exchange and interoperability. The wealth of existing data is of partial use and impact if studied and analysed in silos. The proposed India Digital Ecosystem of Agriculture (IDEA) under the aegis of the Ministry of Agriculture and Farmers Welfare is a transformational initiative that aims to break the data silos and enrich the system. IDEA proposes a secure data exchange between data holders, based on agreed governance and operational protocols under stewardship of the government.

provides farmers with valuable real-time soil analysis, and AgNext, which offers quality assessments of various agricultural products. Both the private sector and academic institutions, such as IITs and IISc as is clear from this, are driving innovation.

Data And Data Analytics

Data is at the heart of digital agriculture. Data has the potential to increase the agency and empowerment of small-scale producers because it can be used as a transactional and transformative tool. In India, there is already a robust system for collecting agricultural data. This includes information from the Direct Benefit Transfer Scheme, the Unique Identification Authority, and various state-level databases

on land, soil, and farmer profiles. There is a wealth of hyperlocal weather information available from the Indian Meteorological Department and satellite images, as well as topographic profiles from the Indian Remote Sensing Agency, National Atlas, and Thematic Mapping Organization. Not to mention the information accessible from the ICAR, public agricultural colleges, businesses, and civil societies. Providing stakeholders with access to this data can boost productivity and cut costs.

There are challenges. The sheer diversity of the agriculture system in India and its fragmented nature, along with abundant small and marginal farmers with less than five acres is a major challenge. Limited mobile data and lack of agency of women farmers is another challenge. However, these challenges can be overcome through an integrated approach to digital agriculture.

Digital Green is a global non-profit with a mission to empower farmers and increase farmers' income through appropriate digital technologies for small-scale farm producers. Digital Green has been working in India since 2008, partnering with various state governments to provide value-added digital solutions to enhance productivity, resilience, and livelihood options. More information at www.digitalgreen.org



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FACT**

Mr Krishnan loves to sit down with his favorite comics - Asterix and Obelix or Calvin and Hobbes with a hot cup of filter coffee and soft classical music in the background

YONO KRISHI

EMPOWERING INDIAN FARMERS

SBI YONO Krishi platform, envisioned to be the digital partner in farmer's progress, was launched in July 2019. YONO Krishi is a one stop solution for agriculturists offering simplified banking services, finance/credit products, investment and insurance products, advisory/market intelligence services and market linkages through online marketplace.

Apart from providing superior customer experience for agricultural needs, existing processes at the branches are digitized to minimize manual intervention, reduce TAT and improve operational efficiency.

YONO Krishi, a multilingual platform, has been made available in 10 regional languages in addition to English and Hindi. Customers can access the products and services in Assamese, Bengali, Gujarati, Kannada, Malayalam, Marathi, Oriya, Punjabi, Tamil & Telugu languages.

Addresses All Agri Needs

YONO Krishi as an eco-system is catering to all agricultural needs of the customers/farmers under 4 sections viz. Khata, Bachat, Mitra and Mandi.

1. Khata (Account) section caters to Agriculture credit solutions with products like Agri Gold Loans, Kisan Credit Card review and SAFAL.

a. Agri Gold loan is a simplified, fully digital gold loan application for availing loan against the gold ornaments for agricultural purpose. It can be applied 24x7. It minimises customer visits to the Branch, make the process quicker for



them to avail the gold loan.

b. KCC review is another fully digital journey under Khata section to enable farmers to access their KCC limit in few clicks. With this added feature, farmers will no longer need to visit the bank branch to apply for a revision in their KCC limit. The feature of paperless KCC review will not only help farmers save costs and effort involved in applying for

revision of the KCC limit, but also make the process quicker for them especially during the harvesting season.

The KCC scheme has been designed to ensure that farmers get adequate and timely credit support from the banking system under a single window with flexible and simplified procedure for their cultivation and other needs. The scheme provides support to farmers to meet short term credit requirements for cultivation of crops; post-harvest expenses; produce marketing loan; consumption requirements of farmer household; working capital for maintenance of farm assets and activities allied to agriculture; and investment credit requirement for agriculture and allied activities.

c. Simple and Fast Agriculture Loans (SAFAL) is a first of its kind pre-approved loan. It is offered to the farmers engaged in dairy activities and associated with Corporates having tie-up arrangement with the Bank. The product leverages data available with Bank and Corporates to offer pre-approved loans to these farmers, ensures quicker processing of loans, thereby providing convenience to the farmers.

2. Bachat (Savings) is a financial super store which allows farmers access to products covering their investment & insurance needs. Personal Accident Insurance (PAI), Motor Insurance, Health Insurance and SBI Life Sampoon Suraksha are the prominent investment and insurance products available in Bachat Section of YONO Krishi which are offered by our Joint Venture Partners. PAI provides coverage against accidental death, Motor Insurance meets



About the AUTHOR

Mr Shantanu Pendsey took the charge of CGM (ABU & GSS) Dept at Corporate Centre on June 21'2022. Earlier, he was GM, Network-III in Bengaluru Circle



YONO Krishi is a one stop solution for agriculturists offering simplified banking services, finance/credit products, investment and insurance products, advisory/ market intelligence services and market linkages through online marketplace

Machinery, Agri Begri, IIHR Seed Portal, Ugao, Farmers Stop, Big Haat, Agri App, Behatar Zindagi, Agricart, Tools-Villa, Kisan e-store, Poorti.

Adoption of YONO Krishi has enhanced the banking experience for the farmers through various customer delight initiatives across Agri and Allied activities. The platform is a one-stop financial marketplace for the farmers providing range of services - banking facilities to the farmers at their fingertips within the comfort of their home, investment and insurance needs of the farmers, online marketplace for farm inputs, market linkages, advisory services for enriching the farming experience, etc.

Since launch till 30.09.2022 - 74 lakh+ Agri gold loans amounting to Rs.1,14,833 crore is sourced and more than 19 lakh KCC accounts are reviewed through YONO platform. Till date, 34 lakhs + customers have visited Mitra and Mandi sections.

The initiatives and impact created by the platform has been recognized on many forums in the form of rewards and recognition. YONO Krishi was awarded as one of the best innovations in top banks category by Business Today in 2020.

YONO Krishi, a digital agriculture platform, is our endeavour towards transforming Indian Agriculture through digital innovation and strategic partnerships. With a holistic ecosystem approach and adoption of modern digital technologies, YONO Krishi is a great value proposition for our farmer customers.

the insurance needs for the farmers for their private vehicles and two wheelers, Health Insurance provides protection against various illnesses for the farmers and SBI Life Sampoon Suraksha is the protection plan providing life insurance for the farmers.

3. Mitra (Advisor) is the Knowledge Hub for the farmers. The platform offers plethora of advisory services for various stages of Agri life cycle like weather updates, Agri Advisory, Crop Prices, Information on Government Schemes and Agri discussion forums (chat with other farmers on Agri related topics) through on-boarded merchants at click of a button. It provides timely and accurate information that can work as a catalyst to improve productivity and farmer income. The services offered by merchants help farmers to get expert advice at every stage of their crop cycle, discover nearby warehouses / cold storages etc. and empower farmers to have better price discovery for their farm produce. Currently 9 Merchants are offering Agro Advisory services on Mitra Section - *Farmizo Khata, Na Panta, Agro star, IFFCO Kisan, Bighaat forum, Skymet Weather, Apni Kheti, Farm Rise, Kisaan*

Helpline.

4. Mandi (Market place) is the online marketplace for purchasing agricultural inputs & farm equipment. It is a one stop shop for farmers to purchase products varying across categories like Tractors / Crop Care / Seeds / Irrigation and Cattle care from the comfort of their home. The on boarded merchants provide additional discount to customers when they place order through YONO Krishi. It provides farmers access to high quality inputs at discounted price. Farmers can seamlessly buy / rent seeds, fertilizers, machinery etc. Currently 15 Merchants are offering Agri marketplace services on Mandi Section - *IFFCO Bazar, NRCSS, Aqua connect, Mahindra Farm*



Mr Pendsey is fond of trekking, photography and tourism

AGRI-ECO TOURISM BOOSTING FARMER PROSPERITY

With rapid urbanisation, agriculture is losing its charm as a reliable source of income. And, urban youth have no clue of what it requires to be a farmer and what they contribute to the nation.

Agri-entrepreneurs have realised the importance of highlighting to the urbanised population the real facts behind agri-businesses. Perhaps that's how the term Agri Tourism evolved. Agri tourism is more about making the generations realise the amount of effort and time required for various things to reach from farm to fork.



About the **AUTHOR**

Ms Jyoti Mayal is President, Travel Agents Association of India; Vice Chairperson FAITH; Chairperson THSC; Member Board ICC National Committee Aviation Tourism Hospitality; Member Board CII National Committee on Tourism & Hospitality; Director, New Airways Travels (Delhi) Pvt Ltd and Chief Executive, Red Hat Communications

Opportunities Aplenty

Most parents want their children to feel the real world in terms of healthy habits, good food, nature, and especially the ecology around them. Agri tourism is a one-stop solution to all that. Spending a day at the farm takes children away from virtual reality. It proves to them how important it is to spend time with nature, especially from the agri perspective.

From an economic perspective, not all farmers own a large chunk of land and therefore are dependent on farm loans, and other means to stay in agriculture. Now, the development of agri-eco tourism in India will provide them with an opportunity to have an extra source of income using which they can reinvest in the fields to grow better quality crops.

The promotion of agri-eco tourism will help provide the rural population with employment in their place. In addition, a lot of young and talented pool of travellers will bridge the gap between rural and urban populations which is the need of the hour. A developing country like India needs to work on it as a large number of people across the country are still deprived of benefits such as basic hygiene. These travellers could be their guide to introduce them to the developed world.

Travellers are looking for sustainability and to reach out beyond the hustle-bustle of a city. This sector of tourism would be able to promote connecting them with mother earth & bring in a wellness perspective, especially after Covid.

Challenges

The lack of incentives to promote agri tourism seems to be the biggest bottleneck. A lot of people in the trade are still sceptical to engage fully in the promotion of the same. Although there are many reasons behind it, one of the major reasons is second/third-generation farmers are not willing to take up agriculture as a profession. The lack of proficiency and limited interest may hamper the growth of the sector in the long run.

The government extended support to the development of rural tourism when National Strategy and Roadmap was

Development of agri-eco tourism in India is and will provide farmers with an opportunity to have an extra source of income. But the lack of incentives to promote agri tourism is the biggest bottleneck



launched. We in the travel trade believe that a dedicated agri tourism campaign must be rolled out. This campaign will only talk about working closely with the agri population to promote tourism sustainably.

The Future Is Bright

Covid devastated the economy, travel trade and many other sectors. However, post Covid, new avenues have been opened for the countries, including India. Travel trade can play a pivotal role. Do-

mestic tourism picked up well resulting in the growth of tourism. Health and hygiene standards have risen, resulting in better eating habits and understanding of the importance of farms. Last, but not the least is the clean environment. The urban population have realised the importance of eco-tourism and sustainability. Therefore younger urbanites, especially the millennials are more eager to explore agri-eco tourism.

We need to skill, reskill, and multi-skill much more to adapt to the diversity of agri-eco tourism. When we develop sectors, we need to look into long-term development, deliverance and sustainability. All of these can only be driven by adopting the correct skills.

India is a land of diversity in terms of agri-eco tourism. States like Uttarakhand, Kerala, Maharashtra, West Bengal, Rajasthan and the entire northeast have a lot to offer. We in the travel trade are doing our best to promote those destinations, we now need rural infrastructure and, at the state level, more willingness by tourism promoting bodies, to accept and promote agri-eco tourism.

MECHANIZATION

VITAL FOR GROWTH



Rising mechanization of agriculture has been one of the largest changes in recent years. The introduction of new technologies, such as mini tractors, has made this possible. One of the most important pieces of agricultural equipment is the mini tractor.

The mini tractor is a compact, functional tool that may be employed for a variety of tasks, such as plough, plant, and harvest. And has various benefits like higher production, lower labour costs, and less reliance on the elements. The tractor is a vital piece of equipment for farmers and has a big impact on the agricultural industry.

There are numerous advantages to agricultural mechanization. Among the most notable advantages are as follows.

Efficiency Gains: Machines are much more effective than humans at executing duties, resulting in higher agricultural output when using limited resources. - Increased Output - Because machines could indeed undertake work more effectively, it is possible to cultivate more crops.

Standardization: Tasks can be standardized through mechanization, which is essential for large-scale production.

No Employee Turnover: When a business transitions from manual to automatic operations, there is no need to hire workers and then lose them due to employee turnover.

About the AUTHOR

Mr Rajesh Patel is the Managing Director of Captain Tractors. His vision is to bring convenience to the farmers fraternity irrespective of their land holding, by minimizing their dependence on manual labour and bullock power



mentation of machines may result in the loss of jobs as humans are replaced by machines. It has made farming more dependent on technology, and it has made some jobs obsolete.

Despite the challenges, mechanization is likely to continue to play an important role in agriculture in the years to come. Farmers will have to adjust their daily routines and work hours as they are now in charge of operating machines rather than performing manual tasks. While these difficulties are difficult to overcome, they are an essential part of the mechanization process.

Farmers have gradually replaced machines with people to carry out various tasks as a result of mechanization in the agricultural industry. The advantages of mechanization include efficiency gains, outcome, and standardization. Disadvantages include high machine and electricity costs. When implementing mechanization, it is important to keep the relevancy of flexibility and adaptability. Overall, mechanization has had a positive impact on agriculture. It has made farming more efficient and productive, and it has helped us to feed more people.

Mechanization is playing an increasingly important role in agriculture today. It helps farmers to increase production, while reducing labour costs. Additionally, mechanization can help to reduce soil erosion and improve crop yields. When looking at mechanization as a solution to your problems, it's important to remember that there will always be some level of change. While it may seem scary, it can be a good thing for your farm.

Mechanization can help to save money, increase your productivity, and reduce your environmental impact. It can even help you respond to market demand more quickly, which is beneficial for your customers. With all of these positive effects, it's easy to see why mechanization has become so widespread in the agricultural sector. Captain Tractors is a leading provider of agricultural mechanization solutions, and we are committed to helping farmers increase productivity and profitability.

Improved Product Quality: Mechanization allows you to produce a higher-quality product or service. Today's agriculture is heavily mechanized, with machines doing most of the work. As a result, labour expenses have decreased and efficiency and productivity have increased.

Since the early 20th century, the agricultural sector in the United States has been more mechanized. This pattern has persisted recently as farmers have adopted more labour-saving machinery and agricultural technology has advanced.

Farmers today significantly rely on machinery carry out to numerous jobs on the farm because agriculture is a highly mechanized sector of the economy. Agricultural machinery, which includes everything from tractors and combine harvesters to grain elevators and milking machinery, is essential to modern farming.

As farmers look to machines to help them improve efficiency and productivity on the farm, this trend is expected to continue in the future.

The way we farm now has been completely transformed by the mechanization of agriculture. We are able to produce more food with less work thanks to machines. This has made farming a more productive and efficient sector, allowing us to feed more people with less effort. However, mechanization has also had some drawbacks.

Mechanization helps save money, increase productivity and reduce environmental impact. It can help to reduce soil erosion and improve crop yields

Challenges

The challenges that we face are as follows.

Machine Costs: The cost of the machines used in mechanization can be very high and is frequently unaffordable.

Requirement for Electricity: Because many machines used in mechanization require electricity, they will not function if there is a power outage.

Requirement for Maintenance: Machines will need to be maintained and repaired, which will incur additional costs.

Job Loss: The imple-

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Reading books, playing cricket and listening to music are stress busters for me. They help me build new venture, strategies and create unique concepts

POST-HARVEST MACHINERY TESTING FACILITY IN INDIA

The Sub-mission on Agricultural Mechanization is one of the major Indian initiatives to promote mechanization of agriculture in India and very many machines are being promoted under this scheme. One of major objectives of this mission is to ensure availability of quality machines to different stakeholders, this is being achieved through establishment of agricultural machine testing facility across the country. The mission also recognizes that post-harvest unit operations are equally important to the Indian agriculture and rural livelihood and hence support is being extended to machines required for post-harvest unit operations or also for some auxiliary unit operations performed by farmers or rural entrepreneurs. There are four major farm-machinery testing facilities (specialized in testing of tractors, engines, power tillers, combine harvesters, agricultural prime movers, etc.) under government of India at Budni (Madhya Pradesh), Hissar (Haryana), Anantapur (Andhra Pradesh) and Biswanath Chariali (Assam) operating since 1959, 1963, 1983 and 1990, respectively. Government of India provided support for opening of additional centers for testing and certification of farm implements & post-harvest machineries at various ICAR institutes and State Agricultural Universities. Whereas there are 27 centers recognized for testing of farm implements, there are four centers across the country authorized to test the post-harvest or agro-processing machinery.

PHMETC, ICAR- CIPHET

The Post-Harvest Machinery and Equipment Testing Centre (PHMETC) at ICAR-Central Institute of Post-Harvest Engineering and Technology (CIPHET),

Some manufacturers apply for the testing of their 2-10 TPH seed/grain processing machines at PHMETC, ICAR-CIPHET, Ludhiana because they are exporting these machines to several developing countries

Ludhiana, Punjab, was established post-authorization granted by the Department of Agriculture, Cooperation and Farmers Welfare (DoAC & FW), Ministry of Agriculture and Farmers Welfare (Govt. of India) on 15th July 2015. The aim of establishing PHMETC across India is to ensure the supply of quality agricultural machinery and equipment under Government Programs.

PHME Testing Centres are authorized to test post-harvest machinery and equipment approved by the competent authority on established testing guidelines for the assessment of performance, and suitability before issuing commercial or confidential test reports of the machine. PHMETCs refer to the guidelines and norms established and approved by the Bureau of Indian Standards (BIS) in form of Test Codes. In scenarios where BIS test codes are not available, the

PHMETCs develop test codes and draft copies of the test codes are sent to the competent authority for approval and also submitted to BIS for consideration to develop a new test code. Besides the test centers also conduct confidential tests following mutually agreed testing protocols.

Various authorized PHME Testing Centre established at different ICAR institutes are:

- PHME Testing Centre, ICAR-CIPHET, Ludhiana.
- PHME Testing Centre, ICAR-CIAE, Nabibagh, Bhopal.
- PHME Testing Centre, Coimbatore, Tamil Nadu, Regional Centre ICAR-CIAE, Bhopal.
- College of Agricultural Engineering and Technology, Orissa University of Agriculture and Technology, Bhubaneswar.

During the initial phase of development PHMETC, ICAR-CIPHET, developed its test facility with modern precision measuring instruments, equipment for machine and material testing, and adequate human resources. The PHMETC, ICAR-CIPHET has been authorized to test all post-harvest machines and machines for auxiliary unit operations in



About the **AUTHORS**

Dr Nachiket Kotwaliwale, Director, CIPHET, Dr RK Vishwakarma and Dr Sukhwinder Singh, ICAR-Central Institute of Post-Harvest Engineering and Technology, Ludhiana



Different types of Post-harvest machineries being tested at PHMETCs

waste and by-product management. The other centers are authorized for testing of certain machines, list of which is available in their respective websites. In general, various types of machines approved for tested under PHME Testing Centres include Grain Dryer (Stationary/Mobile), Seed/ Grain Cleaner/Grader/Cleaner cum Grader/ Destoner, Mobile Grain Cleaner/ Grader, Mini Dal Mill, Grain Cleaner cum Dryer with or without Treater, Popcorn machine, Potato/Banana chips making machine, Mini rice mill/ double rubber sheller/air cooled polisher cum broken separator, Mini oil expeller/ extraction plant (i.e. oil seed such as soybean, mustered, ground nut, sunflower etc., Arecanut Dehusker, Chili/Masala Pounding machine, Hammer beater type pounding machine, Flour mill machine (Attrition/Burr Mill), Grinding Machine, Rawa Suji Grinding machine Plate type, Sugar cane crusher double & triple roller, Papad/Roti/Chapatti rolling/making machine or with electricity, Semi-Automatic Papad/Roti/Chapatti machine, Vermicelli Machine. The aforesaid machines along with their similar variants, operated by electric motor, engine or tractor are tested & certified. The PHMETCs are

equipped with facilities to test machines of capacities suitable for agriculture and allied operations conducted under typical Indian scenario.

Quality, Transparency

Some manufacturers apply for the testing of their 2-10 TPH seed/grain processing machines at PHMETC, ICAR-CIPHET, Ludhiana because they are exporting these machines to several developing countries. The importing countries are demanding test report from approved and reputed organizations. Therefore, the centre is adding some new features in the test protocols to address the requirements of international markets. Thus, the

PHMETC, ICAR-CIPHET, Ludhiana is now emerging as a brand in the area of post-harvest machinery testing.

PHMETC, ICAR-CIPHET, Ludhiana focuses on quality and transparency in its processes, as a result, it has developed such a positive reputation that manufacturers/applicants from pan India are applying for testing at our facility. Besides testing, PHMETC, ICAR-CIPHET, Ludhiana has also developed draft test codes for machines; Grain Cleaner cum Dryer, Mini Rice Mill, Dewatering Machine, Solar Vegetable dryer, SS Pulveriser, Gravity Separator, Potato Chips Making Machine, Juice Extractor. Over the year, PHMETC, ICAR-CIPHET, Ludhiana, has developed the capacity to test more than 80 machines in a year with available infrastructure and manpower. The PHMETC at ICAR-CIPHET, Ludhiana will continue to work for ensuring the supply of quality agricultural machinery and equipment under Government Programs and export markets. The aim of the PHMETC, ICAR-CIPHET, Ludhiana is to develop a state-of-the-art model testing centre and become PHME Testing Nodal body for testing of post-harvest process machines across this part of world.



**Dr Nachiket loves cooking,
Dr Vishwakarma is an avid
badminton player and Dr
Sukhwinder loves cycling**

AGRI TOURISM PROTECT VERNACULAR ARCHITECTURE

Agri-tourism could be the answer to bringing prosperity to India's farm economy. More and more people are flocking to the countryside in search of deeper, more meaningful experiences of the quintessential rural way of life. India's rich cultural diversity across its 600,000 plus villages has evolved over centuries. It presents immense scope for agri-tourism to flourish.

This must be supported by the right marketing and policies that safeguard the interests of the farmer while preserving the cultural identity and vernacular architecture of the region.

Why vernacular architecture?

Agri-tourism is a relatively new concept in India. In 2016, Maharashtra government offered loans and tax benefits for setting up 'agri-tourism centres'. Uttarakhand government announced Rs 10 lakh subsidy for converting houses to home stays in hilly areas and a tax exemption of Rs. 1.5 lakh for the first 5 years. But shabby new roadside constructions mushrooming across the hills in the name of village home-stays bear no semblance to traditional village homes and no sign of associated farming.

India's Natural Building Traditions

Within India, we have such a rich di-

About the AUTHOR

Ms Shagun Singh is the Founder and Director of Geeli Mitti Farms, a social enterprise based in Nainital District, Uttarakhand. She is also the co-founder of Geeli Mitti Foundation, an NGO working on generating livelihood for marginalised communities and specialising in sustainable housing and farming across six Indian States.



versity of vernacular architecture - be it the mud homes and sloping tiled roofs of Madhya Pradesh and Maharashtra, Himachal's *Kathkuni* and Uttarakhand's *Koti Banal* homes made of interlocked wooden planks with tightly packed stones without any mortar, mud and lime *Nalukettu* homes of Kerala with large statement courtyards, or the lightweight *Ikra* homes of the North-East made of bamboo frames and handwoven panels. These constructions use natural materials like mud, stone and timber sourced locally. This has massive ecological benefit, besides automatically generating livelihood for the local community. Every one of these homes is energy efficient. They automatically regulate indoor temperature and humidity to the opti-



BUILDING GRASSROOTS

Regulated Government Policies

- Protect and Revive Vernacular Architecture at village and city-level by establishing clear-cut standards, offering incentives for incorporating natural building techniques
- Promoting Homestays as an Alternative Source of Livelihood to support rather than replace main occupation of agriculture. Encourage smaller set-ups of 1 or 2 rooms and cottages instead of policies favouring large operations. A case in point is the central government's MSME policy which mandates a minimum of 8 rooms with attached bathrooms.

mum level, drastically reducing cooling and heating needs. These homes are designed with the ancestral wisdom to suit local environmental conditions and withstand natural disasters.

Era Of Cement And Concrete

With cement and bricks becoming easily available at every corner of the country, village folk are increasingly opting for standardised 'pukka' cement homes. Invaluable traditional building knowledge and skills are phasing out.

Government policies like Pradhan Mantri Awas Yojna are encouraging communities into believing that so-called 'pukka' homes are a mark of development and social stature. The result is the total demolition of regional and cultural identities. A live example of this is Ladakh - a place renowned for its stunning landscape and century-old mud homes and monasteries that are still standing strong even today.

In recent years, Ladakh has seen a surge of government funds and subsidies 'promoting tourism' due to which these beautiful structures are being replaced by cement homes with tin roofs at an alarming rate. It won't be long before these new buildings, which are already an eyesore in comparison to the traditional homes, will demand ridiculous amounts of energy for heating. Two other instances can be seen in Sualkuchi in Assam and Mawlynnong in Meghalaya,

two north-eastern villages where people responded to the huge influx of tourists by replacing their traditional mud-plastered bamboo homes and thatched roofs with flat-roofed glass and concrete structures and materials like G.I sheets, PVC pipes and concrete.

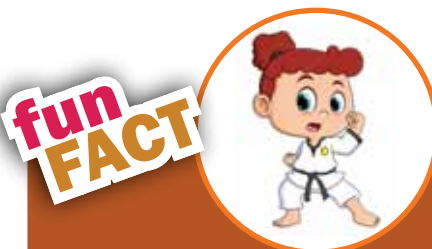
Madhya Pradesh Shows The Way

Reversing this damage calls for a radical shift in government policy, as the Madhya Pradesh government has demonstrated. After consulting with the tourism board and a number of experts, the government amended their agri-tourism policy to explicitly mention that subsidies will be given only to those who use vernacular and natural materials and techniques of building in their structures. While this is a noteworthy step in the right direction, the efficacy of this policy will rest on how well it is publicised among the masses.

Beyond aesthetics of cement homes, there is a larger issue at stake - the longer-term health and environmental consequences of living in homes built with these materials. Besides being energy intensive to construct with, even after being built, cement homes are not in the least energy efficient. In summers, when it is scorching outside, they get even hotter indoors, and in winter, they get colder indoors, thrusting a heavy dependence on electricity for cooling and heating needs.

In contrast, an indoor temperature of 20-25 degrees is easily achieved in summers with well-designed mud homes, thus eliminating the need for energy-guzzling air conditioners. Cement homes don't come close to vernacular structures in their ability to withstand disasters. They are constantly leaching toxic fumes into our homes, putting the health of our families and future generations at risk.

This will spur a natural building movement at the village level. It shall preserve the visual cultural identity of our villages and revive traditional building skills and knowledge. The aesthetic appeal of these structures will attract travellers and revenue to the countryside and discourage migration of youth to the cities. Ultimately, it is natural buildings that offer a long-term solution to our problem of reducing our carbon emissions.



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FACT**

Ms Shagun is trained in combative martial arts and taught self-defense in several government girls schools. She is also a healer and enjoys traditional dancing

THE POWER OF MECHANIZATION



Farm mechanization plays a key role in improving agricultural productivity and reducing the cost of production by timely farm operations. The average farm power availability in the country is still at a low level as compared to other developing countries like China, Korea and Japan. Unlike other agricultural sectors, farm mechanization sector in India has a far more complex structural composition. It is facing various challenges

About the **AUTHOR**

Mr M. Balakrishna is Vice president (Sales, After Sales & Marketing) at Same Deutz-Fahr India (P) Ltd, handling India and the SAARC regions. He has 30 plus years of rich technological & commercial experience in the tractor business

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FACT**



**Mr Balakrishna is fond
of travelling**

related to farm machinery and equipment, technology, markets, operations, legislation, policy framework and other related areas. Land size, cropping pattern, market price of crops including Minimum Support Price (MSP), availability of labour and cost of labour are the major factors deciding the agricultural mechanization. The key challenges faced by the farm mechanization in India are as follows.

- The average farm size in India is small (1.16 ha) as compared to the European Union (14 ha) and the United States (170 ha). Therefore, there will be little mechanization unless machines appropriate for small holdings are made available.

- Mechanizing small and noncontiguous group of small farms is against 'economies of scale' especially for operations like land preparation and harvesting. With continued shrinkage in average farm size, more farms will fall into the adverse category, by making individual ownership of agricultural machinery more uneconomical.

- The major constraint of increasing agricultural production and productivity is the inadequacy of farm power to assure timeliness and quality in field operations.

- Matching equipment for tractors, power tillers and other prime movers are either not available or farmers make inappropriate selection in the absence of proper guidance, resulting in fuel wastage and high cost of production.

- Almost 90 % of tractors are sold in India with the assistance of some financial institution. Sale of farm machinery is driven by factors like financial support, limit of funding, funding/financing institution and the applicant's profile.

- The high cost and energy efficient farm machinery are capital intensive, and unaffordable for most farmers.

- Cropping pattern decides the extent of mechanization required for timely operations and achieving optimum results. The scope of mechanization increases with intensive cropping pattern. Price realized by the crop is also an important factor, as it indicates the cash in hand for

the farmer.

- Hill agriculture, which covers about 20 % of cultivated land, has little access to mechanization. This situation has to be improved by developing and promoting package of technology for mechanization of hill agriculture to achieve higher productivity.

- There are wide technology gaps in meeting the needs of various cropping systems and regions. The Indian farmers have limited access to the latest equipment and technology. 10. The quality of farm implements and machinery manufactured by small scale industries is generally not of desired standard resulting in poor-quality work, longer down time, low output and high operational cost. The quality of equipment has to be improved.

- The after sales service of farm machinery is the other concern in India as the majority of farmers are cost conscious. There are inadequate service centers for proper upkeep of the machinery.

- The farm machineries have large turning radius and require comparatively larger farm for economical use. Mechanization may lead to structural change in agriculture in respect of the occupational distribution in the rural economy. Increasing farm mechanization is going to increase employment in secondary

Unlike other agricultural sectors, farm mechanization sector in India has a far more complex structural composition. It is facing various challenges related to farm machinery and equipment, technology, markets, operations, legislation, policy framework and other related areas

and tertiary sectors but it does displace labour in farm operations.

- Lack of proper knowledge of farmer to purchase farm machinery, operate and maintain it properly leads to wrong choice, makes it uneconomical and risky too.

- There is great shortage of diesel that causes to use extensive oil based farm machinery in an economical way.

- Due to the seasonal activities of the agriculture, the farm machinery remains idle for much of the time.

Hence, idle machineries should put in proper alternate use in the off-season.

Priority areas for Indian agricultural mechanization

- Intensification of R & D to introduce energy efficient machines for relatively un-mechanized crops such as cotton, sugarcane, oil seeds, pulses, vegetables & fruits.

- Intensify research in the area of tractor design engineering due to their extensive use in Indian farming. India is now the largest tractor manufacturer in the world. TMA needs to be involved in this task.

- Farm machinery management research to find out use patterns, annual usage, breakdown frequencies, repair & maintenance cost and above all reliability.

- Research on safety, comfort, exhaust emissions and health hazards in the use of mechanical power sources and machines needs to be expedited.

- Emphasis be laid on conservation farming and energy saving tools and machines.

- An area of utmost importance from environmental point of view is proper utilization of about 540 million tonnes of crop residues available in India. Punjab alone has 10 million tonnes paddy straw which is mostly burnt. Burning needs to be banned. Appropriate machines for incorporation of residues into the soil, for mulching, for collection, handling & transport for briquetting, gasification, power generation, and/or allied usage is a priority area in the field of mechanization.

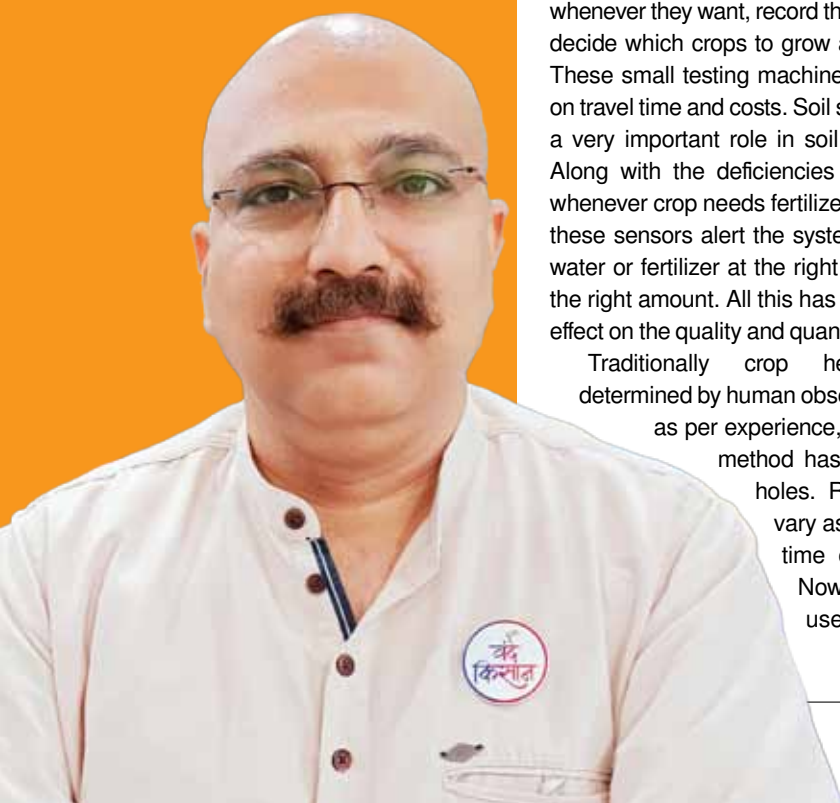


TECH IS KING

BY 2030, INDIAN FARMERS WILL REACH THE WORLD'S HIGHEST LEVEL OF TECHNOLOGY USE

About the AUTHOR

Mr Prasad Kulkarni is founder of Adrise India, a technology driven company working for increasing farmers income by offering the right skills and funding support



The use of technology will not make labour job less. If labour start upskilling themselves, they will get job which will help them to reduce their physical efforts as well. Let's see exactly what technologies are available for farmers and what kind of difference they are making on farmers' life.

Monitoring of Crop and Soil

The healthier and stronger the soil, it's better for the production. But to understand the healthiness of soil, testing is necessary even to understand at least NPK. There are government and private centres for soil testing. Now small and handy instruments for soil testings are available that allow farmers to test their soil on their own whenever they want, record the data it and decide which crops to grow accordingly. These small testing machines also save on travel time and costs. Soil sensor plays a very important role in soil monitoring. Along with the deficiencies in the soil, whenever crop needs fertilizer and water, these sensors alert the system and gets water or fertilizer at the right time and in the right amount. All this has a very good effect on the quality and quantity of crops.

Traditionally crop health was determined by human observation and as per experience, though this method has many loop holes. Results may vary as per expert, time of visit etc. Now, we can use drones



to capture aerial image data, and train computer vision models to use this for intelligent monitoring of crop and soil conditions.

Visual sensing AI can analyse and interpret this data to track crop health, make accurate yield predictions and detect crop malnutrition much faster than humans. AI models can inform farmers of specific problem areas so that they can take immediate action.

Finding bugs and Spraying

Spraying is majorly two types. One is as per schedule which is preventive and second one is per need. Through automation both the sprayings are made effective which saves on time cost and pesticides. Instead of just spraying randomly or across the farms, drones are used to understand the deficiencies, density of bugs, pests, fungus and accordingly spraying is done.

Similarly, in second case, where we take the action as per need, the system first set up a sticky trap to capture different species of flying insect and collect real-

time images. Then based on the detection further action of spraying is done. Because of right system can identify bees, flies, mosquitoes, moths, chafers, and fruit flies with good accuracy.

The future of AI monitoring the health of our food systems is promising. Not only can it reduce labour inefficiencies, but it can do so without sacrificing reliability of the observations.

Fruits & Vegetables: Ripeness, Disease Detection

For the export purpose, many characteristics including size, shape, firmness colour, fruit flavour, sweetness, etc plays major role. For all these characteristics of high value fruits & vegetable, the timing of harvesting is one of critical factor. To monitor such actions AI is very helpful. High definition multiple camera set-up is used in the farm and in certain intervals, clicked images processed, compared and reports get generated for taking further action.

Grading and Packaging

Grading and packaging of produce requires a large amount of labour, fortunately now a day's women's self-help groups are often



fun FACT

Youtube is my best stress buster. Listening to songs from Bengali and Tamil, which I don't understand but love to listen and get refreshed

available for this work. Therefore, adding technology to these women will speed up and improve the work. Grading of fruit or vegetables by size, Colour, quality etc used to be a manual job. Because of automation & AI the process of grading fruits or similar products grading is done with high speed and with accuracy. Similarly, packaging is done in different sizes and weights according to its destination place.

Livestock Counting & Health Monitoring

Livestock monitoring involves transportation, loading or unloading of animals, animal detection & livestock counts across multiple

locations. The use of high-resolution cameras and computer vision algorithms monitor cattle health and behaviour. There is also physical tagging. So instead of physical supervision of cattle's, this skilled labour-oriented job can be made on automation.

The advance features to detect disease, monitoring for skin, identify unusual behaviour, and monitor significant activities such as giving birth. The algorithms are trained to understand the video data and determine what the battles or chickens are up to. This also takes care if the consuming right quantity of food, drinking sufficient water, there sleeping habits or doing something odd that may indicate some disease or behavioural problems.

Farmers or farm owners can chase the reports and take the action accordingly instead of chasing labours. These all notifications and reports come on real time basis.

Future Of AI In Agriculture

The future of AI in farming largely depends on the adoption of AI solutions. Although some large-scale researches are in progress and some applications are already in the market, yet industry in agriculture is underserved. Moreover, creating predictive solutions to solve a real challenge faced by farmers in farming is still in progress at an early stage.

Online Skill Development tools

Education is most powerful tool to transform the society and farmers are not exception for it. Visual learning platforms like 'Vande Kisan' are offering variety of skill development programs for the farmers. As these courses are developed with the collaboration of national and international agriculture universities and agriculture experts, these are recognised and scientifically designed. As all programs are available on mobile app, which offer freedom of learning to the farmers. Farmers can learn, upskill there relevant courses as per their own convenience and pace. Digital platform saves money and energy of the farmers.

Visual learning platforms like 'Vande Kisan' are offering variety of skill development programs for the farmers. Farmers can learn, up-skill their relevant courses as per their own convenience and pace



OPPORTUNITIES & CHALLENGES

AUTOMATION IN INDIA'S COLD CHAIN SECTOR

Over the past two years, India's demand for fresh produce and perishable food items has grown, increasing the requirement for cold chain transportation to deliver goods across the country. Around 45% of the food produced in India is lost as a result of ineffective supply chains. Investments in the cold chain industry and automation technology can help create a smart logistical infrastructure that can improve material handling by reducing wastage.

India's Cold Chain Industry

During the projected period of 2020–2025, the Indian cold chain logistics market is anticipated to expand at a CAGR of more than 14%. The expansion of industries like organised retail, processed food, medicines, expanding interest in horticulture and milk processing industry etc has increased the demand for cold chain.

The dairy industry in India has the most advanced cold chain of any product category. With more than one-fifth share of the world's milk output, India is both the greatest producer and consumer of dairy products. The market surplus milk in India is processed into dairy products which the government of India wants to double by 2025.

The cold chain segments have lately come into the foreground as a result of the expansion of organised 3PLs, QSRs, retail, e-commerce, and the food

India's cold chain business is fragmented, and to cover the complete value chain from procurement to transportation in refrigerated trucks to retail outlets in cities, significant investment will be needed to establish technology-enabled cold storage facilities

service sectors that are fuelled by shifting consumer habits. In order to effectively manage the supply chains, companies must establish a strong cold chain infrastructure since consumers today expect a wide range of fresh produce, including fruits, vegetables, dairy goods, meat, and poultry items. The investments in the agri-tech sector will undoubtedly revitalize the entire industry and change India's farming practices from conventional farming to automated farming solutions supported by technology. Godrej Körber is

automating India's Cold Chain storage facilities by introducing special high-density storage-based ASRS solutions both stacker crane based as well as shuttles based.

Opportunities & Government Initiatives

To overcome the supply gap in the cold chain infrastructure, several initiatives are being taken by the government, including funding and support. For instance, the government scheme 'Integrated Cold Chain & Value Addition Infrastructure' aims to offer seamlessly integrated facilities for the cold chain, preservation, and value addition from the farm gate to the customer. The scheme enables a well-equipped supply chain and cold chain that connects producers with food processors and the market.

A program was initiated in 2014 by the Ministry of Agriculture under the name 'Mission for Integrated Development for Horticulture', which placed a high priority on cold-chain development. The Ministry of Food Processing Indus-

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tries (MoFPI) has launched a program titled 'Scheme on cold chain, value addition & preservation infrastructure that is specifically for cold chains. The Mega Food Park Scheme and the government's plans to double the milk processing output i.e. from 53.5 million tons to 108 million tons by 2025 will give a big boost to the cold chain segment.

Cold Storage Facilities At 30 Airports

Recently, the PM launched the National Logistics Policy wherein it was mentioned that India has built Cold Storage facilities at 30 airports across India. This will increase the competitiveness of Indian products in both the domestic as well as international markets. Godrej Körber is targeting 25% revenue from the cold chain market by 2025. The National Logistics Policy is expected to bring down the logistics cost, which is as high as 14-15 per cent of India's GDP, to around 8 per cent of GDP in the next five years. Moreover, 35 multi-modal logistics hubs are being established across India. The Indian government has finally permitted 100% FDI in the cold chain sector to provide global exposure to the cold chain businesses and to support the unhindered expansion of the industry's infrastructure.

Modern Automation Technologies in India's Cold Chain sector

End-to-end Automation

Automation in warehouses is increasingly being adopted as the best way to improve reliability and efficiency in material handling while meeting the ever-increasing expectations of end customers.

Warehouse Management

Modern warehouse management solutions automate crucial steps from receiving, storing, and picking up items to filling outbound shipping orders thereby, increasing supply chain efficiency.

Challenges

Cold chain industries in India are underdeveloped in terms of intralogistics auto-



mation and still rely on the manual material handling approach, which reduces cost-effectiveness for the producers and the owners. In order to increase storage capacity and achieve optimal space usage, intralogistics automation technologies including ASRS systems, shuttles systems, Conveyors, and Layer Picker solutions provide efficient and faster material handling performance.

High Energy Consumption Cost

Cold chain logistics have more complex needs, higher investment costs, and higher energy consumption than ambient temperature logistics. As opposed to Rs 3000 per cubic meter per year in the West, operating costs for the cold storage industry in India are roughly Rs 4500-5000 per cubic meter per year. Compared to 10% in the West, energy costs

account for around 30% of the overall costs for the cold storage business in India. These elements raise the entry hurdle for the cold storage construction industry.

Lack of Logistical Support

Automated cold stores may include automated storage, such as pallet AS/RS systems Pallet shuttle systems, conveyor and AGV systems for internal material movement, picking and sorting systems a robust Warehouse Control System and Warehouse Management Systems (WMS). India's cold chain business is fragmented, and to cover the complete value chain from procurement to transportation in refrigerated trucks to retail outlets in cities, significant investment will be needed to establish technology-enabled cold storage facilities.

AGRI SECTOR NEEDS DIGITAL ADOPTION

IMPORTANCE OF TECHNOLOGICAL AND FINANCIAL SUPPORT TO FARMERS

Small or marginal farmers make up the bulk of the Indian agricultural economy, with more than half of the entire population either directly or indirectly dependent on the rural trade.

India's agricultural growth over the past decades can be seen in many areas – the second largest horticultural production in the world; the highest milk production in the world, witnessing twelve-fold growth; the second largest fish production in the world. India is now a net exporter and its agricultural production is over 40 percent higher than that of the US.

But today's farmers are realising that agriculture goes beyond tilling the soil and cultivation of crops. In order to reach its full potential, the agricultural sector in India needs digital adoption.

Taking cognizance of the same, Indi-



an government has initiated a digital agriculture mission (2021-2025) for projects based on new technologies like artificial

intelligence, blockchain, remote sensing and GIS technology, use of drones and robots among others. Technology in ag-



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riculture in different aspects such as the application of herbicides, pesticides, fertilisers, and for improving seeds for better yield is making deep inroads.

Use Of Sensors And GPS

The use of sensors and GPS can help farmers analyse their crops and make decisions at a micro level to reduce environmental damage and conserve resources. Tractors that are equipped with GPS technology can align themselves automatically to the best locations, leading to better implantation of seeds and reduction of wastage. Using sensors, farmers can also create a digital fertility map of their lands, which can then be used to guide variable rate technology fertiliser applicators. These sensors can also help assess the moisture content and temperature of the soil which could help farmers determine irrigation requirements.

But small scale farmers face both internal and external challenges due to lack of knowledge of technology as far as the adoption of modern agricultural technologies is concerned.

Other than that, modern agri based technology provides a wide range of solutions for the industry such as crop stress detection, pathogen detection, and monitoring. As the world races toward quantum computing, AI, big data, and other new technologies, India has a tremendous opportunity to reap the advantage of being an IT giant and revolutionise the farming sector. In order to achieve that, farmers of tomorrow must be given technical or vocational training for the sake of themselves and the greater agricultural economy at large.

Through such training and education farmers can better understand their assets and make use of them efficiently and sustainably.

Access To Finance

Apart from technology, another challenge that marginal farmers face is access to finance. Since agriculture as an industry in India is largely unorganised and complex, it suffers from a lack of transparency



Today's farmers are realising that agriculture goes beyond tilling the soil and cultivation of crops. In order to reach its full potential, the agricultural sector in India needs digital adoption

in the value chain. Due to lack of credible data, organised banking, financial services and insurance (BFSI) institutions find it impossible to assess the creditworthiness of farmers and are often hesitant to offer farm credits and insurance products to them.

Introduction of technology in the form of agricultural supply chain can streamline the process and improve coordination between various stakeholders. The emerging Agri commodities and trade finance platforms create a transparent ecosystem with disintermediation and price discovery. Farmers can then make informed decisions about whether to sell or store their produce and when and where and what price to sell it.

In contrast to the traditional setup, the modern agricultural supply chain also provides seamless transactions where digital payments help in instant transfer from the buyer to the seller.

Way ahead

There is no doubt that sustainable and climate-resilient technologies are the need of the hour. In the coming years, establishing a digital ecosystem of agriculture needs to take a long-term view of aspects like interoperability, data governance, data quality, security and privacy. Improved technological advancements will give the farmers complete control over their agricultural produce, sale, and revenue; ruling out any traditional intermediaries thereby facilitating frictionless supply chain management.

It is safe to say, just as the green revolution led to an increase in agricultural production, the IT revolution in Indian farming could be the next big step.



Mr Dutta likes to travel, listen to music and watch field sports

FEASIBILITY OF DRONES IN INDIAN AGRICULTURE

Drone technology will drive the Indian agriculture to new heights. It can perform several agricultural activities like irrigation, crop health monitoring, livestock tracking, geo fencing, planting, chemical spray and soil analysis, etc. and help the farmers in optimizing the productivity and profitability by reducing time and labour cost, increasing the efficiency of inputs. Despite these benefits there are some limitations like high initial cost, requirement of skilled person, weather dependency, small land holding of farmers and some legal formalities which are hurdle for its adoption at large scale. Department of Agriculture and Farmer's Welfare, Government of India subsidize agricultural drone procurement upto 100 % to promote its use in agriculture sector. Drones are an emerging component of precision farming and have various uses.

Irrigation: In traditional method of irrigation (flooding) 300 to 500 liter water requires for one hectare land while drone require only 25 liter water. Multi-sensors of drones identify dry or waterlogged area, which helps to save water up to 90%. In flooding method, it takes approx. 7 hours for one hectare. Tractor mounted sprayer takes two hours, while drone can irrigate the same land in only 25 minutes.

Crop health monitoring : Manually monitoring is time consuming and there is space for human error. Sensors fitted in drones can detect even minute sign of pest and provide accurate data regarding the extent of attack that helps farmers to take timely intervention and claim insurance. Satellite image is very costly and not as effective in many cases as a

In agriculture, drones open new possibilities to increase yield of crop. It is known to achieve precision agriculture. High initial costs and government clearance are obstacles to make it popular and farmer-friendly. Despite these limitations, the technology is rapidly expanding in the agriculture sector

closer drone image.

Livestock tracking: Drone installed with thermal sensor can find lost animals and also detect a wound. Therefore, it is very useful in dairy farming.

Geo-fencing: The drone with thermal cameras can detect animals or human beings and guard the fields from external damage especially at night.

Weather forecast: Drones can forecast upcoming weather conditions, which is of great use to farmers.

Planting: Drone equipped with planting devices fires seed pods into the soil and make planting easy even in hilly or

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terrain area. This technology reduces costs by almost 85% and also increases consistency and efficiency.

Chemical spray: Drones recognize infestation in each pocket of land and spray accordingly, which saves chemicals up to 30- 40%.

Soil analysis: Agricultural drones mounted with sensors can evaluate the moisture content of soil, terrain conditions and fertility of the soil.

Challenges In Adoption

Small land holding: Small land-holdings are the major constraint for farmers, as mechanization in small or fragmented area is very difficult.

Diversified farming system: Currently, the thrust is on diversified farming systems. But drone technology is most effective when crops are planted in large monocultural patterns.

Weather dependent: Under extreme weather conditions like fast winds or heavy rain, it is difficult to use drones.

Connectivity issue: Poor internet connectivity in rural stretches.

Lack of skills: Average farmers struggle to understand drone functions. They remain dependent on an experienced person.

Short flight time: Drones that have a longer flight time can monitor a longer area, but are relatively more expensive.

Multi-sensors of drones identify dry or waterlogged areas, which helps to save water up to 90%. Drone can irrigate one hectare in only 25 minutes

High cost of good features drone: Drones with a better design and features are expensive. The price varies from Rs 3 lakh to 10 lakh.

Chance of accident: The drone uses same airspace as commercial aircraft. If for any reason the operator loses control on drone it may interfere with manned aircraft and cause accidents.

Legal problems: Farmer jitters when they hear about some rule and regulation in order to use it.

Drone technology has great potential to transform Indian agriculture by managing field and resources in a more sustainable way. It is undoubtedly the future of the Indian agrarian community. But in present scenario, farmers inevitably need comprehensive training.

To make application of drone operation easier in agriculture sector, Ministry of Civil Aviation allowed drone operation

through conditional exemption routes and published 'Drone Rules 2021' to regulate the uses of drones. The Ministry of Agriculture and Farmers Welfare also published Standard Operating Procedures for spraying of pesticides and plant nutrient through the drone. For smooth purchase of drone, GOI provides financial assistance to various organizations which will be available till 31st March 2023.

- 100 % of cost or up to Rs 10 lakh to the Farm Machinery Training & Testing Institutes, Institutions of ICAR, KVK, SAUs etc.
- 75% for purchase of drones to Farmers Producers Organizations (FPOs).
- 50% of the cost or maximum Rs 5 lakhs to agriculture graduates who establishing CHCs.
- 40% of cost or up to Rs 4 lakhs to existing and new Custom Hiring Centers under Cooperative Society of Farmers, Farmers Producer Organizations (FPOs) and Rural entrepreneurs.
- If implementing agencies hire drone for demonstration from custom hiring center, Hi-Tech Hub drone manufacturer will receive contingency of Rs. 6000 per hectare. But for buying drones, the implementing agencies will receive only Rs. 3000 per hectare.



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