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AGRITECH IN INDIA: AN OVERVIEW

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Agriculture is the primary source of income for almost 58% of India's population. Due to its enormous potential for value addition, particularly within the food processing industry, the Indian food industry is poised for huge expansion, increasing its contribution to the global food trade every year. One of the largest sectors in India, food processing contributes 32% of the nation's total food market and is rated fifth in terms of production, consumption, export, and expected growth. The Government of India is launching a new AGRI-UDAAN initiative to mentor start-ups and help them connect with potential investors in order to foster innovation and entrepreneurship in farming.

Due to its enormous range of agro-ecological diversity, India is considered to as a worldwide agricultural powerhouse. India's agriculture sector, which contributes approximately 16% of GDP and employs 44% of the labour force there, makes a considerable economic contribution to the nation. India is one of the top 15 exporters of agricultural goods worldwide. According to an Ernst & Young Survey, India's agri-tech startups represent a USD 24 billion opportunity, yet the market is still mostly untapped (with 1.5% penetration). The Agri-tech sector has been given priority by the Indian government, which has been working towards a comprehensive approach to sustainable development. Around 86.2% of all farmers in India are small or marginal farmers who continue to use outdated, unscientific farming practises. The agritech players in this region not only established new financial channels but also enhanced yields through data, real-time crop monitoring, analytics, digitisation, crop and soil health, and weather forecasts for better strategies, ultimately leading to more profitability and less waste.

The increasing demand for agri-tech products in India and the rest of the world makes it one of the most important pillars for creating a sustainable future. According to the Economic Report of India 2022–23, the country's agricultural industry has increased by 4.6% during the previous six years, and more than 1000 agri-tech start–ups have entered the market. Building a strong agri-tech sector depends in large part on the development of infrastructure. There are already more than 1,300 start-ups addressing the untapped potential of the agri-tech area as a result of the growth of transformative technological solutions in the agriculture industry. India will get the third-highest number of agri-tech investments globally until 2021, totalling over USD 1.6 billion. Neglecting technology in the agriculture sector is not a prudent move in the current technological era. The importance and difficulties of agri-tech in India must therefore be re - evaluated quickly.

Technology Play in Agricultural Changes

- **Drones:** Unmanned aerial vehicles (UAVs), commonly referred to as drones, have the potential to drastically change agriculture and bring about a number of changes. Aerial sowing, pesticide treatment, and remote data collection for study are just a few uses for drones.

- **Biotechnology:** Crops with higher yields, resistance to pests and diseases, and drought have all been developed using biotechnology. As a result, there has been a rise in productivity, a decline in crop loss, and an improvement in crop quality.

- **Food processing and preservation:** Due to technology, food processing and preservation methods have been developed that make food safe and have a longer shelf life. As a result, there is less food waste and crops may be transported and stored more effectively.

- **Market Access:** Due to technology, farmers now have improved access to both domestic and foreign markets. Farmers can now interact with customers and sell their goods directly, eliminating intermediaries and increasing earnings through the use of technology and e-commerce.

- **Agri-start-ups:** By integrating cutting-edge technology and modern farming methods, agri tech start-ups can significantly contribute to agricultural reforms. Agri tech start-ups can aid in agricultural transformations by enhancing farming methods, increasing productivity, increasing access to capital, etc.

- **Precision agriculture:** Crops, soil, and weather conditions are monitored using technology such as GPS, drones, and sensors. As a result, farmers can make data-driven decisions and manage resources like water and fertilizers more effectively.

- **Farm machinery:** Mechanization has been important in increasing the agricultural sector's productivity. Tractors, harvesters, and seed drills are just a few examples of the cutting-edge agricultural equipment that has helped farmers become more productive and spend less on labour.

Why are Agritech Startups Needed in India?

Farmers today encounter several difficulties in trying to make a living from farming. Indian farmers are growing increasingly concerned about fraud in the unorganised agricultural marketplaces and the lack of regulated marketing mechanisms for produce. They also have to face with inadequate storage and transportation options, among other issues. Because they have limited access to cutting-edge technologies, they are vulnerable and on their own without timely information and agricultural solutions.

Startups in the agritech sector have the ability to address these issues right away and consequently transform Indian agriculture. They are the shining knights of Indian agriculture.

Initiatives by Indian Government for Agritech

The Indian government has introduced Digital India to address these problems. In short, Digital India is a platform for offering the Indian people a various services via digitally enabled devices. It includes offering services over the internet via computers, phones, etc. The goal of digital India in the farming sector is to offer farmers in rural and urban areas digital access to government services. The benefits of digital India for Indian agriculture have been both predicted and demonstrated.

- **National Agriculture Market (e-NAM):** It offers a national e-marketing platform and supports the development of infrastructure to enable e-marketing. The improved price discovery provided by this cutting-edge market technique is transforming the agriculture markets. As we move towards a "One Nation One Market," it encourages competition and transparency to help farmers receive better compensation for their produce. The fact that farmers, merchants, and commission agents all face related problems makes it difficult for e-nam to expand nationally.

- **National Mission for Sustainable Agriculture (NMSA):** With the goal of increasing agricultural production through the adoption of sustainable technologies.
- **Community Radio (CR):** Using radio station facilities, Community Radio meets the information needs of farmers.
- **National e-Governance Plan in Agriculture (NeGPA):** For supporting cutting-edge technologies like blockchain, drones, and ML.
- **Digital Green:** It is another fantastic programme that uses films to disseminate agricultural information.
- **e-sagu:** One of the most recent digital initiatives offers advice from experts to farmers. Farmers are routinely advised about the many methods to boost agriculture productivity using the internet and audio-visual communication facilities.

Other programmes implemented as part of the Digital India initiative provide farmers with information on funding sources, the availability of warehouses, government subsidies, soil testing and irrigation facilities, preventive measures for droughts and floods, complaint redressal facilities, and many other similar services. The Digital India program's various initiatives have all assisted Indian farmers in raising their productivity levels and profit margins. The Indian government has also launched a lot of other programmes to assist the farmers.

Business Models in India's Agritech Sector

The following categories can be used to categorize business models in the agritech sector:

1. **Margin-based business model:** This model is used to operate segments such market linkage - farm inputs, supply chain technology, and output market linkage. The agritech player makes a profit by establishing market connections at the input or output side of the marketplace and by delivering the promised services.
2. **Subscription-based business model:** Agritech players in industries like precision agriculture, farm management, quality management, and traceability provide a mix of hardware, software, and services-based solutions all year long and charge their clients on a monthly or annual subscription basis.
3. **Transaction-based business model:** Based on the volume of loans or insurance policies provided, this model is used by agritech businesses operating in the financial services sector.

The agricultural sector is actually very promising for the digital India project. Farmers who lack access to such services should receive digital agricultural infrastructure and literacy from the Indian government. Farmers should provide feedback on a regular basis to determine whether the project is beneficial to them. To improve the facilities, farmers should be encouraged to offer ideas and proposals. The government is making a lot of efforts to ensure that all farmers can use the services provided by digital India. And very soon, the Agriculture sector will see the huge success of the digital India project!

How Agritech Boosts Agricultural Efficiency and Productivity in India

Agritech is generally used to describe an ecosystem of firms and startup ventures that are leveraging technological improvements to offer goods or services for boosting production, efficiency - both in terms of time and cost, and profitability for farmers across the agriculture value chain. The several agritech industry segments that support the full value chain include:

- Farming as a service: Agricultural machinery for rent on a pay-per-use basis.
- Farm inputs are linked to the market through physical infrastructure and a digital marketplace.
- Using geospatial or weather data, IOT, sensors, robotics, etc. to increase production; farm management solutions for resource and field management, etc. are examples of precision agriculture and farm management.
- Agricultural automation that uses machines, tools, and robots for planting, handling raw materials, harvesting, etc.
- Financial services: Loan facilities for input purchase, equipment, etc. as well as insurance or reinsurance of crop.
- Farm infrastructure includes farming techniques including drip irrigation, indoor-outdoor farming, greenhouse systems, and environmental controls like heating and ventilation.
- Produce monitoring, quality control and analysis, and traceability during storage and transit are all part of quality management.
- Linking the market for farm product and the supply chain requires a physical infrastructure and digital platform to manage the post-harvest supply chain.

Some Examples of How This Can Be Achieved Are

- The yield can be increased by up to 30% using precision agriculture.
- Adding quality control and traceability will enable farmers to produce higher-quality product and will encourage them to keep using current techniques.
- By removing inefficiencies, such as excessive farm produce wastage, from the post-harvest supply chain, it will be easier to connect output markets, which will benefit both farmers and consumers.
- The current problems associated with input price volatility and inadequate input selection can be resolved by enabling input market linkages supported by a strong physical infrastructure network.
- Farm management can increase operational efficiencies and reduce expenses by digitalizing documents.

Challenges with Agritech in India

- **High initial costs:** Many agri-tech solutions demand significant initial cost, which can be a main barrier for small-scale farmers who may not have the finances to invest.
- **Poorly formulated government policies:** The success of the government's agri-tech promotion policies and programmes is frequently hampered by their inadequacy, consistency, or poor implementation.
- **Absence of cooperation:** Lack of cooperation among stakeholders, such as farmers, businesses, and the government, may hinder the creation and implementation of efficient agritech solutions.
- **Confined market access:** Farmers may encounter difficulties accessing markets to sell their produce even if they use agri-tech solutions because of a lack of market connections and insufficient market expertise.
- **Unconsolidated land holdings:** Due to their small and distributed land holdings, the majority of Indian farmers find it challenging to use more affordable large-scale mechanized techniques.
- **Problem with drone regulation:** Since aerial vehicles are outfitted with advanced sensors and cameras, privacy is a big issue that hangs over the future of this sector.
- **Lack of infrastructure:** The adoption and efficacy of agri-tech solutions may be hampered by the lack of essential infrastructure, such as electricity and network connectivity.

- **Lack of digital literacy:** Despite India's advancements in digitalization, many farmers there lack access to technology and digital literacy, making it difficult for them to implement agri-tech solutions.

What Should Be

- **Encourage training and education:** Farmers, researchers, and other stakeholders should have access to agricultural education and training. In addition to facilitating the transfer of knowledge, this can assist in promoting the adoption of new technologies and practises.

- **Drone regulation reform:** To protect people's privacy and safety, drone regulation is a critical problem that needs to be carefully considered. A clear and uniform set of regulations, the implementation of privacy laws, and other measures are some ways to enhance regulation.

- **Increase technological access:** In India, small farmers sometimes lack access to cutting-edge equipment for crop management, automation, and irrigation. Research organisations should be focused on developing technologies that are accessible and affordable that can increase agricultural productivity.

- **Promote the use of modern technology:** The government should promote the use of modern technology in agriculture. This can be accomplished by offering financial aid and subsidies to encourage the purchase and use of latest devices and techniques.

- **Encourage farmer-centric research:** Research in agriculture should emphasis on the requirements and concerns of farmers. To create technologies and procedures that are appropriate for local conditions, scientists and farmers should collaborate closely.

Role of Technologies in Agritech

By minimising production waste, decreasing carbon footprint, and increasing agricultural productivity, technologies like artificial intelligence, machine learning, and blockchain are helping to improve agricultural and food production and improve sustainable development. According to a MarketsAndMarkets tech forecast survey, the AI in agriculture market is expected to reach $4 Bn by 2026.

1. Artificial Intelligence

Recently, artificial intelligence has shown that it can replicate human intelligence and increase agricultural productivity by streamlining tasks that are more important to stakeholder

interests than others, such as monitoring soil quality, managing pests and diseases in crops, standardising food quality, offering crucial procurement insights, and minimising labour. Farmers and businesses are using artificial intelligence to relieve the strain of discovering faults and redirect their efforts to other parts of agricultural and procurement operations.

AI is revolutionising the agritech industry in several ways:

- **Quality control:** To help reduce waste and enhance, monitor, and manage the quality of food from farm to fork, AI-powered cameras and sensors are automating crop inspection, real-time quality monitoring, and data traceability.
- **Supply chain management:** AI has the potential to increase supply chain efficiency through trustworthy transactions, improve data transparency, lower the risk of product spoiling, and optimise logistics and transportation.
- **Automation:** Automating labor-intensive activities like harvesting and cutting with AI-powered robots and drones can increase efficiency and lower expenses.
- **Predictive Maintenance:** Applications of AI have been useful in anticipating the repair of post-harvest machinery, minimising downtime, and extending its shelf life.
- **Predictive modelling:** AI can help farmers optimise their operations and enhance harvests by forecasting crop yields, detecting disease outbreaks, and determining the ideal time to harvest.

2. Regenerative Agriculture

Regenerative agriculture is an all-encompassing approach to farming that puts soil health first by restocking and strengthening resources rather than depleting them. Intercropping, providing various soil nutrients, crop rotation, cover crops, and reducing the use of synthetic fertilisers are some techniques that can help with this.

Regenerative agriculture will revolutionise the agritech business in various ways by 2023, because of increasing farmer interest:

- **Soil Health:** Regenerative agriculture focuses on enhancing the health of the soil and its capacity to absorb nutrients and water, which can result in higher crop yields and increased resistance to environmental stressors like drought.
- **Reduced use of synthetic chemicals:** By encouraging the use of natural inputs like compost, mulch, and cover crops while using fewer synthetic chemicals, this type of

modern farming helps to improve the overall health of the soil, lessen its negative effects on the environment, and enhance the quality and safety of the harvested goods.

3. Internet of Things

The use of Internet of Things (IoT) devices in agriculture is focused on the effective measurement and monitoring of data, such as soil health, food's chemical and physical composition, equipment efficiency, supplier analytics, and meteorological conditions.

Precision agriculture is one of the most significant applications of the IoT, which is revolutionising agritech. Data on variables like soil moisture, temperature, and nutrient levels, as well as crop growth and health, can be recorded using IoT-enabled devices like sensors, drones, and cameras

4. Blockchain Technology

With the increasing demand for traceability, data management, food safety, and supply chain transparency in the global food ecosystem, blockchain, a revolutionary technology that has recently upended global food chains, will continue to strengthen the dynamics of agro commerce.

Blockchain has the potential to revolutionise Agri trade while maintaining food safety and quality norms, from securing the validity of data to confirming the origins of produce and tracking transactions. According to MarketWatch's estimate for 2023, the technology is expected to expand at a significant rate as a result of a number of industry leaders implementing smart agriculture tactics.

Conclusion

The country currently needs agritech startups. More and more entrepreneurs are starting organisations in this area, recognizing the chance to revolutionize the market. These firms are receiving support from government programmes as well, making it easier for them to attract investors. Farmers may now embrace this new approach and look forward to higher price realisation at last. Due to the adoption of advanced technology and a supportive regulatory environment, the number of agritech firms emerging in India is rapidly increasing. This can only be viewed as the beginning of the infiltration of cutting-edge technologies like blockchain, IoT, AI, and machine learning in the Indian agricultural sector. The agriculture

industry, which is largely dependent on erratic meteorological circumstances, is greatly aided by this collaborative technology.

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