

Innovative Solutions for Agri-Food: Transforming Agriculture through Digital Technologies

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Abstract

The adoption of digital technologies in agriculture can play a crucial role in transforming the Indian agricultural sector, particularly for small and marginal farmers. By increasing productivity, reducing costs, and improving access to markets and services, digital technologies can help farmers improve their livelihoods and contribute to the overall growth of the agricultural industry. However, to fully realize the benefits of these technologies, it is important to address the challenges of lack of access to technology and digital infrastructure, as well as the lack of understanding and education about these technologies among farmers. The government, along with private sector organizations and agritech startups, should work together to create programs that educate and support farmers in adopting digital technologies, and to develop digital infrastructure in rural areas. By doing so, we can make the agricultural industry more sustainable, efficient, and productive, and help meet the challenge of feeding a growing population.

Keywords: *Agri-tech, India, Startups, Agriculture*

1. Introduction

The agricultural industry is a vital sector of the global economy, providing jobs for 19% of the world's population and constituting a \$2.4 trillion global industry. However, with the increasing population and changing climate, the challenge of increasing food supply significantly yet sustainably arises. In order to meet this challenge, we need to produce much more with much less, at both global and local level, and technology could become an important facilitator for this change.

The current landscape of the agricultural industry is such that developed nations have significantly increased agricultural production in comparison to developing ones, which do not have the means or information to put technology in action. Underdeveloped nations rely on agriculture for a

high portion of their GDP and employ more people than any other industry. For example, agriculture is the backbone of the Indian economy, with 58% of the population relying on it as their primary source of livelihood. However, the agricultural industry in India is facing several challenges such as low productivity, lack of access to markets, and limited access to technology. These challenges are particularly pronounced for small and marginal farmers, who constitute 86% of the farming population in India and own only 47% of the total operational landholding.

One of the major reasons for low productivity in Indian agriculture is the lack of access to technology. Despite the government's efforts to promote mechanization and the use of modern technology, a majority of farmers still rely on traditional methods of farming. This is particularly true for small and marginal farmers, who often do not have the means or the knowledge to adopt modern technologies. Digital technologies have the potential to revolutionize the way we produce and consume food, making the agricultural industry more sustainable, efficient, and productive. These technologies include precision agriculture, big data analytics, and the internet of things (IoT).

The Current Landscape of the Agricultural Industry in India

The Indian agricultural sector is facing several challenges, such as increasing population, land degradation, and climate change, which have led to a decline in productivity and profitability.

The average size of landholdings in India is only 1.08 hectares, and 86% of these are operated by small and marginal farmers, who typically have limited resources and access to technology.

Moreover, the sector is facing a shortage of skilled labor, which has led to a decline in productivity.

The government has launched several initiatives to increase productivity and profitability in the sector, such as the Pradhan Mantri Fasal Bima Yojana and the Pradhan Mantri Krishi Sinchai Yojana, but they have not been fully effective in addressing these challenges.

The Way Forward: Transforming Agriculture through Digital Technologies

Digital technologies have the potential to transform the agricultural sector in India by increasing productivity and profitability, particularly for small and marginal farmers. Digital technologies such as precision agriculture, precision irrigation, and precision livestock management can help farmers make data-driven decisions, which can increase productivity and reduce costs. Additionally, digital technologies can help farmers access market information, financial services, and other services, which can increase their income.

Precision agriculture is a farming management concept that uses technology to optimize crop yields, reduce costs, and improve the sustainability of farming. Precision agriculture technologies include sensors, drones, and satellite imagery, which can be used to collect data on soil moisture, crop health, and weather conditions. This data can be analyzed to make data-driven decisions on planting, fertilizing, and harvesting. For example, the Mahindra Agri Solutions in India uses precision agriculture to help farmers increase their crop yields by 20-30% and reduce their costs by 20-30%.

Precision irrigation is a technology that uses sensors and other tools to measure soil moisture and weather conditions, which can be used to optimize irrigation schedules. This can help farmers reduce water usage and increase crop yields. For example, in India, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is working with farmers to develop precision irrigation systems that can increase crop yields by 50% and reduce water usage by 50%.

Precision livestock management is a technology that uses sensors and other tools to monitor the health and productivity of livestock. This can help farmers reduce costs and increase productivity by identifying and treating health problems early. For example, in India, the National Dairy Development Board is

working with farmers to develop precision livestock management systems that can increase milk production by 20-30%.

Big data analytics is another key technology that can be used to improve agricultural efficiency. By collecting and analyzing large amounts of data from various sources, such as weather forecasts, market prices, and sensor readings, farmers can make more informed decisions about planting, harvesting, and marketing their crops. This can lead to improved crop yields, reduced costs, and increased profits.

The internet of things (IoT) can also play a significant role in transforming agriculture through the use of connected devices and sensors. These devices can be used to monitor crop growth and soil conditions in real-time, providing farmers with valuable information about their crops. They can also be used to control irrigation and fertilization systems, leading to more efficient use of water and other resources.

However, despite the potential benefits of digital technologies in agriculture, there are also challenges that must be addressed. One of the main challenges is the lack of access to technology and digital infrastructure in rural areas. This can limit the ability of farmers in these areas to take advantage of these technologies, and can also hinder the development of local agricultural economies.

Another challenge is the lack of understanding and education about digital technologies among farmers. Many farmers may not be familiar with the technology or may not understand how to use it effectively. This can lead to a lack of adoption and a failure to realize the full potential of these technologies.

As per Economic Survey 2022-23 Agritech startups have raised around Rs 6,600 crore over the last four years from private equity investors, witnessing a growth of over 50% per annum. According to the survey there are over 1,000 such agritech startups that are assisting farmers in improving farming techniques.

Further it added that 2023 being International Year of Millets, India has more than 500 startups "working in the millet value chains, while the Indian Institute of Millets Research has incubated 250 startups under Rashtriya Krishi Vikas Yojana –

Remunerative Approaches for Agriculture and Allied Sectors Rejuvenation (RKVYRAFTAAR)".

"This (climate-smart farming) is slowly gaining acceptance with farmers using clean energy sources like solar for irrigation. The farmers have been incentivised to transfer electricity generated through solar to the local grid. Crop yield prediction models using artificial intelligence and drones for monitoring soil and crop health have been initiated," the Survey said.

"Smart farming also enables crop diversification, which will help farmers reduce their dependence on monsoons for water. There are over 1,000 agritech start-ups in India. These assist farmers in improving farming techniques," it added.

A report released last month by investment banking firm Avendus Capital pointed out that in the first nine months of 2022, agritech space saw 30 funding rounds worth \$796 million. The report also noted that the estimated gross merchandise value (GMV) of agritech startups was \$4 billion in 2022, it is likely to grow to \$34 billion by 2027.

The Economic Survey also highlighted the 200% increase in rural internet subscriptions between 2015 and 2021, compared to 158% growth witnessed in urban areas – a trend that is reflective of "the increased impetus the government is putting to bring rural and urban digital connectivity to the same level".

"To further create digital linkages at the grassroots level and increase the consumer experience like the one in urban centres, a project for the saturation of 4G mobile services in uncovered villages across the country has been approved," .

"The project will provide 4G mobile services in 24,680 uncovered villages in remote and difficult areas, and 6,279 villages having only 2G/3G connectivity shall be upgraded to 4G," the survey added.

In addition to precision agriculture, precision irrigation, and precision livestock management, digital technologies can also help farmers access market information, financial services, and other services. For example, in India, the National Agricultural Market (e-NAM) is an online platform that allows farmers to access market information, sell

their products, and access financial services. This platform has helped farmers increase their income by 20-30%.

Conclusion

In conclusion, the adoption of digital technologies in agriculture is essential for increasing food supply sustainably and addressing the challenges facing the agricultural sector in India. The government and private sector have a crucial role to play in promoting the adoption of digital technologies in agriculture, particularly for small and marginal farmers. The government can provide infrastructure and policies to support the adoption of digital technologies, while the private sector can invest in research and development, provide training and capacity building, and provide financial resources. With the right support, digital technologies can help small and marginal farmers to improve their livelihoods and contribute to the economic and social development of India.

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