

Role of high-tech technologies in changing the dynamics of agriculture in India

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The agriculture sector forms only about 18 per cent of India's GDP despite employing almost 65 per cent of the total workforce. Despite significant improvement in food grain production, there are several challenges to tackle as the government aims to increase agricultural production as a share of GDP. Agriculture in India is largely dependent on nature, but climate and global warming issues make farming unpredictable. The need of the hour is to educate farmers in the use of modern technology and innovative approaches to increase productivity and raise profitability. Agricultural development practices over a while have been perceived to exploit natural resources faster than they could be renewed. Exponential growth in the human population has resulted in demand for food and shelter, which the "natural" carrying capacity of the land is under pressure to provide.

Natural imbalance is visible in pollution, soil

degradation, wildlife population decline, and human-created alterations of flora and fauna. It is reasonable to assume that human population growth will continue and place greater demands on the agri-ecosystem. Thus, technology has and will continue to play a major role in agriculture and sustainable development going forward.

Technology has a major role in farming and agriculture practices; and with the advent of digital technology, the scope has widened. Innovation in agriculture is leading an evolution in agricultural practices, thereby reducing losses and increasing efficiency. This is positively impacting farmers. The use of digital and analytic tools is driving continuous improvement in agriculture, and the trend is here to stay, resulting in improving crop yields and helping to increase the income of the farming community.

Improved productivity from the mechanization of agriculture: Manual labor and hand tools used in



agriculture have limitations in terms of energy and output, especially in tropical environments. Resistance to agricultural mechanization, especially among smallholder farmers due to accessibility, cost, and maintenance issues, often acts as a detrimental factor. To reduce manual labor and make processes faster, combine harvesters are finding greater use. Indian farming is characterized by small landholdings, and the need is to partner with others to take advantage of modern machines. Capacity building of farmers through hand-holding, making modern machines available especially to small farms, and tackling affordability issues through policy will lead to greater adoption of mechanization services going forward. Agricultural mechanization has the potential to, directly and indirectly; affect yields through a reduction in post-harvest losses and an increase in harvest gains.

Climate/ weather prediction through artificial intelligence: A major advance in agriculture is the use of artificial intelligence (AI). Modern equipment and tools based on AI enable data gathering and assist in precision farming and informed decision-making. Drones, remote sensors, and satellites gather 24/7 data on weather patterns in and around the fields, providing farmers with vital information on temperature, rainfall, soil, humidity, etc. However, AI finds slow acceptance in a country like India where marginal farming, fragmented landholdings, and other reasons act as impediments. But there is no doubt that technologies based on AI can bring precision to large-scale farming and lead to an exponential rise in productivity.

Resilient crops developed via the use of biotechnology: Agriculture refers to a wide resource of methodologies that include traditional breeding methods, genetic engineering, and the development of microorganisms for agriculture. Generally speaking, genetic engineering uses the understanding of DNA to identify and work with genes to increase crop resistance to pests, and the development of high-yielding varieties also makes improvements to livestock.

The spinoff of biotechnology in agriculture has resulted in all-around benefits for farmers and end consumers. Though some controversial approaches have led to resistance to the adoption of biotechnology, there is no doubt that the future of agriculture is heavily dependent on SAFE biotechnology, given the changing climate and increase in population.

Agriculture sensors: Communications technology has evolved rapidly in India and made smart farming a possibility. Sensors are now being used in agriculture to provide data to farmers to monitor and optimize crops

given the environmental conditions and challenges. These sensors are based on wireless connectivity and find application in many areas such as determining soil composition and moisture content, nutrient detection, location for precision, airflow, etc. Sensors help farmers save on pesticides, and labor, and result in efficient fertilizer application. They allow farmers to maximize yields using minimal natural resources.

Livestock monitoring: The use of chips and body sensors can help prevent disease outbreaks and are crucial in large-scale livestock management. Chips and body sensors measure vital parameters and indicators that could detect illness early and prevent herd infection. Similarly, ultrasounds are a useful tool to judge the quality of meat. This helps control and improve the quality of the meat.

Monitor and control crop irrigation systems through smartphone's – Mobile technology has also been playing a significant role in monitoring and controlling crop irrigation systems. With this modern technology, farmers can control their irrigation systems via smart phones and computers instead of driving to each field. Moisture sensors planted underground can provide information regarding the moisture levels present at certain depths in the soil.

Conclusion :

Technologies can enable the transition of modern agriculture in the field. While some technologies have transformed the way we operate, there is a need for spreading technological advancements in agriculture, like artificial intelligence and machine vision. The use of modern technology in agriculture can enable millions of farmers to benefit from the acquisition of real-time farm information. Farmers can have ready availability of weather information and disaster warnings, and also have instant access to farm data.

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