Agricultural Technologies and its importance in Agriculture Development in India

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Abstract-This paper is a review article on the Agricultural technologies in India. The use of agricultural technologies determines how the increase in agricultural output impacts on poverty levels and environmental degradation. The factors affecting technology adoption are assets, income, institutions, vulnerability, awareness, labour, and innovativeness by smallholder farmers. Technologies that require few assets, have a lower risk premium, and are less expensive have a higher chance of being adopted by smallholder farmers. Modern researchers should therefore seek to understand the rationale behind traditional smallholder farmer behaviour in technology use. This will make their future technological interventions in smallholder agriculture more effective.

Keywords: adoption, technology, agricultural productivity, smallholder

INTRODUCTION

India is home to 1.3 billion people, and globally ranks second in terms of the agricultural output. The agriculture, forestry and fishing sector accounted for 16.4% of the gross value added (GVA) in 2021. In contrast, the sector is serving as a primary source of livelihood for more than 50% of the country's population. Low and stagnant income across these sectors remains a focal

point of policy debate in India. These sectors accounts for the majority of the poor of the country. Recent estimates show that about 220 million people are poor in India. One of the most prominent pathways to enhance farmers' income is the adoption of improved agricultural technologies.

LITERATURE REVIEWS

Papers by Gollin, et. al. (2002) and Olsson and Hibbs (2005) argue that agriculture and the productivity of agriculture is the key to understanding the timing of the shift from an agrarian based to an industrially based society. The importance of agricultural technology in reducing poverty is found in Lipton (1977), Kerr and Kolavalli (1999), Datt and Ravallion (1998), Ravallion and Datt (1999), Mellor (2001), and Thirtle et al. (2003) to name a few. In addition, some non-traditional roles have also been attributed to agriculture in the development process.

The literature reveals that adoption of improved technologies is the key to increase agricultural productivity and farmers' income (Matushcke *et al.* 2007; Subramanian and Qaim 2009; Duflo *et al.* 2011; Mason and Smale 2013; Kumar *et al.* 2020. Despite a very strong impact on the well-being of farmers, the adoption of improved technologies is low, especially in the context of developing regions and countries. Factors include awareness and knowledge about technology, access to credit and relevant inputs, risk implications and marginal returns (Feder *et al.* 1985; Besley and Case 1993; Morris *et al.* 2007; Barrett *et al.* 2010; Duflo *et al.* 2011; Kumar *et al.* 2017; Varshney *et al.* 2019). Factors include policy support, investment in agricultural research and extension system, availability of infrastructure, and institutional arrangements for the delivery and benefit sharing of technologies.

RESEARCH METHODOLOGY

This research study is descriptive in nature and data is collected from secondary sources to describe the importance of agricultural technologies in India.

Importance of Modern Technology in Agriculture in India

Technology in agriculture affects many areas of agriculture, such as fertilizers, pesticides, seed technology, etc. Biotechnology and genetic

engineering have resulted in pest resistance and increased crop yields. Mechanization has led to efficient tilling, harvesting, and a reduction in manual labor. Irrigation methods and transportation systems have improved, processing machinery has reduced wastage, etc., and the effect is visible in all areas. New-age technologies focus on robotics, precision agriculture, artificial intelligence, block chain technology, and more.

In 1960, during the Green Revolution, India managed to achieve self-sufficiency in food grain production by leveraging modern methods of agriculture like chemical fertilizers and pesticides, higher quality seeds, and proper irrigation. Technological advances appeared eventually, in agricultural development in India. The introduction of tractors was followed by new tillage and harvesting equipment, irrigation methods, and air seeding technology, all leading to improved quality of the food and fiber. Farmers can leverage scientific data and technology to enhance crop yields and keep themselves abreast with cutting-edge methods of farming. Technology in agriculture affects many areas of agriculture. India managed to achieve self-sufficiency in food grain production by leveraging modern methods of agriculture along with farm mechanization.

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.

Improving farm yields and supply chain management use Big Data – The collection and compilation of data

and its further processing to make it useful for decision-making/problem-solving are expanding the way big data functions. Big data is slated to play a major role in smart farming, and the benefits percolate across the entire supply chain and the markets. Agriculture is becoming larger, and it depends on a large number of variables. This is resulting in greater collection and use of complex data, which has to be meaningfully interpreted and managed. Data can be from external sources such as social media, supplier networks, markets, or from sensor/machine data from the fields. Transformation of agriculture from using big data is taking place that affects crop yield, supply chain management, yield prediction, etc.

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.

FOUNDATION PROMOTES TECHNOLOGY IN INDIAN AGRICULTURE

The Agriculture Development program at S M Sehgal Foundation promotes sustainable livelihoods by building the capacities of farmers, including women producers, with improved agricultural practices and new technologies that increase crop yields, conserve water, and improve soil fertility. The team works with small-holder farmers in rain-fed and irrigated areas to facilitate the adoption of improved and advanced agricultural practices that include soil health management, crop production management, input-use efficiency, small farm mechanization, water-efficient irrigation techniques, horticultural development, livestock management, use of information and communication technology (ICT) in agriculture. S M Sehgal Foundation in partnership with GE has implemented the Gram Utkarsh project in Prayagraj, Uttar Pradesh, to help farmers make agriculture more rewarding. Some of the areas this scheme has been able to help with:

- Paddy thresher. Through the Gram Utkarsh Project, Brijesh Pal, a farmer of village Chakanur, acquired an electric paddy thresher machine that helps separate the grain from the crop. The paddy thresher has saved time and labor costs needed for crop threshing and has also enabled Brijesh to earn extra income from renting out the machine to fellow farmers.
- Drill. A seed drill is another farm mechanization tool that helps farmers at the time of sowing. Farmer Inderjeet Singh, from village Chakpura Miyan Khurd, used the seed drill he received under the project. He shares multiple benefits, such as penetration of the seed at the right depth in the soil, along with manure, even distribution of seeds, water-saving, use of less seed, good sprouting, and of course financial savings.
- Solar sprayer. Kamlesh Pandey, from village Rahikala, put a solar sprayer to use in his field with the help of this project. He shares that he can now do the spraying himself, and one bigha can be covered in thirty minutes, which earlier was more time-consuming and required manual labor.

CONCLUSION

The world population is slated to grow to about 9 billion by 2050. The challenge is to find ways and means to produce enough to feed it. The challenge of reducing acreage under agriculture and food wastage in production and distribution is having a major impact on the world. The increasing role of technology in agriculture to address these issues is the only way forward to a food-secure future. Technology can help save foreign exchange for countries, increase productivity, and lead to an improvement in the overall standard of farmer communities. India has a long way to go in the adoption of modern farming practices through technology. The pace is slow and path-breaking efforts need to be made to educate farmers about the benefits to be had with technology. Transcending the barriers of archaic farming practices and medieval mindsets is a challenge that needs to be overcome for a better tomorrow. Technology in agriculture has the potential to truly lead India to be “Atmanirbhar Bharat” in all respects, and be less dependent on extraneous factors.

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