

Technology and Its Impact on Agriculture

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Abstract

The use of technology in the Indian agriculture sector has been a key factor in increasing food production and improving farming practices over the years. From the use of simple tools like plows and irrigation systems to more advanced technologies such as precision agriculture and genetically modified crops, technology has greatly impacted the agriculture industry in India. One of the earliest and most significant advancements in agriculture technology was the development of the plow. The plow allowed farmers to cultivate larger areas of land and plant more crops, leading to an increase in food production. In recent years, advances in technology have led to the development of precision agriculture. Precision agriculture involves the use of GPS and mapping technology to monitor soil conditions, crop growth, and weather patterns in real time. This information is then used to optimize planting, fertilizing, and irrigation processes to increase yields and improve crop quality. Precision agriculture also helps reduce waste and increase sustainability. Digital technology has a great impact on the way farmers plant and harvest their crops, from drones to precision agriculture equipment. Additionally, it has facilitated farmers' access to crucial data like weather forecasts, market prices, and crop management tools.

Keywords Precision agriculture, Digital Technology, Crop Management, Weather forecasts.

Introduction

The use of technology has brought about a revolutionary change in the agriculture sector in India. In the 19th and 20th centuries, the invention of the internal combustion engine and the tractor revolutionized agriculture by allowing farmers to work their fields much faster and more efficiently. In recent days, with the implementation of automated technologies, farmers can now manage their fields and harvests much more efficiently. This has resulted in increased agricultural yields and a significant improvement in the quality of crops. For instance, the use of precision agriculture techniques such as GPS and soil sensors has enabled farmers to optimize planting and fertilizing practices. Additionally, automated irrigation systems have helped farmers conserve water, resulting in reduced water waste and increased crop productivity.

The use of genetically modified crops has also had a significant impact on agriculture. Genetically modified crops have been engineered to be more resistant to pests and diseases, which helps reduce the amount of pesticides used in farming. They have also been modified to have improved nutritional content and to be more tolerant of environmental stressors such as drought. The use of genetically modified crops has led to increased food production, improved food security, and reduced poverty in many states in India.

Positive Impact of Technology on Agriculture in India

Technology has played a crucial role in monitoring the growth and health of crops. With the use of remote sensing technology and satellite imaging, farmers can now keep an eye on their crops in real-

time. This has not only reduced crop loss but also improved crop quality. Farmers can now detect plant stress or disease outbreaks early on and take prompt action to resolve the issue. For example, by using infrared cameras mounted on drones, farmers can identify heat stress in crops, which can cause crop damage and loss.

Another positive impact of technology in agriculture in India has been the improved market reach for farmers. With the use of e-commerce platforms and mobile apps, farmers can now reach markets outside of their immediate vicinity, which has increased their opportunities to sell their produce for higher prices. For example, through online marketplaces, farmers can now sell their crops directly to consumers, bypassing intermediaries and reducing their costs. This has helped farmers to increase their income and improve their livelihoods.

Technology has also enabled farmers to have better access to information, which has significantly improved their farming practices. With access to data on market prices, weather, and farming best practices, farmers can now make informed decisions about their crops. For example, with weather monitoring apps, farmers can stay updated on the latest weather patterns and adjust their farming practices accordingly. Additionally, with access to online agricultural libraries and databases, farmers can now find solutions to various problems and improve the quality of their produce. The use of drones in agriculture has also had a positive impact on farmers in India. Farmers can now use drones to scan their fields and keep an eye on crop development, which helps them to make informed decisions. With the ability to spray herbicides and

fertilizers using drones, farmers can save time and money, as well as reduce the exposure of their workers to hazardous chemicals. Additionally, drones can also be used for crop mapping, which helps farmers to identify areas that need special attention. Technology has made a significant impact on the logistics of the agricultural sector in India. With the use of technology, farmers can now trace the movement of their produce from the fields to the market, ensuring that their harvests arrive in good condition. This has improved the quality and value of the product and has helped farmers to receive better prices. For example, with the use of GPS tracking devices, farmers can monitor the temperature and humidity levels of their produce during transportation, ensuring that it remains fresh and of high quality.

The implementation of technology in agriculture has greatly increased production and has simplified field management for farmers. With the use of machines and automated systems, less physical labor is required, reducing the workload of farmers and increasing their overall productivity. For example, with the use of tractors equipped with GPS and mapping technology, farmers can now perform tasks like planting, tilling, and harvesting much more efficiently. Technology has also helped farmers to have better access to financial services, such as loans and insurance, which has improved their financial security. With the use of mobile banking and online platforms, farmers can now apply for loans and insurance from the comfort of their homes, without having to visit banks and insurance companies in person. For example, through the use of mobile apps, farmers can now apply for micro-loans from financial institutions and receive the funds directly into their accounts.

Technology has also brought about a positive impact on the health and wellness of farmers in rural areas. With the use of telemedicine and online health services, farmers now have easier access to healthcare services, improving their general health and wellness. For example, with the use of telemedicine, farmers can now consult with doctors and receive medical advice from the comfort of their homes.

Farmers can now adopt more environmentally friendly techniques, such as using renewable energy sources and reducing the use of hazardous chemicals. This has lessened the environmental impact of farming and improved the overall health of the environment. For example, with the use of solar-powered pumps, farmers can now irrigate their fields using renewable energy, reducing their dependence on non-renewable energy sources. In conclusion, technology has had a

profound impact on the agriculture sector in India, improving logistics, production, access to financial services, healthcare services, and environmental sustainability. With the continued advancements in technology, the agriculture sector is poised for even greater growth and improvement in the future.

Negative Impact of Technology on Agriculture in India

Agriculture technology has had numerous adverse environmental implications, including water and air pollution, biodiversity loss, and soil deterioration. The increasing use of agricultural machinery in India can lead to soil degradation, as compacted soil is less able to absorb water and nutrients. This can result in reduced crop yields and lower overall agricultural production. For example, the use of heavy machinery on the same soil year after year can lead to soil compaction, making it harder for crops to take root and access the nutrients they need. Overuse of chemical pesticides and fertilizers can also have a significant impact on soil fertility. This can eventually lead to lower agricultural production and reduced crop yields. For example, the use of excessive chemical pesticides can lead to a decline in the populations of beneficial insects and soil microorganisms that play important roles in maintaining soil health.

Farmers in India are frequently exposed to pesticides, which can cause major health issues, including respiratory and neurological impairment. This exposure can occur through inhalation, skin contact, or ingestion. For example, farmers who spray pesticides without protective gear are at a high risk of inhaling toxic chemicals.

The cost of technology in agriculture can be a burden for farmers, especially those who are already suffering from low incomes. The use of technology may also result in lower crop prices, which means less money for farmers. For example, the introduction of high-tech machinery into the market may result in lower prices for crops, as there is an oversupply in the market.

The increasing use of machinery in agriculture can lead to a decrease in the need for manual laborers, which can result in unemployment and worker displacement. For example, the widespread use of tractors for planting and harvesting can result in a decrease in the need for manual laborers, leading to unemployment and displacement for those individuals. With the increasing use of standardized seed varieties and monocultures, crop diversity is rapidly declining in India. This homogenization of crops can have detrimental effects on the health of the soil, as well as the resilience of the agricultural system. A lack of diversity can make crops more vulnerable to diseases and pests, and result in a loss

of important genetic material. In the long run, this could limit the ability of farmers to adapt to changing conditions and respond to market demands.

The use of chemical pesticides and fertilizers in agriculture is a major cause of water pollution in India. These substances can contaminate water sources, affecting not only the health of crops but also the health of local communities. For example, contaminated water sources can cause health problems such as skin irritation, eye infections, and even cancer. In addition, the presence of chemicals in water can harm aquatic life and disrupt the delicate balance of ecosystems. The eradication of agriculturally valuable natural habitats, such as wetlands and forests, can result in a decline in biodiversity and the loss of crucial ecosystem services. This can lead to soil erosion, a decrease in soil fertility, and the loss of important pollinators, such as bees and butterflies. In addition, the loss of biodiversity can reduce the ability of the environment to support the livelihoods of local communities, especially those that rely on the land for food and income. The use of large machinery in agriculture can significantly increase greenhouse gas emissions, exacerbating the effects of climate change on agriculture and the environment. For example, the use of tractors and other heavy machinery in agriculture can contribute to the emission of carbon dioxide and other harmful gases, leading to global warming and climate change. These emissions can also affect air quality and lead to respiratory problems for those who live near agricultural areas.

The use of chemicals, fertilizers, and pesticides has become widespread in agriculture, and it has had a negative impact on crop quality. The excessive use of these substances can contaminate soil and water, which can harm plants and people who consume them. For example, the contamination of water sources by pesticides has been linked to various health problems, including cancers and birth defects, in communities that rely on those sources for drinking water.

Agricultural equipment, such as tractors and plows, is frequently heavy and can compact the soil, which reduces water infiltration and causes soil degradation. This degradation can reduce productivity and crop production, leading to reduced yields and lower profits for farmers. For example, in some regions of India, the use of heavy machinery has resulted in soil compaction, which has reduced water infiltration and hindered crop growth. The high cost of technology and machines is a major challenge for small-scale farmers in India. These farmers may not be able to afford to purchase the

required machinery, which can lead to further marginalization and the concentration of resources in the hands of large-scale farms. For example, small-scale farmers in rural areas may struggle to purchase the latest tractors and plows, which are essential for efficient field management and increased yields. This can result in a widening wealth gap between small and large-scale farmers and ultimately limit the growth and competitiveness of the agricultural sector.

Future Impact of technology on agriculture in India

The integration of technology in agriculture has the potential to revolutionize the way crops are grown and managed in India. Farmers are getting the tools and knowledge they need to boost yields, cut waste, and enhance overall efficiency thanks to developments in fields like precision agriculture, digital agriculture, and data analytics. Precision farming techniques let farmers accurately apply inputs like fertilizer and seed in the appropriate amounts at the right time, lowering costs and minimizing the impact of agriculture on the environment. Examples of these techniques include GPS-based tractors and yield monitors. By giving farmers access to crucial data on weather patterns, market prices, and best practices for crop management, digital agriculture technologies, such as mobile apps and cloud-based platforms, improve their capacity to make decisions and lower the risks involved with farming. Additionally, the innovation in the food supply chain is being fueled by the integration of technology in agriculture. In order to ensure that consumers have access to fresh, secure, and high-quality products while also increasing the openness of the food supply chain, technologies like blockchain and Internet of Things (IoT) sensors are making it simpler to track food products from farm to table. Farmers gain from this because it raises the value of their goods and enhances the reputation of their brands, both of which result in higher product pricing and more profitability.

Policy Implications to navigate the negative Impact of technology on agriculture in India

The implementation of sustainable agricultural practices can mitigate the negative effects of technology on agriculture. For example, using integrated pest control methods, such as the release of natural predators to control pests, instead of relying solely on chemical pesticides can help protect soil fertility and decrease the risk of pesticide poisoning for farmers. Agroforestry, which involves integrating trees with crops, can help prevent soil degradation and improve soil fertility while also providing farmers with additional income streams. Conservation agriculture, which involves

practices like reduced tillage, crop rotation, and cover cropping, can help improve soil health, conserve water, and reduce greenhouse gas emissions. Government support for small-scale farmers can help them adopt sustainable agricultural techniques and improve their standard of living. For example, by providing them with access to credit, training, and technical support, they can better manage their farms and increase their crop yields. Supporting small-scale farmers can also have a positive impact on the local economy, as they are often the largest employer in rural areas. Investing in research and development of sustainable agricultural practices and technologies can help reduce the negative impacts of technology on agriculture. For example, new irrigation systems that conserve water and improve water efficiency can help mitigate the effects of droughts and water scarcity. The development of new seed varieties that are resistant to pests and diseases can help farmers reduce their dependence on chemical pesticides and fertilizers.

Improving small-scale farmers' access to markets can help increase their income and improve their standard of living. For example, by establishing direct connections between farmers and consumers, such as through farmer's markets and community-supported agriculture programs, farmers can sell their produce at fair prices and receive a larger portion of the revenue. Public-private partnerships can help promote the adoption of sustainable agriculture practices and improve the overall health of the agricultural industry. For example, partnerships between farmers, agribusinesses, and government organizations can help provide farmers with access to training, technical support, and new technologies. These partnerships can also help increase the public's awareness of sustainable agriculture and the importance of supporting small-scale farmers.

Conclusion:

Technology's beneficial effects on Indian agriculture also benefit the country's overall economy. With millions of people depending on it for a living and contributing to the nation's GDP, agriculture is a significant part of India's economy. Technology integration has improved the efficiency, productivity, and profitability of Indian agriculture, which will spur economic growth and support the creation of new jobs in the sector as well as in allied businesses.

In conclusion, Indian agriculture has a promising future, and technology will be essential to achieving its full potential. Technology is assisting in the development of a more resilient, productive, and sustainable agriculture sector that will benefit

farmers, consumers, and the Indian economy as a whole by providing farmers with the tools and information they need to succeed.

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