

Traditional to Technical Transformation in Agriculture

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Introduction:

Since several decades ago, agriculture has been transitioning from conventional to modern, technology-driven practices. Numerous factors, such as population growth, the effects of nature, and climate change, have contributed to this shift. Since the industrial revolution, the world's population has been quickly growing and is now more than three times larger than it was in the middle of the twentieth century. The global human population reached 8.0 billion in 2022 is expected to increase to 9.7 billion in 2050 (US census bureau, 2016). The world population has been increasing exponentially, but the food production is in linear growth, which leads to volatility of food prices, and therefore of food security, has hit new highs. The overall result has been a dramatic surge in the number of hungry and undernourished people throughout the world. Hence, agriculture needs to simultaneously become both more productive and sustainable. Technology can help transform the global food production system and mitigate its impact on the climate and environment.

Traditionally, agriculture was characterized by small-scale, subsistence farming, which relied on manual labor and simple tools. Farmers used traditional methods, such as crop rotation, intercropping, and the use of natural fertilizers and pesticides, to manage their crops and protect them from pests and diseases. With the advent of technology, however, agriculture has become increasingly mechanized and industrialized. Farmers now use a wide range of modern technologies, including tractors, harvesters, irrigation systems, and genetically modified crops, to improve efficiency and productivity.

One of the key benefits of the modern technologies that they allow farmers to produce more food with less labor, land, and resources. Due to this, agriculture has been able to both keep up with the rising food demand and lessen its negative effects on the environment. Modern agriculture has faced certain difficulties in its transition, though. Industrial agriculture has been criticized for its negative effects on the environment and society,

including soil degradation, water pollution, and the eviction of small-scale farmers (Gulshan *et al.*, 2022). Others have argued that the focus on productivity and efficiency has led to a loss of biodiversity and a decline in the quality of food. Despite these challenges, the trend towards technology-driven agriculture is likely to continue in the coming years, as farmers seek to meet the rising demand for food in a sustainable and efficient manner with the transformation of agriculture from tradition to technology.

Mechanization:

Mechanization has been one of the main factors in the recent transformation of agriculture. As a result, efficiency and productivity have increased, helping farmers to increase their food production while using fewer resources and labourers. Sustainable agricultural mechanization has the ability to make post-harvest, processing, and marketing operations and functions more effective, efficient, and environmentally friendly, which can have a substantial impact on the growth of value chains and food systems. Mechanization is only one part of the process of agricultural intensification, according to IFPRI, and it shouldn't truly start intensification when it isn't already being pushed by market demand and population pressure. Over the past 41 years, the total amount of power available on Indian farms climbed from 0.293 to 1.841 kW/ha at a CAGR of 4.58 percent (FAO 2020).

Precision Agriculture:

Another technological advancement in agriculture is precision agriculture, which involves using data and technology to optimize farming practices. It includes sensors and drones to monitor crops and soil conditions, and using GPS technology to precisely apply fertilizers and pesticides. The global market for precision farming technologies should grow from \$5.2 billion in 2019 to \$9.4 billion by 2024, with a compound annual growth rate (CAGR) of 12.6 per cent for the term of 2019-2024.

Genetically Modified Crops:

Increasingly, genetically modified organisms (GMOs) are used in agriculture. In order to boost agricultural production and the capacity of food producers to absorb environmental shocks, these crops have been genetically modified to have longer shelf life and increased resistance to pests, diseases, and herbicides. In the 24th year of commercialization of biotech/GM crops in 2019, 29 countries grew 190.4 million hectares of biotech crops. In



2019, the average adoption rate of biotech crops grew in the top five biotech crop-producing nations: the USA (95%), Brazil (94%), Argentina (100%), Canada (90%), and India (94%).

It seems conceivable that technology will continue to change agriculture in the future. Vertical farming, aquaponics, and the use of robotics and automation in farming are a few of the new trends in agriculture. Using artificial lighting and regulated settings, vertical farming includes growing crops in layers that are stacked vertically. According to a new analysis from Grand View Research, Inc., the global market for vertical farming is anticipated to reach USD 24,948.3 million by 2030. From 2022 to 2030, it is projected to grow at a CAGR of 20.1%. In aquaponics, fish waste is used to fertilize the plants in a closed-loop system while growing fish and plants simultaneously. The use of robotics and automation in farming can help to reduce labor costs and improve efficiency (Cicekcia and Barlasb, 2014). The global market for agricultural robots is anticipated to increase from USD 4.9 billion in 2021 to USD 11.9 billion by 2026, at a CAGR of 19.3%, according to a report by Research and Markets. The agricultural robot's market is developing rapidly which includes factors such as rising population, increasing labor shortage, and rising wages are driving the market growth. There is also growing interest in regenerative agriculture, which seeks to restore soil health and biodiversity while also increasing productivity.

Conclusion:

While technology has greatly increased productivity, there is also a rising understanding of the importance of sustainable agriculture. In conclusion, tradition to technical transformation in agriculture is necessary. Agriculture has fallen behind many other sectors in the digitalization and application of technology while being a major sector that directly and indirectly employs millions of people. Luckily, however, it is not too late to catch up, but the sector needs more investment, more new ideas and greater participation from young people and smallholder farmers.

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