

# A SURVEY ON THE ROLE OF IOT IN AGRICULTURE FOR THE IMPLEMENTATION OF SMART

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## ABSTRACT

*Agriculture is the oldest occupation in the world, the penetration of technology was very low. Around 48 percent of India's 1.3 billion people depend on agriculture. The country's agricultural GDP stands at \$396 billion as of 2018 and ranks second worldwide in farm output. According to an EY August 2020 report, India ranks second after China, accounting for 11.9 percent of the global agriculture Gross However, the Indian agribusiness ecosystem is significantly fragmented and unorganised with multiple levels of intermediaries and middlemen across the agricultural value chain. Despite the agritech sector having strong investment activity in the last few years, the market penetration in the sector is still very low (1 percent), according to a latest EY report. The untapped market potential, opportunities in agritech, global investment, and a robust policy framework will drive growth in Agriculture. This study helps farmers to monitor micro-climatic conditions of their farms, quantify irrigation and with irrigation prediction so that they can take accurate, proactive and preventive decisions. This helps in precision farming by integrating field data, weather patterns, and crop information to drive agronomic advice to farmers.*

**Keywords:** Agriculture - IOT - Farming –weather forecasting

## 1. Introduction

The farming industry will become more important than ever before in the next few decades. The UN projects that the world's population will reach 9.7 billion by 2050, causing global agricultural production to rise 69% between 2010 and 2050. To meet this demand, farmers and agricultural companies are turning to the Internet of Things for analytics and greater production capabilities.

Technological innovation in farming is nothing new. Handheld tools were the standards hundreds of years ago, and then the Industrial Revolution brought about the cotton gin. The 1800s brought about grain elevators, chemical fertilizers, and the first gas-powered tractor. Fast forward to the late 1900s, when farmers start using satellites to plan their work.

The IoT is set to push the future of farming to the next level. Smart agriculture is already becoming more commonplace among farmers, and high tech farming is quickly becoming the standard thanks to agricultural drones and sensors.

Farmers have already begun employing some high tech farming techniques and technologies in order to improve the efficiency of their day-to-day work. For example, sensors placed in fields allow farmers to obtain detailed maps of both the topography and

resources in the area, as well as variables such as acidity and temperature of the soil. They can also access climate forecasts to predict weather patterns in the coming days and weeks.

Farmers can use their smartphones to remotely monitor their equipment, crops, and livestock, as well as obtain stats on their livestock feeding and produce. They can even use this technology to run statistical predictions for their crops and livestock.

All of these techniques help make up precision farming or precision agriculture, the process of using satellite imagery and other technology (such as sensors) to observe and record data with the goal of improving production output while minimizing cost and preserving resources.

## 2. Need for IOT in Agriculture

With the exponential growth of world population, according to the UN Food and Agriculture Organization, the world will need to produce 70% more food in 2050, shrinking agricultural lands, and depletion of finite natural resources, the need to enhance farm yield has become critical. Limited availability of natural resources such as fresh water and arable land along with slowing yield trends in several staple crops, have further aggravated the problem. Another impeding concern over the farming industry is the shifting structure of agricultural workforce. Moreover, agricultural labor in most of the countries has declined. As a result of the declining agricultural workforce, adoption of internet connectivity solutions in farming practices has been triggered, to reduce the need for manual labor. Farmers have started to realize that the IOT is a driving force for increasing agricultural production in a cost-effective way [1].

## 3. Implementation of IOT in Agriculture

**IoT solutions are focused on helping farmers close the supply demand gap**, by ensuring high yields, profitability, and protection of the environment. The approach of using IoT technology to ensure optimum application of resources to achieve high crop yields and reduce operational costs is called precision agriculture. IoT in agriculture technologies comprise specialized equipment, wireless connectivity, software and IT services.

BI Intelligence survey expects that the adoption of **IoT devices in the agriculture industry will reach 75 million in 2020**, growing 20% annually. At the same time, **the global smart agriculture market size is expected to triple by 2025**, reaching \$15.3 billion (compared to being slightly over \$5 billion back in 2016)[3].

IoT have the potential to transform agriculture in many aspects and these are the main ones[2]

## 4. Applications of IOT in Agriculture

The figure shows the various application of IOT in Agriculture. The IoT technology has realized the smart wearable's, connected devices, automated machines, and driverless cars. However, in agriculture, the IoT has brought the greatest impact.



**Figure 1: IOT Applications in Agriculture**

### 4.1 Data collected by smart agriculture sensors

In this approach of farm management, a key component is sensors, control systems, robotics, autonomous vehicles, automated hardware, variable rate technology, motion detectors, button camera, and wearable devices. This data can be used to track the state of the business in general as well as staff performance, equipment efficiency. The ability to foresee the output of production allows to plan for better product distribution.

### 4.2 Agricultural Drones

Ground-based and aerial-based drones are being used in agriculture in order to enhance various agricultural practices: crop health assessment, irrigation, crop monitoring, crop spraying, planting, and soil and field analysis.

### 4.3 Livestock tracking and geofencing

Farm owners can utilize wireless IoT applications to collect data regarding the location, well-being, and health of their cattle. This information helps to prevent the spread of disease and also lowers labor costs.

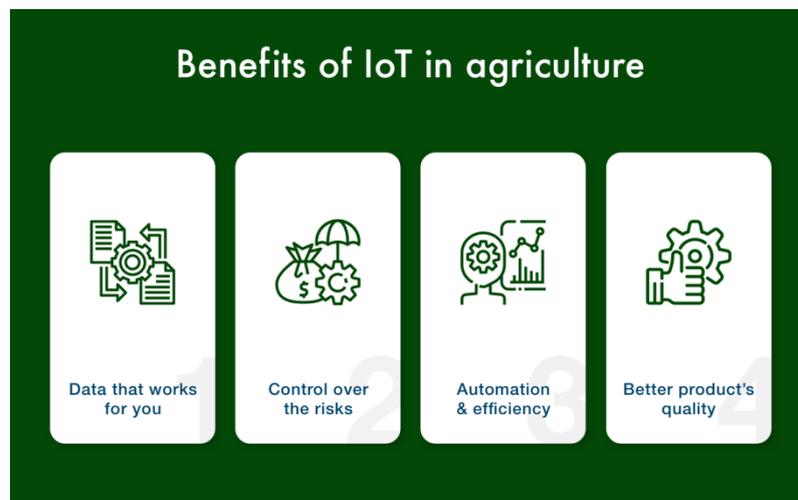
### 4.4 Smart Greenhouses

A smart greenhouse designed with the help of IoT intelligently monitors as well as controls the climate, eliminating the need for manual intervention.

## 4.5 Predictive analytics for smart farming

Crop prediction plays a key role, it helps the farmer to decide future plan regarding the production of the crop, its storage, marketing techniques and risk management. To predict production rate of the crop artificial network use information collected by sensors from the farm. This information includes parameters such as soil, temperature, pressure, rainfall, and humidity. The farmers can get an accurate soil data either by the dashboard or a customized mobile application.

## 5. Outcome of IOT in Agriculture



**Figure 2: Benefits of IOT in Agriculture**

The implementation of IOT in agriculture helps in yield improvement, providing analytical insights into water consumption patterns across fields and soil types ultimately enabling data-based decision support systems for farmer and farming organisations. Weather and water were the most important aspects that impacted the yield of the crop. However, the farmers were restricted by scant data or a decision support system for them to make decisions. “For example, farmers use drip irrigation technologies to improve water use efficiencies, but yet they do not know when and how much to irrigate. Implementation of IOT in agriculture provides an on-ground IoT device that continuously monitors key farm parameters. The on-ground data gathered, combined with the pre-built ML prediction algorithms, help farmers with data-based information and decision support. The farmers use the Kisan App to get daily recommendations and information. It is possible to launch a digital marketplace to help farmers connect with potential buyers and vice-versa. This work is combination of farmers, engineers, and data scientists. In the on-ground study of over 160 small, medium and large farmers (land holdings from 1-50 acres), it is observed that over 80 percent of them use smartphones and a large number of them rely on social media for agri-related information. Hence, using social media to promote technology and its benefits is an important part of marketing strategy .

## 6. Conclusion

Smart farming based on **IoT technologies enables growers and farmers to reduce waste and enhance productivity** ranging from the quantity of fertilizer utilized to the number of journeys the farm vehicles have made, and enabling efficient utilization of resources such as water, electricity, etc. IoT smart farming solutions is a system that is built for monitoring the crop field with the help of sensors (light, humidity, temperature, soil moisture, crop health, etc.) and automating the irrigation system. **The farmers can monitor the field conditions from anywhere.** They can also select between manual and automated options for taking necessary actions based on this data. For example, if the soil moisture level decreases, the farmer can deploy sensors to start the irrigation. Smart farming is highly efficient when compared with the conventional approach. In future working with FPOs to provide customised solutions which can have a large-scale impact with multiple farmers is considered to be done[4].

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