



# Open Journal of Biotechnology & Bioengineering Research

Mini Review

## Importance of Smart Agriculture -

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**Submitted:** 19 November 2022; **Approved:** 23 December 2022; **Published:** 24 December 2022

**Citation this article:** Abobatta WF. Importance of Smart Agriculture. Open J Biotechnol Bioeng Res. 2022 Dec 24;5(1): 025-028. doi: 10.37871/ojbbr.id19

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## ABSTRACT

Smart agriculture aims to adapt, modify and promote agricultural production, in addition enhancing farmers' capabilities to deal with climate change, conserve natural resources, reducing inputs, increasing productivity, protecting the environment, and increasing farmers' profitability. Using of different applications of smart agriculture, especially in developing countries, can play a vital role in increasing agricultural production, providing adequate food for the population, improving the standard of living, and achieving a reasonable level of development. There are numerous application of smart agriculture, such as smart irrigation, site specification and pest control. Smart agriculture improves the use efficiency of the available natural resources, such as water resources, soil, or local plant species. Furthermore, increasing the productivity of the animal production sector of both meat and dairy products.

**Keywords:** Agricultural production; Climate change; Developing countries; Smart agriculture

## INTRODUCTION

Agricultural sector in development countries face various problems that include, weak infrastructure, leaks of Internet service, and poor logistic services that affect negatively crop production and reduce the competitive ability in the global market due to negative impacts on the shelf life and quality of agricultural products particularly perishable commodities [1].

Therefore, there is more interest in the necessity of adopting smart farming techniques in a manner compatible with the circumstances of farmers, particularly in developing countries. Produce enough food in the future rely on integration of a various technologies that are highly efficient to increase food production and environmentally protecting [2].

Smart agriculture aims to modify agricultural practices to sustain agricultural production, achieve flexibility in production systems, reduce greenhouse emissions, and reduce the use of various agrochemicals to preserve the environment [3]. There are many applications that are used as part of smart agriculture, such as irrigation water management applications, which include (rainwater harvesting, laser land leveling, precision irrigation, agricultural rotation), and agricultural climate applications (rainfall forecasting, heatwaves, humidity levels, which are correlated to irrigation management, smart fertilization, and pest control.

Currently, there are more than 7 billion people living on the Earth, and their daily-consumed food, fiber, energy, and other products that already exceed various natural resources. Furthermore, the expectations of international organizations, the world's population is forecast to reach about 10 billion in 2050 [4]. Therefore, producing enough food to feed them and provide other daily requirements represents the most prominent challenge for humanity. In light of the continuous depletion of various natural resources such as agricultural lands, fresh water, and plant and animal species [5].

This situation requires the accurate use of all available resources and using novel management practices, to maximize production from the same available resources, which requires the adoption of smart agriculture, particularly in developing countries.

### Scoping Smart Agricultural Technologies

There are need to increase food production worldwide in the near future by 60% to provide adequate food for 9.6 billion by 2050 [6].

Which exerts more pressure on the agriculture sector and the environment that are already overburdened. There is evidence of the negative impacts of climate change on the growth and crop of fruit trees and other horticultural crops under variable environments. Previous studies indicate that a moderate increase in temperature

will have a substantial impact on citrus, deciduous fruits, and herbs yield [7].

Smart agriculture depends on traditional farming tools and equipment, in addition, new technologies, computerized system, and the Internet of things [3].

Smart agriculture is a package of technologies tools and agriculture practices that reduce the impacts of climate challenges that face agricultural production and affect the sustainability of food availability by increasing the productivity of agricultural crops, increasing the adaptation of plants to climate changes, and reducing emissions of greenhouse gasses where possible [8].

Currently, there is a wide range of agricultural techniques and practices that can be used in various agriculture processing to increase production, reduce costs, as well as preserve the environment. Smart agriculture aims to elevate the whole farming system to increase farmers' profitability and sustain natural resources. Furthermore, it is relies on various data resources that include farm-level data and other data sources such as weather forecasting and marketing data [9].

SA relies on integrating different agricultural management practices and enhancing the usage efficiency of different inputs, such as seeds, agrochemicals, water, the Internet of Things, artificial intelligence (e.g. disease detection and wireless sensors), and robotics like auto-tractors or Multiple usage robots, etc. [10].

### Advantage of Smart Agriculture

Agriculture sector providing food, job opportunities and income for the majority of the population in developing countries. Most of the farmers in developing countries are smallholders (with properties less than 2 ha), which represent the majority of the population. Globally, the small farmers considered a main component of the food chain supply, furthermore, about 84% of small farmers living in developing countries particularly in Sub-Saharan and south Asia [11].

Poverty in developing countries pushes farmers to depend on traditional practices in agriculture, which leads to soil degradation, groundwater pollution, continuous emission of greenhouse gasses, the loss of biodiversity such as a decrease in the pollinators (bees for example) as a result of the excessive use of pesticides, which negatively affects productivity.

Using SA help the farmers throughout the whole growth stages until transportation agricultural commodities to the market.

The adoption of smart farms is necessary for farmers in developing countries. Therefore, raising their awareness of the importance of the adoption of smart is essential to gain more productivity, provide the required food, reduce the negative impacts of climate fluctuations, and improve their livelihood. There are many benefits to smart

agriculture at farm levels, both short and long term, while, the short-term benefits are the most important for small farmers, especially in developing countries, due to their weak financial capabilities, which are improved by using smart agriculture.

The Food and Agriculture Organization (FAO) at 2010 pointed to the essential role of institutional and financial support of small farmers to encourage adoption to smart agriculture in developing countries. It is well known that the small farmers are the poorest particularly in developing countries, so institutional support, whether financial or extension facilities, is necessary to increase the chances of implementing smart agriculture in small farms [12].

**Role of Smart Agriculture**

There are significant impacts for precision farming in improving agricultural production and enhancing quality of various agricultural products.

SA practices support farmers in various processing from preparing soil for cultivation to picking fruits [13].

SA present important influence to increase crop productivity and reduce risks of food supply, improving food safety, sustain various natural resources and increase farmers’ profitability. Furthermore, SA has positive impacts by using new management practices to improve living conditions of farmers’ community.

**Smart Farming Tools**

Smart agriculture uses many technologies to improve agricultural production in figure 1, which includes computer programs and precise devices such as sensors and robotics like automatic tractors, to provide high-accuracy data to farmers, reduce inputs particularly agrochemicals, and regulate irrigation [3].

**Precision Agriculture Tools in Developed and Developing Countries**

The use of PA is not limited to a specific region of the world, it can be applied in any farm, regardless of the size and type of farm, whether conventional or organic farms, as well as in both developed and developing countries.

There are more attention to PA in developed countries particularly US, Canada, and Australia for different reasons, such as availability of high-technology, accessibility of the technical infrastructure and large scale farms. Currently, there are numerous application of PA used as commercial scale technologies in developed countries such as site specification technologies and guidance systems [14].

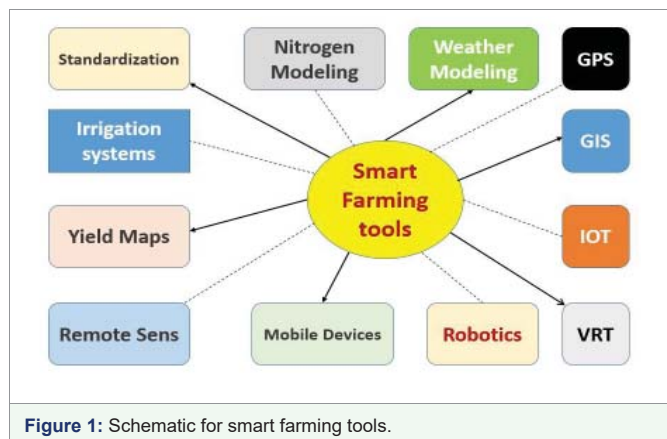


Figure 1: Schematic for smart farming tools.

Furthermore, the most familiar tools in developed countries are as follow

- Yield monitors technology.
- Variable rate technology.
- Automatic control systems.
- GIS.
- Auto guidance farm tractors.
- Site-specific sensors.
- Sampling, and managing.
- Unmanned aerial vehicles.

The continuous development of PA technologies has led to cost reductions, which increasing use of PA applications in developing countries particularly with improve infrastructure and spread of using smart communications [15].

Recently, there are more tools of PA are available in developing countries that include:

- Remote sensing.
- Site specific.
- Variable fertilizer rate.
- Automatic irrigation system.
- Spatially variable nutrients rates.

**The Main Restriction for Precision Agriculture**

There are various factors affect the adoption of smart agriculture applications in developing countries that including:

- Weak infrastructure.
- Economic capabilities.
- Weak institutionally.
- Social issue.
- Economic factors.
- Political issue.

**CONCLUSION**

Smart agriculture reduces various inputs, increases agricultural production, adapting agricultural sector to climate changes, maintain natural resources, and protecting the environment, which leads to increased profitability for farmers. Therefore, adoption to smart agriculture in developing countries could play a vital role in increasing agricultural production, producing adequate food for the population, improving living of local communities.

There are many benefits of smart agriculture that include improving the efficiency of using available natural resources, such as water resources, soil, or plant species. Moreover, increasing the productivity of the animal production sector of meat and dairy products.

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