

Digital Technologies in Agriculture: Innovations and Prospects

Charshanbiyev Alibek Begxanovich

Termez State University of Engineering and Agrotechnology

alibek19914@gmail.com



Abstract

This article provides information on the importance of the widespread use of digital technologies in agriculture, not only in improving state and public administration, but also in creating great convenience for people in the social sphere and agriculture, improving the quality of products and services, and reducing unnecessary costs.

Keywords: Agriculture, digital technology, internet of Things, artificial intelligence, drones, cloud technologies.

Introduction

Agriculture is one of the oldest and most vital sectors of humanity, playing an important role in providing food and other basic human needs. It is also an integral part of the economy. In recent years, agricultural sectors have been driven to more efficient and sustainable development with the help of digital technologies. Digital technologies play an important role in optimizing agricultural processing processes, effectively using resources, increasing production efficiency, and ensuring environmental sustainability.

The main areas of application of digital technologies in agriculture:

1. High-tech agrosensors and IoT (Internet of Things) systems.

Sensors and IoT technologies play an important role in agricultural processing and crop care. Currently, there are systems that can measure soil moisture, temperature, oxygen levels and other parameters in real time on crop fields. Through these systems, farmers can effectively manage resources and optimally use water and mineral fertilizers.

Agrosensors are devices used to monitor the condition of land, water, air or plants. They collect information in real time.

Main types:

- Soil sensor: measures moisture, temperature, pH level and nutrients.
- Climate sensor: monitors air temperature, humidity, wind speed, precipitation.
- Plant sensor: assesses plant health, growth rate, stress levels.
- Water sensor: controls water pressure and quantity for irrigation systems.

2. Artificial intelligence and machine learning

Artificial intelligence and machine learning algorithms are used in agriculture to monitor crops and animals, detect diseases, and many other processes. For example, artificial intelligence can be used to predict plant development or develop optimized strategies for pest control. Machine learning can be used to develop special analysis systems that allow for high-precision control of production processes.

3. Drones and robots

In agriculture, drones and robots are used to care for crops, irrigate, and distribute pesticides and fertilizers accurately and efficiently. Drones can quickly scan large areas and obtain high-resolution cartographic data, which helps farmers make accurate decisions.

The main applications of drones in agriculture are:

- Ground monitoring: drones monitor the condition of the field (moisture, disease, pests).
- Cartography and mapping: fields are mapped based on accurate GPS data.
- Fertilizer and pesticide spraying: the required amount can be sprayed in specific areas, saving resources.
- Crop assessment: drones analyze crop conditions using infrared or multispectral cameras.

Robots, on the other hand, allow the use of automated methods in processes such as tillage, harvesting, and pest control.

Types and functions:

- Irrigation robots: provide precise and individual watering to plants.
- Harvesting robots: automatically harvest fruits, vegetables or grains.
- Weed control robots: detect and destroy weeds (chemically or mechanically).
- Fertilization and seeding robots: operate based on precise location.

4. Cloud technologies and data analysis.

Through cloud technologies, agricultural entrepreneurs have the opportunity to collect and analyze important data about their production processes. This helps to effectively use resources in the agricultural sector, as well as monitor production in real time. With the help of Big Data and analytics, farmers can optimize production based on market demands and adapt to climate change.

5. Agrotechnological platforms and mobile applications.

Nowadays, a number of mobile applications and agrotechnological platforms have been developed to help farmers and agricultural specialists carry out their work effectively. These platforms help farmers manage production processes by providing real-time instructions in the field. Through mobile applications, it is possible to manage crops, animals, and land resources, as well as monitor financial and production indicators.

Positive effects of using digital technologies:

1. Increase productivity.

Increasing productivity in agriculture is one of the most important goals for farmers and agricultural specialists. Digital technologies significantly increase productivity by automating and optimizing production processes. In addition, proper resource management, data-based decision-

making, the right choice of seeds and varieties, and timely control of diseases and pests are important. With the help of sensors and analysis systems, errors in agriculture are reduced and yields are increased.

2. Efficient use of resources.

Irrigation, fertilization, and pesticide applications are based on accurate data, which helps save water, energy, and other resources.

Through efficient use of water resources, i.e., drip irrigation and soil moisture sensors, water consumption can be reduced by 30-50%. Through the correct use of fertilizers and protective agents, i.e., accurate fertilization technologies and soil analysis through sensors, fertilizer waste can be reduced by 20-40% without contaminating the soil. By using solar-powered irrigation pumps, electricity use is optimized and costs are reduced.

3. Environmental protection.

Digital technologies help reduce environmental impacts. For example, pesticides and fertilizers are used in precise doses and only when necessary, which helps maintain the health of the earth.

4. Market Integration.

Digital technologies allow farmers to quickly analyze the market and plan production according to demand. This helps to quickly sell products and maintain optimal prices.

Prospects of digital technologies:

1. Transition to a green economy.

Digital technologies also play an important role in ensuring environmental sustainability. Agriculture plays a major role in combating climate change through energy efficiency and resource conservation.

2. New research and innovation.

Digital technologies will help develop new technological research and implement cutting-edge innovations in agriculture. Innovations in artificial intelligence, genetic modification, and biotechnology will create opportunities for more efficient agriculture in the future.

3. Global integration.

Global integration is the connection of national producers, farmers and agro-companies in the agricultural sector to the world market, paving the way for development through modern technologies, investments and knowledge exchange. The rapid development of digital technologies in the agricultural sector ensures the creation of a global network. This, in turn, implies effective integration in international trade and expansion of product markets. Uzbekistan has also been paying great attention to global integration in recent years: exports to the European and Chinese markets, organic production, and attracting foreign investors.

Conclusion

The use of digital technologies in agriculture is of great importance not only for increasing production efficiency, but also for effective resource management, ensuring environmental sustainability and promoting market integration. Through the implementation of technological innovations, new opportunities are opened up in the agricultural sector and play an important role in ensuring global food security. Therefore, cooperation between the public and private sectors is necessary to expand and improve digital technologies in agriculture.

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