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Analysis of the Possibilities of Using Digital Technologies in the Agrarian Sphere

Toxtamurod Atakulov, First Deputy Director of the Graduate School of Business and Entrepreneurship, tatakulov @ gmail. com
Aman Kenjabaev Professor, Head of the Department of Marketing and Digital Economy, Graduate School of Business and Entrepreneurship, amankenja059@gmail.com
Akbar Kuvandikov Associate Professor of the Ministry of Emergency Situations.

Annotation: In this article, increasing productivity of labour in network and the issue of decreasing expenses were observed through disseminating modern technologies to the agriculture. Moreover, taking digital technologies' video through satellite, charting, exact farming, smart farms, smart greenhouses, management of raw-materials, delivering products of agriculture and saving, controlling products of agriculture and transports and lastly, disseminating the Big-data to the agriculture have been illustrated.

Key words: digital technologies, digital devices, sensors, database, smart technologies, smart farms, smart greenhouses, information system, optimization, modelling, wireless network and drones.

Introduction

The Food and Agriculture Organization of the United Nations (FAO) predicts that by 2050, one and a half times as much food must be produced to feed the world's growing population as today. The environmental situation, rising energy prices, and declining soil fertility are serious obstacles to the production of essential foodstuffs. These problems can be solved by changing the technologies and methods of growing agricultural products, in particular by introducing the latest technologies and innovative solutions, namely smart technologies based on digital devices.

Through the use of digital technology, crop yields and livestock productivity will increase and production costs will decrease.

The fast development of the use of digital technology in foreign countries creates serious problems for the agricultural sector of Uzbekistan, as, despite the favorable environmental conditions in our country, lacks competitiveness in the production and sale of its products. This, in turn, has a significant impact on the economy of our country, since half of Uzbekistan's population lives in rural areas and more than 1/4 of the working-age population is employed in the agricultural sector, which accounts for almost half of the gross domestic product.

The new Uzbekistan strategy includes comprehensive reforms to develop the agricultural sector and the introduction of modern innovative technologies in

agriculture. Modern clusters are being established in the main leading branches of the agricultural sector, cotton growing, grain growing, and rice growing. The processes of merging farms into large cooperatives are underway. These reforms and advances are creating competitiveness in the industry.

Analysis of literature on the topic

Many scientific researches are being conducted abroad and in our country on the application of digital technologies in the agricultural sector. The journal Digital Agriculture Technology reports on the process of digitizing agriculture in the Netherlands. According to the results of the study, it was mentioned that training, retraining and attracting investments in digital technologies are one of the main factors of accelerating the process of digitalization of agriculture.

Nowadays, livestock breeding is one of the promising directions. Smart farms increase livestock productivity and improve product quality. According to expert conclusions, digitization of livestock feeding, milking and veterinary control will lead to an increase in the volume of milk production by 40-50%. Innovative technologies based on artificial intelligence, automated digital technologies are developing rapidly in foreign countries.

Research methodology

The study used the results of scientific research of foreign authors, statistical data, analytical tables, as well as methods of economic analysis. A comparative analysis of information and proposals of IT-companies on the digitalization of agriculture, the design of intelligent information systems based on algorithms and the use of digital devices was carried out.

Analysis and results

Digital agriculture is an economy based on modern methods that use digital technologies to increase productivity and reduce production costs in food production. Digitization has changed all communication chains of agriculture. Any element of the system can be optimized based on the principles of resource management, individual approach, rationality and pre-forecasting. Real-time operation of the system relies on data-driven hyperlinks. Ensuring full traceability and compliance in the value chain allows for optimal models for control and management of agricultural land, crops and livestock. Digital agriculture creates an environment with high productivity, predictability and adaptability to changes, including those caused by a changing climate. This in turn contributes to food security, profitability and sustainability.

The future of smart agriculture depends on the Internet of Things platform. The Internet of Things (IoT) is a system of interaction and information exchange between various devices and machines that allows to automate control and monitoring processes through various "smart devices" and significantly reduce human participation in them. IoT technology will increase the competitiveness of the industry,

taking into account the increase in productivity and demand for agricultural products. Improves product quality, agricultural machinery reduces fuel consumption, prevents crop loss during transportation and storage of products. The fields of application of IoT technology in agriculture are precision farming, smart farms, smart greenhouses, raw material management, agricultural product storage, agricultural machinery and transportation management, (Big-data) database establishment. Now let's analyze them.

In precision farming, smart devices are used to manage crop yields based on changes in the plant environment as well as available land resources. As a result, it is possible to increase productivity by an average of 18-22% by optimizing operating costs, reducing consumption of seeds, agrochemicals, fertilizers and water.

Precision farming also avoids parallel control of farm machinery using GPS navigation, overstocking plants in the field or losing seedlings in the field, and excessive consumption of seeds and chemicals.

Smart greenhouses allow to keep plants under constant control, use fertilizers, chemicals and water more efficiently during cultivation, as well as reduce losses due to the human factor when taking care of the crops and optimize the number of necessary workers. According to experts, although the international market for "smart" greenhouses does not exceed 3% of the total number of greenhouse structures, their number is growing by 9% every year. Smart greenhouses allow us to control the process of watering and microclimate regulation, monitor the profitability and quality of work of all systems. At the same time, it provides 25-45% increase in yield by increasing the quality of the produced product and reducing its cost.

Currently, projects to create a network of mini-farms that deliver daily fresh and natural lettuce and blueberry products for short periods of time around major cities of foreign countries are widespread. In this way, more crops can be obtained from a smaller area of land, and manual labor is replaced by digital devices. It is estimated that such a 0.4-hectare farm can produce as much as a 12-hectare open-air classic farm in a year. At the same time, the land in the mini-farm can be replaced with hydroponics.

With the help of "smart" farms, cattle productivity and product quality are improved. According to scientists, cattle breeding based on traditional methods is ineffective today because cattle are raised on one third of the planet and cattle consume a significant portion of the crops grown during the growing season. According to foreign experience, automation of feeding, milking cattle and their veterinary control on the basis of modern technology, the use of information systems, provides an increase in milking and efficient use of available feed. In addition, there are technological solutions for increasing the efficiency of veterinary services, which allow you to create personal veterinary records, a single database of animals, animal registration, monitoring their growth. For example, based on the chip, an "electronic passport" of the animal is made, in which the database of information obtained during breeding is constantly updated, thus ensuring constant and reliable veterinary control.

Monitoring the use of agricultural machinery with the help of satellite navigation systems allows to reduce fuel consumption, as well as to optimize the route and workload for service personnel. It should be noted that almost 100 percent of agricultural machinery is sold with navigation equipment in EU countries.

During the collection and transportation process, the safety of raw materials can be monitored using appropriate sensors, which allows full control over the location and weight of the transported raw materials.

Smart warehouses for fruits and vegetables allow to monitor the condition of the product during storage according to specially set algorithms (storage temperature, humidity level, carbon dioxide) in real time, which helps to make the right decision on sale. If conditions are violated, the system corrects the situation and informs the warehouseman about the changes. Automation of development of technological processes of processing and storage of agricultural products, which reduces labor costs of workers and improves storage conditions of harvested crops.

Irrigation automation reduces the cost of irrigation water and at the same time allows high yields. Modern systems allow you to analyze each plot and determine the amount of moisture needed to avoid overuse of water. For example, a system based on wireless sensors transmits a signal to the controller and the irrigation control unit, which allows us to automate the irrigation process and control its implementation, from monitoring the operation of irrigation systems to analyzing soil moisture.

Electronic trading platforms for farmers make it possible to sell products of agricultural producers (farmers), prompt communication with trade organizations, which reduces the time of delivery of products from the field to the counter and reduces losses associated with temporary storage.

If a farmer produces organic products or wants to emphasize a special type of certification, he can use blockchain technology to track product delivery. To know what they are buying, consumers can scan a product barcode at the supermarket and build a supply chain from the farmer to the supermarket.

Blockchain-enabled programs can automate the process of tracking data throughout the grain supply chain. As grain is harvested from each field, all harvest data is collected and analyzed in real time in the program and then sent to suppliers' warehouses, where it is allocated according to the required quality and price, which ensures storage of grain in bulk. According to experts, currently about 30% of grain and other goods are lost due to intermediaries and logistics.

Drones are land guided vehicles, unmanned aerial vehicles (UAVs), multicopters, (quadcopters, hexacopters, octocopters) and winged drones. The last are often used for mapping work on large territories. They also make it possible to create electronic 3D maps of fields, calculate fertilizer application rates, inspect fields and monitor the condition of crops, control the operation of vehicles and agricultural machinery, protect plants, and control the application of crop protection products and fertilizers to fields. Monitoring carried out by drones can provide information not only about cultural plants, but also about weeds, for example, their density and the composition

of the species. Thermograms can be constructed by using images obtained by drones, as the temperature of plants signals about their stress levels from a particularly arid state.

At the same time, according to experts, drones justify their costs only if they serve at least 10 thousand hectares of land. In this regard, it is more profitable to use the services of outsourcing companies that specialize in providing this kind of services to small farmers.

Drones are actively used in agriculture in the USA, Europe, Brazil, Argentina and other countries, but most of all they are used in China and occupy the leading position in drone production in the world. Sensors, installed on the ground in control points, are the basis of soil characterization system, for example, can detect different terrain features, soil types, light conditions, weather, weeds, pests, and immediately report it to the user for decision-making. Thus, sensors and sensors located in the field at a considerable distance from each other and connected to the network provide information on the state of the fields and crops, in particular on moisture, temperature, weed formation, plant growth phases, etc.

Drones can create a system that provides wireless communication with land-based devices that measure physical and chemical properties of the soil, as well as the full set of data needed to make the right decision for the farmer or agronomist and today's "smart" machines that use autonomous weather stations.

Robots performing various tasks, from harvesting crops to weeding fields, are rapidly gaining popularity in agriculture. According to the Tractica consulting company, by 2024, the supply of agricultural robots will reach 594 thousand units. By the beginning of 2020, there were more than 200 companies supplying agricultural robots in the world. The following main types of robots used in agriculture are noted: unmanned tractors and drones; automated systems controlling vegetative processes of crops; automated livestock farm management systems, etc. At the same time, smart tractors and harvesters can work autonomously and do not require human intervention, which allows them to be used at any time of the day or night. In addition, they can be equipped with many additional functions, such as pest control systems.

For example, the American company Blue River Technology has created robots that can distinguish crops from weeds by using computer vision to spray chemicals only on weeds, and in Japan robots have been created that can pick strawberries on farms instead of humans. According to scientists, in a few years, all field work such as planting, weeding, and watering will be done by agro-robots.

In Israel, less than 20% of the land is suitable for agriculture, but farmers supply the food needs of 95% of the population. Israel has developed drip irrigation technology for crops, taking into account the acute shortage of water for irrigation. At the same time, the Israeli government supports agriculture in the country, subsidizing farmers up to 40% of the purchase price and introducing new technologies. The main components of the smart farming approach are software, irrigation systems, and innovative harvesting equipment, which are inexpensive due to the subsidy system.

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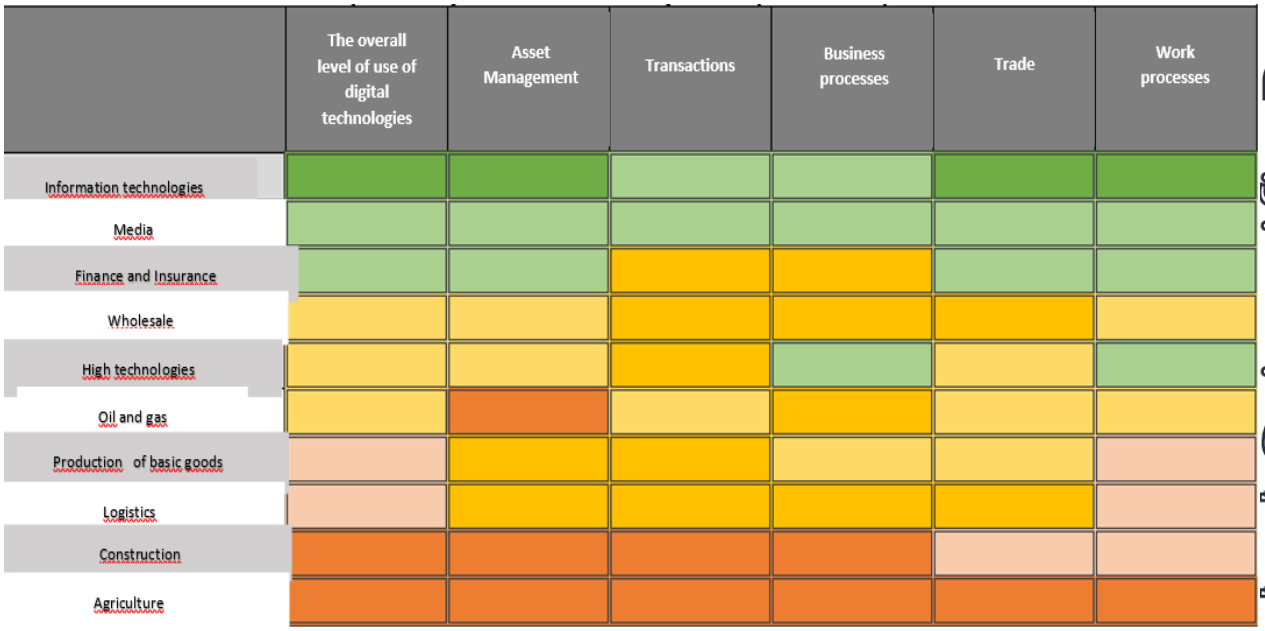
Thanks to this approach, as well as close cooperation between the public, private and scientific sectors in agriculture, high rates of adoption of new technologies in the agricultural sector are maintained.

Discussion of research results

In the world, modern innovative technologies such as smart greenhouse, smart farm, smart crop field, precision farming are widely used. In American and European countries, the implementation of digital technologies in agriculture has reached 65-70%, in Russia - 15%, and in our country - 5%. In the Asian region, the implementation of digital technologies in agriculture is developing in the countries of South Korea, China and Japan. In these countries, the use of innovative technologies in the agricultural sector is in full swing. Precision agricultural innovation has begun to concentrate with the introduction of digital technology. The application of digital technology in agriculture allows high efficiency through the optimal use of available resources.

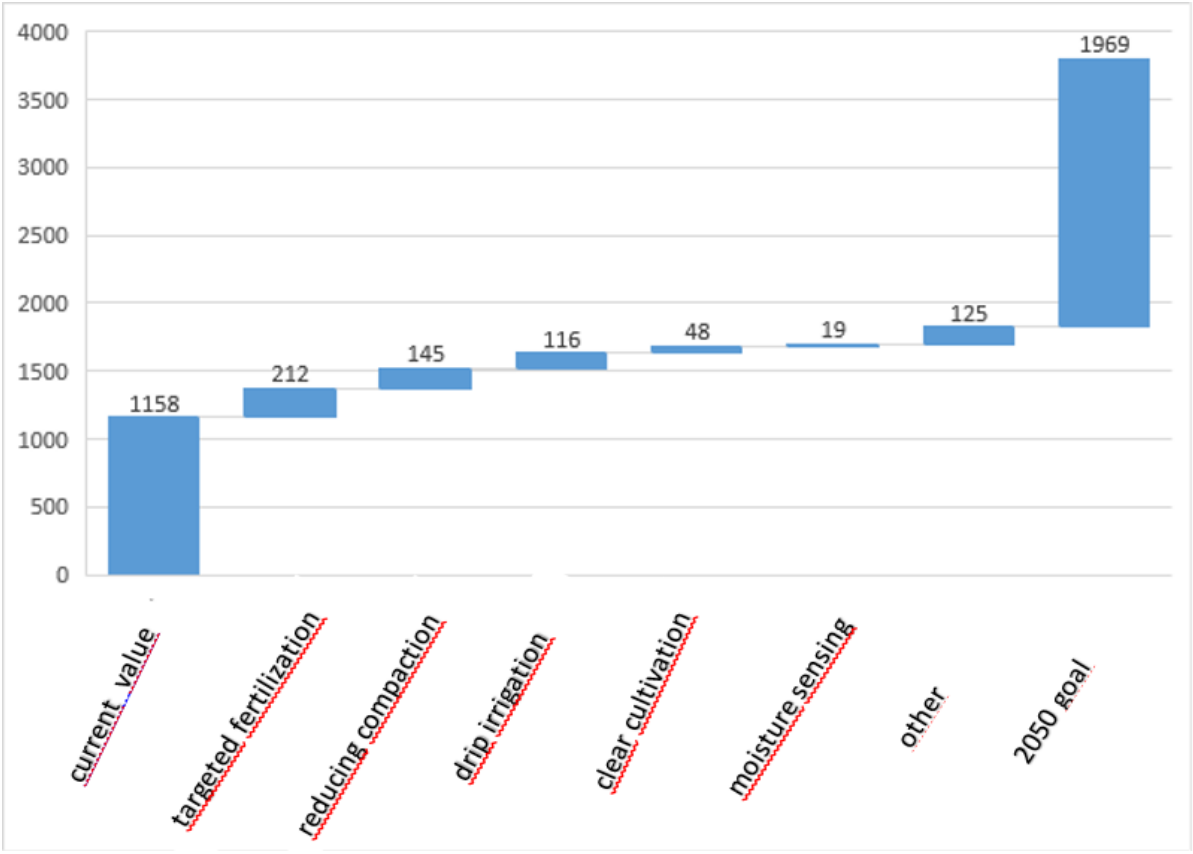
In various sectors of the world economy the relative level of digital technology adoption (Based on data from MCKinsey and CBINSIGT)



In another report published by Goldman Sachs, it is noted that productivity has increased significantly based on the improved technology of precision agriculture. According to their report, these new technologies can increase the productivity of agricultural land by 70 percent. This means that by 2050, the total market capitalization will be $240 billion.

The figure below shows how different digital technologies are impacting productivity costs globally in the US.

Impact of smart technologies on productivity ($ in million)



From the results of the analysis, it can be concluded that the process of digitalization of agriculture is just beginning. In 10-15 years, it will be possible to observe unimaginable achievements in this field. In particular:

- Digital agriculture platform minimizes human participation in agricultural production;
- Automatically carries out the connection of crops, herd condition, resources, Meteorological and hydrological information, haywon and crop type selection to the entire set of tools, all agricultural machinery and transportation to the intelligent agricultural platform.
- state agriculture manufacturers expanded creation of higher education facilities, and this is a supervision of influence.
- preparation and preparation of products within the 3-5-th stage of production, as well as involvement of the population in the discussion of issues. Thus, it can be concluded from foreign experiments that the development of agriculture using digital technologies based on artificial intelligence is a straight path that has no other alternative option.

Conclusions and proposals

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The introduction of smart technologies based on modern energy and resource-saving digital devices into the agricultural production process will help agricultural enterprises, farmers to conduct business more efficiently, reduce production costs and get huge profits. First of all, to increase openness, reliability and interest in digital technologies, to help farmers use digital technologies for maximum benefit; linking education and production, focusing education on the digital transformation of agriculture.

In our opinion, the following can be mentioned among the promising smart technologies applied to the agriculture of our country:

- Satellite navigation - pointing devices on the ground, tracking cultivated fields and animals;
- unmanned vehicles and drones - soil treatment, plant growth monitoring and crop control;
- sensors and sensors - monitoring the condition of crops, animals, etc.;
- IoT-platforms-a system for managing data from sensors, equipment, and other devices;
- Big-data-a large database that clouds data from sensors at all times to highlight useful information for agriculture.

At the same time, there are some problems that arise in the creation of an intelligent agricultural system.

When creating an intelligent agricultural system, it is necessary to select the appropriate sensors for the devices. The choice will depend on the types of information to be collected and the purpose of making an informed decision. In any case, the quality of the sensor to provide accurate and reliable information is important to the success of the product.

Data analysis should be the basis of every intelligent agricultural decision. The information collected is useless if it is not sufficient to understand the situation and make decisions. Thus, the user must have strong data analysis skills and be able to use predictive algorithms and machine tools to generate new ideas based on the collected data.

An intelligent farm software application must be easy to use. The farm owner or farm manager must be able to access data either from Max or remotely via smartphones or mobile computers. In addition, each connected device must have autonomous operation and a sufficient wireless network to communicate with other devices by sending data to a central server.

A software application for intelligent agriculture will require a reliable internal infrastructure to work well. In addition, the security of the system must be ensured. External cells will be able to modify data, take control of technical devices and machinery.

It will be necessary to develop a platform of intelligent agricultural information system and equip it with digital devices and sensors depending on the area of land.

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