

FEATURES AND BENEFITS OF DIGITAL TECHNOLOGIES IN AGRICULTURAL ENTERPRISES

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Abstract. This article substantiates that innovation is objectively necessary to ensure sustainable development of agricultural enterprises and the agricultural sector. The study notes that the introduction of digital technologies such as the Internet of Things, cloud computing, big data, blockchain, artificial intelligence, robotics can be widely applied in the agricultural sector. It is noted that the agricultural has a number of specific features: a variety of biological objects that are affected; various and complex technological processes, distribution of controlled parameters over a large area; high risks of the external environment. In this regard, the use of technologies for working with large data arrays is especially important here. The smart Agriculture concept will allow monitoring the growth of crops, a decision-making system for irrigation and the choice of fertilizers. The main goals of introducing digital technologies into agricultural production are to increase labor productivity, increase the quantity and quality of products. The introduction of digital technologies will make it possible to manage the quality of agricultural products through the introduction of modern breeding and genetic developments, provide an individual approach to the maintenance and feeding of livestock and poultry. The use of digital technologies has a positive environmental effect and will reduce the harmful impact on the environment. Updating the technological base of agricultural production through the use of digital technologies will allow controlling costs and increasing the economic efficiency.

1 Introduction

Experts note that the growth of competitiveness and efficiency of enterprises in any areas of activity is possible only through the implementation of innovative transformations [1-5]. This is especially important for enterprises in the agricultural sector. The orientation of the agricultural sector towards innovative development and the transition to open innovation systems are relevant for Russia.

The experience of innovative companies shows [6, 7] that the use of digital technologies can improve the efficiency of economic activities, reduce operating costs, as well as the costs of storing and transporting products, and carry out management actions in real time using modern means of communication.

The results of a McKinsey study and other scientists have led to the conclusion [8-10] that the introduction of digital technologies into production contributes to a positive dynamics of labor productivity (an average growth of 45-55%), a reduction in maintenance costs of production equipment by 10-40% and downtime of equipment by 30- 50%, and also contributes to an increase in quality indicators by 10-20% and a decrease

in warehouse costs by 20-50%. It is noticed that the period of commercialization of innovations is reduced by 20-50%, and the accuracy of forecasting sales is increased by more than 85%.

In this regard, the relevance of the implementation of the achievements of scientific and technological progress is beyond doubt. Innovative technologies are actively penetrating various spheres and sectors of the Russian economy [11, 12]. Innovative development serves as an objectively necessary basis for ensuring sustainable development of agricultural enterprises and the national agricultural sector.

2 Materials and methods

The agrarian sphere has its own specific features (Fig. 1).

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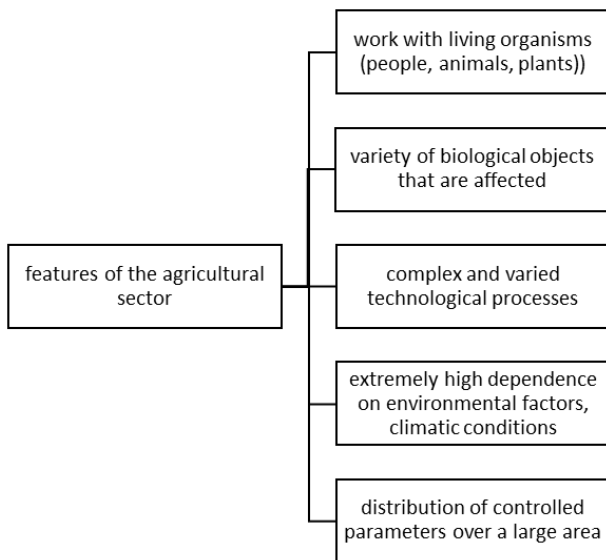


Fig. 1. Features of agricultural production.

In recent decades, enterprises in the agricultural sector have been actively introducing digital innovations. In agriculture and the processing industry, scientific achievements are used in the field of robotics, automated decision-making systems, precision farming, remote sensing of the earth, and satellite mapping. The agricultural sector is now fully capable of utilizing Industry 4.0 technologies. The Internet of Things, cloud computing, big data, blockchain, artificial intelligence have ample opportunities for application in the agricultural sector [13-15]. These technologies are transforming the agricultural sector into a flexible, intelligent system. The use of digital technologies will allow in the future to integrate each of the technological processes into the production chain.

Due to the specific features of agricultural production, the smart Agriculture concept is relevant.

The farmers face a number of challenges during growing and harvesting. Inadequate consideration of specific factors can lead to crop loss. Precision farming is used to increase crop yields using advanced technologies. Modern technologies make it possible to obtain information about various aspects of the environment. In addition to environmental monitoring, other solutions must be applied to increase crop yields. For example, farmers use insecticides and pesticides to help eliminate insect and pest influences. Crop spraying and fertilization can be controlled with the smart Agriculture concept.

The variety of biological objects that are affected in agriculture, as well as diverse and complex technological processes, require the use of technologies for processing big data arrays and cloud storage. The high level of performance of modern computing power allows you to store, analyze and process large amounts of data. Typically, agricultural production is spread over a large area. In this regard, it becomes necessary to consolidate the controlled parameters. The use of cloud technologies allows you to get additional savings on communications and access to shared documents.

The solution to all problems is to take into account the peculiarities of agricultural production and develop an integrated system that contains modern digital technologies.

Agriculture plays an important role in the Russian economy. More than 37 million people live in rural areas. This represents 25% of the country's population. Agriculture accounts for 3.8% of the total production in the country (as of 2019). Investments in agriculture amounted to 838.8 billion rubles in 2019, or 4.3% of the total investment in the country for the year. The level of innovative activity in agriculture is growing. The cost of technological innovation in 2018 amounted to 13.3 billion rubles in growing annual crops, 6.5 billion rubles in livestock breeding, and 0.2 billion rubles in growing seedlings. The volume of innovative products in the cultivation of annual crops amounted to 10.3 billion rubles, or 1.5% of the total volume of production, in animal husbandry - 21.7 billion rubles, or 2.1% of the total volume of products produced. Statistics show that there are prospects for the application of innovative technologies in agriculture.

The main arguments in support of the introduction of digital technologies into the activities of enterprises in the agricultural sector are as follows:

- reducing labor intensity and increasing productivity of agricultural production;
- increasing the efficiency of the resources used, adapting biological objects to the territorial specifics of farming;
- individual approach to keeping and feeding livestock and poultry;
- an increase in the quantity and quality of the crop, a decrease in the yield deviation;
- the ability to manage the quality of manufactured products through the introduction of modern breeding and genetic developments;
- reducing dependence on the influence of the human factor;
- reduction of harmful effects on the environment;
- updating the technical base of agricultural production.

The use of cloud data storage is promising for enterprises in the agricultural sector. The advantages of cloud storage technology should be outlined:

- access to data from any computer with Internet access;
- organization of joint work with data, simplification of interaction between different departments of the enterprise;
- ensuring the safety of data;
- growth of computer productivity;
- there is no need to bear the costs of purchasing, maintaining and maintaining your own data storage infrastructure.

In addition, the cloud storage provider is responsible for backing up and maintaining data integrity and does not involve the client in this process.

From an economic point of view, the effectiveness assessment of the feasibility of implementing a project to create a cloud storage is carried out by conducting a comparative analysis. For comparison, two projects are

evaluated: the first - on the creation of a cloud data storage, the second - on the creation of a data storage system without the use of cloud technologies.

The total cost of building a cloud data warehouse is a combination of one-time capital and operating costs over the life of the project (1):

$$TC = CC + OC * n \quad (1)$$

where TC - total cost of building a cloud data warehouse, monetary units, CC - capital costs, monetary units, OC - operating costs, monetary units, n - number of years.

Capital expenditures include such items of expenses as: hardware costs, software costs, telecommunication line installation costs, equipment installation and configuration costs, and personnel training costs.

Operating costs include personnel costs, cloud storage subscription costs, and Internet service costs (2).

$$OC = C_1 + C_2 + C_3 \quad (2)$$

where OC - operating costs, monetary units, C_1 - wage fund, C_2 - subscription fee for using cloud data storage, C_3 - payment for Internet provider services.

It should be noted that when creating your own data storage system, the composition of operating costs is different. In this case, operating costs include: hardware and software costs, software complex design costs, personnel remuneration with deductions, equipment depreciation, payment for Internet provider services, equipment maintenance costs, including salaries of service personnel, other general production costs (3):

$$OC = C_1 + \dots + C_8 \quad (3)$$

where OC - operating costs, monetary units, C_1 - hardware costs, C_2 - software costs, C_3 - costs of designing a software package, C_4 - wage fund, C_5 - depreciation of equipment, C_6 - payment for Internet provider services, C_7 - equipment maintenance costs, including staff salaries, C_8 - other general production costs.

Calculations show that the cost of implementing your own data storage system, as a rule, is two to three times higher than the cost of using cloud storage.

The annual operating costs are multiplied by the number of years of project implementation. The investor recognizes as expedient the project, the implementation costs of which are lower.

It should be noted that the implementation of cloud technologies has both obvious advantages and difficulties. A company implementing a project to create a cloud storage of data must have constant access to the Internet. With large amounts of processed information, poor access to files is possible due to the low speed of access to them.

The introduction of digital technologies and automated control systems into the activities of agricultural organizations makes it possible to integrate production processes into a single information space and significantly increase the efficiency of economic activities. The increase in efficiency is expressed in

optimizing the operating modes of machines and equipment, increasing productivity and labor safety, improving the quality of products, their quantity, in optimizing logistics, and reducing the time to market products.

3 Conclusions

This study demonstrates the important role of digital technologies in the development of modern enterprises in the agricultural sector. Traditionally, for the Russian economy, an important role is assigned to government influences. The government is called upon to activate agricultural enterprises in the use of digital technologies.

In Russia, the State Program for the Development of Agriculture and the Regulation of Markets for Agricultural Products, Raw Materials and Food is being implemented. It outlines the priority tasks: development of a system of incentives for agricultural producers to purchase modern equipment; the use of promising agricultural technologies; increasing the innovative activity of all enterprises in the agricultural sector; improving the innovation system of the agricultural sector; modernization of the institutional environment that regulates various aspects of innovation processes; development of the infrastructure for the transfer of biotechnology in agricultural production. A comprehensive and systematic solution to these problems will contribute to the active introduction of digital technologies in the national agricultural sector.

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