The use of digital technologies in agriculture in Russia

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Abstract. Production in agriculture is developing towards unmanned vehicle driving and the implementation of many other operations using digital technologies that is changing the structure of labor in the agro-industrial complex, increasing the demand for operators of certain production processes. The article presents quantitative results of the collection of agricultural products based on statistical observation data, taking into account the use of digital technologies in agriculture. The dynamics of agricultural production is shown, as well as the most promising agrotechnological solutions in the current conditions are given.

1 Introduction

The deployment of the digital revolution on a global scale is increasingly immersing us in a new reality [8]. The variety of technical and technological innovations that change our lives has increased many times in the last decade, and in the most diverse areas of human life [9]. When it comes to digitalization, first we mean the infrastructure, hardware and software, the list of Internet platforms and offers [10].

Digitalization is the transition of production from work models and traditional planning to models that are based on information technology and information.

Exploring the stages of agricultural transformation, it is worth noting informatization, computerization of agricultural production, which was replaced by automation, digital transformation and digitalization. Today, services and robots, design, communications, engineering calculations, databases that are controlled by programs are increasingly used.

The current digital technologies provide completely new opportunities for organizing the agricultural economy. Since 2006, the implementation of national projects has begun, which make it possible to acquire the latest equipment. Thus, the modern stage of digitalization in agriculture has begun.

The digitalization of the agricultural sector eliminates the shortcomings associated with a decrease in yield due to unpredictable weather during cultivation, harvesting and storage, also conducts operational monitoring of acreage, reduces theft of fuel, material assets,

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means of protecting for seeds and plants, and also receives state support or sell products in time [1].

To date, the agricultural sector is not lagging behind modern trends, and more and more often we can observe the development and implementation of innovations in the agro-industrial complex (AIC). One of the most important strategic directions of innovation development in agriculture is innovation processes, as well as scientific and research progress, which ensure continuous development. Innovations in the agro–industrial complex are new or well-known, but not yet implemented in the domestic agro-industrial complex, scientific ideas of Russian and foreign researchers, the use of which in the development and implementation of technical, technological and engineering projects will significantly increase the efficiency of agro-industrial production [5].

2 Materials and methods

The work contains the results identified in the framework of published reports and analytical materials of international organizations. The purpose of this article is to identify the problem of low use of digital technology in agriculture.

Methods of the performed research:

- Theoretical and empirical methods.
- Descriptive methods.
- Method of graphical illustration of data.

3 Results

To conduct a study of the dynamics of the development and implementation of innovations in agriculture, we turn to the data of Rosstat, as well as other sources of statistical and analytical information for the period from 2018 to 2021. Let's consider the data describing the level of innovative activity of organizations in each separate area of the agro-industrial complex are presented in Table 1.

Table 1. The level of innovation activity of organizations in the agricultural sectors [6].

Indicators	2018	2019	2020
	%	%	%
cultivation of annual crops	4.0	4.8	7.1
cultivation of perennial crops	1.4	2.4	4.8
growing seedlings	5.6	5.0	8.7
Animal husbandry	4.2	4.0	7.5
mixed agriculture	9.4	2.8	2.5

It is expected that by 2024, information on 100% of agricultural land should be stored in digital format.

The Food and Agriculture Organization of the United Nations (FAO) and the Organization for Economic Cooperation and Development (OECD) have published an agricultural forecast for 2021-2030. Analysts expect that, subject to stable weather conditions and a stable political environment, it will be possible to achieve the UN sustainable development goals during this period [2].

An important role for the growth of agribusiness productivity in Russia will be played by the development of digital technologies and the use of biotechnologies that increase crop yields and shorten the production cycle in animal husbandry. The use of digital technologies will contribute to the sustainable development of the agro-industrial complex.

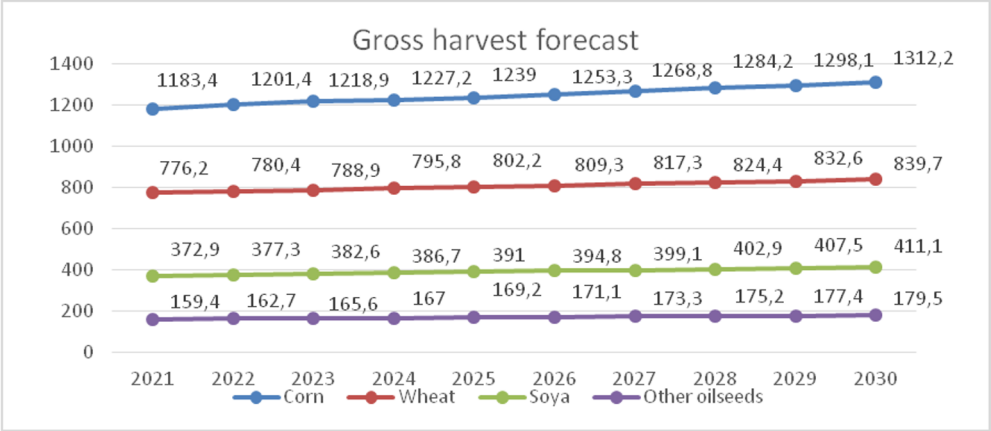

Fig. 1. The forecast of the gross harvest of agricultural products in million tons. Source: OECD-FAO.

The development of the agro-industrial complex in recent years has demonstrated steady positive dynamics. So, in 2020, the index of agricultural production, according to Rosstat, amounted to 101.3% compared to the previous year, 106% to the level of 2018, and in 10 years the growth reached 47%. Including the index of crop production in 2020 amounted to 100.7% by 2019, 107% by 2018 and 178% by 2010.

At the end of this year, the growth of agriculture is likely to continue. According to forecasts, agricultural production may increase by 1.3% in 2021, including crop production — by 1.5% at comparable prices.

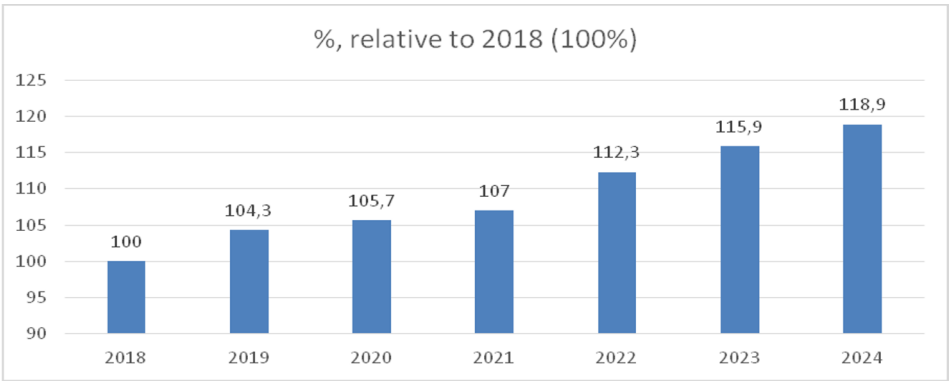

Fig. 2. Dynamics of agricultural production. Source: Vnesheconombank Institute.

In the long term, the development of agriculture will be influenced by the degree of achievement of the goals set to increase the acreage under the state program for the involvement of agricultural land in the turnover, the development of land reclamation, the increase in the effectiveness of anti-epizootic measures, the implementation of energy transfer to reduce greenhouse gas emissions [3].

In agriculture in Russia today, there are a sufficient number of promising areas for the development of the innovation sector. According to experts, the innovative development of 18 agro-industrial complex in general and agriculture in particular in 2025-2030 will develop in such areas as [7]:

- IT and cognitive technologies.
- Biotechnologies.
- Robots and new technology.

- Innovative food.
- New farming systems.

A more detailed consideration of the prospects for the development of these areas in 2025 and in 2030, as a percentage, is presented in Figure 3.

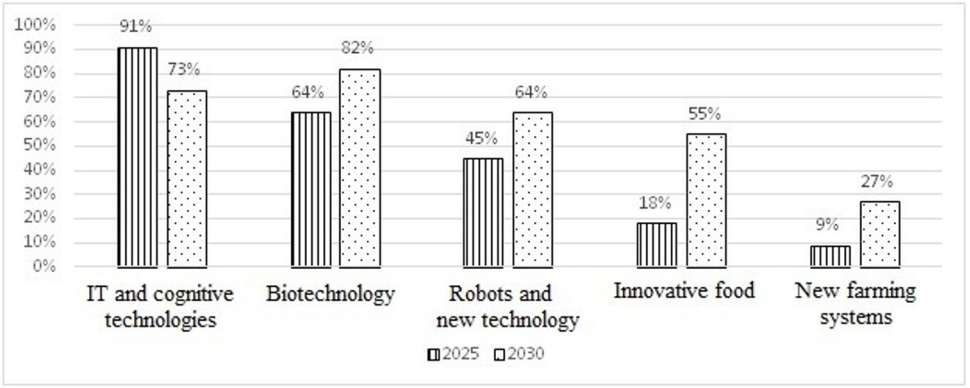

Fig. 3. Key promising areas of technology development in the Russian agro-industrial complex.

4 Discussion

Thus, having conducted a study of the dynamics of the development and implementation of innovations in agriculture in Russia, we can conclude that today this industry is just beginning to introduce new technologies, but at the same time it has sufficient prospects in the future.

As can be seen from table 2, the highest level of innovation activity, on average for the period under review, falls on the sphere of agriculture, which is aimed at growing seedlings, the indicator for 3 years did not fall below 5%.

By 2020, innovative activity is increasing in the livestock industry, where the indicator has increased by 3.3% since 2018. Almost the same situation is observed in the field of growing annual crops, where the indicator of innovation activity in 2020 reached 7.1%.

However, positive dynamics is not observed in all areas, for example, mixed agriculture is undergoing an outflow of innovation activity, the indicator is decreasing every year, in 2020 the threshold reached 2.5%.

From the data in figure 3, we see that by 2025, IT and cognitive technologies will be the most promising areas of development, their percentage will increase to 91%, however, according to analysts, this area will fall into second place by 2030 and the indicator will drop to 73%. In the first place in 2030, there will be such a direction as biotechnology and its percentage ratio will be 82%.

By 2026, it is expected that the growth of digital technologies in agriculture in Russia will be 5 times, including through the support of agrotechnological startups. Among the most popular solutions are: decision support systems, applications for precision agriculture, production management systems, plant and animal health control; user interfaces and unified platforms integrating various management tools of an agricultural enterprise, including those based on a cloud environment.; automated systems for harvesting and ensuring the activities of livestock farms; intelligent supply chain analysis and management systems.

The state creates conditions that contribute to the introduction of digital technologies. The Strategy for the Digital Transformation of the Fishery and Agro-Industrial Complex dated December 29, 2021 was approved, which, in the context of development will help

maintain the competitiveness of domestic producers through the active use of digital technologies that minimize human impact on the environment and rational use of resources.

Digitalization refers to the production of both raw materials and also food, so the current trend of switching to alternative analogues of familiar products should be analyzed in terms of future human health.

It is especially important to introduce technologies to replace human labor with technology in production processes. Over time, there will be a decrease of labor force involvement in agricultural production in order to protect human health, minimize the human factor impact, and the effect of digitalization, cost reduction and optimal use of material resources will be obtained. A man will remain in agriculture, because the figure will not replace a person, but will only save him from complicated, routine and unsafe processes [4].

5 Conclusion

From all of the above, it can be concluded that the use of modern technological solutions and the use of digital platforms can improve product quality, reduce communication time and thereby increase the competitiveness of the Russian agro-industrial complex.

Among the growth points of the Russian agro-industrial complex until 2030, he highlights the active development of digitalization and the introduction of artificial intelligence in agriculture. The spread of new technologies can significantly reduce production costs and increase productivity. So far, these are initially quite expensive technologies that pay off mainly in large companies, but over time they will become available to more farmers. Another trend is the development of organic agriculture, which is designed not only to provide the population with useful products, but also to contribute to the preservation of soil fertility and environmental ecology.

However, for the mass introduction of modern technologies and the preservation of Russia's worthy place in the international arena, long-term development strategies and effective state policy are necessary. It is necessary to improve the skills of the rural population, pay more attention to the development of agricultural education, create breeding, seed and genetic centers, etc. Government support plays an important role in this, but so far the budget for technology development is extremely small, and targets are set at a low level. For example, according to the Federal Scientific and Technical Program for the Development of Agriculture for 2017-2025, only 51.1 billion rubles are planned for nine years, including 26.1 billion rubles from the federal budget.

Of course, one of the main trends in agriculture in Russia and in the world will be an increase in the level of digitalization and automation of processes. At the same time, in the perspective of ten years, digitalization will be applied not only in production, but will also actively enter into the scheme of relations between the manufacturer, the consumer and the state, which administers and controls.

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