Application of digital technologies in the agro-industrial complex of Russia

A I Beksultanova, M A Sadueva and M I Nazaeva

1Chechen State University, 32, st. A. Sheripova, Grozny, 364024, Russia
2Grozny State Oil Technical University named after acad. M.D. Millionshchikova, 100, H. Isaeva Ave., Grozny, 364051, Russia
3Chechen State Pedagogical University, 33, st. Kievskaia, Grozny, 364037, Russia

E-mail: adamovaaybika@mail.ru

Abstract. Digital technologies are increasingly used in all segments of agriculture. Improving the efficiency of agricultural enterprise management through digitalization technologies helps to maintain competitiveness in the market. To make the right management decisions, you need information, data that allows you to collect technologies such as satellite images, high-tech sensors, GPS systems, and more. The apogee of the digitalization process of the enterprise will be the transition to precision farming. The paper presents data analyzed by the Department of Science and Technology Policy and Education of the Ministry of Agriculture of the Russian Federation together with the Center for Forecasting and Monitoring of the Kuban State Agrarian University. The collection of statistical information is organized through the regional governing bodies of the agro-industrial complex on the use of elements of precision agriculture in 2019. The article explores the role of digital technologies in the agro-industrial complex, notes the benefits from the use of digital technologies, characterizes pressing economic and economic issues and problems that hinder the development of the agro-industrial complex (agro-industrial complex). It also provides recommendations on how the use of digital technologies contributes to the increase and functioning of the efficiency of agri-food systems.

1. Introduction

Appeared at the end of the twentieth century the concept of the digital economy is usually associated with the works of N. Negroponte D. Tapscott [1]. As N. Negroponte noted a quarter of a century ago: being digital is more than just living in a situation that has all the characteristics of digital [2].

Today, digitalization covers most areas. Agriculture, a strategic industry for the Russian Federation, was no exception. The Ministry of Agriculture of Russia is implementing the Digital Agriculture project, which sets itself ambitious goals - digitalization should help to double the productivity of agricultural enterprises by 2024.

The digital transformation of agriculture needs specialists with new knowledge, as well as new “smart” solutions that will come to their aid. Experts of Ruselectronics spoke about one of these developments at the Federal IT Forum of the Russian agro-industrial complex “Smart Agro: Digital Transformation in Agriculture” - an information and analytical system for crop production management.

From gathering to the cultivation of fields, the invention of fertilizers, the cultivation of plants, the use of automation and mechanization of production - any revolutionary innovation raised agriculture to a new level of development. The current agrarian revolution is focused on the introduction of...
advanced information technology (IT), which will reduce costs and manual labor, while increasing yields and productivity.

Today, the use of IT in agriculture is not only about the use of computers. Digital technologies make it possible to control the full cycle of livestock or crop production - “smart” devices measure and transmit the parameters of plants, soil, microclimate, etc. Special programs analyze all this data from drones, sensors and other equipment. Online or mobile applications come to the aid of agronomists and farmers - to calculate the fertilization scheme, to set a favorable time for planting or harvesting, to predict the yield, and much more [3].

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The ratings are compiled based on data from 64 precision farming regions and 68 precision livestock regions. The reliability of the results provided is primarily due to the reliable presentation.

2. Materials and methods
The work uses statistical and analytical research methods, also the methods of the research performed contain theoretical and empirical parts, methods of description and are supported by tabular methods of data illustration.

3. Results
Because of the analysis, 64 subjects were considered; precision farming is used in 55 subjects, 2834 farms on an area of 15.5 million hectares (2019). Of the analyzed regions, precision farming is used in 10% of farms. In 2018, 52 subjects were analyzed; precision farming was used in 40 subjects, 1930 farms on an area of 12.5 million hectares. The number of entities applying the latest technologies in crop production increased by 38%; farms increased by 47%; the total area in which precision farming is used increased by 24% (table 1).

| Year  | Number of regions | Farms using elements of precision farming | Total area, million hectares |
|-------|------------------|------------------------------------------|----------------------------|
|       | Total            | Using elements of precision farming       |                            |
| 2018  | 52               | 40                                       | 1930                       |
| 2019  | 64               | 55                                       | 2834                       |
| Difference, units / % | 12/23 | 15/38 | 904/47 | 3/24 |

The results of the analysis indicate that the Volgograd region is the leader in the use of precision farming, where there are 257 farms, Krasnodarsky Krai has a total of 250 farms and the Voronezh region has 211 farms. They compete in terms of the total area on which elements of precision farming are used - Krasnodar Region (1.22 million hectares), Volgograd Region (1.2 million hectares), Voronezh Region (1.33 million hectares). Comparative rating of the leading regions in 2018–2019 shown in table 2.

In the Krasnodar Territory, the number of farms increased by 32%, in the Voronezh Region - 16%. The area where precision farming is used in the Krasnodar Territory - 27%, in the Voronezh region increased by 18% [4].

4. Discussion
The leaders in the rate of implementation of digital approaches in agriculture, as can be seen from the results of the Center's research, are the Altai and Krasnodar Territories, Kursk, Lipetsk and Samara Regions, the Republics of Bashkortostan and Tatarstan. The lowest rates are recorded in the Jewish
Autonomous Region, Amur, Kirov, Kostroma, Magadan and Murmansk regions, Kamchatka and Primorsky Territories, Kabardino-Balkar and Karachay-Cherkess Republics.

Table 2. Comparative rating of the leading regions in 2018–2019.

|                         | By the number of farms | By area, million hectares |
|-------------------------|------------------------|---------------------------|
|                         | 2018 | 2019 | 2018 | 2019 |
| Krasnodar region (189)  | Krasnodar region (257) | Voronezh region (1.13)   | Voronezh region (1.33) |
| Voronezh region (182)   | Krasnodar region (250) | Krasnodar Territory (0.96)| Krasnodar region (1.22) |
| Nizhny Novgorod region (144) | Voronezh region (211) | Omsk region (0.92)       | Volgograd region (1.2) |

Experts and industry researchers note that today, in different parts of the country, the introduction of digital technologies in farms is heterogeneous (territories with high agricultural potential, as a rule, have more marginal production, and, therefore, huge investment opportunities), and the digitalization process in Russia is taking place today, with some lag in comparison with Western Europe, USA and Canada. At the same time, the spread of the trend of digital technologies itself is advancing very rapidly - for example, three four years ago, the level of equipment with navigation systems was significantly lower, but with the improvement of technologies and their reduction in cost, the development of this technology began to go everywhere. This suggests that there is great potential for the subsequent introduction of digital technologies, and experts expect an effective expansion of their application in the Russian Federation [5].

Experts note that one of the drivers for the development of digital transformation of the agro-industrial complex in the Russian Federation is the virtual absence of competition and a significant degree of cooperation between digital service providers for this complex; the presence of large agricultural holdings; government measures to develop the digital economy [6].

Agricultural producers expect that modern digital technologies will help them in solving pressing economic and economic issues and problems, the main of which they include:

- Low level of profitability, insufficient for effective development of production;
- The need to take into account and prevent the risks of agricultural production: weather, diseases of plants and animals, pests, prices for products in season, prices for fuels and lubricants and others;
- Difficulties with access to the competencies of qualified specialists; - significant expenditures of own time for planning and control of execution "in the field" to the detriment of other production and management tasks;
- Unproductive loss of resources (fertilizers, fuels and lubricants, plant protection products, etc.);
- Difficulties with access to advanced technologies, practices and knowledge bases;
- The need to simplify work with the state (taxes, reporting, audits);
- Difficult access to finance and insurance [7-8].

Thus, the main directions for the development of digital technologies in the agri-food industry can be:

- Increasing production efficiency (crop yields and animal productivity);
- Reduction of production costs, increase in labor productivity;
- Timely response to climate change;
• Reduction of transaction costs in sales by building a transparent supply chain of products from the field to the consumer;
• Minimization of management risks;
• Reducing the shortage of skilled labor;
• Timely provision of important information to rural producers;
• Simplification of access to borrowed funds;
• Gaining access to digital marketing channels for agricultural producers [8].

5. Conclusion
COVID-19 has seriously impacted daily life in the past year, and as businesses and ordinary people dealt with the challenges that arose, digital technology began to play a big role in all areas, including agriculture.

The past year saw a peak in the adoption and use of digital technologies in the global agricultural industry. The market has seen a significant increase in the number of digital agriculture cooperation agreements. There has also been an increased interest in environmental sustainability, especially with a focus on carbon markets and supply chain initiatives.

The growing number of agreements in the industry has become a major topic of thought in 2020, and the trend is expected to continue in 2021. There is an increase in demand from farmers for the tools needed to work together (from high-precision equipment to farm management software connected at all stages of production). The increasing demand for simple solutions creates new opportunities for market expansion, and as the integration between solution providers and farmers grows, a large number of highly specialized products will enter the market. However, it should be borne in mind that farmers are more focused on deriving additional benefits from existing tools, rather than on introducing and learning new ones. Therefore, in a few years, the growth in the development of digital products in agriculture may slow down.

Infrastructure improvements (some of which are yet to be fully implemented) will make technology more affordable in 2021. Initiatives such as 5G and the expansion of broadband in rural areas will help digitalize many farms. It is also worth noting that while COVID-19 has brought attention to digital technology, more affordable and more centralized solutions are becoming more common. With a focus on accessibility, better connectivity and centralized strategies, 2021 will be a key year for the growth of digital tools adoption in agriculture [9-10].

In 2021, a recovery growth in household consumption is expected: retail trade turnover will increase by 5.1%, the volume of paid services to the population - by 6.7%. In 2022–2023, the retail trade turnover will continue to grow at a rate of 2.8–2.9%, the volume of paid services to the population - 3.0–3.1%.

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