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ECONOMIC ASPECTS OF THE DEVELOPMENT OF THE "DIGITAL AGRICULTURE" SYSTEM

Igor Leonidovich VOROTNIKOV, Nadezhda Viktorovna UKOLOVA, Sergey Vladimirovich MONAKHOV, Juliya Anatolyevna SHIKHANOVA, Vasily Voldemarovich NEYFELD

Saratov State Agrarian University, Teatralnaya square, 1, Saratov, 410012, Russia, Emails: igor_leon_vorotnikov@bk.ru, 812637@mail.ru, 184605@inbox.ru, 648096@mail.ru, 214283@inbox.ru

Corresponding author: igor_leon_vorotnikov@bk.ru

Abstract

In the article, the authors are revealing the features of the transition to a new type of farming. The possibilities of modern agriculture, use of smart technologies for agriculture, development of highly intelligent agriculture, features of the use of artificial intelligence in agriculture, use of the Internet, namely FoodNet, active use of GIS technologies, improvement of logistics systems, and banking services for farmers and agriculture producers are being examined on the ground of digital technology. The conclusion is being made concerning the need for the active development of the digital agriculture system.

Key words**:** *development economics, digital agriculture, GIS technologies, smart agriculture*

INTRODUCTION

Agriculture is one of the most promising areas of application of digital technologies and an opportunity to develop a digital economy. Being a key sector of the economies of many developing countries, agriculture provides significant growth in the global economy. Modern agriculture is characterized by a high share of the use of new technologies, both in the production process and in the service infrastructure. The use of new digital technologies is possible thanks to the active development and technological modernization of the agricultural production process. Now it is difficult to imagine new means of production used in agriculture without the presence of highly intelligent devices that minimize costs in the production process, as well as contribute to improving the efficiency of the production process.

MATERIALS AND METHODS

The study used various methods of economic science. The main research method was the dialectic method. The theoretical basis of the study was the work of scientists of the world and Russian science [1, 2, 3, 4, 8, 12, 13, 14, 15, 16, 17, 18, 20, 21], devoted to the use of digital technologies in various sectors of the economy, adaptation of these technologies to modern agriculture. The methodological basis of the study was the analysis of normative legal acts [5, 6, 9, 10, 11] and reports of state executive authorities, state programs, statistical data [7, 19], monographs, articles and scientific works.

RESULTS AND DISCUSSIONS

The active use of digital technologies in agriculture forms a new segment of agriculture, which, in our opinion, should be separated from the others and given the name of "digital agriculture".

"Digital agriculture" is the technological basis of agriculture of the future, its constituent element provides for the creation of highly efficient agriculture that can meet the growing needs of the population through the more economical use of limited resources, effective control of the expenditure of funds allocated for the implementation of the production process, and the use of the system control of the production process immediately from the

start of production to its delivery consumer-screw.

Modern agriculture is in the stage of active use of digital technologies [7]. This stage of development is largely based on the use of robotics and artificial intelligence, paving the way for an autonomous decision-making system and performing operations without human intervention [13]. At the same time, modern agriculture is becoming increasingly capital intensive. Agricultural production requires high costs for the purchase of modern high-performance machinery, equipment, software. Many medium-size and small enterprises face difficulties in solving the problems of investing financial resources for the development of agricultural production on a fundamentally new technological basis. And already in the short term they will be forced to leave the industry or carry out a comprehensive modernization of production, taking into account the availability of modern production systems.

Digitalization of agriculture involves an active investment policy in terms of IT technology, consulting, as well as data processing. All this is possible on the basis of the construction of large holding companies incorporating relevant structural units, as well as free financial resources. Another aspect of digitalization should be the active participation of the state in stimulating the development and use of digital technologies in this industry. The mechanism of interaction between state structures and private business is presented in Figure 1.

One of the directions of using digital technologies in agriculture is the creation of a modern infrastructure based on the use of digital technologies. Thus, the active use of GIS-technologies in the formation of digital agriculture is promising, especially in connection with changes in climatic conditions [18], as well as the development of the GeoFarmer system in connection with its successful testing in West and East Africa, as well as in Latin America [8]. The geographic information system in agriculture is a single centralized database in which you can collect, store, process, analyze and compare any information necessary for making management decisions, including cartographic data and data on any objects placed on the corresponding maps.

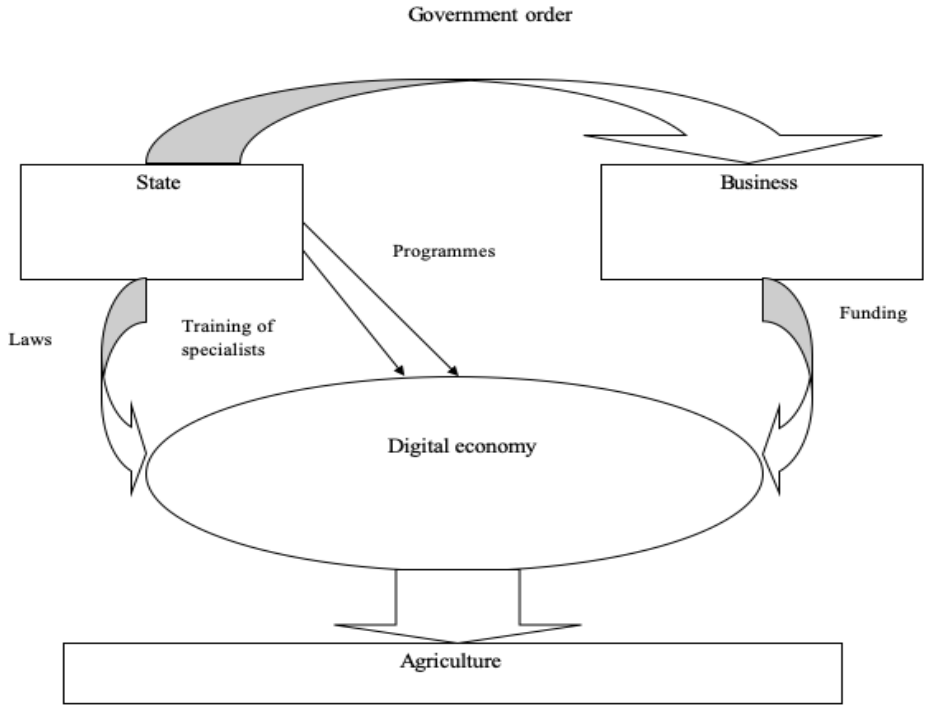

Fig. 1. The mechanism of interaction between the state and business in the process of development of the digital economy in agriculture
Source: compiled by authors.

The main advantage of this system is the ability to control the relevance of information by various methods, including from space and using unmanned aerial vehicles, the interaction of which with the global system should be automatic. This is an obvious advantage of introducing this system into agricultural management bodies, as it allows constant monitoring of the actual state of the industry and improves the quality of forecasts and recommendations on the development of business entities or individual regions as a whole.

Creating smart agriculture is a key task for the economies of many developing countries. For example, in China it has been the strategic goal of creating a new agricultural industry of the future since 2009 [20]. Russia's agriculture is also actively changing towards the development of highly intelligent agriculture, the active use of digital technologies [13]. The basis for creating smart agriculture is the ability to control all production processes, minimize costs, reduce environmental damage, improve the quality of manufactured products. The process of digitalization of production processes is most actively observed in large agricultural companies, such as RosAgro Group of Companies, EkoNiva Group of Companies, etc. Of course, the possibilities of small forms of managing using new technologies are very limited. To this end, government agencies should provide support to small farms and individual entrepreneurs engaged in modern agribusiness by providing soft loans, leasing modern equipment, and creating the appropriate infrastructure.

In the global economy, a new segment of the Internet, FoodNet, is actively developing, as one of the platforms for placing products on the Internet, which ensures the rapid promotion of products from the manufacturer to the consumer, as well as monitoring the promotion of products at all stages of the product life cycle. Active development of FoodNet allows both producers and consumers to receive additional benefits. To manufacturers in the form of increasing the speed of product sales and minimizing transaction and other costs. And the consumer to buy products at lower prices with high quality products.

Modern digital technologies significantly reduce the costs associated with logistics, which is especially important for countries with large territories. So, the growth in farm size and new branches mean that logistics is becoming even more complex [3].

In the banking sector, commercial banks are also actively developing and applying digital technologies in lending to agricultural producers of both legal entities and individuals. For example, new digital technologies are already actively used in bank lending and customer service. Leading banks, both Russian and foreign, create entire divisions whose work is aimed at the development and subsequent implementation of these technologies, as well as their further technical support. The main emphasis in the development of digital technologies in the banking sector is made on the formation of a unified identification system: using biometric technologies, the development of a digital communication system: on the basis of modern communication platforms, improving the digital transaction service and digital settlement service, as well as using a big data analytics system to build predictive and reference models and more.

Digital platforms provide agricultural producers with access to the provision and efficient use of limited financial resources. The experience of their successful application is most clearly shown in the study by C. Agyekumhene and others [1].

Modern agriculture in Russia is a high-tech industry that actively uses modern digital technologies, digital logistics systems, digital infrastructure and equipment that use GPS / GLONAS and related software. Russian companies such as LLC Infobis [19] are actively introducing online control services and accounting work in agribusiness. These services can reduce costs and reduce losses during the implementation of technological operations, significantly increase the level of profitability, simplify the management process and increase labor productivity.

The objectives of the development of the digital economy in the agricultural sector are: to increase investment in 2024 to 8.9 trillion rubles, increasing revenue from the sale of expert products for the perspective of 2025 to $ 45 billion, creating, scheduling and accumulating information resources to create end-to-end chains from agricultural production to consumption with full integration into related sectors of the digital economy [9].

The current and future indicators of the effectiveness of the development of the digital economy in domestic agriculture are shown in Figure 2.

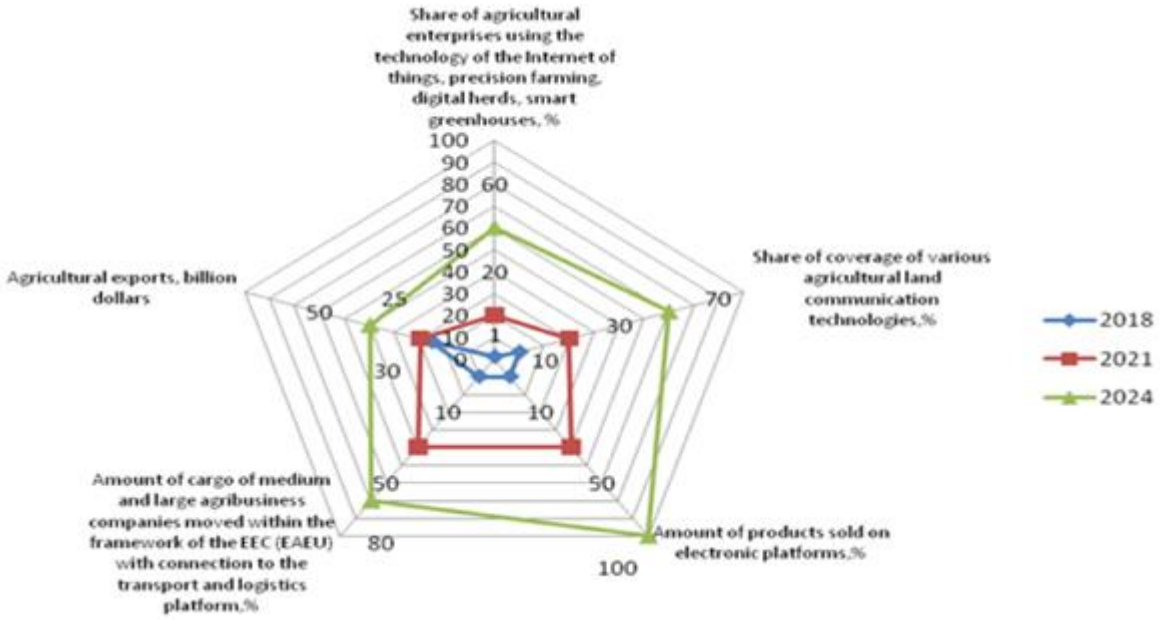

Fig. 2. Indicators of the application of the digital economy in agriculture of Russia
Source: compiled by the authors on the basis of data [9].

Regional projects of the digital economy in Russia, such as "Normative regulation of the digital environment", "Information security", "Personnel for the digital economy", "Digital public administration", "Information infrastructure", "Digital technologies" provide for financing in the amount of 0.2 billion rubles and suggest a decrease in the share of purchased and rented foreign software to 10%, an increase in the number of university graduates in IT areas, providing grant support for regional projects to introduce domestic products, services and platform solutions created on the basis of end-to-end digital technologies.

The degree of economic development significantly affects the level of agricultural development. If earlier it was believed that agriculture was the basis of the economies of developing countries [15], then with the possibility of using new technologies and the active role of large multinational companies, it becomes possible to shift emphasis in the development of highly efficient agriculture.

The development of economic thought at the present stage is mediated by a number of features caused by the progressive pace of development of social production, the introduction of information and telecommunication technologies, which has a direct impact on the formation of the categories under consideration. The mechanism of forming information flows in the digital economy of the agricultural sector is a system of interconnected and interdependent economic regulators operating on a single methodological basis.

Despite the large number of advantages in creating a digital agriculture system, some authors have expressed concern about the imperfection of the digital technologies used, their vulnerability, and the safety of

information [3]. However, successful experience in the use of digital technologies in resource conservation issues in Africa and Latin America contributes to the expansion and active use of these technologies [8].

In addition, the leading agrarian countries of the world economy are also actively developing the digital economy, which is confirmed by research by G.W. Norton and others [15] and Fan TongKe and others [20].

Professor I.S. Sandu [17] in his scientific work on digitalization of agriculture, he pays attention to the fact that Russian farmers use elements of the digital economy in limited quantities due to lack of financial resources. In his opinion, it is necessary to expand the scope of the digital economy through public investment, as well as the formation of various cooperative associations.

Professor P.I. Ogorodnikov [16] in his studies on the transition of agriculture to the digital economy emphasizes the need for more thorough training of specialists in information and communication services for agricultural production.

The study by V. Korostelev [12] pays attention to the use of digital technologies in the agricultural risk insurance system. In his opinion, it is necessary to use satellite monitoring technology in the agricultural risk insurance system. They found that accounting for remote sensing of land during examination procedures is an important step towards improving the methodology for assessing agricultural risks.

In the study, P.B. Akmarov, M.Kh. Gazetdinov, O.P. Knyazeva [2] substantiates the need for the development of information technologies in the agricultural sector of the economy, as the main factor in ensuring the country's food security and the competitiveness factor of domestic agricultural products.

Professor E.A. Bubenok [4] conducts research on the possibility of using artificial intelligence in a digital platform as a driver for the innovative development of breakthrough technologies for the development of domestic agribusiness.

According to N.V. Ukolova and N.A. Novikova [21] digitalization opens up opportunities for gaining new knowledge, broadening one's horizons, mastering new professions and advanced training. And they proposed a model: man - digital economy - knowledge - development, which is designed to become the basis of the modern model of economic development of the Russian Federation. In the study by N.I. Kuznetsov and others [14] the need to create a single information space and the application of effective information technologies in agriculture are proved.

CONCLUSIONS

In conclusion of the economic study, it is necessary to draw the following conclusions.

The development of the "digital agriculture" system will improve the efficiency of modern agriculture. It should be noted the high potential of modern digital technologies to optimize costs and improve the quality of planning, budgeting in improving the efficiency of agriculture.

The use of digital technologies in modern agriculture will contribute to the development of production of environmentally friendly products, reduce environmental pollution from agricultural production, reduce the anthropogenic impact of production on the environment, help minimize resource costs in the process of agricultural production, increase the efficiency of agricultural production, and increase competitiveness and sustainable development.

The results of digitization of agriculture will be the creation of a common information space, improving the quality and efficiency of management decision-making through the use of modern analytical methods of research, promotion of state support for domestic agricultural producers, optimum satisfaction of transforming the needs of users of information resources, increase the reliability of indicators of development of agricultural production, reduction of response time to possible threats to the sustainable development of agriculture, the further

improvement of the technical, organizational and methodological basis of effective use of information technology.

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