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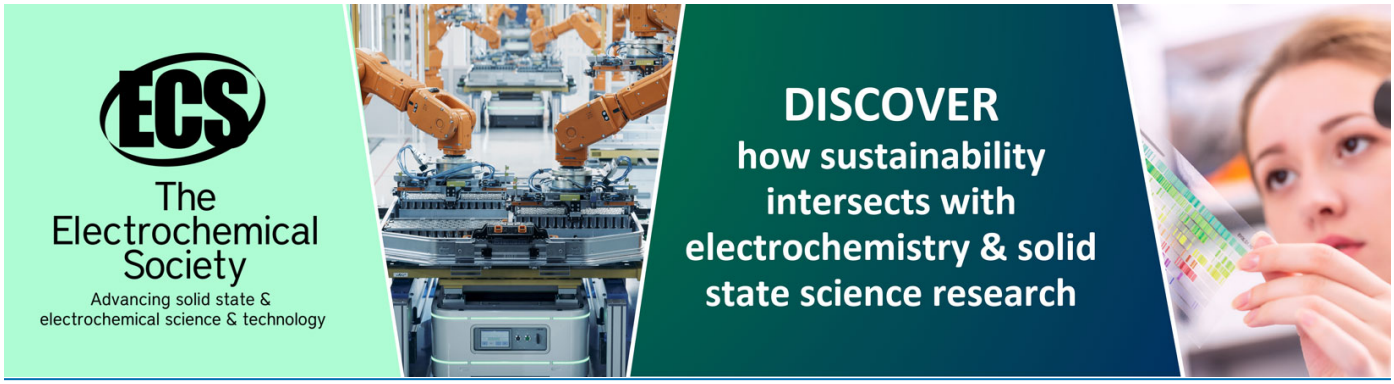

State support of the Russian agro-industrial complex in the digital economy

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Abstract. The relevance of the study is determined by the need to solve the problem of the development of state regulation of the functioning of the agro-industrial complex in the context of digital transformation, as well as the development and justification of ways to improve its efficiency. The existing system of state regulation does not fully take into account the needs of the agro-industrial complex in the development of digital transformation and is not sufficiently focused on stimulating the introduction of digital technologies. The scientific novelty of the study is to clarify the methodology for evaluating the implementation of the state program for the introduction of the digital economy. To analyse the effect of the introduction of digital technologies in agriculture, we have clarified the methodology for calculating the efficiency assessment. We have proposed a new model for the successful transition to digital technology of agricultural enterprises.

1. Introduction

Nowadays the issue of deciding the problems of agriculture, namely its development and modernization, with regard to the introduction of new and innovative ones, remains relevant. Agriculture always remains in the first place, with regard to the assistance allocated for its development [1].

From our point of view, it is relevant to study the methods and directions of state support for agriculture, as well as the possibility of their improvement and expansion under the influence of new requirements.

Under the «state support», it is necessary to understand a system of measures focused on the payment of funds from the state budget to agricultural producers, which are aimed both at the development of the industry and rural areas in certain areas, and at directly increasing their profitability by producing the necessary agricultural products, the main criterion of which is the effectiveness of the use of this support.

The vector of the current stage of economic development is its digitalization. According to the estimates of the Department of Digital Development and Management of State Information Resources of the Agro-Industrial Complex of the Ministry of Agriculture of the Russian Federation, due to the digitalization of agriculture, the volume of the Information and communication technologies market in the agro-industrial complex it should increase by 5 times in the coming years, from 400 billion rubles in 2017 to 2 trillion rubles in 2024.

To form the purpose of the study, we studied a number of scientific sources. Companies with both radical innovations and service innovations are much more likely to use the potential of implemented technologies, and they also note that in high-tech sectors, digital technologies have a direct impact on productivity and, thus, are more likely to realize efficiency gains [2]. A number of authors say that technology will play an increasingly important role in agriculture in the future. Thanks to improved ground and airborne robotics, some operations will be automated, from planting to harvest. This paper discusses the most relevant research activities aimed at improving and stimulating the implementation of SF methods in an agricultural context [3]. A number of authors developed a conceptual framework that combines evidence on the implementation of technologies at the farm level with a systematic perspective on the dissemination of technologies; the implementation of universal precision and digital farming technologies in crop production was considered. The mechanisms of adoption and diffusion of digital farming technologies must be understood on both farm and system level, where system refers to the collection and organization of entities relevant for the adoption and diffusion [4].

The purpose of the study is to clarify the methodology for calculating the assessment of the effectiveness of state support for the agro-industrial complex of Russia in the digital economy, as well as to develop a specific model for the successful transition of agricultural enterprises to digital solutions.

In accordance with the Decree of the President of the Russian Federation No. 204 of May 7, 2018 «On national goals and strategic tasks for the development of the Russian Federation for the period up to 2024" [4], the national program «Digital Economy of the Russian Federation» was formed. The modern institutional foundations of the digital transformation of agriculture, in addition to acts and programs dedicated to digital processes in the national economy, in particular the Federal Scientific and Technical Program for the Development of Agriculture for 2017-2025 [5], are fixed in the Departmental Project «Digital Agriculture».

2. Overview of the problem

The program «Digitalization of agriculture» [6] should provide participants with the opportunity to use broadband, mobile, LPWAN communication, information technologies (small and big data, AI, management platforms) of domestic instrument engineering (tags, controllers, sensors, and controls) to significantly improve the efficiency of agriculture.

We agree with this goal of the project, because the development of agricultural organizations both in the regions and in the country as a whole, first of all, should rely on state financial support, which will strengthen their work, increase efficiency and solve the most important financial problems. We believe that, in turn, the effect of the introduction of digital technologies will create a data flow for creating end-to-end chains from agricultural production to consumption with integration into related sectors of the digital economy.

The current level of digitalization of domestic agriculture is of serious concern: lack of scientific and practical knowledge on innovative modern agricultural; technologies and methodology; the lack of a global forecast for agricultural prices; the lack of proper amount of information technology tools and equipment; the underdevelopment of the logistics, storage and delivery system leads to high production costs [7].

Only a small number of agricultural producers have the financial capacity to purchase new equipment, use IT equipment and platforms. The AIC digitalization provides for widespread introduction of digital technologies in this sector of the economy, which is strategically important for the country due to the need to ensure food security and thanks to its high export potential. In the agricultural sector, several concepts emerged, which show various forms of digitalization in agricultural production systems, value chains, and, more broadly, in food systems [8].

A number of scientists are also engaged in the issue of digitalization as one of the main directions of agricultural development, for example, Yu. Spinev, Candidate of Law, notes in his work that the digitalization of the agro-industrial complex that has begun can level many investment risks and make the industry more attractive to potential investors. However, for the full digitalization of agriculture, investments are needed, which, for the reasons outlined above, is quite problematic to attract [9]. Several

authors review of digital technologies for agricultural purposes, namely network "Tibbo Aggre Gate" – an integration platform for the Internet things that provide monitoring, management and configuration of electronic devices that can be used to monitor multiple sensors and complex control logic, and artificial ecosystems used in the context of urban agriculture, which differs from the greenhouse [8]. Earlier in our work [1], we identified the concept of "smart village", which is understood as the introduction of end-to-end digital technologies: digitalization of production, processing and sale of agricultural products in rural municipal areas; digitalization of rural infrastructure; digital and financial literacy of the rural population.

Russia ranks 15th in the world in terms of agricultural sector digitalization. With its huge resource potential, Russia is striving to strengthen its competitive position in the agricultural market [10].

The use of digital technologies contributes to the functioning and efficiency of agriculture. Thus, the use of mobile applications will allow agricultural producers to receive information about prices, reduce cases of market imbalance and ensure the planning of production processes. The ability of modern technologies is to respond in a timely manner to outbreaks of diseases and pests, crop failures, climate changes; farmers, having received notifications, will change their actions in advance, taking into account the weather forecast. Software plays a significant role in the industry because it focuses on resource planning for agricultural manufacturers, helps to optimize the process from procurement to production and sales, allows you to respond to environmental problems, etc.

One of the main tasks of Departmental Project «Digital Agriculture» is to increase the effectiveness of state support measures in terms of stimulating the digitalization of the agro-industrial complex economy by identifying and analyzing problems and conditions that hinder the development of digital technologies in the agro-industrial complex of the studied subject of the Russian Federation, as well as by determining the main and the most promising digital technologies from the position of an agricultural producer [6]. To date, there is a «State Program for the development of Agriculture and regulation of markets for agricultural products, raw materials and food for 2013-2025» [11] which includes the Departmental project "Digital Agriculture", the purpose of which is to ensure the development of the agro-industrial complex through the introduction of digital technologies in agriculture.

Based on data from the Ministry of Agriculture of the Russian Federation, we analyzed and systematized data on investments in digital innovations in agriculture (figure 1).

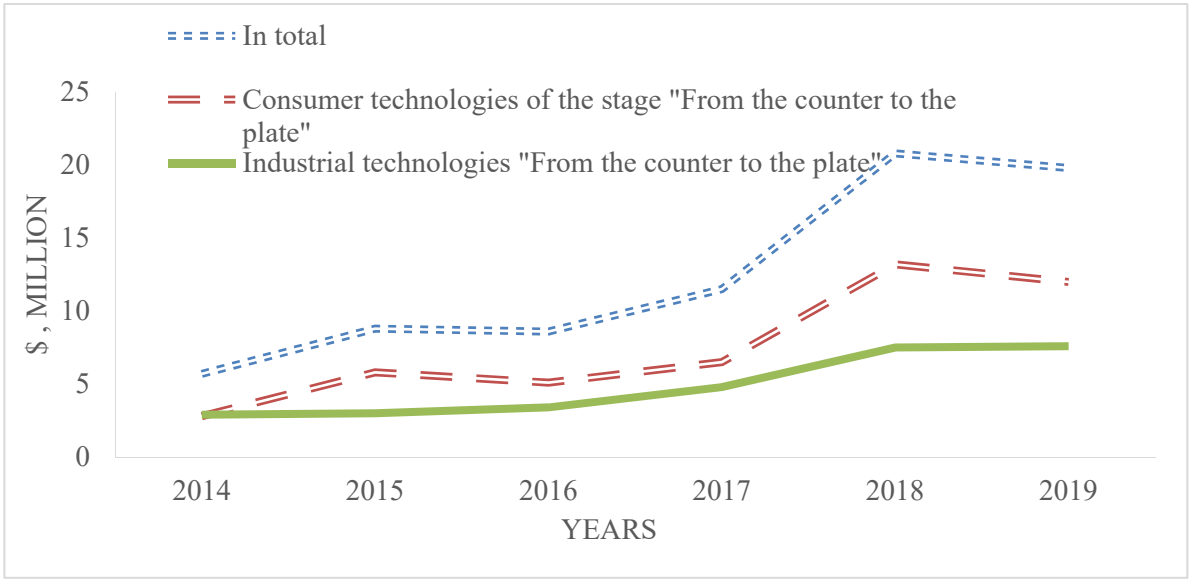

Figure 1. Investing in digital innovation in agriculture. Compiled based on data from the Ministry of Agriculture of the Russian Federation.

As can be seen from the figure 1, the number of investments in digital innovations in agriculture is growing today. Compared to 2014, the indicator increased by 14 or 240%, which indicates the great

attractiveness of this area, its innovation. If this direction gives us such figures, then we can say about its effectiveness in the future. In view of the growth of both prices and raw materials for the development of digital agriculture, producers need some help that will give an impetus to the development of their economy. Based on the program for the development of agriculture, we reviewed the indicators for evaluating the effectiveness of state support for agriculture and decided to apply them in our direction, which we are investigating, namely, the calculation of two indicators to ASSESS the ACHIEVEMENT of the planned indicators of the state program from the introduction of digital technologies, as well as the monetary implementation of this program.

To calculate the effectiveness of the introduction of digital technologies in the organization of agriculture, we offer the calculation of two indicators that every agricultural producer should pay attention to. These indicators are necessary to achieve the planned indicators of the state program from the introduction of digital technologies, as well as the monetary implementation of this program.

The overall assessment of the achievement of the planned values of the state program indicators in the reporting year (*ODp*) is calculated using the formula:

$$ODp = \frac{k1 \times \sum_{q=1}^{D} SD_{PNP_q} + k2 \times \sum_{i=1}^{M} SD_{PSI_i}}{k1 \times D + k2 \times M} \quad (1)$$

where SD_{PNPq} is an assessment of the achievement of the planned q-value of the state program indicator (implementation of digital technologies); SD_{PSIi} – the degree of achievement of the planned value i (indicator of the state program, which is not used to calculate the indicator of the national project in the reporting year); *D* – the number of target indicators of the state program level (the introduction of digital technology); *M* – the number of planned indicators of the state program is not an indicator for the calculation of the national indicator project in the reporting year; *k1* and *k2* – coefficients of significance of achieving the planned value of the state program target indicators for the introduction of digital technologies (*k1*) and which is not an indicator for calculating the indicator of the national project in the reporting year (*k2 = 1*).

To assess the monetary performance of the state program for the development of digital technologies in agriculture, we will use the following formula:

$$D_{ns} = \frac{\sum_{n=1}^{N} \frac{E_K}{E_b}}{N} \quad (2)$$

where D_{ns} – indicator of monetary execution of the state program for the development of digital technologies in agriculture; *N* – number of main activities of the state program during its implementation; E_k – cash expenditures of the federal budget for the implementation of the main activities of the state program in the reporting year; and E_b – amount of budget allocations for the implementation of the main activities of the state program according to the budget.

Based on the obtained estimates, it is possible to distinguish the categories by finding the overall average value of the integrated estimates of the effectiveness of the implementation of the state program for the introduction of digitalization in agricultural organizations as follows:

1 degree – a high degree of efficiency in the implementation of the state program;

2 degree – the degree of effectiveness of the implementation of the state program above the average level;

3 degree – the degree of effectiveness of the implementation of the state program below the average level;

4 degree – low degree of effectiveness of the implementation of the state program.

A number of authors in their work take into account the investment of public resources to support the growth of entrepreneurship, it is important to know whether such programs really benefit innovative enterprises. The authors attribute this to a complex set of selection and processing mechanisms associated with how programs find interrelated trade-offs to maximize results with their limited resources [12].

3. Results

Any farmer should use the knowledge stored on the Internet, be able to share this knowledge, and possess the necessary level of digitalization. The goal of developing digital agriculture is to achieve certain indicators of productivity growth in agricultural sectors, reduce production costs, create new high-tech and knowledge-intensive products and services, as well as improve the overall standard of living in rural areas.

V. Shankarnarayan the study notes that new technologies such as Big Data, there are common problems that must solve each industry to realize the benefits of digital transformation. For the agricultural sector is useful to learn from other sectors that are more advanced in the implementation of Big Data analytics. A heavy investment in erudite agricultural equipment does not address the food-scarcity issue, and this is where the Big Data concept is required [13].

Mingaleva Z., Mirskikh I., Kuranov V., talk about a new concept of «digital twins», namely a new object appeared (Digital Twin) that deserves an effective protection because it can provide variability and increase of competitiveness of an enterprise by giving the opportunity to minimize risk of insufficient implementation of innovations. Digital Twins are protected by means of intellectual property law as commercial confidential information. The protection of such information requires creating a special system of protection within the framework of the company. This system includes technical, legal and psychological measures, stimulating the loyal employees and working out a special program of intellectual property rights protection [14].

We propose a model (figure 2) of a successful transition to digitalization of agricultural producers, namely small farms and farms that are located in rural areas. This model will include the main conditions for the transition: the development of an existing ecosystem, the launch of a program to improve the skills of workers in the use of information and communication technologies in agriculture, the launch of digital online courses for farmers, the purchase of the necessary software, the development of financing mechanisms for the development of digitalization of agriculture. In our opinion, these areas will help to develop a mechanism for the introduction of digital agriculture in any economy. For the characteristics of digital technologies, it is necessary to include flexibility for the implementation of processes and operations, the ability to automate both the process of cultivating a particular crop, and the possibility of automated accounting, as well as intelligent automation of solutions, their availability to employees. By digitalization, we will understand the automation of production, for example, the processes of robotization, automated process control, that is, everything that represents objects in models and further interactions.

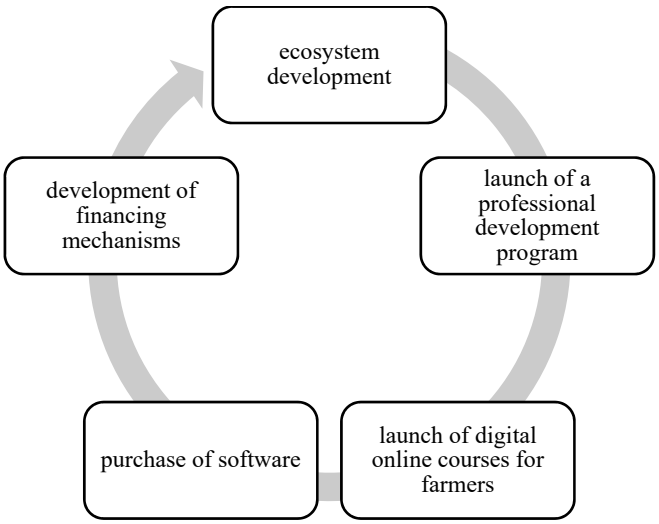

Figure 2. Model of successful transition to digitalization of agriculture.

T. N. Astakhova, M. O. Kolbanev and others in their work talk about the attempts to create the most general model of digital agricultural production. The main hypothesis is as follows. The structure of the processes of digitalization of agricultural production should be linked to the structure of the main production factors (economic resources) and the products produced [15]. We propose a model that will be focused on the successful start of the transition to digital solutions in terms of introducing new directions for development.

To effectively implement digitalization in agriculture, funding is needed. According to the «Resolution No. 1598 of December 5, 2019» [4], established the procedure for the provision of subsidies from the federal budget in the framework of support for projects on transformation of priority sectors of the economy and social sphere based on the implementation domestic products, services and platform solutions created on the basis of «end-to-end» digital technologies, with the use of concessional lending. The federal budget provides for these purposes in the amount of 3.66 billion rubles in 2020 and 7.124 billion rubles in 2021.

«The changes that are taking place in the world today are called in different ways. This is the «Fourth Industrial Revolution», and the «third wave», people also say «society 5.0». But the main thing that should be noted is the pervasive nature of digitalization», said Prime Minister M. Mishustin during a panel discussion in July 2020.

In order to move to digital, today it is necessary, first of all, to create better conditions for access to communications, infrastructure, services and data; to fully unlock the potential of effective use of digital technologies; to encourage entrepreneurs in this area, ensuring the availability of financial instruments; to reduce barriers to trade and investment, as well as to improve taxation in the digital world.

To put the figure into effect in an agricultural organization, you need not only a financial start-up, but also qualified personnel in the IT field. To solve the problem of the lack of qualified personnel in the field of information technology, it was proposed by M. Mishustin to gradually increase the target figures for admission to universities in IT-specialties from 50 thousand this year to 120 thousand in 2024.

To achieve the goal of the Departmental Project, it is planned to solve the following tasks:

1. Improving the system of control over the activities of agricultural producers;
2. To assess the environmental condition of the objects of the Nizhny Novgorod region and develop a digital model of rational use;
3. Provide scientific support for the program of prevention of pollution of natural resources of the Nizhny Novgorod region;
4. Justification of design solutions for the development of digital solutions for agriculture;
5. Development of a system of evaluation indicators to characterize the evaluation of the implementation of the state program project;
6. Optimization of traffic flows based on road network analysis methods;
9. Development of a public information web product to inform the population and students of the Nizhny Novgorod region about the state and use of digital technologies in agriculture.

Assessment of the level of socio-economic development of municipal areas and city environ-GOV in the Nizhny Novgorod region is carried out in accordance with the methodology approved by the decree of the government of Nizhny Novgorod region dated March 1, 2006 #60 «Methodology of assessment of socio-economic development of municipal areas and city districts of Nizhny Novgorod region» [16].

4. Conclusion

In the course of the study, a model of a successful transition to the digitalization of agriculture was proposed, which includes the main conditions for the transition. We have proposed a methodology for evaluating the effectiveness of the implementation of the state program for the development of digital technologies in agriculture on the basis of target indicators, the volume of budget allocations, cash expenditures for the implementation of the state program, as well as calculating the overall assessment of the achievement of the planned indicators for the implementation of the program for the introduction

of digital technologies. The main categories by which the degree of effectiveness of the implementation of the state program should be divided are identified.

The obtained research results can be directed to agricultural organizations, their prospective development, namely, the introduction of digital technologies into their farms, a successful transition to a new stage of development, the transition to "digital", which can be used as production growth, product quality improvement, improvement and simplification of the work of both the enterprise and employees, the growth of not only production as a whole, but also individual segments. The model, which was proposed will help to move to new conditions of development, not only technologies for automation will be introduced, but also the ecosystem will be improved primarily, employees of the enterprise will develop and qualify, there will be an opportunity for new ideas, new opportunities.

Method of calculating the evaluation of the effectiveness will look, and how much has been allocated funds for the implementation of the implementation of digital technologies and how much was executed, but also what effect did we get. As a result, our proposed activities can be used for the international community for the development of rural areas in the world. The proposed model and methodology for evaluating the effectiveness of implementation can be considered for the transition of agricultural producers to digitalization, which are located in rural areas, as well as to analyze the result of the introduction of digital solutions in agriculture.

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