Problems in the development of digitalization of Russia's agriculture

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Abstract. The purpose of this work is to consider and highlight the main problems of introducing digital technologies into the work of agricultural organizations in Russia. Moreover, the main emphasis is placed on the coordination of the practice of using intelligent technologies and the rural contingent. Considered are decrees and resolutions of the Government aimed at the priority development of the agricultural sector of the Russian Federation (RF) through digitalization, for example, the order of the Government of the Russian Federation dated July 28, 2017 No. 1632-r “Digital economy of the Russian Federation”. The infrastructure of rural settlements in the Russian Federation, its state and composition of the population were studied, the shortcomings and problems associated with digitalization in the agro-industrial complex were identified, and ways of overcoming them were simultaneously proposed – in particular, the use of clustering of Russian regions to improve work in the agricultural sector of the Russian Federation, the determination of the main characteristics for carrying out multidimensional scaling both for all territories of the Russian Federation and for agriculture in each region.

1. Introduction
The coronavirus pandemic has changed the whole world, having a great impact on Russia. The head of the World Food Program (WFP), David Beasley, said that in the near future about 80% of humanity will be in dire need of food, that is, they will have nothing to eat, and it may so happen that a "biblical famine" will come. In turn, the president of the Global Ecological Footprint Network (GFN) Mathias Wackernagel noted that to overcome this situation, at least $ 5 billion is needed. D. Beasley emphasized that, according to analysts’ forecasts, in a pandemic in the world, the following situation is expected, presented in Table 1.

Table 1. Increase in the number of hungry people in different regions of the world.

| Region                  | Increase in the percentage of hungry people |
|-------------------------|--------------------------------------------|
| Latin America           | 269%                                       |
| East and Central Asia   | 135%                                       |
| Africa                  | 90%                                        |
However, the humanitarian West has recently imposed various sanctions on the Russian Federation, including food sanctions, thus causing great problems for itself and for Russia. But this had a positive impact on the economy and agricultural sector of the Russian Federation. Import substitution has taken place, the practical conduct of agribusiness is changing, various government bodies are seriously engaged in the country's economy, as well as the modernization and digitalization of the agricultural sector, considering this a priority. As a result, agriculture has become very much revived and healthier, and it is not alone. And now the world community is pinning its hopes on Russia. The analytical center of Rusagrotrans JSC said that in August 2020 alone, about 5.5 million tons of grain were sold from Russia abroad. Note that the majority of foreign exchange earnings in the Russian Federation comes from agriculture. More than 11 million tons of high-quality grain was harvested in the Krasnodar Territory. It should also be noted Chuvashia, some regions of the Russian Federation, where they collected very large harvests in 2020. In Figure 1 and Figure 2 shows the data of the Federal State Statistics Service of the gross harvest and yield of grain and leguminous crops in 2020 in the federal districts of the Russian Federation.

**Figure 1.** Harvested grain and leguminous crops in 2020, thousand tons.

**Figure 2.** Grain and leguminous crops threshed in 2020, centner per hectare.
Russia imports grains and legumes to the EU countries, the Middle East, and North Africa, especially Egypt, Turkey, Iran, and Central and South America. Note that the prices for American wheat fell due to the RF.

The current state of agriculture is presented in Table 2.

Table 2. Key indicators of agriculture in Russia, 2020.

| Indicator                                               | Value                      |
|--------------------------------------------------------|----------------------------|
| The industry employs                                    | 4 million people           |
| The industry's contribution to GDP                      | 3.69 trillion rubles or 4.01% |
| Export revenue                                          | $ 20.7 billion             |
| Large agricultural holdings and medium-sized enterprises | 36.500                     |
| Small businesses                                        | 136.700                    |
| The growth of the contribution to the economy in the future until 2024 | to 8.9 trillion. rub      |
| Growth of export earnings in 2025                      | to $ 45 billion            |

In Russia, as in the rest of the world, digitalization is being carried out, including in the agronomic sector. Nevertheless, Russia is in 41-38 place in the world in the use of information technologies in the economy among developed countries. In addition, in the Russian Federation, innovative digital methods are used in processing fields only in 10%. This leads to very large financial and other losses. The digitalization of the technology of most of the processes of agronomy is the main resource for further increasing the productivity of agriculture, all over the world and, especially, in the Russian Federation. It should also be noted that the lack of necessary information in agronomy leads to a large loss, up to 40% of the yield, during harvesting, logistics and storage -40% of the yield. However, as recent studies have shown, besides the weather, 66% of losses can be avoided through digitalization. Its main difficulty is the integration of all systems and business processes.

Competition among agricultural producers increases annually in the world. It remains to be hoped that the use of modern intelligent technologies will prevent Western and Chinese representatives from entering their niches in the agricultural market. However, at present, increasing cooperation in agriculture continues between China and the Russian Federation. Especially in the coming big crisis of relations between the United States, which produces genetically modified products, in contrast to the Russian Federation, and China, where they do not want to use them. There are other reasons for the crisis between them.

To achieve the greatest efficiency of agricultural production in the Russian Federation, it is necessary to increase its productivity through modernization using digital technologies.

The population in the world at the moment (2020) is 7,794,798,739 people and in the coming decades, according to forecasts, will increase to almost 10 billion. Naturally, the amount of food required will also increase; UN experts estimate that it will be necessary to increase the volume of foodstuffs produced by about 70%. This applies to both the whole world and Russia. Therefore, it is necessary first of all to increase the level of labor productivity, to lower the cost of a unit of marketable output all over the world. This requires a transition to high-tech production, the introduction of digitalization in agriculture.

The Russian state gives priority to the agricultural sector due to new technologies and changes the practice of agricultural work in the agro-industrial complex of the Russian Federation [1]. The Russian government motivates agricultural holdings and farmers to introduce digitalization into the agricultural sector and has received many positive moments.

For example, various agricultural stationary and mobile platforms have been created, new business models have been created, the infrastructure of the rural population has improved, although not everywhere, and much more [2, 3]. Relevant decrees and decrees of the Government have been issued, aimed at the priority development of the agricultural sector of the Russian Federation through digitalization.

The main purpose of these scientific studies is to find and describe the shortcomings and problems of introducing information technologies in the agro-industrial complex of Russia and ways to
overcome them, as well as consider issues related to the infrastructure of the agricultural sector, digital literacy of the population and some other segments.

Solving the task, we tried to answer the questions:

- what are the features and aspects of living in rural areas in Russia?
- how has the Russian government responded to sanctions and the digitalization of agriculture in order to increase the profitability of agribusiness?
- how to bring the work of the country's agricultural sector to the most modern world level using intelligent technologies in agriculture?
- what are the shortcomings and problems of using and implementing digitalization in the Russian agro-industrial complex at the moment in Russia?

2. Materials and Methods
In Russia, various scientific and practical conferences of the international and all-Russian level are held annually on the use of digital intelligent technologies in the agricultural sector of the Russian Federation [4]. For example, the conference "Precision Farming 2018" and others. Forums where scientists and agrarians get acquainted with the latest achievements of innovative technologies, new developments, discuss the introduction of the latter in the agro-industrial complex, highlight the main trends [5] for the improvement and use of digital technologies in the agro-industrial complex, consider modern methods of introducing robotization in the agricultural sector of the Russian Federation. Therefore, we considered and analyzed the achievements and works of farmers at various forums, seminars, conferences. The application of the EASY software product and intelligent technologies in agriculture was studied, it was found out how and for what to use multidimensional statistical methods in the agricultural sector, it was considered how to improve the digitalization of the agro-industrial complex using remote sensing of the Earth (ERS). Regular monitoring of periodicals was carried out, central and regional publications were studied.

The work used structural and logical research methods. Analyzed were government decrees, the "Digital Economy" program of regulations, laws, speeches of Soviet and foreign scientists, graduate students, government and agriculturalists at various conferences on digitalization in agribusiness.

3. Results and Discussion
The methodology of modern agriculture in the context of digitalization is studied and proposed by many foreign scientists and agrarians. However, Russian scientists also bring a significant research component to these developments and their use in practice. In their work [6], the authors considered the use of digitalization and outlined the prospects for the development of agricultural regions in new conditions. Even during the coronavirus pandemic in the Russian Federation, artificial intelligence is used to improve digitalization methods, world-class mathematical research is carried out, inverse problems of natural science are considered, bioinformatics is used for agricultural purposes. Note that modern laboratories of digital technologies have been created and are operating in Russia, for example, in Novosibirsk. However, for many reasons, there is a different level of use of digitalization both in the country's economy, especially in the agricultural sector, and in developed countries. At the same time, the rate of application of intelligent technologies is increasing in Russia, and much faster than in many advanced states.

We will briefly describe the main problems and disadvantages identified as a result of the study, associated with the implementation of digitalization in the agricultural complex of Russia (Figure 3.)
Let us describe the main problems and disadvantages associated with the introduction of digitalization in the Russian agricultural sector.

1. Many agricultural regions of the Russian Federation lack modern high-quality computer equipment. It is quite expensive, there is no progress. The Internet is not available everywhere, there is a lack of specialists capable of timely servicing the material technical base, even if there are modern computers. These are mainly problems of small agricultural enterprises, in contrast to large agricultural holdings.

2. Quite often the existing equipment in the agricultural sector is very old (its service life often exceeds 10-15 years), which does not allow the use of advanced intellectual technologies. To this there are no necessary funds to replace it. There is also a great distance from regional centers, which affects logistics [7] and management in the agro-industrial complex. By the way, the solution of most logistics problems leads to the solution of the transport problem: either by the criterion of cost, or by the criterion of time. The task at hand plays a decisive role here.

3. Even in the presence of a material base, questions arise related to the working contingent. Most of the villages have poor infrastructure that does not meet the vital requirements for citizens' living, sometimes there is even no gas supply, water supply, and no police stations. And to be honest, there are and arise problems associated with the behavior of citizens who abuse alcohol, especially in the most remote villages, where the authorities do not pay the necessary attention to improve the lives of the villagers. There is a shortage of qualified IT specialists who are proficient in modern mathematical methods, who can quickly collect the necessary statistical information, analyze and interpret the results obtained, consult with farmers and give the necessary recommendations to the management of the agribusiness.

4. It is necessary to modernize agriculture using the most modern technologies. There is a change of generations with different outlooks on life, nevertheless, there are still a lot of elderly workers working “the old way”. Nevertheless, with the help of private IT-structures, it is proposed to increase the computer literacy of farmers. Competition is increasing. Mobility is required. The contingent must change.

5. Note that the “optimization” of education in the villages has done a great deal of damage to agriculture, most small schools were closed, many young parents left for the city, their children already have a different mentality: there is no love for the land, and they do not want to work on it. Empty the houses. Nevertheless, when regional leaders care about the future of the region, for
example, in the Yaroslavl region, and some others, where new modern schools with the Internet, sports facilities, a swimming pool and a medical center are being built, big changes are taking place in the countryside. These schools are “town-forming” enterprises in rural areas. There is no outflow of young working-age population to the city, their children grow up on the earth and love it, and after receiving a proper higher and secondary specialized education, they will return to where they grew up. Citizens are provided with state subsidies, as well as rural preferential mortgages. New houses are being built, so, for example, in the relatively small population (596,508 people in 2020) of the Novgorod region, from 2008 to 2020, 935 families of villagers improved their living conditions. There is an influx of population, including city teachers, doctors, sports workers, IT specialists, farmers.

6. Particular attention should be paid to the training of agricultural specialists in Russian universities. In most agricultural Russian universities, especially with the introduction of the Bologna education system, there has been a significant reduction in mathematical disciplines. Especially in regional universities, where, at the expense of the hours set by the state for the study of the necessary mathematical part, highly specialized disciplines are taught, since there are not enough hours for other teachers. However, at present it is necessary that the graduates of these universities are familiar with modern intelligent technologies: neural networks, multidimensional statistical methods, possess practical technologies of farming, that is, they could conduct management in the agroindustry, plan current work, competently predict the future of production, which requires at least familiarity with network optimization planning and control methods. Therefore, it is necessary to change the programs in universities to obtain workers in the agro-industry of the required qualifications, able to analyze the results obtained by IT specialists, and to be able to competently collect the necessary statistical information [8]. Suppose that for the introduction of a particular intellectual technology in a certain branch of the agro-industrial complex, it is necessary to consider a number of criteria for the optimality of the developed process, which are different in nature, then in this case the problem of multi-criteria optimization arises. To solve such problems, there are certain optimization control methods in dynamic systems, that is, the so-called multicriteria optimization must be performed.

Consider the choice of such optimality criteria, note that basically three cases are possible: 1) the criteria can be mutually exclusive; 2) the criteria act in one direction; 3) the criteria do not interact with each other in any way. The solution of these problems necessarily requires not only IT specialists, but also the proper participation of experts from the agro-industrial complex of the Russian Federation, their interaction and understanding of each other.

Although, of course, departments of digitalization of agriculture have recently appeared in leading agricultural universities, we emphasize in the leading ones, this is extremely small for our vast homeland. Since according to statistics, in Russia, the agricultural sector lacks about 90 thousand IT specialists.

7. In Russian research institutes there are many outstanding scientists, such as: L. I. Abalkin, I. N. Buzdalov, S. Yu. Glazyev and many others, conducting research of the world level and above, receiving significant results. But when it comes to practical recommendations, then there are big difficulties: what to choose, where and how to use, there is no qualified implementation in practice [9]. Many agricultural holdings use the methodology obtained abroad, but it does not always suit Russian conditions for many reasons: weather, land, equipment, contingent, biology, economics, and other reasons, although a regular exchange of experience between Russian and foreign researchers is necessary, to mutual the benefit of both. The work [10] considers the use of such intelligent technologies as Big Data for practical recommendations on the work of agricultural structures. The articles of Russian scientists also analyze the principles of using digitalization in the agricultural sector.

8. It should also be noted that the Russian Federation lacks the necessary cooperation between various state agricultural departments. Often one agricultural state structure does not know what the other is doing, that is, there is no proper interaction between them, which leads to large material losses.
9. It is necessary to highlight another important problem - this is digitalization and ecology, the impact of one on the other [11]. Numerous questions of their interaction arise. It turned out that ecology and digitalization are closely related, that sometimes digitalization without an environmental component can lead to negative consequences for nature. It is necessary to carry out digitalization in the agro-industrial complex so as not to harm the environment, to work so that everything in nature can be immediately restored. This area of eco-digitalization is a multidimensional vector space that requires further research, analysis, and practical recommendations. The Government of the Russian Federation paid due attention to this, in particular, in some agricultural higher educational institutions, the specialties "ecobiology", "bioecology" and the like were introduced. We also note that numerous forest plantations take place throughout the country, which also leads to an improvement in the ecology and condition of the soil, agricultural lands.

10. The country still has an insufficient number of testing laboratories. Since in order to supply agricultural products to the international market, all international requirements must be met. There must be proper documentation and certification of products. There are no documents confirming the quality. Because of this, our higher quality products are outperformed by foreign ones.

Note that in addition to the above-mentioned features of the use of intelligent technologies in the agro-industrial complex, there are also problems associated with the economy, marketing, legal support, cybersecurity of the Russian Federation [12], agronomy, animal husbandry, mechanized complexes, etc., which are necessary in the near future. thoroughly analyze, settle, draw practical conclusions and recommendations. By the way, many Russian researchers [13] are doing this, headed by the Russian government.

4. Conclusion
The digitalization of agriculture is moving forward by leaps and bounds not only in developed agrarian countries, but also in Russia. For example, in many regions of the Russian Federation, the regions of the region are being clustered according to the quantity and quality of crops grown, which makes it possible to forecast the future in perspective. It occurs especially in the leading Western countries, using neural network technologies, classification according to the degree of prospects of agricultural holdings, LLCs, and leading agricultural enterprises.

Therefore, we can state that digital technologies are now inevitably penetrating all layers of the state economy, including the agro-industrial complex. The above problems standing in the way of digitalization of agriculture require immediate solutions. Therefore, the relevant ministries and departments must find ways to overcome them.

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