

# The complexity of digitization of agriculture in Russia

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**Abstract**—The article describes the process of transition of agriculture of Russia to digital agriculture and describes the list of tasks, the solution of which will allow it to be carried out in a comprehensive and planned way. The process of digitization of agriculture includes the solution of several problems. They relate to regulatory support, the implementation of technical and technological support, the introduction of innovative solutions, the creation of a financing system with the participation of the state and private capital, the introduction of electronic automated systems and communication channels, the elimination of problems related to environmental protection, the introduction of special training in knowledge economy and digitalization. In solving these problems, the obstacles affecting the quality and time of the process of digitization in agriculture have been described. These include: a certain lag of Russia from the developed countries in the implementation of information and communication technologies in the agrarian sector of the economy, insufficient robotization, a somewhat late creation of the target sub-program “digital agriculture”, etc. At the same time, these obstacles can be relatively briefly covered in the case of the implementation of a systematic approach of solving the previously listed tasks. This is confirmed by what has already been done in the country for the digitization of agricultural production. In particular, the necessary regulatory framework has been created. On the basis of a single information platform, typical projects of agricultural modernization in the regions are being formed. The introduction of end-to-end digitalization has begun, services and forms of providing services to data producers are being developed. In some Subjects of the Russian Federation, business models are created for renting mechanized equipment (Uber for agricultural machinery). Agricultural universities open new departments, whose training programs consider digitalization and digital economy as two interrelated phenomena.

**Keywords**—*digitization of agriculture, tasks of creation smart agriculture production, digital technology, investments, financing system, personnel training, digital economy*

## I. INTRODUCTION

The tasks of digitization of agriculture in any country are extremely difficult due to the large volume of activities requiring financing, the underdevelopment of information technology infrastructure and a shortage of specialists in the field of knowledge economy.

According to the Ministry of Agriculture of the Russian Federation, presented at the All-Russian Conference "Precise Agriculture 2018", the country still holds the 15th place in the ranking of countries implementing digitalization of agriculture. Currently, there is an economic assessment of the measures proposed for implementation for the period up to 2024. Among them, the increase in the number of high-tech companies of the agrarian profile, investment in more than 2,000 startups for the agricultural industry, taking into account the experience of the United States, China, India, Canada, Israel. We are talking about expanding the “Internet of Things” (io Tag), which is the vertical segment of the Industrial Internet of Things IIo - the industrial “Internet of Things”.

These technologies currently cover only 6% of all projects implemented in the world that are accounted for by agriculture.

Developing this complex of technologies, domestic or agronomists, farmers, veterinarians, heads of enterprises become available mobile or online applications containing accurate recommendations on the sequence of actions, especially when planting seeds, applying fertilizers, soil moistening, harvesting, storage and transportation of agricultural raw materials. Russian farms have an operational opportunity to receive electronic extracts of land plots from the State Register.

Many small agricultural organizations began to order images taken from satellites or taking drones to evaluate the Normalized Difference Vegetation Index (NDVI) - the normalized relative vegetation index, which can be used to judge the development of plant biomass during the growing season.

A new trend is developing in the form of consulting, which includes agro-consulting, the provision of chemical means of protection, analysis and sampling, agrochemical analysis of the soil, agronomic aerial survey.

Digital technologies are gradually being introduced to monitor crops and graze livestock; digital models of the entire agricultural production cycle are being created. It becomes possible to obtain data on each object and its environment, and through digital integration it is also possible to create recommendations for the care of plants and methods for using robotic technology. These and other

measures for the digitalization of agriculture in Russia have a tendency to increase, which directly affects the increase in labor productivity in this industry.

It is predicted that the number of the rural population younger than the working age by 2040 will decrease by 4.5%, and those of working age by 15.7%. These trends are typical for depressed regions of the northwest and the center of the European part of the country, regions of the Far East with almost universally declining rural population and agricultural production [1, 2].

M. Porter believes that any digitization in the economy is also the production of "smart" technology, new requirements and new opportunities. For example, user interfaces for "smart" technology make it possible to install special applications on a tablet or smartphone, which, unlike "physical" buttons and levers, increases the mobility of control and the adoption of necessary decisions. For agriculture, it is a stack of technologies for integration, data exchange, their storage and analysis, expansion of the application areas of robotized complexes [3, 4].

Researchers of the processes of introducing the digital economy, considered the same robotization as an automated version of human labor .

For training the necessary competence in Russia, research and practical implementation of digital technologies has begun. The agrarian universities combine disciplines of agrarian science, software development, precision farming, digital economics, and automation of management of agricultural production systems, which ultimately can have a positive impact on improving the quality of agricultural products [5, 6].

All the above indicates a change in the economic sphere of production methods - from industrial to information technology. The use of scientific and technical information in agriculture, automation of production processes, large data arrays, their transfer, allow introducing promising digital platforms in a relatively short time

## II. LITERATURE REVIEW

The process of creating "smart" agricultural production began no more than two decades ago, therefore, scientific articles on this topic are interesting not only from the standpoint of knowledge of this new direction of increasing labor productivity in rural areas, the quality of agricultural products and raw materials presented to the market, but also because the crucial importance of introducing new digitalization technologies. Some authors of publications rightly argue that an analysis of the prospects for digitalization of agriculture for any country is necessary, which requires an assessment of the effectiveness of already existing robotic technologies and their compatibility with the machines and equipment available on farms [7].

We support the proposals of those researchers who, when digitizing agriculture, propose to form a holistic mechanism for such modernization , in which the processes of robotization and the introduction of "Internet of Things" technologies would be complex [8]

Digital, intellectual technologies directly affect the receipt of intellectual rent in the agrarian sector of the economy. Convincing arguments about this are available in

monographs , scientific articles of specialists in management and law, researchers of NBIC technologies [9-11].

In 2017, the Digital Economy Program was approved in Russia, and the sub-program for it "Digital Agriculture" will be adopted in 2019. The introduction of digital technologies in the FoodNet roadmap previously adopted by the Government of the Russian Federation will contribute to progressive implementations in all areas of smart agriculture [12].

One of the remarkable articles "IT in the agronomic complex of Russia" gives a detailed picture of digitization of agriculture with a deep assessment of foreign experience , which is extremely important when implementing the tasks of remote sensing of the earth, blockchain for tracking seed material, control systems, bioferms and robotics [13].

## III. RESEARCH METHODOLOGY

Effective implementation of information and communication technologies for the development of "smart" agriculture requires a systematic, and with it an integrated approach in solving the problems of digitalization of this sector of the economy. Scientific and practical results of researchers from foreign countries on the knowledge economy, target programs and technologies implemented in domestic agriculture, scientific articles, and monographs of specialists that consider the attractiveness of agriculture for business taking into account the active introduction of promising information technologies were used as source material.

The main goal of digitalization is to ensure the food security of the country by increasing labor productivity in agriculture by 4-5 times. In the process of researching the theory and practice of digitalization on the basis of a SWOT analysis, its undeniable benefits as well as tasks that need to be solved as soon as possible are revealed. There are 54 agrarian universities for timely training, scientists are involved in introducing start-ups, agrarian holdings are ready to consolidate their efforts with them. In essence, we are talking about new opportunities for the commercialization of the achievements of agrarian science. Another conclusion can be made: the methodology of research on this issue makes it possible to clarify the new structure of the digital ecosystem of the agrarian sector of the economy with timely methodological and legal support. It can be the same for all territories, including those located in the Arctic [14].

In the process of research, regulatory and statistical data characterizing the level of socio-economic development of the agricultural sector in Russia were used. It was applied: observation, comparison, analysis, synthesis, monographic method, logical modeling.

## IV. RESEARCH RESULTS, DISCUSSION.

A study of the digitalization of agriculture in Russia over the past few years has shown that since the beginning of an active policy of creating "smart" agricultural production, the intensity of the implementation of the necessary measures has not been significant yet. And this is despite the fact that by the area of arable land, Russia ranks third in the world (116 million hectares). First place in the United States, second in India, and the industry employs more than 4 million people.

In 2017, Russia occupied only 45th place in the ranking of countries in terms of the development of innovations (The Global Innovation Index), which indicates its lag when introducing modern information and other technologies [15].

In developed countries, digital technologies in the agricultural sector have been introduced by the housekeeper for more than two decades. These initiatives are supported by the United Nations Economic Commission for Europe, with the participation of which the standards of electronic business turnover, including the agri-food sector of the economy, were developed and implemented [16].

The Food and Agriculture Organization (FAO), based on the results of several forums, has released a Guide to the Development and Implementation of an E-Agriculture Strategy [17].

In Russia, for the accelerated digitalization of agriculture, it is necessary, in our opinion, to solve a number of interrelated tasks: regulatory support; technical support; total innovation; financing; environmental protection and resource conservation, upgrading the system of personnel training.

Essentially, this is a comprehensive digitalization of the entire agricultural sector, which over time should become attractive to investors. Today, the products of the agricultural sector in terms of competitiveness are often inferior to Western models in the external market. There are several obstacles of a technical-technological, financial, economic, organizational nature, but the developing information technologies allow them to be gradually eliminated.

A synthesis of materials on the digitalization of agriculture in Russia showed that, unfortunately, the regulatory and legal framework for this process is fragmentary. With a certain delay, the "Digital Agriculture" subprogramme began to be prepared, the approval of which is expected in 2019. Its plan is as follows: the creation of a unified information system for accounting agricultural land; implementation of projects for tracking the movement of agricultural products from producer to consumer; the formation of an interactive soil map of the country; continuation of the program of robotization of agricultural production, which does not meet modern requirements. As of mid-2017, robotics was used only in 28 regions of Russia and 103 agricultural organizations, mainly dairy products [18].

The SWOT analysis revealed four main objectives of digitization of agriculture in providing technical support to the industry.

The first of these tasks is focused on the applied nature of digitalization. It is about the compatibility of various devices and computer programs in order to coordinate all management processes in the agrarian sector.

The tool here is the "Internet of Things". This is not only the process of converting various instrumentation data, meter readings, sensors, special devices into a general system for generating information contents, but also creating special computer platforms. And here there is a problem that is equally difficult for all states: the instruments and sensors of machines and equipment of various companies and many modifications will need to be combined with a computer through the introduction of a single language and algorithm. The uneven distribution of the same Internet in the

territories, the lack of unified agricultural technology do not allow it to be done quickly.

The second task is to expand the availability of high-speed or ultra-high-speed broadband Internet, which requires significant funds for infrastructure development.

The third task of technical support for digitization of agriculture is the digitization of the necessary resources through the creation of a domestic computer platform on which all data on the location of land plots, their affiliation and agronomic characteristics will be placed.

The fourth task is the modernization of agricultural engineering with the installation of all equipment and units of navigation systems and remote control equipment. In this case, there are new opportunities for the development of digital precision farming, unmanned application of mineral fertilizers, precise coordination when plowing the land, etc.

Solving these problems requires large financial resources, the introduction of Uber models for agricultural equipment with the payment for using the equipment according to the actual time of its use, creating a pool of resources with a single automatic control, increasing the means of mechanization for tractors, this is plus 300 thousand units [19].

Thus, SWOT-analysis and logical modeling showed that the country will have to switch to the production of agricultural equipment equipped with modern navigation tools, and the introduction of a payment model based on actual usage time or other metrics will allow creating a subscription fee system and parks of rented agricultural equipment on specific territories.

The introduction of elements of the digital economy in the conditions of modernity is essentially total innovation. They, as a non-linear process, do not manifest themselves consistently, they often have an explosive, synergistic character, when the innovation potential reaches a critical mass. In all countries, it is considered a national treasure and is subject to protection. Total innovations supported by digital technologies, according to our convictions, are extremely important in the agricultural sector [20]

For agriculture, it is: a digital database for management support systems (digitization of maps, databases, accessible via API, etc.); digitalization of production (robotization, smart technology, agricultural equipment with AI, well-equipped satellites and drones, point irrigation systems, etc.); analytics and BIG DATA (analytical computer platforms for all levels of management of the agricultural sector, forecasting the safety and increase of agricultural land, climate threats, yields, etc.).

The Sverdlovsk region to create these tasks can create an Information and Technical Agrakhab whose goal is to transfer new technologies to the agricultural sector of the territory. Total innovation then can be considered as the creation of breakthrough types of products, goods or services with previously unknown or simplified properties. Products of this kind create a new market, form expansion of needs, change consumer behavior, increase efficiency in all segments of agricultural production, expand the possibilities of an integrated electronic automated system, its integration into other information bases. At the same time, the creation of an agrohob will require the consolidation of financial resources from interested participants. If we consider that

state financial support in the incomes of agricultural producers in Russia is no more than 3.5%, then it is not particularly necessary to rely on it.

The research results suggest that the main environmental and resource-saving task is the sustainable use of water resources, improvement of their quality, access to safe food water, wastewater management.

Here, digitalization of agriculture is considered not only as a sphere of development of agricultural production, but also in rural areas, in the context of improving the quality of life of citizens.

The named task is difficult and complex. Consumers increasingly understand the benefits of foods with a specific nutrient content and low pesticide content. Therefore, reduction of aggressive technologies, precision farming systems, methods of soil aeration and obtaining its "ideal form", organic farming will be needed, which will reduce emissions to water bodies.

The managerial tasks are connected with the training of professionals and specialists who would be involved in the implementation of digitalization technologies in practice. It will require not only the systematization of large databases, but also the creation of new forms of artificial intelligence, bots and robots, retraining and advanced training of all agronomists and livestock specialists. Agronomy science should make a special contribution [21]

But there remain the problems associated with the conservative essence of human nature. Unfortunately, our mentality today is holding back the transition to digital development, which is becoming a natural obstacle. The understanding that innovative implementations, digitalization is a new quality of life, new types of products, medicines, new types of clothing, new logistic models of supply of goods, comes gradually. There is reason to believe that in the next 5-10 years, agriculture will be different. This is for him the most important sign of competitiveness, and for every participant in agrarian relations - an incentive to the formation of professional competencies.

## V. CONCLUSION

In Russia, there is a basis for creating a single information space. These are network technologies, development of the consulting services market in the agricultural sector. At the same time, it is impossible not to notice new threats. Digitization of agriculture will reduce the participation of citizens in real economic life. Many unskilled workers will lose access to earnings, and at the same time the material well-being of the family will be disturbed, and access to the social risks insurance system will be reduced. There is reason to assert that in organizations actively using digital technologies, robotic machine complexes, it will be necessary to change the approach to taxation. Perhaps, through the separation of the payback period of such equipment and the period of occurrence of net profit. In the period after the payback tax may increase. These amounts should preferably be directed to the development of education. But for this to happen, for the production of robotic systems, drones and other automated systems need a good effective demand, otherwise such production becomes meaningless. In other words, it is necessary to make changes to three laws at once: on employment, on social security, on taxes. But one should be

wary of a large number of bylaws. Nevertheless, there is a threat that digitalization of the economy will not only affect the division of labor, but may also cause a division into peculiar "varna": people with a set of needs and actual opportunities, lumpens and marginals and a "new elite" introducing the latest electronic technologies and decision maker for others. To prevent this from happening, in rural areas it is already necessary to create models of socially significant employment [22].

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