

# DIGITAL DEVELOPMENT OF AGRO-INDUSTRIAL ORGANIZATIONS IN RUSSIA

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## Abstract

The article is devoted to the digitalization of the agro-industrial complex of Russia. Current regulations define the main efforts of the state in this direction. The prospects for the digitalization of various industries are heterogeneous. Hence, a list of industries subject to digitalization in the first place is fixed. Sectors as agriculture are considered the most difficult to digital process. Global challenges are formed the prerequisites for digitalization of agro-industrial organizations. The digitalization process is affected by climatic conditions, the extent of territories, industry traditions, as well as the trends of the new digital lifestyle. The analysis of statistical data has shown a significant lag of the agro-industrial sector from other sectors of the Russian economy, as well as from European countries in digitalization. The results of the study are allowed us to conclude that in addition to government policy, medium and large businesses are interested in digitalization. In this regard, the agenda is including the coordination of government and business efforts in the digitalization process and the transition from corporate governance to managing corporate agro-industrial ecosystems.

**Keywords:** agro-industrial organizations, digitalization process, corporate governance

**JEL Code:** O13, Q18

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## Introduction

The need for economic development of countries is most acute. There is an active process of digitalization all over the world. For Russia, digitalization is one of the priority areas of the economy. According to the Higher school of Economics (Moscow), in 2017-2019, Russia occupied the middle position in international economic development ratings and digital economy development ratings. The data is presented in Table 1.

**Tab. 1. Russia's Place in the world rankings of economic development and digital economy development**

International index of economic development and development of the digital economy of the country	Year of the rating	Place in the rating	Number of countries
Global Innovation Index, a consortium of Cornell University, INSEAD business School, and the WIPO	2018	46	129
	2019	46	
Global Competitiveness Report, WEF	2018	43	141
	2019	43	

ICT Development Index	2017	45	176
E-government Development Index, UN DESA	2018	32	193
Global Cybersecurity Index	2018	26	180

Source: hse.ru

These data show that Russia is not a leader in digitalization. It has a stable position only in the cybersecurity and e-government. The Digital economy of Russia program shows that Russia is far behind such leading countries as Singapore, Finland, Sweden, Norway, the United States of America, the Netherlands, Switzerland, Great Britain, Luxembourg, and Japan in terms of readiness for the digital economy. In terms of economic and innovative results of using digital technologies, Russia lags far behind Finland, Switzerland, Sweden, Israel, Singapore, the Netherlands, the United States of America, Norway, Luxembourg, and Germany. (Order No. 1632-R, 2017)

## **1 State of digitalization of various branches of the Russian economy, global trends in digitalization of the agro-industrial complex**

The significant lag in the development of the Russian digital economy is due to gaps in the regulatory framework and an unfavorable environment for doing business and introducing innovations. In 2017-2019, regulations were adopted that define the main efforts of the state in this direction. The digital economy is represented by three levels that affect the lives of citizens and society as a whole:

- Markets and industries for interaction between specific entities (suppliers and consumers);
- Platforms and technologies for development markets and industries;
- The environment creates conditions for the development of platforms, technologies, and interaction between the market and industry actors. It combines legal regulation, information infrastructure, human resources, and information security.

Traditionally, business leads in the use of new technologies. Its activity directly depends on the optimization of internal processes and operations with suppliers and customers. Digital technologies are used to create more effective business models. They reduce costs, improve the quality of services provided, and improve customer interaction. Often, the introduction of digital technologies is a necessary measure to maintain market share or adapt to new challenges. Recent changes are transforming the current way of doing business and some industries in General. The prospects for the digitalization of various industries are not uniform. Hence, the list of industries subject to digitalization is primarily fixed: media, telecommunications, the financial sector, high technology, tourism, energy, trade and industry. In this order, government and business measures are aimed at transforming the main areas of activity. Russia's place in the business digitalization index is shown in Table 2.

In 2018, Rosatom presented the digital business index, in which Russia is in the third block of countries for digitalization. The most digitalized industries are traditionally information and communication technologies, the hospitality industry, transport, wholesale trade and electricity. Of the nine industries, construction is the least digitized. The agro-industrial complex is not represented in this rating. Sectors, such as agriculture, are considered the most complex for the digital process. Although the agro-industrial complex is the basis of the country's food security and economic activity in most countries. Its digitalization is the slowest.

**Tab. 2. Index of business digitalization and Russia's place in the context of industries.**

Economic sectors and areas of activity	Place (from 32 countries)	Index value
Digital business, including:	23	0,334
Information and communication technologies	23	0,494
Wholesale	19	0,380
Electricity, air conditioning and water supply	22	0,343
Hospitality industry	25	0,327
Transport and storage	21	0,320
Realty	19	0,316
Industry	20	0,312
Retailer	18	0,310
Construction	23	0,216

Source: National index, 2018

Information and communication technologies have been used in agriculture for years, but digital agriculture is distinguished by: 1) the reliance on sophisticated tools for collecting and aggregating agricultural data, and 2) the use of algorithms for sorting through and drawing information from large datasets (Bronson, K., & Knezevic, I., 2019)

AgFunder venture Fund allocates two parts of the product system: downstream and upstream. In this study, we will consider industrial technologies (upstream). According to AgFunder, over the past seven years, investors' interest in AgroTech has grown rapidly. During this period, annual investment increased from 1.1 billion dollars in 2012 to 4.7 billion dollars in 2019. The total volume of investments in this direction for 2014-2019 amounted to about 25.9 billion dollars (just over 40% of the total). Upstream includes the entire range of solutions in the production, processing and logistics of agricultural products, in particular the following technologies (Agri-Foodtech, 2019; Farm Tech, 2020):

- Agri Biotechnology. On-farm inputs for crop and animal including genetics, microbiome, breeding, animal health.
- Midstream Technologies. Food safety and traceability technologies, logistics and transportation services used by farmers.

- Farm Management Software, Sensing and IoT, data capturing devices, decision support software, big data analytics.
- Farm-to-Consumer eGrocery. Online platforms for farmers to market and deliver their produce directly to consumers
- Agribusiness Marketplaces. Commodities trading platforms, online input procurement, equipment leasing.
- Novel Farming Systems. Indoors farms, aquaculture, insect, and algae production.
- Bioenergy and Biomaterials. On-farm agricultural waste processing, biomaterials production, anaerobic digesters.
- Farm Robotics, Mechanization, and Equipment: on-farm machinery, automation, drone manufacturers, grow equipment.
- Miscellaneous e.g., FinTech for farmers.

**Tab.3. Data from Farm Tech Investment, 2019**

Category	Volume	Volume, %	Median Deal Size
Agri Biotechnology	\$ 1.1 B	23	\$ 3.0 M
Novel Farming Systems	\$ 945 M	20	\$ 3.1 M
Farm Management Software, Sensing & IoT	\$ 886 M	19	\$ 1.4 M
Agribusiness Marketplaces	\$ 672 M	14	\$ 1.4 M
Bioenergy & Biomaterials	\$ 632 M	13	\$ 3.0 M
Farm-to-Consumer eGrocery	\$ 202 M	4	\$ 3.5 M
Farm Robotics, Mechanization & Other Farm Equipment	\$ 179 M	4	\$ 1.8 M
Midstream Technologies	\$ 99 M	2	\$ 4.8 M
Miscellaneous	\$ 41 M	1	\$ 3.4 M
<b>TOTAL</b>	<b>\$ 4.756 B</b>	<b>100</b>	

Source: research.agfunder.com

Table 3 shows investments in industrial technologies according to AgFunder data in 2019. Data shows that the greatest interest of investors is directed to Agricultural Biotechnology, Novel Farming Systems and Farm Management Software. At the same time, Midstream Technologies projects have the largest median deal size of \$ 4.8 million. Investors ' interest in these areas is stable and has been maintained for several years.

Digital technologies increase production efficiency, complement other production factors, and stimulate innovation, significantly reduce costs, overcome information barriers that impede market access for many small farmers, expand knowledge through new ways of providing extension services and provide new ways to improve management supply chains in agriculture. (Vasilevska, D., Rivza, B., & Rivza, P., 2019)

Some scientists express concerns about the digitalization of the agro-industrial complex, justifying their point of view as not being able to overcome the existing gap between the largest

players, and the accumulation of big data by a limited number of players. Corporations can benefit from big agricultural data, but farmers who help collect data do not always have free access to it. (Bronson, K., & Knezevic, I., 2019)

## **2 Study on digitalization of Russian agricultural organizations**

Agriculture 4.0 is comprised of different already operational or developing technologies such as robotics, nanotechnology, synthetic protein, cellular agriculture, gene editing technology, artificial intelligence, blockchain, and machine learning, which may have pervasive effects on future agriculture and food systems and major transformative potential. These technologies underpin concepts such as vertical farming and food systems, digital agriculture, bioeconomy, circular agriculture, and aquaponics. (Klerkx, L., & Rose, D., 2019)

Global challenges shape the requirement for digitization of Russian agro-industrial enterprises. The digitalization process is influenced by climatic conditions, the scale of territories, industry traditions, as well as trends of a new digital lifestyle. "The competitive advantages of the Russian agro-industrial complex are determined by the unique agroclimatic and agro-soil potential due to the presence of black earth soils and the high amount of active temperatures in the southern part of the country." (Technological future, 2018) This item is a positive factor in the growth of production volumes. However, there is a low level of digitalization and introduction of new advanced technologies in the activities of farms, which does not allow achieving a new level of efficiency. A 2015 study by European scientists showed that small agricultural enterprises are not interested in new IT solutions (such as cloud computing). They don't trust this and only 10% are considering taking a remote software or data server. (Botos, S., Herdon, M., & Várallyai, L., 2015).

In 2019, the HSE conducted a study of the leaders of manufacturing organizations. The purpose of the study is the level of industry digitalization. Assessment of respondents showed that the most popular technologies were: production robotics (high level - 4%; average level - 19%); end-to-end automation and integration of production and management processes (high level - 3%; average level - 17%); a digital workplace (high level - 3%; average level - 15%). Digital activity most enterprises has increased compared to 2018. More than 25% of the managers noted an increase in the demand for production technology, while more than 60% considered the current level of digital activity normal. (Digital activity, 2020)

Although agribusiness in some studies relates to the manufacturing industry, it has a number of its own features, which show the need for further study. Nowadays, the department program "Digital Agriculture" is being implemented in Russia. The main objectives of the program include:

- Create and implement a national platform for digital governance, «Digital Agriculture»;

- Create and implement the «Agri Solutions» module to increase the agricultural producers' efficiency;
- Create a continuous training system of agricultural enterprise specialists in order to form digital competencies.

The project is designed for six years. Its financing will amount to 300 billion rubles. The ministry plans to spend about 102 billion rubles on the first task until 2024. The main direction is government support for agricultural producers. Subsidies are aimed at filling the system with data on agricultural resources (agricultural land, livestock and livestock, agricultural machinery), agricultural raw materials and finished products. Data is transmitted to the digital agriculture platform via digital technology. "The National Digital Agriculture Platform is a digital platform integrated with digital sub-platforms for agricultural management at the regional and municipal levels. The main goal is the digital transformation of agriculture with the help of platform solutions to ensure a technological breakthrough in the agro-industrial sector and to achieve productivity growth in digital agricultural enterprises." (DP "Digital Agriculture", 2019)

It is planned to spend 18.75 billion rubles on the second task. As part of the testing, experimental digital farms will be created on the basis of educational and experimental farms of the Agriculture Ministry and commercial structures. The "Agri Solutions" module is a digital sub-platform for improving the efficiency of agricultural producers. The main tasks of the module are:

- increase of labor productivity in agricultural enterprises by 2 times per employee;
- reduce the unit cost of business administration by 1.5 times;
- reduce the share of material costs in the product unit cost (fuel, fertilizers, electricity, planting material, feed, etc.) by 20% or more.

The cost of implementing the third task will amount to 3.5 billion rubles. The key result is a sufficient number of specialists with digital competencies working in the agro-industrial sector.

Although the state has taken an active position in digitalizing the agricultural sector, there are still factors that hinder digital transformation: (Digital activity, 2020):

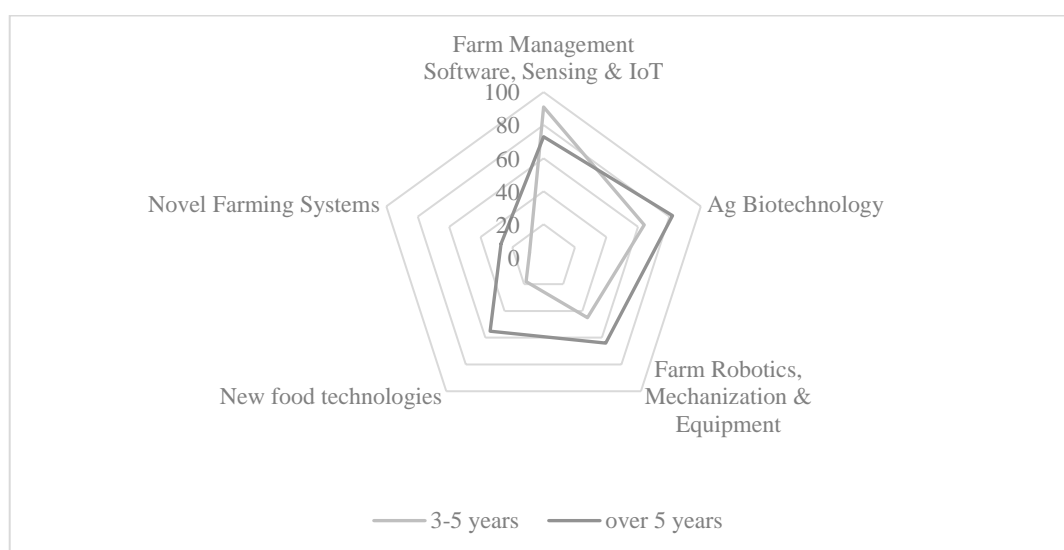
- insufficient financial resources of enterprises and farms;
- low adaptability of production to digital transformation;
- lack of a developed digital strategy as part of the organization's development strategy;
- low return on investment in digital transformation;
- low level of digital literacy, etc.

The impact of several factors is planned to be reduced through the implementation of the Digital agriculture program. In February-March 2020, the HSE Institute for agricultural research conducted a survey among representatives of agribusiness in Russia. It again showed that business

leaders are aware of the inevitability of the digital transformation. They see the goal of digitalization primarily in reducing costs and minimizing risks - 91%, and only 9% - creating of new or unique products for the market. According to the survey results, risk minimization includes maintaining competitiveness (64%), or achieving leadership in the industry (27%). (Innovative development, 2020)

The expert survey showed a high level of business awareness about the main global technological trends. Key areas of digitalization highlighted by respondents such as Farm Management Software, Agri Biotechnology, Farm Robotics, Machinery and Other Farm Equipment are key global investment areas. On the other hand, the choice means overcoming the gap, rather than creating something fundamentally new. In this regard, in the next 5 years, small and medium-sized businesses are ready to implement commercial technologies that have been tested in the world practice. (Fig. 1)

**Fig. 1: Priority technologies for digitalization of small and medium-sized agribusiness in Russia**



Source: own author

According to the Expert analytic center, «the largest agribusiness enterprises have almost exhausted the opportunities for organic growth in the country. Over the next few years, they will increase revenue through mergers and acquisitions and increased exports, and efficiency via digitalization.» (50 largest agribusiness companies, 2020)

Majority were actively implementing the following areas:

- digitalization and the Internet of things (including the corresponding component base in the form of probes, sensors, etc.). This idea applies to the equipment of cars with GPS-sensors and monitoring the movement of equipment, inventory, work performed. This simple technology allows

to establish control over the use of fuel, track tractors and combines, monitor the costs and validity of write-offs of seeds, chemicals, and so on. In animal husbandry, digitalization is relevant in production accounting, the use of chip tags for animals, scanners for reading information from tags and transmitting information to the accounting program. Also relevant are flow meters (water, feed, energy carriers) that allow to quickly respond to changes in the condition of animals.

- introduction of Novel Farming Systems (vertical, container farms, etc.). Eco-culture holding has built a computerized system for controlling the greenhouse microclimate. «The processor controls the full cycle of growing crops, regulates the heating system and cooling, light mode, drip irrigation, and the content of carbon dioxide in the atmosphere. The equipment creates ideal conditions for the growth and development of plants. Additionally, employee time tracking is monitored. » (50 largest agribusiness companies, 2020)

- Agri Biotechnology. Amongst the most significant technologies, experts identify genomic selection, new biotechnologies for plant protection and animal health, and the development of synthetic biology. At the moment, this direction is being developed by research institutes, and the most advanced laboratories of large international companies. The demand for innovative products from research institutes is very low. As a rule, those companies that are interested in Agri Biotechnology buy the material abroad.

In the short and medium term, Russian business is wary of New food technologies. The transition to new food products is associated with the need to introduce innovations that correspond to the change of value consumer orientations. So far, these conditions have not received a mass distribution in the Russia. But in the long-term horizon, there may be drastic changes in the industry due to the widespread of alternative technologies for obtaining traditional products, both food and feed, which is considered as an absolute threat to the crop and livestock industries.

## **Conclusion**

The use of digital technologies has been recognized as one of the great challenges for businesses of the 21st century. This digitalization is characterized by the intensive use of information technologies in the different stages of the value chain of a sector. In this context, smart agriculture is transforming the agricultural sector in terms of economic, social, and environmental sustainability.

The results of the study prove that in addition to government policy, medium and large businesses are interested in changes and have begun to digitize the processes. In particular, multinational companies are rapidly implementing new digital technologies in production and management.



In this regard, the government and business need to coordinate efforts in digitalization and transformation of corporate governance into the management of corporate agro-industrial ecosystems. Multi-stakeholder partnerships are examples of system leadership in practice that can help promote innovation ecosystems at the country and regional levels by engaging diverse stakeholders around a common vision, encouraging transparent and inclusive dialogue and facilitating collaboration and coordinated action.

Considering the ecosystem as a complex actor network, each actor has its own background and attributes. The principle of decision-making means that the mechanism and priority of decision-making can be very different among ecosystem actors. All actors behave in accordance with their own principles of rationality and decision-making. The study of the agro-industrial complex as a developing ecosystem transforms the rules and conditions of activity. (Tsuji moto, M., Kajikawa, Y., Tomita, J., & Matsumoto, Y., 2017)

According to BCG experts «Ecosystems compete with other governance models, such as vertically integrated organizations, hierarchical supply chains, and open-market models. An ecosystem is the preferred model in unpredictable, but highly malleable business environments and when high modularity of the offering is combined with a high need for coordination among players». (Pidun, U., Reeves, M., & Schüssler, M., 2020)

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