Digital Innovations in Agribusiness Industry in the Russian Federation

A. V. Shchutskaya

Abstract The use of innovations, including digital technologies, is the main condition to provide for promotion of competitiveness under conditions of global challenges and threats. Russian agribusiness industry demonstrates a steady growth in production volumes and dynamic digitalization. The author aims to determine the features, problems and prospects of digital farming based on the analysis of the current innovation and digitalization processes in the agribusiness of the Russian Federation. Due to the methods of theoretical and economics and statistics analysis, it was revealed that despite some positive trends, Russian agricultural industry is characterized by a low level of innovation activity and a limited distribution of digital technologies, since they are more widely implemented in large agricultural enterprises and holdings. At the same time, the socio-economic conditions during the COVID-19 pandemic have become a powerful incentive for all manufacturers to introduce elements of digitalization in food production and marketing processes. The analysis of the domestic and global experience on digital innovations allowed the author to identify promising areas that contribute to provide all commercial farm units in the agribusiness industry with digital technologies, stimulate digitalization processes and increase the efficiency and environmental friendliness of the agricultural sector of economy.

Keywords Agricultural industry · Digital farming · Innovations · Russia

1 Introduction

Today, digitalization is the main trend in the economic sectors development in Russia, including the agricultural industry. Having a huge resource potential and seeking for an increase in a competitive position in the global agrifood market,

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Russian agricultural industry has been intensively involved in the digital innovations introduction. It is in the national agricultural sector that transition from traditional farming technologies to digital ones, based on innovative methods of generating, processing, storing and transmitting data, artificial intelligence, robotics and information computer technologies, is the most evident.

The COVID-19 pandemic and lockdown with a need to reduce human contacts in goods and food production, distribution and consumption has promoted to a powerful incentive for the digital technologies implementation. The agrifood sector is a life-supporting sphere of any state. Consequently, a need to use IT solutions has massively increased both in agricultural enterprises' management and production, and food production and distribution. Nowadays, digitalization has affected the entire product chain of food production and marketing [10].

The agribusiness industry digitalization brings fundamental changes, since they affect all areas of business entities' activity, provide for new opportunities and remodel interaction, social integration and communication. Efficient digitalization is the main source to increase competitive advantages. In this regard, the study of the features of the digital innovations implementation in the agribusiness industry, problems and prospects of digitalization is relevant.

2 Methodology

The author used general scientific and special methods and techniques of economic research. A review, analysis and generalization of the works of national and foreign scientists and practitioners on the innovative development problems and the digital technologies use in the agribusiness industry were a methodological basis of the study. A theoretical analysis of the papers allowed the author to identify the features and problems of the digital innovations introduction in the agricultural industry. A synthesis of the best recommendations and experience of scientists helped develop measures to stimulate digital innovations in the agribusiness. The trends of the innovative activity development in the agricultural industry, including digital technologies, are determined through statistical analysis methods. The official data of the Federal State Statistics Service of Russia (Rosstat) and the Ministry of Agriculture of the Russian Federation were an empiric basis of the study. To intimately analyze the processes of agribusiness industry digitalization in the Russian Federation, the studies conducted by Higher School of Economics National Research University, Federal State Budgetary Institution of Science "Russian Research Institute of Information and Technical and Economic Researches on Engineering-Technical Support of the Agribusiness Industry", Center for Forecasting and Monitoring the Scientific and Technical Development of the Agribusiness Industry of the Federal State-Funded Educational Institution "Kuban State Agrarian University named after I. T. Trubilin", as well as the data from info-analytic agencies and research and training conferences were analyzed. The research was based on a systematic and integrated approach to

the subject under study that made it possible to ensure credibility and validity of conclusions and proposals.

3 Results

Russian agribusiness industry has recently become one of the most developing areas in the national economy. The main growth driver is a core branch of the agribusiness industry, that is agriculture, and it increased production volumes by 3.3% on average per year in 2013–2019. Despite the most difficult socio-economic conditions in production in 2020 caused by the COVID-19 pandemic, there was some positive dynamics in the agricultural development. According to the preliminary estimates of Rosstat, the agricultural production index in 2020 compared to the previous year is 101.5% (in comparable prices) [4]. The current trends are supported by extensive and intensive factors in the economic development and the innovation activity expansion on behalf of rural manufactures [12]. According to the statistics (Table 1), the volume of innovative goods, works and services in agricultural enterprises of the Russian Federation increased more than 3 times in 2016–2019 due to increased costs for innovations.

Table 1 shows the dynamics of technological innovation costs that are the main direction of innovation activity of rural manufacturers (about 99% in the total costs for innovations), and it is typical for labor-intensive and capital-intensive industries. Despite three-times increase in the technological innovations costs, their share in the total volume of goods shipped, works and services remains extremely insignificant (1.6%) due to the low innovation activity of rural producers. According to Higher School of Economics National Research University, only 4.2% of agricultural enterprises implemented innovations in 2019 [6].

Technical re-equipment and modernization in the agricultural industry are developing, and this development is extremely necessary in the context of technical

Table 1 Core indicators of an innovation activity in agricultural enterprises in the Russian federation

Indicators	2016	2017	2018	2019
Sales of innovative goods and services, bln. roubles	22.2	28.4	33.8	69.6
Innovative goods and services as a percentage of total sales, %	1.4	1.8	1.9	2.3
Expenditures on technological innovations, bln. roubles	15.0	15.8	22.0	49.4
Expenditure on technological innovation as a percentage of total sales, %	0.9	1.1	1.2	1.6
Level of innovation activity, %	4.0	4.6	4.2	4.2

Source Author based on[6]

and technological lag in domestic agriculture in comparison with developed countries. The transition to the innovation-based development and agribusiness industry digitalization involve the availability of modern equipment for rural producers.

Digital farming is a new technological paradigm that includes co-utilization of precision farming technologies (production processes management through information, navigation and telecommunications technologies, including global positioning technologies and distant land sensing) and intelligent networks and data management tools (Internet of things). To implement digital farming technologies on a practical level, two main conditions should be met: the first is "smart machines" which are capable to receive, send, generate and process data and the second is "connected machines", that is to say, communication and interfacing standards have to provide for unobstructed data sharing among machines, business partners and portals [9].

The experts distinguish three stages (trends) in the digital technologies development and implementation in the agricultural industry [9]:

- *Leading technologies.* The technologies for geo-positioning, monitoring farm equipment conditions, etc. have been introduced since the mid-2000s.
- *Market saturation* is characterized by a situation where a number of digital technologies and industry standards in the agricultural industry reaches a critical mass. Almost all equipment manufacturers offer their own programs and solutions that can optimize the use of their machines and equipment. The diverse options for using geodata for crop forecasting, agricultural operations optimization, logistics management, etc. are offered. The introduction of agricultural technologies, such as Internet of things and blockchain, has an additional impact on customers.
- *Integration* is the core prospective trend. Companies that will be able to offer common standards and solutions to integrate existing developments in digital agricultural technologies and eliminate the problem of choice and risks will become leaders in agribusiness industry digitalization.

Today, first two stages are the most evident in the Russian agribusiness industry. Moreover, there are developments and first attempts to implement an integration trend. Digital technologies are being intensively introduced into production in large agro-industrial enterprises [6]. These technologies have been already established in large agro-industrial enterprises, both at the level of accounting, planning, financial management, supply and sales activity, and performing production technological operations. Software products of the domestic company 1C have become the most promoted in agricultural enterprise management (ERP-systems).

According to the study conducted by the Center for Forecasting and Monitoring the Scientific and Technical Development of the Agribusiness Industry of the Federal State-Funded Educational Institution "Kuban State Agrarian University named after I. T. Trubilin" together with the Department of Scientific and Technological Policy and Education of the Ministry of Agriculture of the Russian Federation, the most used elements of digital technologies in crop production in 2019 were the following [14]:

- parallel driving,

- satellite monitoring of vehicles,
- creating digital field maps,
- graded weeds spraying,
- graded fertilization,
- graded seeding.

The digital technologies rating in livestock business is as follows:

- electronic database of the production process,
- monitoring of the livestock products quality,
- identification and monitoring of individual animals,
- monitoring of animal stock's health,
- milking operation robotics,
- microclimate autocontrol.

More than 60 Russian regions took part in the survey mentioned above. It was revealed that 2834 enterprises in 55 regions implemented precision farming, and the area amounted to 15.5 million ha. The land area, covered by digitalization, increased by 24% compared to 2018. Precision livestock farming was used in 58 regions by 1707 enterprises with 3 million cattle population in 2019. The cattle population, covered with digitalization, increased by 76% in 2018–2019. The regional leaders in the digital technologies implementation in crop production in 2019 were the following: the Volgograd Region (257 enterprises and 1.33 million hectares), the Krasnodar Territory (250 enterprises and 1.22 million hectares), and the Voronezh Region (211 enterprises and 1.20 million hectares). Animal farming digitalization is intensively developing in the Udmurt Republic (123 enterprises and 166,000 heads), the Kirov Region (92 enterprises and 142,000 heads), the Altai Territory (88 enterprises and 160,000 heads), the Sverdlovsk Region (86 enterprises and 188,000 heads), and the Krasnodar Territory (81 enterprises and 212,000 heads). According to the scientists, precision farming was introduced in 10% agricultural enterprises and precision animal farming was implemented in 13% enterprises in 2019 [14].

There was a rapid startups development in regard to digitalization in 2020 during the COVID-19 pandemic. Agribusiness enterprises have become more active in introducing innovative digital technologies into production processes, building digital logistics supply chains for products, creating sales sites, introducing product tracking systems, etc. There are projects of integrated solutions in agribusiness. Digital Agro, Agrosignal and Cognitive Pilot Companies are planning to build an integrated agroecosystem for commercial farm units' digitalization in Russia within a strategic partnership. It is being planned to create a unique product that integrates full-cycle agro-ERP and unmanned vehicle control technologies. The solution will be a hardware-software system for unmanned equipment control, collecting, processing and transforming telemetrics data, as well as managing all economic activities of companies within a single digital profile [2]. The autonomous control system of agricultural machinery with the use of Cognitive Agro Pilot artificial intelligence, developed by Sber and Cognitive Pilo Companies, has been already used in harvesting by 35 Russian regions in 2020. The largest agricultural holdings in Russia, such as

"EcoNiva", Agricultural Enterprise Group "Resource", Corporate Group "Steppe", Agro Union "The South of Russia", "Agricultural Complex named after Tkachev", "Peschanokopskaya Agro Group", "South-Eastern Agro Group" and others became Cognitive Pilot customers. More than 350 combine harvesters, equipped with Cognitive Agro Pilot, processed more than 160,000 hectares of land and harvested more than 720,000 tons of crop in an autonomous mode from June to October 2020 [3]. Based on the project participants' estimates, every tenth combine harvester in Russia will be able to become unmanned in three years.

Today, the programs for the digital farming development, support and implementation are being introduced in many Russian region, and they provide for subsidy assistance of the costs for hardware and digitalization equipment purchase [14]. The Ministry of Digital Development, Communications and Mass Media of the Russian Federation have been providing projects on Russian digital solutions development and implementation with grant support since 2020. According to the experts' forecast, the number of agribusiness organizations which implement Internet of things, precision farming, digital herds and smart greenhouses will increase to 60% by 2024 [13]. The main purpose of agricultural industry digitalization is to achieve a significant increase in functioning efficiency and sustainability. Digital transformation involves fundamental changes in management quality in both technological and decision-making processes at all hierarchical levels, based on information and communication technologies (ICT).

According to the statistics, 82.5% of agricultural enterprises used ICT, 62.5% used electronic document management and 65.4% used Internet to communicate with suppliers and consumers of goods, works and services in 2019 [5]. There was a significant increase in ICT costs from 4 billion rubles to 11.8 billion rubles in the agricultural industry in 2015–2019. The costs for communication services (41.5% and 4.9 billion rubles), computer and office equipment purchase (22.9% and 2.7 billion rubles) and software purchase (8.5% and 1 billion rubles) dominated in 2019. In general, ICT costs in the agricultural industry accounted to only 0.5% of ICT investments in all sectors of the national economy in 2019. Organizations' internal costs for building, distributing and using digital technologies and related products and services were only 0.6% [1]. These are the lowest indicators among the national economy branches. This fact provides evidence of the lack of digitalization in Russian agriculture. At the same time, while comparing the digitalization costs in the agricultural industry with the contribution of ICT sector to the economic development, which amounted to 3.8% of GDP, we can conclude that there is a high return on costs and therefore, there is a need for the digital agriculture development and a large-scale government support for enterprises that implement digital innovations [1].

4 Discussion

Modern innovative digital technologies have a huge potential for economic growth. National and foreign studies have proved that agricultural industry digitalization

significantly improves production efficiency due to an increase in agricultural yield, animal productivity, performance and resource optimization. Moreover, a harmful production impact on the environment decreases [7, 9, 11, 13, 15]. Food and ecological safety are powerful drivers for the digital technologies introduction in the agribusiness industry. Nowadays, Russian agricultural industry has already accumulated some experience in the digital technologies introduction. On the other hand, it is worth mentioning that it is still too sporadic, since only large agro-industrial enterprises and holdings use these technologies. Digitalization processes are of limited use in small businesses. This trend is evident throughout the world especially in developing economies, as small arable farms have high costs for technology implementation, as well as limited knowledge and skills [15]. A low level of access to Internet in distant rural areas is also a significant problem [8, 10]. An unequal access to digital technologies means that there is a risk to increase the digital difference among large and small agricultural enterprises, rural and urban regions, as well as people with differences in age, socio-economic status and education [11].

To strengthen the digital technologies introduction in Russian agribusiness industry, it is necessary to provide all rural producers with an access to them. It is important to start with connecting rural areas with the digital infrastructure. To promote awareness of digital innovations and involve small businesses in innovation processes, it is essential to stimulate rural information and consulting services activity [12]. The Institute of Agricultural Consulting is able to become a center for the digital innovations distribution and provide agricultural producers with information about digital technologies and opportunities for advanced training in regard to digitalization, as well as assistance in introducing innovations into production.

The world experience shows that the key role in the innovative processes development should belong to the state. We are able to achieve the greatest effect in agribusiness industry digitalization only through the cooperative efforts on behalf of the state, scientific institutions and agribusiness.

5 Conclusion

The study showed that despite an intensive introduction of digital technologies in the agribusiness industry in the Russian Federation, the number of enterprises which implement them does not exceed 10–15%. Only 4.2% of agricultural organizations demonstrated an innovative activity and implemented technological innovations in 2019. A need to reduce human contacts during the COVID-19 pandemic became a powerful incentive for the innovative digital technologies introduction in the product chain of food production and sales in 2020. In addition to particular elements of digital technologies in the agricultural industry, enterprises have begun to implement integrated agricultural digital solutions, including unmanned vehicle control technologies. Large enterprises and agricultural holdings are the most active in regard to digitalization. The digitalization processes in small businesses are of limited use due to high costs for the technologies implementation and lack of knowledge and

skills in digital farming. To provide all commercial farm units with digital innovations in the agribusiness industry, it is necessary to strengthen state support in the development of digital infrastructure and scientific, educational, information and consulting activities.

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