Role of innovative digital technologies in transformation of Agricultural and Industrial Complex

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Abstract. The conditions of the digital economy development are studied in the article taking into account the application of innovative technologies. The authors considered features and the role of their influence on the digital transformation of the Agricultural and Industrial Complex. The review of the main government programs to intensify the industry development by using digital technologies is presented here.

Keywords: digital economics, digital transformation, digitalization of agriculture, innovation, informatization of economics

1. Introduction
The informatization process led to the development of digitalization processes in the economy as a whole, as well as its individual industries. To do this, a single information space is being created, including data warehouses, the Federal Geographic Information System (GIS), regional customers (regional GIS centers), the site of the main computing center and other components.

The existing information environment in the Agricultural and Industrial Complex sector is inefficient. Transactional costs in production are rising. The comparison of foreign analogues with domestic products reflects the low level of domestic food products financial affordability, as well as their low competitiveness.

2. Enterprises functioning in the digital economy features
Enforcing the accelerated application of digital technologies in the economy and social sphere is one of the goals in national development of Russia for the period until 2024 [1]. The national program “Digital Economy of the Russian Federation” was developed to achieve this goal. Within its framework in 2024 it is necessary to:

- increase domestic costs for the development of the digital economy at the expense of all sources at least 3 times compared with 2017 (in terms of the share in the country’s GDP);
- create a stable and secure information and telecommunications infrastructure for the large amounts of data (accessible to all households and organizations) high-speed transmission, processing and storage;
- ensure the use of predominantly domestic software by organizations, state bodies and local governments.
Favorable conditions were developed in Russia to solve a number of problems aimed at achieving the above targets. Between 2014 and 2018, the gross added value in the ICT sector increased by 13.7%. The relative share of the ICT sector for the period of 2014-2018 ranged from 2.6 to 2.8%. In 2018, the share of the ICT sector in the business sector added value amounted to 3.2%; however, it is 3 times lower than in the Republic of Korea (9.6%) and 1.5-2 times less than in most developed countries. In 2018, the investments in fixed assets increased significantly - by 26% compared to 2017. The increase in the number of organizations in IT industry was by 6.3%, the decrease in the number of employees was by 7.4%, which indicates such negative trends as job cuts.

During 2018, the share of profitable organizations in the information and communication field amounted to 75.2% (7.1% more than in 2017), including 76% in the IT field. The business sector organizations have widely mastered basic and relatively simple digital technologies, but only a small part of them conducted a deep automation and restructured business processes according to advanced digital technologies. The individual technologies intensity use is distinguished by a significant differentiation. Thus, more than 80% of organizations use broadband Internet and more than 60% of them use electronic data exchange technologies. The share of organizations using more sophisticated technologies remains quite low: less than a quarter of organizations use cloud services, slightly more than 20% of them use ERP-systems, and less than 10% use RFID-technologies. Less than half of the organizations in the business sector have a website, and cloud services are used primarily for e-mail purposes. This is another negative aspect of the digital economy development in Russia. The highest levels of digitalization have organizations in such types of economic activities as "Telecommunications", "IT industry", "Manufacturing industry" and "Whole sale and retail trade". As to the software tools, organizations most often use electronic document flow systems, software for financial calculations, as well as for solving organizational, managerial and economic problems [2].

International comparisons on the totality of factors show Russia's promising positions in terms of the digital technologies development and implementation main indicators, since it is included in the top 50 major international ratings of digital development. Thus, in terms of the e-government development index, Russia lay in the 32-nd place in 2018 (35 in 2016); in terms of ICT development index in 2017 – 45-th place (in 2016 - 43). By the value of the global cyber security index, in 2017 Russia lay in 10-th place, but in 2018 it dropped to 26.

The Institute of Statistic Studies and Economics of Knowledge National Research University Higher School of Economics has developed a Business Digitalization Index to measure the speed of business adaptation to digital transformation. That index characterizes the level of broadband Internet, cloud services, ERP-systems, RFID-technologies use and the involvement of business sector organizations in electronic commerce. The value of this index for Russia in 2017 amounted to 28.4%, that is 1.6-1.8 times lower than in the leading countries (Finland, Belgium, Denmark, the Republic of Korea) [3]. By the intensity of the digital technologies use in the business sector, Russia is located next to Bulgaria, Hungary and Romania. In terms of the digital technologies spread, leading positions, in addition to telecommunications (more than 40%), are occupied by organizations in whole sale and retail trade, manufacturing and IT (35%) [4].

According to the Index “Digital Russia” [5], the Volgograd Region for 2018 lies in 39-th place out of 85 entities, that is 2 points lower than for the previous year. The Governor approved the Program “Digital Development of the Volgograd Region” by the resolution No. 204 of April 23, 2019 in order to strengthen the position of the region and successfully implement of the national program “Digital Economy of the Russian Federation” on its territory.

The Volgograd region has all the necessary prerequisites for the further digital technologies application and the Program implementation. The share of organizations in the Volgograd Region that used special software in 2018 amounted to 82.5%, it is 4.5% higher than that level in 2014. The most common are software tools for solving organizational, managerial and economic problems, for making financial payments electronically, as well as legal reference systems (they are used by more than half of the organizations surveyed). Programs for providing access to databases are less in demand (30% of organizations). Less than 20% of organizations use training programs, programs for managing
automated production and/or individual technical means and technological processes, design software, as well as CRM, ERP and SCM systems. However, according to these types of software in recent years, there has been a steady tendency to increase the share of organizations which use them. This is especially true for ERP, CRM and SCM systems: the annual increase in the share of organizations using them amounted to almost 2% [6].

3. Agricultural and Industrial Complex digital transformation based on innovative technologies
Traditional technologies have already exhausted their resources, and the digitalization of agricultural production requires costs, and sometimes significant ones, the change farmers’ mentality, and acquiring new skills and abilities. The challenges facing the digital economy are solved by using: relevant knowledge bases; information resources; interactive communities; integration business platforms; digital environment; and personnel who are able to perform work in new conditions.

This integrated approach creates a digital ecosystem. Each participant in this system simultaneously acts as a client and a data server. All this is the basis for the formation of subject-oriented clusters. Inside these clusters, the functioning of agricultural digital ecosystems occurs [7, 8].

The core of such a cluster includes agricultural producers, terminals and reception centers, processing enterprises, logistics centers, distributors, etc.

The sectors of coordination and management, scientific research and technology, personnel training and retraining, transport and technological services, financial services and lending, insurance, information and consulting services, technical supply, etc. are the cluster's satellites.

The authors propose to create a digital economy ecosystems global platform on the basis of the integration and interaction of large corporations, educational structures - training classes (higher education institution, vocational education institution, distance teaching system, etc.).

The effectiveness of the operation through the use of digital technologies in the Agricultural and Industrial Complex sector lies in the growth rate of productivity and profitability in the agricultural industry, which is directly related to the use of digital technologies [9].

According to the head of the Project Office for “Digital Economy of the Russian Federation” program application Vladimir Mesropyan’s opinion, the digital platform is “a key tool for the traditional industries and markets digital transformation, the central concept of the global digital agenda that distinguishes between digitalization (digital automation) and digital transformation strategies” [10, 11, 12].

It should be noted that digital platforms appeared in the 90s of the XX century due to the information and communication technologies active use in various sectors of the economy, including the widespread use of the Internet. Thanks to ICT, software and hardware conditions and opportunities appeared for the platform business-model formation and development.

The digital platform belongs to the category of disruptive innovations and represents an “integrated information system that provides multilateral user interactions for the exchange of information and values, leading to lower overall transaction costs, streamlining business processes, and increasing the efficiency of the chain of goods and services supply” [10].

According to experts at the working group led by B. M. Glazkov, the vice president of public joint-stock company “Rostelecom” and the head of the Competence Center “Information Infrastructure” of the Russian Federation Digital Economy Development Program [13], the digital platform is “the system of algorithmic mutually beneficial relationships of the significant number of independent industry participants in economics (or areas of activity) implemented in the single information environment, and leading to lower transaction costs due to the digital technologies package use for work with data and changes in the division of labor system” [14]. The authors identified five key criteria for digital platforms:

1) the algorithmization of the platform participants interaction;
2) the mutually beneficial relationship of the platform participants (the principle "win-win");
3) the significance of the participants number in the activity (scale) using the platform for interaction;
4) the presence of a single information environment where the participants’ interactions are carried out, and the corresponding information technology infrastructure;

5) the presence of the effect in the form of lower transaction costs during the interaction of various platform participants - compared with the same interaction without a platform.

An appropriate material base is needed to implement measures aimed at the industry digitalizing. For example, the introduction of precision farming is impossible with outdated equipment. Special GIS-driven tractors, combines, trailed devices are needed for this. In the course of the government program No. 1432 application, “our domestic agricultural machinery has become a competitor to the foreign production most modern models” [15]. However, according to the experts’ opinion, the amount of domestic equipment produced is clearly not enough to stop the mechanization dropout level in the village [15]. According to experts’ estimation, the aging of agricultural machinery is slightly ahead of the new machines purchase. The quantity of tractors older than 10 years in Russia exceeds 50 percent, the combine harvesters - about 45%. As the result, losses when harvesting with the use of old combines make up 10 percent of the grown crop, and when using new equipment it is about one.

To fulfil the tasks of the Agricultural and Industrial Complex technical modernization, farmers take advantage of the soft lending possibilities, and also receive discounts on the so-called “1432” Program. Leasing is becoming more widespread: in 2019, in cooperation with “Rosagroleasing” JSC, farms in the region acquired equipment worth 425 million rubles, while 80 percent of buyers are small and medium-sized businesses representatives.

For example, the Volgograd region is annually recognized as one of the most active regions in the field of Agricultural and Industrial Complex technical modernization. In 2014, farmers purchased equipment for a maximum of 2.5 billion rubles, in recent years the annual volume has been approaching to six billion [16].

The use of computer systems for automating the management of business processes in animal husbandry allows to work individually with each animal, taking into account its current condition and real needs, and provides detailed data on milk yield, fertility, health and nutrition of the whole herd. The use of such technologies made it possible, in particular, to increase milk yield by 30-40 percent in the farm enterprise “Donskoye”.

The information system of veterinary control "Mercury" is successfully used in the Volgograd region. It helps to control the number and condition of farm animals, and makes it easier to obtain veterinary certificates. Through this system, about 28 million documents have already been issued.

Chipping of farm animals is another area of digitalization. In ten live stock districts at the Volgograd region in 2019, the stock of cattle was fully microchipped. 20 million rubles were allocated from the regional budget for these purposes.

The farm land monitoring information system won the title of laureate at the All-Russian competition of regional and municipal informatization “PROF-IT.2019”.

The system covers the entire territory of the region and uses satellite imagery data. It contains digitized information about the location, condition and users of more than 57 thousand land plots. With the help of the agricultural portal, accounting and control of farm land is carried out, accurate information on crop rotation and field work is collected [17].

So in 2017, unused lands were identified during the satellite monitoring and inventory of agricultural lands. The result was a 84.6 ha reduction in uncultivated arable land.

It should be noted that at present, there is a Unified Federal Information System on Agricultural Lands (UFIS AL) in our country, which so far is the main information resource for digital land management.

Its main task is to quickly provide the Ministry of Agriculture and its subordinate organizations with relevant and reliable information about the boundaries and areas of agricultural lands and crops, land users, soil quality indicators, negative processes, objects and land reclamation facilities, etc.

However, at present, this information is not enough to form an effective land management system, because the system of updating data has not been fully developed, there is no quality control of the information provided, the system does not contain decision-making blocks [18, 19].
For example, according to the Analytical Center data, 22 regions out of 83 regions with agricultural lands did not provide data to the Unified Federal Information System on Agricultural Lands. More than half of the regions that provided information do not have reliable information in their information databases. In 42 subjects of the Federation, the land user database fill rate is less than 50%. There are also significant errors in cartographic support [20, 21].

It should be emphasized that nowadays the full implementation of the project “smart land management” is impossible due to the following reasons:
- the lack of a unified information resource on agricultural lands [22];
- obsolete cartographic materials (the latest update on agricultural lands was conducted in the period from 1987 to 1990);
- the lack of competent specialists in the field of cadaster and land management (In the course of previous researches, the authors found out that there are a large number of errors in the work of the currently available specialists. For example, according to the cadastral valuation results of the agricultural land in the Volgograd region, the estimated land area is 14.9 million hectares, it is 3.6 million hectares more than the entire area of the region (11.3)) [23];
- the lack of the necessary coordinate description for half of the land plots (about 29 million), and, as the result, the lack of the full register of rights to the land plots;
- the lack of specialized equipment and software.

4. Conclusion
The digital economy contains elements that allow performing land monitoring, optimization of payments between producer and buyer, rationalization of credit systems, investment, the use of marketing techniques, opposition to monopoly, electronic interaction between the digital economy participants.

The purpose of technological digital platforms (elements of an innovative infrastructure) is to ensure efficient and effective communication, stimulating the agricultural producers’ interaction with other interested parties.

The initial stage of digital transformation (digitalization) includes the creation of a centralized information space by integrating existing data warehouses, using distributed data storage and tools for managing information and business intelligence, implementing a network-centric approach.

Digitalization, therefore, in the Russian Agricultural and Industrial Complex is at the initial stage. A detailed study of programs for informational support of the industry and the economy as a whole is required. Basically, it is proposed to automate what has already become fixed, but how to make this global transformation is still unknown. It is designed to enable the intelligent systems construction, the use of great data technologies and machine learning technologies, the introduction of technologies that have shown effectiveness in piloting framework. The search for a solution and its execution are carried out by the system.

An optimal digital ecosystem should be created by developing a digital platforms network in all areas of the Agricultural and Industrial Complex sector.

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