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AGRICULTURE DIGITIZATION: TRENDS AND PROBLEMS’
REVIEW

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Abstract

Increasing agriculture competitiveness in our country and its regions is a solution to the problems of its further development. It should be noted that international political situation leads our country to the significant changes in agriculture. Industry transformation based on digital economy determines existing and potential threats to the food security. Digitization of agriculture is the main trend of the industry development in the nearest future. According to the estimates done by the Ministry of Agriculture, agriculture digitization will increase productivity. The article describes the specific nature of agricultural industry which makes introduction and application of digital technology possible. Agriculture has a great potential for the development based on the effective utilization of land, biological and labour resources. For the sound interaction of these resources there is a necessity to modernize production technologies and the system of management. It has preconditioned the design and implementation of the industry project “Digital agriculture”; some of its components are described in this article. Studying the main trends of agriculture digitization allowed determining two main aspects: digitization of the state management in agriculture and agricultural industry digitization. As an example of a successful data system an on-line database “Subsidies for agro-industrial complex” has been introduced, as it integrates key functions of the industry subsidizing process. The article outlines main problems of agriculture digitization and outlines the ways of their solution. The conclusion is that strengthening the state support for agriculture will create conditions for the industry digitization.

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Keywords: Industry project, agriculture, digitization, digital platforms, digital technologies.



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1. Introduction

According to the Ministry of Agriculture of Russian Federation, Russia is in the 15th place in the world according to the level of digitization; only 10 % of tilled land is processed with digital technologies. The peculiarity of the agricultural industry makes it possible to introduce and actively apply digital technologies. These peculiarities are determined by the technological variety of agriculture production and crops, with the variety and complexion of production processes provided by digital technologies, engagement of living beings in the technological process, connection of equipment operational modes with plants, animals and people, distribution of the controlled parameters on the big area, their random nature.

Scale effect cannot be achieved with sporadic attempts of farmers to introduce new instruments into the work; system planning and the state support are necessary for digitization (Gorlov, Fedotova, Slozhenkina, & Mosolova, 2018). Ministry of Agriculture of the Russian Federation has developed a national project “Digital farming”, its idea is in digital transformation of agriculture by “introduction of digital technologies and platform solutions to provide technological breakthrough in the agro-industrial complex and increased production of “digital” agriculture enterprises two times by 2024”. The supposed project budget is expected to be 304 billion rubles (additional state subsidies and external funds from agribusiness and IT-business (about 152 billion rubles). According to the Ministry of Agriculture of the Russian Federation today about 3 % of the gross product of the industry is made with the application of new digital technologies. The data in Table 01 show that this process has been increasing lately.

Table 01. Targeted parameters of the national project “Digital farming”

Year	Amount of acquired innovative technologies and software	Amount of produced ware, goods and services, billion rubles
2010	21267	1243.71
2011	40646	2106.74
2012	31639	2872.91
2013	33280	3507,87
2014	28705	3579.92
2015	24361	3843.43
2016	64914	4364.32
2017	79825	5109.32

Source: Akmarov, Gorbushina, and Knyazeva (2019).

2. Problem Statement

In the context of globalism, agriculture is a link creating conditions for the development of related sectors. Hence, agriculture digitization is important for enhancing production efficiency and goods processing (Akmarov et al., 2019).

3. Research Questions

Agriculture digitization will support the growth model of agriculture, which reflects modern characteristics of the country and targeted on domestic and export markets. Studying the main directions

of this trend will allow determining the problem scale and possible solutions when introducing digital technologies into agriculture

4. Purpose of the Study

The purpose of the article is to study main trends and problems of agriculture digitization.

5. Research Methods

The research is based on studying and generalizing theoretical and factual material on peculiarities and problems of agriculture development in the context of digital economy with different methods: system, logic analysis, synthesis, induction and deduction.

6. Findings

There are two directions of agriculture transformation in the context of digitization: digitization of agriculture industry and that one of the agriculture state management (state support). In the digitization of the agriculture state management we can denote the following moments. First, introduction of smart-contracts suggests creation of intelligent systems of state support (subsidies, investment credits and others), personal accounts for agriculture goods producers. Banks participating in crediting the industry will provide electronic identification of agriculture good producers. According to the forecast, by 2021 year 100 % of smart contracts will have been signed electronically. The second component in the context of agriculture state management is an effective hectare, which will make possible precise forecasting of harvesting. It is expected to introduce the mechanism of forecasting and planning agriculture production. Ministry of Agriculture of the Russian Federation has introduced the Unified Federal Information System about the agriculture lands. This system integrates information on agriculture lands and the state of agriculture vegetation in the real-time mode. It will provide introduction of industry smart planning in 85 subjects of the Russian Federation on the principle of planting the most economic crops (Shkarupa, Perehodov, & Ulanova, 2018).

The most important technologies in agriculture digitization are: “Smart Farm”, “Smart Field”, “Smart Herd”, “Smart Greenhouse”, “Smart Processing”, “Smart Warehouse”, “Smart Agriculture Office”. All national digital agricultural solutions will be ranged (MCX, 2019). It will increase control of production processes and reduce resources and labor results loss; it will allow handling the work distantly “any time from any place”. Table 2 shows target indexes of the national project “Digital Farming”.

Table 02. Target indexes of the national project “Digital Farming”

Resources percentage in Big Data (%):				
land	75	100	100	100
cattle	1	25	50	100
equipment	50	75	100	100
Percentage of SMART-contracts with grants recipients, %	0	10	50	100
Cost reduction coefficient, %	0	5	15	20
Percentage of tangible costs in the primary cost of agriculture production, %	65	60	55	50
Increase in labour productivity, %	0	105	150	200
Investments into Digital Technologies (including made in Russia), %	0.5(0.1)	1(0.5)	3(1.5)	7(5)

The Analytical Center of Ministry of Agriculture of the Russian Federation has been created in order to transform the agriculture and provide the technological breakthrough in AIC with introduction of digital technologies and platform solutions. The primary task of this structure is to consolidate the available statistics on the industry; the key task is to provide access of the branch information and to coordinate the interaction of the Ministry of Agriculture of the Russian Federation with the economic agents of the industry.

The Ministry of Agriculture of the Russian Federation creates digital services aimed at simplifying, clarity and manageability of the state support process (the list of the information management system is on the official site of the establishment) (MCXAC, 2019).

As the primary tool of monetary support for the industry is subsidizing, let's deal with integrated data system "Subsidies AIC". Its purpose is to integrate the key functions of the industry subsidizing (subsidies distribution processes, informing the subjects of the RF on subsidies, control on subsidies distribution, monitoring for subsidies record). Combining different sources of information in this system allowed monitoring financial measures of the organizations which receive subsidies and estimate the financial support of AIC. IDS "Subsidies AIC" reduces the time of distributing subsidies to the agriculture goods producers almost 2–3 times due to significant time reduction required to sign the agreements between the Ministry of Agriculture of the Russian Federation and the Subjects of the Russian Federation.

According to the estimates in 2022 year not less than 75 % of subsidies and 50 % of preferential credits will be provided via digital services. That is why it is planned to create an information management system of AIC by 2021, which will reach 83 agrarian regions in Russia and more than 120 thousands of agriculture goods producers, who received the state support in agriculture (MinAgro, 2019).

Ministry of Agriculture of the Russian Federation and PJSC "Sberbank" have signed an agreement on cooperation in order to introduce digital technologies into the industry to boost digital transformation of agriculture.

This agreement suggests collaboration in order to introduce digital technologies and platform solutions into AIC, cooperative forecasting and recommendation on business solvency of the industry, collaboration in implementation of infrastructure projects on agriculture lands, and informing about available measures of support, services and advantages of rural business (MCXAC, 2019).

PLC "Rosselkhozbank" implementing scale projects of digitizing calculation processes and developing digital technologies is ready to start a digital ecosystem "Farming as a Service" for small agricultural business in 2020 (Rosselkhozbank, 2019).

The key trends of this system are introduced by the following blocks. The first block deals with the human resources (searching and involvement of seasonal workers). The bank platform will create conditions to provide skilled veterinary aid and will give the core set of opportunities for digital control of the farm. The second block of services will be aimed at marketing development for the bank clients and assisting them in service advance. Via PLC "Rosselkhozbank" agriculture goods producers will offer independently their goods to a wide range of distributors. This block will be represented by the service aimed at revealing tourist potential of the industry. The third block will integrate all financial services,

including applying for preferential credit. The main aim of remote banking is to simplify the loan processes and enhance the quality of bank services. This digital ecosystem will provide business interaction with the governmental authorities. As small agricultural business has little opportunity to invest into digitization, the bank's platform will be a strong impulse for digitization of the business.

To provide measures of the State support for agriculture it is planned to create a Unified service for the State support of AIC, which makes it possible to report electronically, increase volumes and sales revenues domestically and when exporting goods due to interacting on the base of Unified Electronic Trading Facility, digitization, acceleration of the receiving processes and enhancing efficiency of the State support for agriculture. The modern stage of agriculture development is characterized by sporadic digitization as digital technologies are only introduced and used by some economic units of the industry. On one side, software engineers cannot create specific technologies for the industry due to the absence of necessary data, on the other hand, industry digitization results in some problems. This is a low level of knowledge in creating and application of information technologies, jobs transformation (about 40% of professions can have disappeared by 2030 year, lack of IT-specialists in the industry (there are about 113 thousand people in IT AIC, the shortage of technicians is minimum 90 thousand people), poor awareness about possibilities of digital technologies, dependence on imports due to the absence of necessary amount of devices and transducers of Russian production in order to implement into the process of agriculture digitization, insufficient financial ability (or even its absence) of economic unities to buy and apply digital technologies, increase in cyber crime. A number of agriculture goods producers who can buy new equipment, apply information technologies in Russia is insufficiently. The amount of expenditures for ICT in 2015 was 4 billion rubles, which makes 0.34 percent of all ICT-investments across all sectors of economy, in 2017 year it was 0.85 billion rubles or 0.2 percent. It is the lowest index across all sectors that evidence low digitization of agriculture. But these data show that the industry has a good potential to invest into ICT-technologies. As positive aspects of agriculture digitization we should mention: increase in industry profitability, the prime cost reduction as well as that of the produced agriculture raw materials, accessibility and product promotion on the global scale.

7. Conclusion

Making a conclusion we can say that agriculture nowadays undergoes gradual transformation conditioned by digitization of the industry. In order to make the State support available for agriculture it is necessary to create the technological sphere in the industry, conditions to simplify communication between the agriculture goods producers with the State authorities, as well as data bases on the state of agriculture in general. Digitization as a primary trend of agriculture development in Russia allows fulfilling it. The study proved the potential of this trend. However, there are problems and restrictions which cannot be eliminated without the State support. The state should create the optimal statutory regulation for digitization development and its application (MinAgro, 2019). The problem of IT-specialists shortage will be solved with a quasi-corporate electronic educational system "Land of Knowledge". It is planned to train 55 000 specialists for agriculture enterprises in digital economy competences during 3 years, to implement chat-bots, on-line consultants. However, it will lead to the increase of unemployment which is a threat for the industry. There are Centers of Competence in

Agriculture Digitization (for example, the Kemerovo region, the Oryol region and others) in some regions in order to increase digital literacy in agriculture. Understanding the necessity of accelerated agriculture digitization, it is necessary to provide the State support to the industry via expanding the existing methods and instruments (subsidizing and granting tax exemptions to the organizations participating in development and introduction of digital products, grant financing, referential credits).

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