

Analysis of Digitalization Processes as a Factor of Production and Income Generation in Agriculture of Russia

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ABSTRACT

In the work, the authors considered the features of the state and development of agriculture in Russia in the conditions of the digital transformation of the economy, estimated the impact of digitalization on production and income formation of agricultural producers as a whole in the industry, and in the context of categories of farms. The most important factor hindering the transition of agriculture to a new level of development is the high proportion of small forms of management with low levels of intensification, technical and technological equipment, lack of financial resources for automation and digital transformation of production processes. As a result of the grouping of subjects of the Russian Federation according to the level of digitization, the level and intensification of production, the impact of investments and means of state support on the development of agriculture, as well as the formation of gross value added in the agricultural sphere in each of the types of regions were determined.

Keywords: *digital economy, agriculture, agricultural producers, regional differentiation, information society*

1. INTRODUCTION

In accordance with the "Strategy of Development of the Information Society of the Russian Federation for 2017-2030" being implemented in Russia, the digital economy is an economic "activity in which the key factor of production is data in digital form, the processing of large volumes and the use of the results of the analysis of which, in comparison with traditional forms of economic activity, can significantly improve the efficiency of various types of production, technology, equipment, storage, sale, delivery of goods and services". The program "Digital Economy of the Russian Federation" provides for measures aimed at stimulating the development of information and communication technologies and their use in various economic sectors. This indicates a special attention to the development of the digital economy, as well as the need for adequate assessment of socio-economic changes associated with the implementation of these programs [1].

Traditionally, in the world practice, the leaders in the development and use of the latest technologies and innovative solutions are IT companies, media, finance and insurance. In the real production sector, including agriculture, the level of digitalization is significantly lower.

Digital agriculture - agriculture based on modern methods of agricultural production and food using digital technologies (Internet of things, robotics, artificial intelligence, analysis of large data, e-commerce, etc.), which provide productivity growth and reduce production costs [2]. This will not only increase the competitiveness

of agricultural products [3], but also significantly increase income and profitability of agricultural enterprises.

The objective of the study: to analyze the state of digitalization of Russian agriculture and assess the impact of digitalization level on production and industry revenues.

Study objectives:

- analyze the status and general trends of digitalization processes in Russian agriculture;
- conduct a study of regional differentiation by the level of digital transformation and assess its impact on production and income in the agricultural sector.

2. METHODOLOGY OF THE STUDY

The theoretical basis for the presented research was the development of domestic and foreign authors in the study of principles and foundations of the digital economy, as well as its impact on the formation of income in the agricultural sector.

The main materials of the research were the official data of Rosstat on the results of the agricultural sector in Russia as a whole, the data of the Ministry of Agriculture of the Russian Federation, the results of the All-Russian agricultural census of 2016, the results of the research of the Moscow School of Management Skolkovo.

The system of macroeconomic statistics indicators was used as research methods; methods of time series analysis, grouping method as a basis for identifying typical groups of regions by the level of digitization in order to assess the impact on income in agriculture. The authors consider the

gross value added (GVA) by type of economic activity "Agriculture, forestry, hunting, fishing and fish farming" as the main indicator characterizing the level of income at the macro-level [4,5].

3. RESULTS OF THE STUDY AND THEIR DISCUSSION

The use of a systematic, thought-out government approach to the introduction of a new generation of digital technologies in agriculture is an important and promising component of the development strategy of the Russian agro-industrial complex [6]. It is generally accepted that the use of digital technologies is a key factor and the main driver of economic growth. Their application in agrarian sphere will allow to increase profitability of agricultural production due to optimization of costs at all stages of production and more efficient distribution of resources.

Summarizing the scientific results of research both in the economy as a whole and in the agricultural sphere, we will highlight the main constraints for the development of digitalization of agriculture.

First of all, it is the high cost of implementing innovative technologies. It is also worth mentioning here the lack of funding for digitalization processes both at the federal and regional levels, mainly due to the limited (deficit) budget. According to a study by the Skolkovo Moscow School of Management, there is a positive correlation between the level of digitalization in the regions and their investment attractiveness. Thus, among the leaders of the National rating of investment climate in 2018, there were 5 subjects of the Russian Federation: Tyumen region, Moscow, the Republic of Tatarstan, St. Petersburg, and Moscow region, which are also leaders in the development of digitalization

in accordance with their values of the index "Digital Russia" [7].

The second important factor is such peculiarity of domestic agriculture as multiplicity. Given the fact that 43.5% of all gross output (Gross Domestic Product (GDP) falls on the farm sector and households (HH), with a high share of manual labor and low level of marketability, it is obvious that the prospects for further transformation of agriculture are only for large agribusiness. However, a positive trend should be noted here: over the past 10 years, the share of agricultural organizations (AO) in EaP production has increased by 8.5% and amounted to 56.5%, while HH has yielded its position in production from 43.6% to 31.0%. From the point of view of digitalization of the economy prospects, this is a significant step towards a new level of development, since it is AOs that are more receptive to the introduction of new technologies, they have the necessary resources (labor, financial, managerial) to introduce digital innovations, and HHs are among the most conservative and insensitive to new technologies [8]. It should also be noted that the payback period of digital technologies is long, waiting for the effect of the implementation of which can only be afforded by high-income, usually large enterprises.

Another constraint is the insufficient level of the technical and technological infrastructure of agricultural producers [9]. The average age of machinery and equipment in agriculture is 9.3 years. The material and technical condition of the industry is better in many respects than the average situation in the economy (Table 1), but this does not allow them to move to a new level of development due to low incomes and high risks of production even when they receive funds for digitalization of the main aspects of economic activity.

Table 1 State and Development Indicators of Agriculture, Forestry, Hunting, Fisheries and Fish Farming and Economy as a whole

Indicators	Agriculture, forestry, hunting, fishing and fish farming	Economy as a whole	Difference between agriculture, forestry, hunting, fishing, and fish farming to the indicators for the economy as a whole, ±
Labor productivity indices for 2014-2019.	119.3	105.8	+13.5
Share of machinery and equipment in the total volume of fixed assets, including those related to high, medium and low degree of technological sophistication, for commercial (without small businesses) and non-profit organizations in 2019, %.	38.6	26.5	+12.1
Fixed asset renewal ratio, including those relating to high, medium and low technological level, for commercial (without small business entities) and non-profit organizations in 2019, %	12.9	8.7	+4.2

Source: authors' calculations based on Rosstat data

The picture is worsened by small commodity forms of management. For example, according to the All-Russian Agricultural Census of 2016, the level of technological

development of agricultural producers (AOs, peasant (farm) holdings (PH), HH), which is the basis for further digital transformation was extremely low (Table 2).

Table 2 Indicators of the Level of Technological Development of Agricultural Enterprises (as a percentage of the total number of organizations (farms), according to the All-Russian agricultural census, 2016.

Indicators	AO	including large and medium	PH and self-employed entrepreneurs	Personal subsidiary and other individual farms of citizens
Telephone communication	70.6	75.4	50.7	14.8
Intracompany fixed telephony	8.5	19.7	x	76
Internet connection	47.6	63.5	17.9	22.8
Accurate driving system and remote quality control of technological processes	5.4	12.3	0.5	x

Source: authors' calculations based on the data of the All-Russian agricultural census, 2016 [10].

Thus, such an important indicator from the point of view of modern realities as "Internet connection" covers only two-thirds of all large and medium agricultural producers, for other categories, it is even lower.

Farmers in rural areas have a low level of access to digital technologies, which is explained by the lack of competition among service providers in areas with a low population, relatively high cost of building telecommunication infrastructure [11]. This is due to the significant length of the agricultural zone, which plays an important role in the digital transformation of the industry. The program developed by the Ministry of Agriculture of the Russian Federation, "Digital Agriculture" provides for a number of target indicators: reduction of the share of material costs in the cost of agricultural products at "digital" enterprises from 65 to 50% for 2018-2021, the growth of labor productivity over the same period by a factor of 2, the share of investment in Digital Technologies from 0.5 to 7%. Improvements in these indicators lead to the higher efficiency of enterprises and higher revenues. Analysis of digital transformation in the industry involves monitoring these and other indicators for all agricultural enterprises. However, at present, there are practically no statistical data that would allow to study the level and trends of digitalization in agriculture. In accordance with the official data of Rosstat, the researcher has mainly available data on the digitalization of the Russian economy as a whole. The data to be collected under the "Digital Agriculture" project relates exclusively to "digital" farms,

which will not include all agricultural producers. Therefore, it is problematic to form an idea of development and assess the processes of agricultural digitalization in general, taking into account the data provided by official statistics.

The transition to digitalization of the industry in the Russian Federation is complicated by the large territorial extent, which causes natural and industrial and economic differences between regions [12]. According to the calculated index "Digital Russia" for 85 subjects of the Russian Federation in 2018, developed by the Center for Financial Innovation and Cashless Economy of the Moscow School of Management Skolkovo, there is a strong differentiation of regions by the index (from 39.74 in the Republic of Tyva to 76.48 in the Republic of Tatarstan. At the same time, the existence of information society and digital economy in the country is possible only under the condition of uniform transition to digital technologies of all subjects of the Russian Federation [13]. For more detailed analysis of the influence of the level of digitalization on gross output and the formation of income of agricultural producers, the authors studied the totality of the country's regions, which was divided into three equal groups in terms of size according to the index "Digital Russia" (Table 3). The analysis was conducted for 79 subjects of the Russian Federation, except for cities of federal significance and autonomous regions. Data were used for 2018, reflecting the outcome of government policies aimed at digitalization.

Table 3 Gross Product and Gross Value Added by Typical Groups of Regions Depending on the Level of Digitalization

Indicators	Typical groups			On average / in total	Ratio of the highest group to the lowest, %
	lowest	average	highest		
There is gross value added of agriculture, forestry, hunting, fishing and fish farming on 100 hectares of agricultural land, thousand rubles.	134	180	306	219	228.4
Gross Product output per 100 hectares of agricultural land, thousand rubles	2014	1985	3242	2484	161.0
GVA of agriculture, forestry, hunting, fishing, and fish farming in GRP, %	11.2	7.2	5.5	6.5	49.1
GVA output of agriculture, forestry, hunting, fishing, and fish farming, rub.	17.3	24.3	20.7	20.7	119.7
Share of loss-making organizations by type of activity "crop and livestock breeding, hunting and provision of appropriate services in these areas", %	33.3	29.2	13.4	25.5	40.2
Growth rate of GP of agriculture in 2015-2018, %	8.5	5.6	8.2	7.4	96.5
Distribution of GP of agriculture by groups, in percentage of total	18.2	30.6	51.2	100	281.3
Distribution of GVA of agriculture, forestry, hunting, fishing and fish farming by groups, in percent of total	15.6	33.7	50.7	100	325.0
GP structure by categories of farms, % to total					
AOs	40.8	54.9	60.1	55.0	19.3
HH	45.8	30.4	28.4	32.2	-17.4
PH	13.4	14.7	11.5	12.8	-1.9
For reference: there is 100 hectares of agricultural land:					
state support funds, thousand rubles	63.3	53.0	96.8	72.5	152.8
investments in fixed assets, thousand rubles	134	180	306	219	228.4
fixed assets, million rubles	911	1,051	1,960	1,376	215.1

Source: authors' calculations based on Rosstat data.

As you can see from the table, the selected groups differ significantly in the main indicators. Thus, the regions of the highest digitalization group account for the major part of the GP (51.2%) and the GVA of agriculture, forestry, hunting, fishing and fish farming (50.7%). At the same time, the efficiency of agricultural land use, expressed by the output of GP and GVA per unit area, is also 61.0% and 2.3 times higher here, respectively, as compared to the regions of the lower group. As a result, the share of loss-making organizations is the lowest (13.4%). It is also worth mentioning a significant level of investment in fixed assets as compared to other groups, where fixed assets availability exceeds the indicators of the first and second groups by 2.2 and 1.9 times. However, despite significant state support funds (52.8% higher than the first group), the income from agriculture per unit of area, characterized by the indicator "Output of GVA of agriculture, forestry, hunting, fishing and fish farming by 1 rub. of state support funds", remains at an average level. And the industry's contribution to the GVA of the regions is even lower than the average for the aggregate and amounts to 5.5%. Special attention should be paid to the structure of agricultural production by categories of farms in regions with different levels of digitalization. The analysis showed

that in the regions of the highest group the main part of production is produced by agricultural organizations (60.1%), while in the lower group the situation is exactly opposite: the share of small-scale AO and PH accounts for 45.8% and 13.4% respectively.

4. CONCLUSION

The study of digitalization of agriculture in Russia allowed:

- highlight the peculiarities of the development of Russian agriculture in the context of the digital transformation of the economy. The most important problem and limiting factor of involvement of increase of competitiveness of branch in the conditions of formation of digital economy still remains high specific weight of AO and PH in agricultural production, low level of intensification, technical and technological equipment of small business, financial means for automation and digital transformation of economic processes;
- assess the status and identify the main trends of digitalization processes in Russia's agricultural sector;

– analyze agricultural production and income formation of farmers depending on the level of digitalization of the region.

The results obtained may be useful for government agencies that monitor and develop directions for the digital transformation of Russia's agricultural sector, as well as for organizations that collect and analyze data on the digitalization of agriculture, research and international organizations, consulting services. The results of the survey can also be used by government agencies to identify leading and lagging regions, which will help to adjust the industry development strategy in the digital economy.

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