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**PROBLEMS OF DIGITIZATION OF AGRICULTURE AND USING INFORMATION  
AND COMMUNICATION TECHNOLOGIES IN THE MANAGEMENT  
OF THE AGRO-INDUSTRIAL COMPLEX**

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**Abstract**

The manuscript presented addresses the study of problems related to the commitment to digitization of agriculture of the Russian Federation from the viewpoint of the current state of available allowances for the acquisition and fastest wide implementation of the necessary information technologies that will allow for a qualitative breakthrough in solving different issues with their help (both grand-scale and specific) issues to make managerial decisions in the economic and technological spheres of the agro-industrial complex of the North Caucasian Federal District.

**Keywords**

Digitization – Agriculture – Agro-industrial complex – Regions

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## Introduction

Digitization of the economy of the country on the whole and industries of the agro-industrial complex in particular are in focus today which leads to a heightened scientific interest towards new processes taking place in the society. Since the sphere of information and communication technologies developed relatively recently, it has a strong potential for research work, studies and implementation of capabilities of information technologies in the management of economic activity of the agrosphere of the economy.

A scientifically substantiated, intelligent organization of the process of accumulating and using data arrays for the purposes of management assumes a high qualification of the managerial staff, special skills and knowledge to use them and analyze them. And now many people think that it is sufficient to perform some simple actions on the computer, and the result will appear without human participation. In reality, such systems don't exist, and managers of different levels often either don't want or don't have an opportunity to receive additional, quite complicated continuing education that is one of the factors of a slow implementation of information technologies in the AIC.

## Materials and methods

The issues of the establishment and development of the digital economy are overall studied in the works of the following scientists: Bukh R., Heeks R., D. Charoen, M. Rouse, Rob Kling and Robert Lamb, Erik Brynjolfsson<sup>1</sup>. The studied works of foreign authors allow to distinguish the main theoretical approaches to the digital economy - the resource-oriented, process-based, structural, business-oriented approaches that were further and extensively studied by domestic scientists Starodubtseva E.B., Keshelava A.V., Budanov V.G., Panshin B.N. At the present time the research of the typical features of industry digitization takes up a significant place in the Russian science.

## The results

The President signed a Decree No. 203 "On the Strategy of Development of the Informational Society in the RF for 2017-2030" on May 9 2017<sup>2</sup>. The Decree states the main principles, areas of focus, indicators of creating a single digital environment, digital economy; the goal of the development of the information and communication infrastructure of the RF is ensuring providing free access for citizens and organizations, governmental authorities of the RF, local self-governance authorities to information at all stages of its creation and dissemination. A special place in the digital economy is taken up by the electronic government, i.e. to information and communication resources directly related to governmental organizations.

The importance of information and communication technologies in the agro-sphere is underestimated. People consider them to be an important but complicated resource requiring significant financial investments with an unclear payback<sup>3</sup>. For the purposes of

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<sup>1</sup> R. Bukht y R. Heeks, "Defining, Conceptualising and Measuring the Digital Economy", International Organizations Research Journal Vol: 13 num 2 (2018): 143–172.

<sup>2</sup> Decree of the President of the RF No. 203 "On the Strategy of Development of the Informational Society in the RF for 2017-2030". May 9, 2017. Available at: <http://kremlin.ru/acts/bank/41919>

<sup>3</sup> K. M. Baliyants, "Problems of Using Informational Technologies in the AIC", Issues of Structuring of the Economy num 4 (2013): 57-59.

this manuscript it is assumed that management is the process of creating a task-oriented interaction of a subject and object of management to achieve the results important for the public<sup>4</sup>.

There are no universally applicable approaches or strong principles that would make management effective. However, there are approaches that help leaders to improve the probability of an effective achievement of goals<sup>5</sup>.

The concept of a systemic approach allows to widely use information technologies in the economy as an aggregate of methods, production processes and programming-technical means united in a technological chain providing for the collection, storage, processing, output and dissemination of information to reduce the labor intensiveness of processes of using informational resources, improving their reliability and operational efficiency.

Informational systems of management of the AIC may be used both on the local and the highest state level<sup>6</sup>. Originally in Russia large bets were made on forming and developing of information and consultation services of the AIC because such types of systems were widely used and had a relatively high effectiveness in many foreign countries. It was proposed that information and consultation services had to promote the establishment and development of an effective interaction of administrative authorities of the AIC and agricultural goods producers, promote active advancement of the governmental policy in the rural area, support AIC administrative authorities in forming it<sup>7</sup>.

However, overall, both in the RF and in the regions, this system over the years of its existence has not received the anticipated wide development for the following reasons:

- insufficient activity of economic subjects in the conditions of deficit of state attention to the needs of physical infrastructure and organizational and economic problems of informational support;
- underdevelopment of the infrastructure of information and communication technologies in the modern agrosphere;
- lack of interest of economic subjects in implementing informational support software products<sup>8</sup>.

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<sup>4</sup> K. M. Baliyants; S. V. Dokholyan; S. Z. Hidirova y Z. N. Zhamolatova, "The Resource Potential of the Agro-industrial Complex of the North-Caucasian Federal District as a Factor of Innovative Development of the Macro-region", *International Journal of Economics & Business Administration (IJEBA)* Vol: 7 num 1 (2019): 339-347.

<sup>5</sup> B. N. Gamidullaev, "State evaluation procedure of management cycles in management processes reengineering at an enterprise", *Revista Espacios* Vol: 40 num 28 (2019).

<sup>6</sup> S. V. Dokholyan, "Prospects for implementing innovative technology in enterprises within the agro-industrial complex", *Scientific Papers Series-Management, Economic Engineering in Agriculture and Rural Development* Vol: 19 num 3 (2019): 187-195.

<sup>7</sup> Z. S. Babaeva, "Development of Methods of Financial Support for Investments", *Scientific Papers: Management, Economic Engineering in Agriculture & Rural Development* Vol: 18 num 3 (2018): 27-33.

<sup>8</sup> K. M. Baliyants, "Characteristics of Evaluation of Information Technologies in the Managerial Activity in the AIC", *Regional Problems of Economic Transformation* num 1 Vol: 63 (2016): 38-43.

Besides, financing of this service in the NCFD regions was reduced every year because originally it had been planned to make some of the services for a charge but these services did not turn out to be in sufficient demand.

The Russian Federation is one of the largest holders of masses of fertile land but based on the situation in December 2018, it is taking up only the 15th position for the level of its digitization of agriculture. Solutions for precision agriculture are used only in 3% agricultural enterprises of Russia. In the USA this same indicator is at 60%, and in the European Union countries it is even higher - at 80%<sup>9</sup>.

At the present moment there is no detailed regional statistical accounting of the situation with information technologies in the agro-industrial complex therefore the main tendencies can be followed using statistical data on the whole for the national economy of the RF<sup>10</sup>. It should also be taken into account that the same indicators in the AIC will be significantly lower because there are other economic fields where information and communication technologies have a significantly higher absolute weight.

	Expenditure on ICT - total	including							
		on purchasing computer and office equipment	on purchasing telecommunicationse quipment	on purchasing software	on paying for electro communications services	including Internet access services payments	employee training related to the development and use of ICT	on payments for services of external organizations and ICT specialists (other than communications and educational services)	other expenses
<b>the North Caucasian Federal District</b>	<b>8832.7</b>	<b>1681.9</b>	<b>1436.0</b>	<b>1419.8</b>	<b>2450.2</b>	<b>938.2</b>	<b>38.4</b>	<b>1471.7</b>	<b>334.7</b>
the Republic of Dagestan	905.9	121.4	375.1	149.2	177.9	88.3	2.6	72.7	7.0
the Republic of Dagestan	379.7	56.1	21.9	21.1	99.7	80.	1.8	177.2	1.9

<sup>9</sup> Digitalization of Agriculture in Russia: stages, conclusions, plans. "Geometer". Available at: <https://gpsgeometer.ru/a219060-tsifrovizatsiya-selskogo-hozyajstva.html>

<sup>10</sup> IT in the Agro-Industrial Complex of Russia. TAdviser, 2019. Available at: <http://www.tadviser.ru/a/355086>

Republic of Ingushetia						9			
the Kabardino-Balkarian Republic	515.3	107.8	112.0	74.5	146.2	67.4	1.4	65.0	8.3
the Karachay-Cherkess Republic	515.3	148.3	50.5	80.2	157.3	71.9	4.0	63.4	11.6
the Republic of North Ossetia – Alania	770.0	143.9	179.1	93.7	225.7	96.3	18.5	79.4	29.6
the Chechen Republic	1423.0	226.4	120.4	473.6	487.4	186.8	4.6	78.5	32.1
Stavropol Territory	4323.6	878.0	577.0	527.5	1155.9	346.8	5.5	935.5	244.2

Table 1  
Expenditures on information and communication technologies in 2017  
(millions of roubles)<sup>11</sup>

The data of the regional statistics do not allow to evaluate the expenditures specifically on industries of the agro-industrial complex, however, based on the data from Table 1 it is possible to state that the NCFD entities are financed on informational support objectives in a very uneven way. The spread in the amounts of used monetary funds is more than 10 times difference (between the Republic of Ingushetia and Stavropol Territory). Most of the funds were directed towards purchasing equipment and payment for electro communications services, while a very small part of expenditures is used on staff training.

	2010	2011	2012	2013	2014	2015	2016	2017	2018
the Russian Federation	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6
the Central Federal District	2.3	2.4	2.3	2.4	2.4	2.3	2.3	2.4	2.2
the North Caucasian Federal District	1.2	1.0	0.9	0.9	0.9	0.9	0.8	0.9	0.8
the Republic of Dagestan	0.7	0.7	0.4	0.7	0.5	0.6	0.6	0.8	0.5
the Republic of Ingushetia	0.8	1.0	0.8	1.1	0.8	0.7	0.6	0.6	0.6
the Kabardino-Balkarian Republic	0.4	0.6	0.6	0.5	1.2	0.8	1.3	1.0	1.1
the Karachay-Cherkess Republic	1.3	0.8	1.1	0.8	0.7	1.1	0.4	1.2	0.4
the Republic of North Ossetia – Alania	2.4	2.2	1.8	1.2	1.6	1.0	0.6	0.4	1.1
the Chechen Republic	0.2	0.1	0.4	0.2	0.4	0.5	0.2	1.1	0.5
Stavropol Territory	1.8	1.3	1.4	1.4	1.4	1.3	1.1	1.0	1.1
the North Western Federal District	2.1	2.1	2.1	1.8	1.8	1.7	1.8	1.7	2.1

<sup>11</sup> Regions of Russia. Social-Economic Indicators. Available at: [http://www.gks.ru/bgd/regl/b15\\_14p/Main.htm](http://www.gks.ru/bgd/regl/b15_14p/Main.htm)

theSouthernFederalDistrict	1.2	1.2	1.3	1.2	1.2	1.2	1.2	1.2	1.1
theVolgaFederalDistrict	1.4	1.5	1.5	1.5	1.5	1.6	1.6	1.4	1.4
theUralsFederalDistrict	1.6	1.6	1.6	1.5	1.7	1.7	1.8	1.6	1.4
theSiberianFederalDistrict	1.4	1.4	1.4	1.5	1.4	1.6	1.5	1.5	1.5
the Far Eastern Federal District	1.3	1.4	1.3	1.3	1.5	1.4	1.4	1.3	1.2

Table 2

The ratio of those employed in the ICT sector to the total value of the employed population, %<sup>12</sup>

It is also concerning that the ratio of those employed in the ICT sector (table 2) to the total value of the employed population over the most recent three years is steadily dropping in all regions of the RF. In the best case scenario this indicator stays the same (the Siberian Federal District and the North Western Federal District). The North Caucasian Federal District is also following the common tendency with an insignificant but steady reduction in the ratio of the employed in the ICT. Compared to the developed center (the cities of Moscow, St. Petersburg, etc), this indicator is significantly lower in the regions (by 5-6 times). Therefore, it is premature to be talking about the most effective use of investments into acquiring computing equipment. Human resource specifically, from this point of view, is a significant in its potential and not yet utilized resource.

	2014	2015	2016	2017
Workingwithtextprocessors	38.1	38.8	41.5	41.7
Workingwithhardwareaccessories	23.8	27.6	29	27.4
Workingwithspreadsheets	19.6	21.7	22.9	22.7
Using programs to edit photos, audio and video files	19.4	21.3	21.4	20.6
Connection and installation of new devices	7.2	8.4	8.9	9.7
Creatingelectronicpresentations	7	7.6	8.5	9.1
Changing parameters or settings of software	3	3.3	2.8	3.4
Installinganoperatingsystem	2.8	2.8	2.7	3
Independent use of programming languages to write programs	1.1	1	1	1.2

Table 3

Digital skills of the population of the RF (in % from the total population aged 15-74)<sup>13</sup>

Digital skills of the population are an approximate indicator of the preparedness of the population, entrepreneurs to use those capabilities that are provided by computer and communications equipment, to use those information resources that stipulate growth in effectiveness of the spheres of economy due to its digitization. Based on this table 3 it is clear that all indicators of digital literacy of the population are growing over the most recent three years, however this increase is not very advanced, but rather a small increase making up from 0.1 to 3%. The most growth is in using text processors, working with hardware accessories and entertainment programs (editors of photo, video and audio files). This speaks of insufficient digital literacy of the population for the needs of innovative economics. It must be assumed that in rural areas that AIC industries are largely related to, and where at the present moment there are significant issues with connecting to high

<sup>12</sup> Regions of Russia. Social-Economic Indicators. Available at: [http://www.gks.ru/bgd/regl/b15\\_14p/Main.htm](http://www.gks.ru/bgd/regl/b15_14p/Main.htm)

<sup>13</sup> G. I. Abdrakhmanova; K. O. Vishnevsky y L. M. Gokhberg, The Digital Economy: 2019: statistical summary digest (Moscow: NRU of HSE. 2019).

speed Internet, the indicators will be lower than the average indices overall in the country<sup>14</sup>.

In 2017 in Russia 84% of the total number of Internet users used it for entertainment purposes of watching videos, gaming content, and only 25% for reading books, newspapers and educational literature, including only 4% in the latter category using distance online learning (vs 20% in the USA)<sup>15</sup>.

Therewith, among the factors that hold back the use of the Internet predominates the absence of the need (not wanting to use, not interesting) at 70.1% and the lack of skills in working with the Internet at 29%.

These figures attest to the unpreparedness of the population to either morally or professionally accept the digital economy. It will require significant investments into continuous education of people including entrepreneurs and employees.

The modern system of education in the RF trains only 5% of top level specialists (Bachelors, specialists and Masters) and no more than 6% of mid level specialists in the Information and Communication Technology field, but even this number of graduates are specialists in the basic areas of training, i.e. not having special, particular skills to work in the agro-industrial complex sphere<sup>16</sup>.

Therefore, the number of existing problems in the IT area in the agro-industrial complex draw attention to the lack of personnel: there aren't enough specialists, the income of IT specialists is higher than that of the Chief Agronomist, as an example.

One of the most important needs of agricultural enterprises is selling the goods produced. Selling agricultural raw materials and food products by its added value is 4 times more than the processing industry and 3 times more than agricultural production. Therewith, up to 90% of the margin<sup>17</sup> from selling agricultural products stays in wholesale-retail sales and with banks, and while the products have low quality, the retail price is high in relation to the level of real disposable income.

## Discussion

Financing of the informational support sphere in the NCFD is taking place extremely unevenly, and most of the funds is spent on office equipment and the Internet services, while the proportion of everyone employed in the ICT sector to the total population is steadily decreasing.

Digital literacy of the population in cities is growing extremely slowly, and in the rural area this index does not even increase up to that level. The reason for that is, mostly, the absence of a need or the lack of skills for working in the digital field of the AIC.

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<sup>14</sup> G. I. Abdrakhmanova; K. O. Vishnevsky y L. M. Gokhberg, The Digital Economy: 2019: statistical summary digest (Moscow: NRU of HSE. 2019).

<sup>15</sup> G. I. Abdrakhmanova; K. O. Vishnevsky y L. M. Gokhberg, The Digital Economy...

<sup>16</sup> G. I. Abdrakhmanova; K. O. Vishnevsky y L. M. Gokhberg, The Digital Economy...

<sup>17</sup> B. N. Panshin, "The Digital Economy: Definitions and Areas of Focus of Development", Science and Innovations num 3 Vol: 193 (2019): 48-55.

In the conditions of the absence of the necessary specialists and the level of digital literacy of the population of the region, breakthrough development of information and communication technologies may be problematic.

Therefore, one of the deciding factors for their effective implementation in the AIC industries and agriculture is that it is necessary to provide for significant investments into continuing education of people including both entrepreneurs and employees. Solving these issues must be taking place under a strict and dynamic control of governmental regulation, and must become one of the important areas of focus for the goals of global digitization of the economy of the region and the country on the whole.

## **Conclusion**

The manuscript has distinguished and studied the issues that are relevant in connection with the fact that as for today, digital globalization has been widely developing, and agro-industrial complex spheres satisfy considerable prerequisites to have higher effectiveness when using the following scientific achievements:

- reduce the risks related to the natural conditions;
- regulate the crop yield and productivity of animals;
- improve the organization of all routine processes in agriculture, competently approach the use of cash resources and attraction of new resources;
- improve the sales of products through creating digital sales sites;
- timely bring urgent information to all goods producers and a lot more other opportunities.

It has been noted that state support of agricultural producers is necessary due to special risks in this economic sphere. Creating a single digital platform of agricultural product promotion to the consumer may become one of the main and effective mechanisms of it which will allow to modernize the economic behaviour of agricultural goods producers and receive additional profits many times higher than all of the governmental support of the AIC. Calculations show that the reduction of the added cost of trade agents by 10% will allow producers to receive additional income 5.4 times higher than the governmental support received by all AIC enterprises in 2018, and the total expenditure on AIC support over the most recent 6 years.

It has been determined that the main elements of digital transformation are hardware technical support, software and computer databases, access to analytical systems and volumes of information allowing to forecast risks in specific conditions of activity using software and systems directly in the production process (the work of equipment of greenhouses, animal feeding, storing products in storages), digitization of selling products which allows to receive information at a new level, use modern scientific methods of its processing and based on them make correct managerial decisions.

It has been established that a great importance in the development and implementation of digitization, as well as in expanding the use of information technologies in the AIC has the training and creation of jobs for ICT specialists who must not only have a good command of communications and computer equipment but also have specialized

basic education in the sphere of agro-industrial professions, understand the details and peculiarities of production, goods processing, storage and sales. In relation to this, it is suggested paying special attention to an urgent development of special faculties of information system development in industry specific Universities, and in multi disciplinary Universities opening a department of relevant specialty occupations studying specifics of AIC industries. An important role of applied studies of research institutes, technological solutions have to immeasurably grow with the development of digitization and informational support of the industry.

It is proposed that activating such powerful financial and organizational levers requires significant management strength that state regulation should become, and that supposes a clear control on all stages of fulfillment of a digital technological reform. Its success overall will depend on a systematic and controlled implementation of it in the regions.

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