

**SCTCMG 2021****International Scientific Conference «Social and Cultural Transformations in the Context of Modern Globalism»****REGIONAL PROBLEMS OF DEVELOPING DIGITAL TECHNOLOGIES IN THE AGRICULTURAL SECTOR**

Baliyants Karina Mikhailovna (a)\*, Dokholyan Sergey Vladimirovich (b),  
Eminova Elnara Migazhidinovna (c), Dokholyan Samvel Bakhshievich (d)

\*Corresponding author

(a) Institute of Social and Economic Research of Dagestan Scientific Center, Russian Academy of Sciences,  
75, M. Yaragskogo Str., Makhachkala, Russia, reklama-ka@rambler.ru

(b) Institute of Social and Economic Research of Dagestan Scientific Center, Russian Academy of Sciences,  
75, M. Yaragskogo Str., Makhachkala, Russia, sergsvd@mail.ru

(c) Dagestan SAU, 180, M. Gadzhiev Str., Makhachkala, Russia, eminova@mail.ru

(d) Moscow City University. Institute of Law and Management, 16, Novokuznetskaya Str., Moscow, Russia  
sam0333@mail.ru

**Abstract**

Many contemporary authors discuss the application of digital technology. However, there are still many questions concerning the rational use of their potential in managing the economic activities of the agricultural sector. The current stage of economic development calls for the introduction of digital technologies and their effective use in operational and strategic management. The agricultural sector as an important source of national food security requires further improvement and has significant challenges compared to other production sectors. Due to the increasing use of digital technologies in the agricultural sector, there is no doubt about the benefits derived from their use. But the development and real implementation of new digitalization tools in the economy of regional agriculture and adjacent industries requires substantial costs, operating costs, human labour costs, a comprehensive solution to the problems of personnel training, and the introduction of an updated model in the thinking of agricultural employees. This article examines the factors that hinder the large-scale implementation of information and communication technologies in the agricultural sector of the region, and identifies ways to remove these barriers, to increase the use of digitalization in managing and organizing its agriculture and processing spheres. It is necessary to consider information and communication technologies along with other available material resources of the agricultural sector. Thus, it is an important component influencing the stability of sustainable production of food and raw materials for industry, improving the quality of ecology and food safety, environmental protection, reducing losses in the production process of agricultural products..

2357-1330 © 2021 Published by European Publisher.

*Keywords:* Agricultural sector, digitalization, information resources, North Caucasus federal district



This is an Open Access article distributed under the terms of the Creative Commons Attribution-Noncommercial 4.0 Unported License, permitting all non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## **1. Introduction**

Today, information and digitalization of the agricultural sector has moved from the theoretical to the applied realm of industry and enterprise.

The expression associated with the Rothschild family saying 'He who owns the information, owns the world' has not lost its significance and has been reinterpreted in the light of developing information and communication technology. The role of information for effective management can hardly be overemphasized. In other words, there is a constant need to accumulate and analyse information for managing agribusinesses, and making the right decisions based on it is an untapped resource for sustainable functioning in a market economy.

At the current stage of economic development, research into the prerequisites, issues and effects of information technology on decision-making by managers is critical given that the agricultural sectors are important for food security, but remain in a difficult economic situation compared to other sectors of production. This raises relevance for identifying the problems that prevent their use from having a meaningful effect.

## **2. Problem Statement**

Russian research on the informatization of economic activity dates back to the 1970s. Today, studying the specifics of sectoral digitalization occupies an important place in Russian science.

This article attempts to investigate the current state of digitalization in the agricultural sector of the region and to identify the factors that hinder the development of various types of information and communication technologies. Since the North Caucasian Federal District's regions are predominantly agricultural, with underdeveloped industrial production facilities and a corresponding lack of skilled labour, we can assume that these factors account for the lack of a developed base for introducing advanced technology into the region's economy. In addition, the digitalization of the economy requires substantial financial investment in material and human resources, which is difficult to achieve since most regions in the district are subsidized and have many socio-economic issues that remain unresolved. However, it is necessary to identify the problems hindering the development of information and communication technologies to address them in an orderly manner.

## **3. Research Questions**

To implement the state digitalization programme of the Russian Federation and improve the coordination of cooperation between agencies for its implementation, the regions of the North Caucasian Federal District adopted digitalization programmes with a number of indicators which were used for the subsequent digital development rating of the regions. The rating index allows for a comparative assessment of the state and level of digitization in RF subjects and federal districts, the level of their use of information and communication systems in various spheres of public and economic life, in approaches to decision-making to modernize the socio-economic infrastructure of RF subjects (Dalgatova et al., 2020). In the North Caucasian Federal District, the ranking pays particular attention to the Republic of Dagestan and the Chechen Republic,

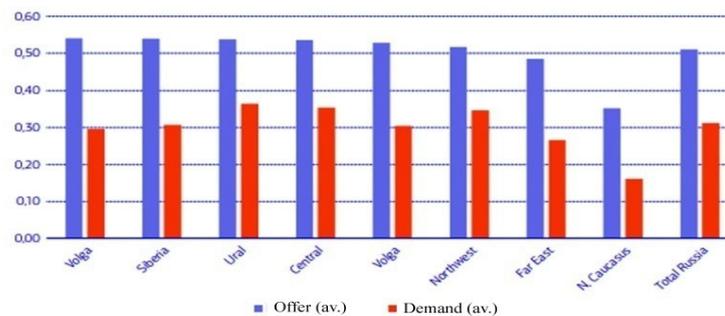
as their digitalization growth rate for the first half of 2018 was 61.1 %, while the national average growth rate is 26.4 % (Skolkovo, 2020).

**Table 1.** Digital Russia 2017/2018 ranking of regions by level of digitalization

	Russian regions index, 2017	Ranking of federal districts of the Russian Federation/Ranking of constituent entities of the North Caucasian Federal District	Russian regions index, 2018	Ranking of federal districts of the Russian Federation/Ranking of constituent entities of the North Caucasian Federal District
Ural Federal District	57.17	1	65.81	1
Volga Federal District	46.93	4	59.55	3
Central Federal District	50.05	3	59.82	2
North-West Federal District	50.90	2	58.95	4
Siberian Federal District	41.91	7	53.48	5
Far Eastern Federal District	44.20	5	52.28	6
Southern Federal District	43.06	6	51.35	7
North Caucasian Federal District	33.37	8	43.44	8
Republic of Dagestan	26.76	81	45.52	73
Republic of Ingushetia	28.03	77	40.42	82
Kabardino-Balkar Republic	40	50	47.06	67
Karachay-Cherkess Republic	27.69	79	40.31	83
Republic of North Ossetia-Alania	30.15	72	41.99	79
Chechen Republic	25.76	84	48.61	64
Stavropol Territory	53.54	30	53.58	51

\*Source: edited by the authors based on data from "Digital life of Russian regions 2020. What defines the digital divide?" (2020).

As shown in Table 01, the North Caucasian District is at the bottom of the Russian regional ranking table in 2018. Its subjects rank from 51st to 84th in the Russian regional ranking. In 2020, the Urals and Central Federal Districts remain the leaders in the Digital Life Index study at the federal district level. Although Krasnodar is still in the middle of the ranking, the Southern District is in 5th place, followed far behind by the North Caucasian District. These rankings were compiled based on supply and demand for digital services and technologies. In separate analyses of supply and demand, the figures change: the Southern District, the Siberian and Ural districts lead in supply, while the Ural, Central and North-Western districts lead in demand. The difference in demand is more pronounced than in supply (Figure 01).



**Figure 1.** Digital supply and demand gap by federal districts of the Russian Federation

According to the Republic of North Ossetia-Alania's Information Technology and Communications Department, the republic made a breakthrough in 2020 and ranked among the top 20 regions in the Russian Federation's National Digital Economy Development Index, ranking 18th, actually rising from 79th place in 2018. Currently, there are programmes developed and being implemented in the subjects of the North Caucasian Federal District in pursuance of the Russian President's decrees: State Programme of the Republic of Dagestan Development of information and communication infrastructure of the RD for 2017–2022; In the Chechen Republic there are 5 regional projects: Personnel for digital economy, Information infrastructure, Information security, Digital technologies, Digital public administration; sub-program Development of information society in the Stavropol Territory; Development of Information Society in the Republic of North Ossetia-Alania for 2020–2022; the State Programme Development of Transport, Energy, Communications and Informatization in the Republic of Ingushetia; the State Programme Information Society in the Kabardino-Balkarian Republic; the State Programme Development of Industry, Trade, Energy, Transport, Communications and Information Society of the Karachay-Cherkess Republic in the KCR. The increase in the national digital ranking of the regions in the North Caucasian is probably linked to the implementation of existing programmes.

Ratings of the digitalization of the Russian regions' economies mainly affect the development of transport and financial infrastructure, healthcare, education, trade, media, and public services for the population. It is indeed a huge contribution to the modernization of social services and public services making life more convenient and the management of urban complexes more responsive and complete. But when it comes nowadays to the digitalization of rural areas, reporting data is limited to broadband Internet lines and conference calls to the administrative centres of rural areas. While the agricultural sector of the country is one of the largest consumers of various information services and resources due to a wide variety of factors, conditions, technologies and methods of production and marketing of products. The growth of agricultural production in the new economic conditions largely depends on providing agricultural enterprises with the necessary means of information support and information infrastructure (Samarina & Nikitina, 2020).

There are currently no detailed regional statistics on the status of information technology in the agricultural sector and rural settlements, so the main trends can be traced back to statistics for the overall national economy of the Russian Federation. We should also consider that for the above-mentioned territories and the agricultural sector similar indicators will be significantly lower, as the analytical data consider areas of the economy where information and communication technologies have a significantly higher share.

**Table 2.** Dynamics of spending on information and communication technologies in the North Caucasian Federal District (RUB million) (Rosstat, 2020)

	2017	2018	2019
<b>North Caucasian Federal District</b>	<b>8832.7</b>	<b>10635.9</b>	<b>13802.3</b>
Republic of Dagestan	905.9	1367.0	1404.3
Republic of Ingushetia	379.7	521.5	306.9
Kabardino-Balkar Republic	515.3	596.7	572
Karachay-Cherkess Republic	515.3	598.6	651.5
Republic of North Ossetia-Alania	770.0	819.2	1088
Chechen Republic	1423.0	1411.4	2298.9
Stavropol Territory	4323.6	5321.4	7480.6

Figures in Table 02 show that spending on information and communication technology development increased by 20 % in 2018 for almost all subjects and overall across the NCFD (except the Chechen Republic); in 2019, actual spending also increased by 29 % in all subjects and overall across the NCFD (except the Republics of Ingushetia and Kabardino-Balkaria), which also shows an overall increase in ICT spending growth rates over the past three years. This fact also confirms the data in Table 1 on the growing digitalization of the economy in the North Caucasian Federal District.

**Table 3.** Dynamics of the number of active users to fixed broadband Internet access characterizing the development of telematics and data network services in the North Caucasian Federal District, ths\*

	2017		2018		2019	
	Individuals, ths.	Legal entities, ths.	Individuals, ths.	Legal entities, ths.	Individuals, ths.	Legal entities, ths.
<b>North Caucasian Federal District</b>	<b>787.0</b>	<b>38.3</b>	<b>811.9</b>	<b>41.1</b>	<b>871.5</b>	<b>46.8</b>
Republic of Dagestan	70.3	3.5	74.5	4.2	92.8	6.1
Republic of Ingushetia	4.5	0.3	5.6	0.4	7.2	0.4
Kabardino-Balkar Republic	79.3	3.4	82.9	3.5	84.9	3.4
Karachay-Cherkess Republic	45.0	2.3	45.8	2.4	46.4	2.3
Republic of North Ossetia-Alania	86.7	3.1	109.7	4.6	112.1	4.9
Chechen Republic	56.1	1.3	61.9	1.3	68.4	2.3
Stavropol Territory	445.1	24.4	431.5	24.8	459.7	27.3

\*Source: edited by the authors based on data from Rosstat (Innovative activity of organizations, 2020).

Table 03 shows the progressive growth of broadband internet users across the North Caucasian Federal District, both individuals and legal entities. The growth rate has increased for both individuals (3and 7 % in 2018 and 7and 14 % in 2019 for individuals and legal entities, respectively), which also confirms the growing and evolving digitalization of the region's economy. However, this indicator for legal entities shows a slight increase in the number of users among legal entities (Republic of Ingushetia, Kabardino-Balkar Republic and Karachay-Cherkess Republic).

**Table 4.** Dynamics of digital skills of the Russian population ( % of the total population aged 15 and over) \*

	2014	2015	2016	2017	2019
Working with text editors	38.1	38.8	41.5	41.7	40.4
Working with peripheral devices	23.8	27.6	29	27.4	31
Working with spreadsheets	19.6	21.7	22.9	22.7	22
Using photo/video editing software	19.4	21.3	21.4	20.6	21.9
Connecting and installing new devices	7.2	8.4	8.9	9.7	15.3
Creating electronic presentations	7	7.6	8.5	9.1	9
Changing parameters or software settings	3	3.3	2.8	3.4	5.8
Operating system installation	2.8	2.8	2.7	3	2.9

\*Source: (Abdrakhmanova et al., 2019)

As shown in Table 04, the digital skills of the population have grown slightly over the last six years, indicating a low willingness of the population to adopt digital ways of living. While there is some progress in domestic issues with mobile communications and consumer services, there is a much slower adaptation process in professional production areas (in particular the agricultural sector) (Table 03). It is probably implied that the population over the age of 15, not included in the above-mentioned percentage, has almost no digital skills

even for everyday life, let alone knowledge and skills suitable for professional use. Moreover, Table 5 shows that the digital skills of the population in rural areas lag far behind those in urban areas.

**Table 5.** Digital skills of the population in urban and rural areas of the Russian Federation in 2019 (% of the total population aged 15 and over)\*

	Urban areas	Rural areas
Working with text editors	45	26
Working with peripheral devices	34.8	19.4
Working with spreadsheets	24.9	13.4
Using photo, audio and video editing software	24.3	14.5
Connecting and installing new devices	17.3	9.3
Creating electronic presentations	9.9	6.3
Changing parameters or software settings	6.5	3.5
Operating system installation	3.4	1.6
Using programming languages to write programmes by yourself	1.4	0.5

\*Source: (Abdrakhmanova et al., 2020)

**Table 6.** Proportion of the employed in the ICT sector to the total employed population, % \*

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Russian Federation	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.6	2.1
Central Federal District	2.3	2.4	2.3	2.4	2.4	2.3	2.3	2.4	2.2	2.7
North-West Federal District	2.1	2.1	2.1	1.8	1.8	1.7	1.8	1.7	2.1	2.3
Southern Federal District	1.2	1.2	1.3	1.2	1.2	1.2	1.2	1.2	1.1	1.6
Volga Federal District	1.4	1.5	1.5	1.5	1.5	1.6	1.6	1.4	1.4	1.9
Ural Federal District	1.6	1.6	1.6	1.5	1.7	1.7	1.8	1.6	1.4	1.8
Siberian Federal District	1.4	1.4	1.4	1.5	1.4	1.6	1.5	1.5	1.5	1.8
Far Eastern Federal District	1.3	1.4	1.3	1.3	1.5	1.4	1.4	1.3	1.2	1.7
North Caucasian Federal District	1.2	1.0	0.9	0.9	0.9	0.9	0.8	0.9	0.8	1.1

\*Source: edited by the authors based on data from Rosstat (2020)

Table 06 reveals an alarming decrease in the share of workers in the ICT sector as a share of the total employed population in all regions of the Russian Federation until 2018. This indicator remains unchanged at best in the Siberian Federal District and the North-West Federal District. The North Caucasian Federal District also follows the general trend with a slight but stable decrease in the share of workers employed in ICT. As compared to the developed centres (Moscow, St. Petersburg, etc.), in the regions this indicator is much lower (5–6 times). Only in 2019 there is a slight increase across all regions of the Russian Federation which is most probably caused by the need to create new jobs for ICT workers to implement the government's digitalization programme. It is therefore premature to talk about maximising investment in the digital economy, and it is human capital from this perspective that appears to be a significant potential and still untapped resource.

Turning back to the informatisation of farming and other sectors of the agricultural complex, on the basis of the statistical and analytical data given, we can note that the development of technical means causes intensive data flow to the sectors of the agricultural complex. There is already a mass of information coming from devices used in progressively equipped farms, fields, greenhouses, nurseries, weather stations, satellites, external systems, partner platforms, suppliers, processed arrays of incoming data from all possible partners in the production chain, minimizing risks and therefore increasing production efficiency and profitability growth (Yunusova, 2014). Professionals and farming managers can now access mobile or online applications that after

downloading their land data, provide recommendations and cultivation technologies, considering a multitude of data and factors, helping them determine, for example, the best time to sow, apply fertilizers, make logistical calculations; forecast yields and income, and get advice on all matters of interest. Without additional education and new competences, any state-of-the-art technology will be dead weight and the cost of its purchase and other activities will remain unused and economically inefficient (Baliyants et al., 2019).

Today, among the five existing specialized agricultural higher education institutions in the North Caucasian Federal District, only two – Dagestan State Agrarian University and Stavropol Agrarian University – have training programmes in information and communication technology. The Dagestan State Agrarian University trains staff in one speciality – Applied Informatics. The Stavropol University has two training programmes – Business Informatics and Information Systems and Technology. These two universities offer 119 state-funded places and 145 fee-paying places per year in these programmes, which is probably not enough. The digitalisation of the regional economy means that the requirements for the growth in the number and competence of specialists will increase and will require strong financial investments not only in the agricultural sector itself, but also in higher and secondary vocational education, further education and technology parks. This way seems to be the highest priority, as retraining agricultural workers will be more difficult because of their direct employment in agricultural processes, their age and mentality, their habit of relying on their existing knowledge, and perhaps simply the difficulty of absorbing technical innovations. Among the factors constraining the use of the Internet by the population, the dominant one is lack of necessity (no desire to use, not interested) – 70.1 % and lack of skills to work on the Internet – 29 %. (Abdrakhmanova et al., 2020).

#### **4. Purpose of the Study**

The purpose of the study is to identify regional peculiarities and factors hindering large-scale implementation of information and communication technologies in the regional agricultural sector and, on their basis, to outline directions that can help to eliminate these obstacles and to increase the use of digitalization in managing and organizing its agricultural sectors.

#### **5. Research Methods**

Based on official statistical data from Rosstat and analytical and expert data from leading economic development research institutes in the Russian Federation, we analysed and summarized the volume of data reflecting the level of digitalization of the economy across the North Caucasian Federal District. The methods of logical analysis, dynamic series based on statistical data, revealed the main factors hindering the effective development of innovation activities of the region in the digitalization of the agricultural sector.

#### **6. Findings**

The study has shown that the problems hindering the development of digitalization in the North Caucasian Federal District are as follows:

- Lack of personnel with the required competences and qualifications and the consequent need to adjust the system of higher and secondary vocational education, to open modern budget-funded specialities on their basis, and to organize vocational guidance work with young people.
- Digital divide within the constituent entities of the region. Quite a large proportion of the population and organizations remain without access to broadband internet.
- Insufficient or no financing of local budget components and raised commercial funds in public programmes.
- Moral and professional unreadiness of the population, especially workers in the agricultural sector for the breakthrough development of digitalization of the agricultural sector, peculiarities of mental perception of innovation, inclination towards traditional lifestyles.

## 7. Conclusion

It is necessary to consider information technologies along with other available material resources of the agricultural sector. Thus, it is an important component influencing the stability of sustainable production of food and raw materials for industry, improving the quality of ecology and food safety, environmental protection, reducing losses in the production process of agricultural products.

## Acknowledgments

The research has been funded by the Russian Foundation for Fundamental Research in the framework of scientific project No. 20-010-00965A.

## References

- Abdrakhmanova, G. I., Vishnevsky, K. O., & Gokhberg, L. M. (2019). *Digital Economy Indicators: 2019: a brief statistical digest*. Higher school of economics.
- Abdrakhmanova, G. I., Vishnevsky, K. O., & Gokhberg, L. M. (2020). *Digital Economy Indicators: 2020: statistical digest*. Higher school of economics.
- Baliyants, K. M., Dokholyan, S. V., Hidirova, S. Z., & Zhamolatova, Z. N. (2019). 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 and business administration*, 7(S1), 339–347.
- Dalgatova, I. D., Dokholyan, S. V., Eminova, E. M., Valieva, D. G., & Dokholyan, S. B. (2020). The European Proceedings of Social and Behavioural Sciences. *SCTMG 2020 International Scientific Conference. Social and Cultural Transformations in the Context of Modern Globalism* (pp. 229–235). <https://doi.org/10.15405/epsbs.2020.10.05.32>
- Digital Life of Russian Regions 2020. What defines the digital divide?* (2020). Skolkovo Institute for Emerging Market Studies (IEMS).
- Rosstat (2020). *Innovative activity of organizations*. Retrieved on 1 July 2021 from: <https://rosstat.gov.ru/storage/mediabank/Innov-27.02.pdf>
- Samarina, V. P., & Nikitina, K. A. (2020). Analysis of the region's digitalization indicators. *Bulletin of Eurasian Science*, 3. <https://esj.today/PDF/06ECVN320.pdf>
- Yunusova, P. S. (2014). Information Resource of the Agricultural Sector of the Republic of Dagestan. *Issues of Economic Structuring*, 1, 9–14.