

## Agricultural Communication

# Implementation of Innovation Development Models in Agrarian Sphere of Economy at the North Caucasian Federal District, Russia

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## ABSTRACT

The present paper aims to analyse the problems of the innovation development component in the agricultural economy of the North Caucasian Federal District of the Russian Federation in terms of the operational settings of agro-economic systems, facilities of economic entities, organisational and economic mechanisms, managerial function and prioritisation of innovation directions. The current aspects of innovation-driven development of the regional agro-industrial complex are discussed. Priorities of innovation development in agriculture and related industries of the agro-industrial complex of the North Caucasian Federal District are proposed, based on the technological re-equipment of agro-industrial enterprises, instituting the innovation-driven mechanism of agro-industrial operations, building up the information, people and financial support of the innovation development system of the agro-industrial complex, ensuring proper economic conditions for implementing innovation programmes and projects, state financing of innovation activities, broad attraction of investment and improving solvency. The practical implementation of innovations should rely on a built system of regional innovation-driven development, clear and structured iterations in adopting all groups of innovations in agro-industrial sectors based on centralised vertical alignment between all branches of government and horizontal cross-departmental cooperation. A crucial regulatory role in this process should be played by government structures across economic and education sectors closely tied with agro-industrial production. Effective implementation of innovation policies will depend on ensuring proper economic conditions for putting forward innovation programmes and projects, on the availability of state funding to support innovation activities, attracting investment in the innovation sphere, advancing entrepreneurship and commercialisation of innovation projects. The identification of factors inhibiting the adoption of innovation in the agro-economy of the North Caucasian Federal District and current trends in innovation activities of enterprises and operations suggests a conclusion concerning the need for a systemic approach to innovation in the region taking into account national interests and makes the basis for further proposals of scientifically-based directions of economic transformations and coordination of efforts between all government structures engaged in this process and responsible for solving these tasks. The findings of this paper can be used by the control bodies of the regional agro-industrial complex, by the students of agricultural colleges and other public and private entities of the North Caucasian Federal District for better economic transformations and coordination.

**KEY WORDS:** AGROINDUSTRIAL COMPLEX, FACTORS OF INNOVATION, INNOVATION-DRIVEN TRANSFORMATION, REGIONAL AGRICULTURAL INNOVATION.

## INTRODUCTION

In the current setting, the problem of transforming agricultural enterprises to a new level of economic management is

pursued, and the task is to develop, adopt and implement innovation-led approaches to technologies, organisation and management of agricultural production and related sectors of the agro-economy. It is crucial to make sure that the ongoing transformations are maintained continuously and progressively to achieve the indicative targets adopted and applicable as the basis of government programmes. The

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effectiveness of innovation activities depends on a complex of elements (Kornilova et al. 2021).

A successful transformation of the agro-economy depends on the ability to understand the existing problems that can get in the way in using state-provided funding and hamper the region's competitiveness. Therefore, it is crucial to analyse the current situation with innovation in the agro-economy through the lens of several interrelated problems, the causative relations and potential lines of development. The aspects of innovation processes and innovation development are covered in the previous works (Kanygin 1974; Santo 1990; Bulakh and Fliaster 1991; Zhebrovskii 1992; Samkaev and Strizhkov 2007; Neudakhin 2007). The trends observed in innovation processes in agroproduction are discussed in previous studies (Ushachev, Sandu and Ogloblin 2007). The reviewed works by foreign authors provide input to identify the main theoretical approaches to innovation processes in general and with regard to regional agro-economies in particular (Bakytzhan et al. 2020; Polushkina et al. 2020; Kornilova et al. 2021).

Numerous approaches currently exist in arranging the operation of regional agro-economies, specifically, the adoption of advanced equipment, intensification of production, technological innovation, implementation of scientific results in production and business-related and socioeconomic dimensions of innovation. These include upgrading the institutional environment and transformation of state support, as well as new methods of production management in the agro-economy. The transition to an effective innovation economy integrates a systemic approach, modernisation of the methods and forms of management of the resource potential across the levels of the innovation system and a new level of cooperation between different parts of the value chain. The existing approaches are based on setting the foundation of innovation requirements and analysing the regional innovation potential as needed for innovation development (Bakytzhan et al. 2020).

The observed requirements primarily reflect some of the specifics of the agro-economy:

- beyond being profitable, innovation in the agroindustrial complex should also contribute to food security of the country and region, which stipulates the long-term nature of scientific research that eventually may or may not lead to further implementation (Fedotenkov 2014; Iunusova 2018).
- considerable time lag between the implementation of innovation and economic results (1-7 years).
- wide product ranges maintained by production enterprises, reflecting high production risks in agroindustrial sectors (Kurbanov 2019).
- extreme dependence on natural and weather conditions substantiating the breeding of specific varieties for the area and cultivating crops under cover.

- low levels of cooperation and the lack of machine tractor stations result in a situation when specialist vehicles are unavailable for most small and medium-sized enterprises, leading to lower economic results in production and even further unaffordability of the equipment (Polushkina et al. 2020).

- the system for implementing scientific results in production in the agro-economy was destroyed and never restored until now, which has led to the extremely low rate of innovation in most medium-sized and small enterprises. Only the biggest regional producing enterprises usually have access to effective innovations (Reznichenko and Andreev 2016). The discussion of the regional aspects of innovation will focus on the definition of innovation as a sequence of activities to create and improve agricultural goods, to advance technologies and management systems based on the integration of scientific results or production expertise (Ushachev 2007; Dokholyan 2019; Polushkina et al. 2020).

At the regional level and the agroindustrial economy, innovation development would also involve the development of an underlying system of economic relations and conditions. Innovation requirements can be external, originating from regional strategic development plans, or internal, shaped within agroindustrial enterprises and their interactions and interrelations (Kazikhanov 2016; Polushkina et al. 2020; Kornilova et al. 2021). The main problem of our study is the identification of regional innovation requirements and the available potential, including innovation infrastructure, people potential (research institutions, HEIs, etc.), the degree of wear-and-tear of fixed capital, operation margins of the enterprises, adoption rates of information innovation, organisational and management aspects of innovation.

## MATERIAL AND METHODS

To solve the set problems, we conducted a mixed type study comprising several stages, including description, explanation, assessment, comparison and analysis of relationships. The object was the North Caucasian Federal District consisting of the Republic of Dagestan, the Republic of Ingushetia, the Kabardino-Balkarian Republic, the Karachayevo-Circassian Republic, the Republic of North Ossetia-Alania, the Chechen Republic and the Stavropol Territory. The description part of our study was addressed by plain gathering of data from documents. The main sources for document review were research works by Russian and international researchers and statistical materials. One of the main goals we focused on was to capture data to further aggregate them.

## RESULTS AND DISCUSSION

The figures in Table 1 suggest that spending on the adoption of information and communication technologies has been rising in the North Caucasian Federal District over the last three years. However, there are significant severalfold differences among the constituent federal entities in terms of the amounts spent on informatisation. When specific items of spending are considered, the maintained trend is

toward channeling the most funding toward purchases of equipment and paying telecommunication bills, while only a small fraction of total spending comes into employee trainings, which showed a downside trend between 2017

and 2018 (38.4 million rubles in 2017 vs. 19.7 million rubles in 2018). No further statistical data is provided. Therefore, we should note that all economic sectors and specifically in rural areas do not realise the innovation potential of the existing staff (Gokhberg et al. 2020).

**Table 1. Spending on the adoption of information and communication technologies (million rubles) (Federal State Statistics Service, 2020)**

Region	Spending on ICT in 2017, total	Spending on ICT in 2018, total	Spending on ICT in 2019, total
North Caucasian Federal District	8,832.7	10,635.9	13,802.3
Republic of Daghestan	905.9	1,367.0	1,404.3
Republic of Ingushetia	379.7	521.5	306.9
Kabardino-Balkarian Republic	515.3	596.7	572.0
Karachayevo-Circassian Republic	515.3	598.6	651.5
Republic of North Ossetia-Alania	770.0	819.2	1,088.0
Chechen Republic	1,423.0	1,411.4	2,298.9
Stavropol Territory	4,323.6	5,321.4	7,480.6

**Table 2. Aggregate level of innovation activities of enterprises, % (Gokhberg, et al. 2019; Gokhberg et al. 2020)**

Russian Federation	9.5	8.4	12.8	9.1
North Caucasian Federal District	6.2	2.9	4.4	1.7
Republic of Dagestan	6.7	2.5	2.2	0.5
Republic of Ingushetia	–	–	10.5	0.8
Kabardino-Balkarian Republic	8.3	2.4	10.3	3.9
Karachayevo-Circassian Republic	4.3	0.8	6.5	5.7
Republic of North Ossetia-Alania	7.7	3.8	9.6	1.6
Chechen Republic	0.8	0.3	0.2	0.2
Stavropol Territory	7.2	4.9	7.9	5.1

As can be seen from the table, the level of innovation activity shows unstable growth on average for the region, however, it shows a steady downward trend in the Republic of Daghestan, and for some regions, no comparable figures are available. Moreover, the level of innovation activity is very low even when all types of economic activities are considered, so one may assume that the figure would be even lower in agriculture. The figures in Table 3 show that innovation resources in the North Caucasian Federal District are primarily focused on technological innovation (much as in the majority of other regions (except the Far Eastern Federal District). The data indirectly confirms the high rate of wear-and-tear of capital assets in production and the insufficiency of modern machinery, mechanisms and technologies.

**Table 3. Enterprises putting forward technological, marketing or organisational innovation in 2017, % (Gokhberg et al. 2019; Gokhberg et al. 2020)**

	Relative share of organisations conducting specific types of innovations, as percentage of the total		
	technological	marketing	organisational
Central Federal District	3.8	0.5	1.1
Northwestern Federal District	2.9	1.4	1.1
Southern Federal District	4.6	0.1	0.7
North Caucasian Federal District	0.9	0.7	0.2
Volga Federal District	2.7	0.6	0.7
Ural Federal District	3.4	0.3	1.2
Siberian Federal District	3.1	0.3	0.8
Far Eastern Federal District	1.2	0.4	1.6

No regional figures on innovation activities across the types of economic activities are provided, therefore, consider the nationwide Russian figures for agriculture. Considering the data from Table 4, one can see that the vast majority

of agricultural and food enterprises spend their available resources to purchase machinery and equipment, software and research. Employee trainings were provided by 2.9% of enterprises in agriculture and 7% of enterprises in the food

industry. Given the fact that the count of enterprises does not include private subsistent farms producing a significant share of products in the regions of the North Caucasian

Federal District (68.7% of potatoes, 66.2% of vegetables, 32.8% of cattle and poultry for slaughter, 68.4% of milk), therefore, the respective percentage is actually very small (Gokhberg et al. 2020).

**Table 4. Relative share of enterprises in the RF conducting technological innovation by the types of economic activities in 2018, % of the total (Gokhberg, et al. 2019; Gokhberg et al. 2020).**

	Enterprises conducting							
	Research and development	Purchases of machinery and equipment	Purchases of new technologies	Purchases of software	Engineering	Employee training	Marketing research	Other, incl. design
Agriculture	8.1	78.1	2.4	9.0	7.6	2.9	0.5	11.9
Food production	18.9	70.4	3.7	7.8	9.3	7.0	6.7	21.1
Beverage production	15.9	59.1	9.1	13.6	13.6	6.8	9.1	56.8

The data in Table 5 shows that the degree of wear-and-tear of fixed assets in agricultural spheres is significant, which has led to a massive trend of fleet upgrading among enterprises. When the numbers of researchers by branches of science are considered, the share of researchers in the field of agricultural sciences equals 13% of the total, which

is next to the lowest figure among seven types of research. In (2019), internal spending on scientific research and development in agricultural sciences equaled 17% of the total amount. The predominant share comes into natural sciences and engineering disciplines (28% and 24% respectively).

**Table 5. Fixed asset condition in agriculture, forestry, fishing and fish farming as of the end of 2019, % (Federal State Statistics Service 2020)**

	RF	Central Federal District	Northwestern Federal District	Southern Federal District	Volga Federal District	Ural Federal District	Siberian Federal District	Far Eastern Federal District	North Caucasian Federal District
Degree of wear -and-tear	41.4	39.0	43.5	42.9	41.2	38.5	46.3	47.5	40.6
Completely worn out	10	8.6	12.1	11.6	10.2	9.2	12.6	10	9.2

The data in Table 6 shows that agricultural enterprises in the region have remained profitable on average over the last 15 years, however, a downward trend or sharp fluctuations have been observed in the most recent years in profitability figures. Moreover, regional averages are primarily driven by the biggest constituent entity, the Stavropol Territory. The profitability of agricultural enterprises has also shown a downward trend, as can be seen from Table 7 (almost 10% over the past five years).

The above data in Table 7 indicates that agricultural enterprises in the region have generally remained profitable. However, a downward trend has been observed since 2015, with negative indicators in nearly all entities of the North Caucasian Federal District, except the Stavropol Territory and the Karachayevo-Circassian Republic. Based on the data from Tables 6 and 7, the question remains how strong is the role of state support of producers in maintaining the levels.

According to Table 8, agricultural enterprises in nearly all constituent entities (except the Republic of Ingushetia and the Kabardino-Balkarian Republic) have increased investment in fixed capital. However, the primary direction is to rebuild fixed capital due to its considerable natural wear-and-tear, as mentioned above, thus, the ability to renew the active component of fixed assets makes the basis for the adoption of new technology on the way to innovation in the agroindustrial complex (Gokhberg et al. 2019).

Meanwhile, when government funding is limited, the role of the state could be in ensuring a favourable investment climate through the development of infrastructure, efforts to provide consultancy and education services for producers with the use of information technology, employee training and continued education and by adopting new methods and forms of economic support for agricultural producers implementing and advancing innovations in their operations. The list of factors inhibiting innovation cited by industry leaders was topped by economic factors, specifically, deficits

of own funding sources and high costs of innovations, insufficient state support; internal factors came second, including, poor innovation potential of the enterprises and

skills shortage, as well as uncertainty of economic benefits from innovations (Gokhberg et al. 2020).

**Table 6. Balanced financial result (profit minus loss) of enterprises, million rubles (Federal State Statistics Service 2020).**

	Plant farming						Animal farming					
	2005	2010	2015	2017	2018	2019	2005	2010	2015	2017	2018	2019
North Caucasian Federal District	1,176	3,743	16,820	11,071	13,943	10,030	91	515	2,707	2,610	3,399	823
Republic of Daghestan	41	-5	68	172	178	169	4	39	24	144	51	-14
Republic of Ingushetia	-50	-21	-12	-25	4	-54	-3	-1	0.1	0.4	0.4	–
Kabardino-Balkarian Republic	-157	-57	135	235	202	114	-17	-8	201	103	53	51
Karachayevo-Circassian Republic	39	-175	219	445	437	383	-90	39	10	11	14	34
Republic of North Ossetia-Alania	-84	-48	0.2	0.3	-59	76	-10	-33	-0.0	–	–	9
Chechen Republic	...	-235	-58	-81	-15	2	...	-4	-10	-0.2	-3	-11
Stavropol Territory	1,387	4,284	16,468	10,325	13,196	9,340	207	483	2,482	2,352	3,284	754

**Table 7. Profitability of sales, goods (works, services), %, among enterprises (Federal State Statistics Service 2020).**

	in plant farming						in animal farming					
	2005	2010	2015	2017	2018	2019	2005	2010	2015	2017	2018	2019
North Caucasian Federal District	10.5	16.6	36.6	21.2	23.2	18.9	5.3	7.0	14.8	13.9	17.4	9.2
Republic of Daghestan	4.0	0.7	5.6	8.6	8.7	12.8	-1.4	-9.1	-1.3	5.1	5.6	-4.1
Republic of Ingushetia	-37.5	-29.3	-11.7	10.4	13.8	-14.2	-11.5	28.7	9.8	19.8	12.3	–
Kabardino-Balkarian Republic	-4.2	4.7	10.9	7.5	12.9	17.5	-1.1	3.0	12.8	11.1	10.4	10.2
Karachayevo-Circassian Republic	10.0	-7.5	22.2	19.6	11.7	14.2	-13.4	6.7	9.7	7.6	5.0	3.8
Republic of North Ossetia-Alania	-20.7	-21.8	3.2	-61.5	-48.6	14.9	-7.8	22.5	–	–	–	-6.5
Chechen Republic	...	-29.2	-9.9	-11.5	-12.0	-11.3	...	-15.8	-28.8	-20.6	-2.6	-44.7
Stavropol Territory	12.9	19.7	39.7	23.0	25.3	19.5	9.4	10.1	15.4	14.7	18.2	9.9

The above analysis of economic indicators of the agroindustrial complex of the North Caucasian Federal District suggests that innovation activity levels of most enterprises are low. They lack capabilities to adopt new technologies in production, which is attributed by enterprise leaders to high initial costs and insufficient support from the state in agriculture. While on average across the agroindustrial complex of the North Caucasian Federal District, operations are breaking even, the levels of profitability in many constituent federal subjects have been declining and the averages are primarily driven by the biggest constituent entity, the Stavropol Territory.

In this context, enterprises face operating obsolete or undifferentiated technical equipment, using extensive technologies or technological facilities that are morally or physically outdated. Moreover, the already limited free cash is primarily used to purchase machinery and equipment and auxiliary items (such as software).

Research, design, marketing and organisational innovations only constitute a minor percentage of the total use. A crucial component for advancing ahead in the way of innovation development of the agroindustrial complex is the development of infrastructure of innovation activities

and making sure that the combination of facilities, legislative and other instruments are in place to provide for information, expert, marketing, financial, people and

other forms of support of innovation operations (Gokhberg et al. 2020).

**Table 8. Investment in fixed capital by the types of economic activities (excluding small businesses; million rubles) (Geometr Russia, 20018; Federal State Statistics Service, 2020).**

	2017			2018			2019		
	Total	Incl.		Total	Incl.		Total	Incl.	
		Agriculture, forestry, fishing and fish farming	Informatisation and communication activities		Agriculture, forestry, fishing and fish farming	Informatisation and communication activities		Agriculture, forestry, fishing and fish farming	Informatisation and communication activities
<b>North Caucasian Federal District</b>	<b>190,560</b>	<b>24,070</b>	<b>8,004</b>	<b>227,652</b>	<b>24,535</b>	<b>9,286</b>	<b>268,066</b>	<b>33,238</b>	<b>10,731</b>
Republic of Dagestan	23,138.7	1,199.8	1,405.8	29,744.8	20,37.0	1,684.1	36,036.9	3,451.1	2,263.0
Republic of Ingushetia	9,624.9	220.2	274.1	11,785.5	4.3	344.9	15,066.6	-	989.7
Kabardino-Balkarian Republic	15,714.8	2,575.0	656.2	16,123.5	1,926.9	776.4	20,034.7	1,148.4	1,316.3
Karachayevo-Circassian Republic	12,633.8	549.8	354.5	15,728.6	935.1	430.0	17,460.2	-	604.8
Republic of North Ossetia-Alania	16,653.8	7.5	705.1	18,825.2	17.8	859.6	21,101.7	1064.4	1,257.0
Chechen Republic	42,698.7	4,974.4	1,331.8	51,328.0	2,484.8	1,302.0	55,166.3	2,296.6	1,261.6
Stavropol Territory	70,095.1	14,543.4	3,276.8	84,116.0	17,128.9	3,889.3	103,200.0	24,499.5	3,038.6

Given the identified factors inhibiting innovation processes, the following directions of innovation development arguably appear as the most relevant in the current economic settings: technological reequipment of enterprises in the agroindustrial complex; adoption of effective resource-saving technologies; storage and processing of agricultural products; melioration efforts for soil improvement and preventing soil degradation, maintaining farming systems, forming and maintaining agroecosystems and agrolandscapes; given favorable environmental settings, a promising direction is presumably the development of organic production, fishery and fish farming; enhancing the economic mechanism of maintaining the innovation ways of the agroindustrial complex; building up information, people and financial support to maintain innovation development in the agroindustrial complex (Baliyants et al. 2019; Bashirova 2019).

The efficient adoption of innovation will significantly depend on ensuring stable economic and legal settings and state funding for innovation activities. The financial rehabilitation of agricultural enterprises would require a new approach to the economic component of production operations and improvement of solvency. This implies balancing the mechanisms of purchases of agricultural products and establishing long-term storages (Gokhberg et al. 2020).

## CONCLUSION

The findings of the present study suggests that a steady development of agricultural production depends on

overcoming the factors inhibiting innovation activities in the sectors of the agroindustrial complex; solving the problem of effective resource management would help to progressively address the issues of providing competitive food supply in the region and country. The innovation-driven development of the North Caucasian agroecology is contingent on the availability of effective mechanisms for developing and spreading innovation and innovation management, which creates relevance for building regional innovation systems. Focusing on competitiveness of the agroindustrial production of the North Caucasian Federal District would help to improve the rankings of its constituent regions both at the national and international level, which will benefit the overall perceptions of the mesoregion.

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