Formation and development of innovative agricultural system of the Republic of South Ossetia

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Abstract. The paper discusses the theoretical and practical aspects of innovative development of agriculture in the Republic of South Ossetia, whose territory is located in the foothills and mountains, which imposes special requirements on the technologies used for the production of agricultural products, raw materials and agricultural food. The ambiguity of ongoing processes in the agricultural sector of the economy, including a high level of unoccupied population in rural areas and a low level of involvement in the turnover of agricultural land requires new approaches to regulating innovation processes. A set of measures and directions for the formation of the innovation system of the Republic of South Ossetia is proposed, in which the key role is assigned to the recommended interstate technological agricultural platform.

1. Introduction
Recovery and development of the national economic complex, as well as the pace of implementation of the recovery process are determined by the capabilities of the current economic system with appropriate institutions and their focus on solving problems related to increasing production, expanding the market, ensuring employment, increasing the efficiency of reproduction, increasing access to long-term borrowed resources, ensuring a low level of inflation and many other macroeconomic aspects of the effective functioning of the country’s economic system. Among these aspects, the problem of innovative development of agriculture on a new technical and technological basis, covering a whole range of areas: breeding and zoning of new seed varieties up to their mass introduction by economic entities; breeding work to breed new livestock species and increase their productivity up to the use of new systems for feeding farm animals; development and implementation of highly mechanized, automated and robotic technical means for performing various agricultural works before stimulating and state support for their implementation in the real sector of the economy. These technical and technological innovations in agriculture, along with organizational, managerial, marketing and other innovative solutions implemented as part of the development of the scientific and technical program, with appropriate state policy, have a decisive impact on economic growth in the agricultural sector, qualitative changes in the structure of employment and reduction of unemployment in rural areas in the long term.

Among the problems that hinder the large-scale application of innovations in agriculture in the Republic of South Ossetia, along with its inherent features of the production and economic conditions
of management, we can highlight the nature of the economic system of the region. In particular, in 2008, the Russian Federation and the Republic of South Ossetia (RSO) signed the Agreement on friendship, cooperation and mutual assistance, including in the scientific and scientific-technical sphere, according to which the territory of the RSO is covered by the ruble zone. At the same time, the legal acts regulating the economic activities of the subjects of the Russian Federation, although largely based on the legislation of the Russian Federation, nevertheless belong to independent legal acts of a sovereign state. This fundamental aspect determines, in our opinion, the possibility and necessity of considering the problem of formation and development of the innovative system of the agricultural sector of the Republic of South Ossetia as an independent object of research, at the same time integrated through economic ties into the Russian economy.

2. Methods
In the course of the research, traditional methods of studying economic phenomena and processes were used, such as: monographic, analytical, economic and statistical, computational and constructive, and others. Also, in some cases, the authors considered it justified to use such a method as benchmarking as one of the promising tools of argumentation in building the evidence base. Materials of the state statistical bodies of the Republic of South Ossetia and normative legal acts of the Government of the Republic of South Ossetia were used in the preparation of this paper. In some cases, the legal framework of the Russian Federation, including documents of the Ministry of Foreign Affairs of the Russian Federation, as well as analytical and statistical materials of the Russian Customs Service, was involved. We also used the results of research activities of the NCRIMFA - a branch of the Vladikavkaz Scientific Center and other research centers and institutes of the corresponding profile of the Russian Federation.

3. Results
With the potential opportunities of the RSO implemented in a complex but relatively stable military-political environment, the region has land, production and labor resources that can and should be involved in the development of agro-industrial production, including on the innovative basis. At the beginning of 2019, the Republic had: agricultural land with a total area of 127677 hectares, livestock-15120 heads, sheep – 2940 heads, pigs – 3434 heads, poultry – 31655 heads. However, according to the official statistics bodies of the Republic, only 2,540 ha of the sown area was processed and sown in 2018.2 ha [1]. Arable land in general accounts for about 11.3% of the total land area, pastures – 81.3%, haymaking – 7.2%.

| Name of indicators       | 2018   |
|--------------------------|--------|
| Total farmland, ha       | 127677 |
| Including arable land    | 14481  |
| Pastures                 | 103865 |
| Hayfields                | 9211   |
| perennial plantings      | 120    |
| Household plots          | 4714   |

Source: Statistical compilation of the RSO. Department of state statistics of the Republic of South Ossetia. 2019 p. 102-103.

The agricultural lands available in the Republic are fixed (owned or leased) and are processed by producers of 56 public farms, 84 farms and 8632 private subsidiary farms. The current share of agriculture in the gross domestic product, which was only 0.43% in 2018, does not reflect the role that the industry can have with optimal utilization of non-used production and labor resources. Moreover, having significant areas of arable land, pastures and haymaking, the Republic provides itself with food
only at the 37-38% level; the remaining share is accounted for food imported from the Russian Federation. In recent years, there has been an increase in livestock production, the share of which in the gross agricultural production in 2018 reached 84.1% (Fig. 1), amounting to 832.1 million rubles.

The involvement of at least part of unused land resources in agricultural turnover will not only increase the level of food self-sufficiency of the population, but also create additional jobs and contribute to improving the living standards of the population. Out of the RSO total working-age population, which in 2018 numbered 32.4 thousand people, only 65% were employed in all sectors of the economy, with an officially registered unemployment rate of only 8.7%. The acute problem of employment of the region’s population is also manifested through the analysis of the sectoral structure of the economy, which indicates the insufficient role of the sphere of material production in providing jobs for the available labor resources.

The country’s predominance of pastures and hayfields, whose territories are located in the mountainous and foothill zones, determines the potential direction of specialization of agriculture - the production of livestock products, which also implies a corresponding bias in the innovative provision of direct agricultural producers.

Taking into account the fact that the current structure of farming in rural areas is formed with the predominance of personal subsidiary farms, and it tends to reduce the role and place of public and expanding farms in reproduction, the focus not only on technological, but also on organizational innovative solutions, seems more than justified. As the high cost of scientific developments and technological innovations, as well as their long payback period, requires significant financial resources, which is often impossible and economically inappropriate for a single economic entity. Combining the resources of several commodity producers in various forms – cooperative, partnership, and state enterprise –provides them with the opportunity to participate in the innovation process in order to improve the efficiency of management and generate additional income (profit). Moreover, such an association, but so far material and technical resources, has found its embodiment in the Republic in the form of the state enterprise “Iragropromservice” created in 2007, which has a significant part of the agricultural equipment available in the region on its balance sheet. According to statistics of the RSO, 83% of 47 tractors and 100% of 8 combine harvesters are in the state enterprise “Iragropromservice”. Almost the entire train of basic agricultural machines and tools (harrow, tractor rakes, cultivators, seeders, etc.) is secured in the ownership of this organization. Although this situation is hardly rational enough, in our opinion, it reflects the real level of provision of agricultural equipment for South Ossetia’s producers.

4. Discussion
One of the guidelines for introducing innovations in the economy is the transition to high-industrial technologies, the use of modern production and labor management systems, new marketing solutions in the promotion of manufactured products, the presence of institutions that ensure the introduction and use of science and technology. In agriculture, high-industrial technology should be understood, in
our opinion, as an algorithm for timely and complete implementation of the entire complex of technological operations by the optimal composition of robotic, automated, and highly mechanized machine systems in accordance with zonal science-based technologies for growing crops and producing livestock products.

The inclusion of robotic and automated machine systems in this definition is an imperative of the times, especially given their widespread use by farmers in many developed countries of the European Union, the United States, Canada, and others. They are implemented with the direct participation of states that systematically implement a system of measures supporting the use of high technologies in the agricultural sector. For example, in 2017, the level of state support in total expenditures for stimulating the use of agricultural science and innovative technologies in relation to general measures of support in agriculture, according to the Organization for economic development and cooperation, was 10% in the EU (28 countries); the US – 9.26%; Norway – 4.41%; Canada – 26.5% [2]. In absolute terms, the volume of support for innovation in agriculture is very significant: for comparison, in 2017 in the EU (28 countries), it reached 10.4 billion euros, or about 60 euros per 1 ha of agricultural land used.

Of course, taking into account the budget potential of the RSO as a whole, the independent state’s ability to support innovation in agriculture and agricultural education is limited, due to many macroeconomic factors, in particular the significant share of financial assistance from Russia, which in 2018 amounted to 80.1% of the revenue of the Republican budget. Further reduction of the high level of financial assistance in the budget of the RSO remains one of the guidelines of economic policy, in particular aimed at finding the most rational measures and effective institutions for the introduction and use of advanced scientific and technological achievements. It is necessary to adapt and implement the entire set of scientific results, which cover a wide range of new knowledge: in agriculture, from the method of reducing erosion processes on slope lands [3] to selection achievements in the breeding of potato varieties; in animal husbandry - from the breeding of new breeds of livestock to improving the diet of farm animals [4]; in the organization of production [5, 6, 7, 8] – from zonal placement of agricultural production to the formation of various forms of cooperation and marketing innovations; in state regulation - from the introduction of strategic forecasting and planning to improving the ways of state support and control of the targeted use of budget funds. Implementation of measures to introduce innovative technologies will require improving the skills of rural workers and increasing investment in human capital in agriculture [9].

When solving these problems they should take into account the results and achievements of research institutes and higher educational establishments of agrarian profile of Russia, such as: North-Caucasus Scientific-Research Institute – branch of the Vladikavkaz Scientific Center; Gorsky State Agrarian University, Altai Research Institute of Agriculture, Mountian-Altai Research Institute of Agriculture and other institutions in Russia, development of methods of agricultural production with the features of mountain and foothill areas.

Forms of interaction between commodity producers of the RSO and these institutions can be in the form of allocation of experimental plots for zoning of agricultural varieties (in public and farms) or the creation of joint research laboratories (with the South Ossetian State University). And economic relations in the process of obtaining and using patents can be built both on a free basis and on paid terms between the owners of scientific results and producers of agricultural raw materials and agricultural products in the RSO. The gratuitous form involves the transfer of the rights to use patents, the rightholder of which is the state represented by the Russian Federation. In our opinion, one of the most promising forms of such relations may be the supply of innovative technologies to the region in exchange for some of the products produced by agricultural producers in South Ossetia. This direction may have prospects for the cultivation of environmentally friendly agricultural products and their export.

But, in our opinion, it is necessary not to make individual decisions between the subjects of the proposed innovation system, but to form an integrated innovation system in agriculture. Such a system can be offered by us to the creation of international technological agricultural innovation platform
(ITAIP). In order to minimize budget expenditures for the formation of ITAIP, it is possible to use the state enterprise “Iragropromservice” as its base with the inclusion of organizers and participants:

- from the Republic of South Ossetia: Ministry of Agriculture of South Ossetia, South Ossetian State University;
- from the Russian Federation: Gorsky State Agrarian University, Vladikavkaz Scientific Center, North Ossetian State University.

The creation of the platform on the basis of an existing state enterprise will, in our opinion, form the core of the innovation system in the agro-industrial sphere of the Republic of South Ossetia with the least additional budget expenditures. The most important necessary elements of the proposed technological agricultural innovation platform in South Ossetia that need to be created are also:

- pilot farms, one for each of the districts based on existing public farms;
- breeding station;
- breeding farm;
- information and consulting center for farms and agricultural producers;
- scientific agricultural center within the South Ossetian State University.

This list of potential participants of the proposed platform is not exhaustive and other innovative companies, as well as other research institutions, may participate.

The formation and development of an innovation system based on the proposed interstate agricultural innovation platform requires adjusting approaches to the implementation of state support for agricultural producers in South Ossetia. In particular, we need to step up measures aimed at using innovative technologies in all sectors of agriculture, and not just for laying intensive gardens, as is currently being implemented. In our opinion, the state’s stimulation of organizational (production, sales, credit cooperatives) and marketing (building a production and logistics vertically integrated network of food sales) innovations in the field of agro-industrial production will create the necessary production base for involving the unemployed population in material production and the infrastructure that serves it. In the future, the possible expansion of innovative technologies can also be based on the experience of stimulating the countries of the Eurasian Economic Union [10], which will allow increasing the introduction and use of advanced technologies created in these countries.

5. Summary
One of the directions for the development of agriculture in the Republic of South Ossetia and improving the efficiency of agricultural producers is the integrated use of advanced innovative technologies, the introduction of which requires the use of non-standard approaches to the organization of such activities. Based on the conditions of farming in rural areas and the formation of the revenue part of the budget of the region, a promising direction in the influx of innovations into the industry is, in our opinion, the proposed integrated association on an innovative basis – the technological agricultural platform of South Ossetia.

6. References
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