Economic analysis and justification of the directions of innovative development of the Krasnodar region’s agroeconomics

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Abstract. The analysis of the current state of the agricultural economy of the Krasnodar region is conducted, and the priority directions of its innovative development are substantiated, including the increase in the productivity of livestock and crop production sectors, the level of technical and technological equipment of production and the effectiveness of state support for commodity producers. The necessity of restoration and development of branch science is noted with the intensification of the processes of its integration with private capital, education, and production. A critically high dependence of commodity producers on imported seeds of high-yielding varieties and hybrids of individual crops has been established and recommendations have been formulated to reduce it. It has been established that the most problematic subsectors that hamper the implementation of the import substitution program in the region are the meat and dairy cattle breeding sectors, which require their primary improvement. The necessity of developing the livestock breeding as an important factor of preservation and restoration of soil fertility in the region due to growth of production volumes and application of organic fertilizers, as well as expansion of the area of sowings of perennial and annual grasses, is substantiated in the paper. It is noted that an important direction to improve the efficiency of the agro-economy of the region is to strengthen the system of its state support and the development of small forms of management with deepening the processes of cooperation and integration.

1. Introduction
The problems in the functioning of domestic agriculture, which have been accumulated over the years of market transformations and become even more aggravated under the conditions of the existing sanctions pressure on our country by the collective West, require the introduction of industry innovations that ensure growth in labor productivity in the industry, lower unit costs of basic production costs, and, consequently, the achievement of the country’s food security, as well as the increase of its export potential. At the same time, the limitations of the main types of production resources, the difficult financial and economic situation of most producers, the unfavorable investment climate in the industry require a deep scientific substantiation of the priorities of its innovative development [5-8].

In recent years, there has been a marked positive trend in crop production in the Krasnodar region (Table 1). In the period from 2010 to 2016, the production of grain, sugar beet, vegetables, fruits, and
grapes significantly increased. It is worth noting a significant increase in the profitability of production and sales of products of these subsectors.

At the same time, the production potential available in the region is far from being fully utilized in agriculture. The profitability of milk and meat production is still low, the technical and technological base of producers needs to be modernized as quickly as possible; it is important to ensure a reduction in the critical dependence on imported technologies, equipment, seed material, and chemical plant protection products as soon as possible. All this requires a deep scientific substantiation of the priorities of innovative transformations in the agrarian sector of the regional economy.

| Table 1. Production and economic indicators of agroeconomics in the Krasnodar region. |
|---------------------------------------------------------------|
| Indicator                                                | 2010       | 2013       | 2016       | 2016 in % (pp) by 2010 |
|---------------------------------------------------------------|
| Production volumes, thousand tons:                         |            |            |            |                      |
| grains                                                      | 9868.3     | 11977.6    | 13862.9    | 140.5                |
| sugar beet                                                 | 7095.4     | 6717.4     | 9988.2     | 140.8                |
| sunflower                                                  | 1028.8     | 1165.8     | 1104.6     | 107.4                |
| vegetables                                                 | 667.9      | 716.2      | 872.2      | 130.6                |
| fruits                                                     | 191.0      | 354.1      | 428.1      | 224.1                |
| grape                                                      | 132.0      | 210.7      | 237.5      | 179.9                |
| increase in live weight of livestock and poultry            | 268.1      | 306.0      | 341.6      | 127.4                |
| milk                                                       | 869.6      | 824.7      | 871.4      | 100.2                |
| Profitability of subsectors, %:                            |            |            |            |                      |
| field crops                                                | 49.4       | 41.2       | 57.0       | 7.6                  |
| vegetable growing                                          | 8.7        | 9.7        | 39.7       | 31.0                 |
| viticulture                                                | 39.0       | 26.4       | 40.8       | 1.8                  |
| fruit growing                                              | 19.0       | 10.3       | 64.9       | 45.9                 |
| animal husbandry                                           | 5.9        | 1.5        | 10.4       | 4.5                  |

2. Results and Discussion

The agricultural economy of Krasnodar Region has a high scientific and technical potential, represented by sectoral and regional research institutes of agriculture, as well as a leading Russian state agrarian university, which can serve as a powerful driver of innovative development of agriculture in the region. Realization of this potential in practice requires the deeper integration of capital, science, education, and production, which would allow continuous research in the areas of priority for the agricultural economy of Krasnodar Region, create innovative products with the involvement of private investors, developers, specialists of agricultural organizations, provide scientific and industrial activities highly qualified personnel with deep innovative thinking.

The solution to this major problem, unfortunately, is hampered by many factors, including a critically low level of funding for basic and applied research in the agro-industrial sector, low innovative activity of commodity producers, etc. Innovative development of agriculture in Russia is complicated by the uncertainty of the prospects for further development, and perhaps the very existence of agro-economic science and higher education in the agrarian economy. So, more than 15 agricultural universities in 2016–2017 were deprived of accreditation for economic educational programs. At the same time, it is fair to say that in most agrarian universities, educational programs in economics and management poorly reflected industry specificities. And this is even despite the fact that the economy and organization of agriculture have distinct features in relation to other sectors of the national economy.
One of the main threats to food security in Russia is the critically high dependence of commodity producers on seed varieties and hybrids of agricultural crops of imported breeding, such as sugar beet, sunflower, corn, and vegetables [4]. In the Krasnodar region, the share of imported seed material in the crop structure of these crops varies from 60–99% (Figure 1).

![Pie charts showing the structure of crops](image)

**Figure 1.** The structure of crops of agricultural crops seeds of domestic and import selection in the Krasnodar region.

This negative trend is characteristic of all agrarian regions of our country. Russia has acquired and continues to retain the status of one of the largest importers of seeds with an annual volume of imports of this type of product worth hundreds of millions of dollars. It is important to note that the share of seeding of non-conforming seeds in agricultural organizations and farms in Russia reaches 30%, which in turn leads to a significant decrease in yield and, consequently, profitability of crop production.

To solve this important problem, it is necessary to form and develop a highly efficient regional system of breeding and seed production, ensuring short terms of variety change and variety renewal on the basis of domestic varieties and hybrids of agricultural crops adapted to the soil and climatic conditions of the crop area, which would increase crop yields, lower unit production costs, and increase the competitiveness of the final products of the subindustry in the domestic and foreign markets.

When developing strategies and programs for the development of domestic plant breeding and seed production in the region, it is necessary to take into account the positive foreign experience of organizing large seed breeding companies with a single complete production cycle, including breeding and seed farming, the preparation and sale of final seed products to the market with active use of various marketing techniques of sales.

For Russia, the problem of reducing acreage, which occurred in the post-reform period, is acute. Thus, in the last decade, about 35–40 million hectares of arable land was not used in Russia, which is a large reserve for the growth of production and sales of products, the implementation of the Strategy of Import Substitution of Agricultural Raw Materials and Food in the Country. This requires improving the system of state regulation of land relations, aimed at restoring and subsequent involvement of unused agricultural lands into economic circulation. At the same time, the level of involvement of arable land in the Krasnodar region in economic circulation was almost 100%, and this excludes simple extensive directions for increasing the efficiency of use of land resources in agricultural production.

In the Krasnodar region, as in other agricultural regions of the country, the state of agricultural land continues to deteriorate. This is due to violations of scientifically based recommendations in the development of field crop rotations in most agricultural organizations in the region and the unjustifiably low level of mineral and organic fertilizers, which are significantly lagging behind the removal of nutrients from the soil along with the harvest. An analysis of the existing structure of field crop rotations in the region showed that the share of areas occupied under perennial and annual herbs, which are the most important source of nutrients to the soil, averages only 6.5–7.0% at recommended
values reaching 20%. The solution of this major problem in the region is hampered by the underdevelopment of livestock, which is the main consumer of green and roughage. An important reason for the deterioration of land in Russia and the Krasnodar region is the low level of mineral and organic fertilizer application, which is 4–5 times lower than in the economically developed countries of the West. At the same time, the relatively low level of chemicalization of domestic crop production creates some competitive advantages in organizing the production of organic agricultural products with markedly higher selling prices, which should also be taken into account in strategic planning for the development of the industry.

Improving the processes of specialization and location of production in agriculture is closely connected with the increase in the efficiency of land use. In recent years, there has been a noticeable deepening of the specialization of agricultural organizations in crop production in the Krasnodar region, which has a higher profitability than animal husbandry. This significantly hinders the growth of the livestock of agricultural animals and the volume of meat and milk production in the region. At the same time, the developed animal husbandry should provide not only the population with high-quality domestic animal production, but also the plant industry with valuable organic fertilizers, which contributes to the preservation and improvement of soil fertility in the region. For this, it is necessary to ensure the speedy increase in cattle population of highly productive dairy and meat breeds with a wide use of innovative technologies of reproduction, rearing and final fattening of animals with placement of livestock production facilities in the zones of the region with the most favorable soil and climatic conditions for them.

The existing level of technical and technological development of individual subsectors of domestic livestock is significantly different, while the subsectors of meat and dairy cattle breeding are least developed.

One of the most important factors in improving the efficiency of the livestock industry is the species composition of livestock and poultry. Realization of the high genetic potential of animal productivity allows to ensure high quality, low cost and high competitiveness of the industry’s products [1, 2].

Recently, more than 90% of the volume of increase in live weight of cattle in the Krasnodar region has been produced on the basis of fattening of dairy animals. At the same time, in most of the organizations surveyed in the region, cattle meat production was unprofitable. The experience of countries with developed livestock and individual domestic agricultural organizations in various regions of Russia proves the economic efficiency of the transition in the production of cattle meat to innovative technologies of specialized meat cattle breeding, which are based on the formation, reproduction, growing and feeding of cattle of elite meat breeds with a higher genetic potential meat productivity and quality.

In the dairy cattle breeding of the Krasnodar region, the priority areas for the development of the subsector are also the improvement of the pedigree composition of the dairy herd with an increase in the proportion of elite high-yield dairy cows and the use of innovative artificial insemination of animals, seeding by sex, increasing the productive longevity of using cows, automating and robotizing production processes in the sub-sector.

The growth of labor productivity in dairy cattle breeding can be achieved by increasing the proportion of using the system of animal free housing on dairy farms and complexes with the organization of milking cows in modern milking halls equipped with automated and robotic milking machines instead of traditional for domestic livestock milking technology in a stationary milk pipe [3].

It is important to note that over 90% of the Russian domestic market for technical means of mechanization, automation and robotization of production processes in animal husbandry today are represented by the products of foreign companies. Building the new and modernizing existing livestock farms and complexes and equipping them with expensive imported equipment require large capital investments and are associated with significant financial risks due to fluctuations in the national currency and the unstable economic situation in the country. To solve this problem, it is
necessary to restore in a short time and further advance the development of domestic agricultural engineering.

In the economically developed countries of the West, in the production of crop production, precision farming technologies based on the use of technical means of automation and robotization of production processes, as well as information technologies and databases, have become widespread.

In the domestic agro-industrial complex, the use of navigation equipment, course indicators, and thrusters for organizing parallel driving of agricultural equipment has also become quite widespread. The application of these innovative technologies in practice allows to increase the speed and performance of energy vehicles, the quality of mechanized field work and eliminate the possibility of skipping or re-processing of individual bands of soil when the equipment moves across the field, which in turn provides significant savings in all production resources and reduction of the final cost of production. It is important to note that this will also increase the intensity of work of each power machine through the organization of field work in the dark and, as a result, reduce the overall need for the quantitative composition of the machine and tractor fleet of the agricultural organization.

Modern technologies of precision farming allow fertilizers to be applied to the soil in various volumes, depending on the properties of the soil cover, crop yields of past years, weather conditions, etc., which increases crop yields and reduces the cost of fertilizers with a significant economic effect.

The boundary analysis of the extent to which the agricultural organizations of the Krasnodar region use their productive potential of vegetable growing has shown that the region still has significant reserves for its development. At the same time, the widespread introduction of drip irrigation technology and the organization of the on-farm product processing system are identified as priority areas for innovative improvement in the subsector.

To increase production and competitiveness of domestic fruit production in domestic and foreign markets, it is also necessary to update the technical, technological, and material base of the subindustry as soon as possible, including a significant increase in the share of intensive gardens with the transfer of producers to the drip irrigation system, the use of mechanized and robotic soil tillage technologies, and crowns of trees, harvesting and transporting fruits, improving the system of storage, processing and product sales.

An important direction to increase the efficiency of the Krasnodar region’s agricultural economy is the development of small agrarian forms of management (peasant (farm) enterprises, individual entrepreneurs, and households) with the restoration of the subsectors traditional for small-scale agriculture and the deepening of the processes of cooperation and integration.

Small agrarian forms of management make a significant contribution to crop production in the region (Figure 2).

![Figure 2](image.png)

**Figure 2.** Structure of crop and livestock production in the Krasnodar region.

So, in 2017, the share of peasant (farmer) farms in the total volume of crop production in the region was about 29%. In these farms, mainly wheat, corn, sugar beets, and sunflower are grown. It should be noted that in recent years, the subindustry of crop production in peasant (farmer) farms has been
improved, the level of technical and technological development and profitability of production activities has increased [9, 10].

A completely different situation is observed in the livestock industry of small agrarian forms of management. The share of peasant (farmer) farms in the regional production of the increase in live weight of livestock, poultry and milk is respectively only 2% and 8%. A significant part of the livestock of agricultural animals in the region is located in the household farms, providing about 30% of the industry’s production. At the same time, many innovative industry technologies are unavailable to them, which significantly hinders the increase in the efficiency of their business activities.

The current structure of agricultural production in peasant (farmer) farms in the region is primarily due to the significantly higher profitability of crop production compared to animal husbandry. At the same time, the development of animal husbandry in this category of farms is also necessary, which is explained not only by the need to increase the production of domestic meat and milk, but also objectively required improvement of the crop rotation system with the inclusion of fields occupied by perennial and annual grasses serving as a source of green fodder and hay for farm animals and poultry. To solve this problem, it is proposed to organize in peasant (farmer) farms the cultivation and fattening of small farm animals and poultry, such as rabbits, nutria, geese, ducks, etc.

In terms of the direction and size of state support for the agro-industrial complex, Russia is significantly inferior to the leading Western countries with developed agriculture. Therefore, it is necessary to improve the system of state regulation and support of the domestic agroeconomy in Russia, the priority areas of which should be a significant increase in the volume of direct state support for agricultural sub-sectors that are lagging behind in the implementation of the import substitution strategy, increasing the volume of financing industry science and implementing other measures conducive to the development domestic cost-effective industry innovations that adapt to the zone conditions of production. The completed studies have shown that the most effective direction of direct state support for the region’s agro-economy is subsidizing a part of interest rates on investment loans, attracted to update and replenish the fixed assets of agricultural producers.

At the same time, at present, the funds allocated from the state and regional budgets for state support of Russian agriculture are clearly not enough. Under these conditions, it will be extremely difficult to ensure faster growth rates of investments in the modernization of the technical and technological base of the subsector, to activate scientific research, and to implement an import substitution program in a timely manner.

3. Conclusion
The conducted research allows to draw the following conclusions.

1. Currently, the development of domestic agriculture is carried out mainly on the basis of introducing foreign technologies and equipment into the production that are innovative, as a rule, only for our country. For the transition to the advanced rates of development of agroeconomics on the basis of its own world-class scientific products, it is necessary to restore the competitive sectors of fundamental and applied industrial science, with deepening its integration processes with higher agricultural and economic education, production, and capital due to a multiple increase in the volume of its state financing, professional wage prestige of a scientist, as well as improving the mechanism of commercialization and dissemination of the obtained scientific results.

2. An important direction to ensure food security and independence of the country is the implementation of the program focusing on import substitution in the markets of seeds of sugar beet, sunflower, corn, and vegetables with a critically high share of imported products. Large investments are needed in the creation of new high-yielding varieties and hybrids of these crops of domestic breeding, adapted to the soil and natural-climatic conditions of the region, to form and develop a highly efficient seed production system, which ensures short terms of variety change and variety renewal on the basis of the cultivated varieties and hybrids.
of agricultural crops, the organization of large seed breeding complexes with a full production

cycle.

3. In the Krasnodar region, fertility of agricultural lands continues to decline, which is happening
mainly due to violations of scientifically based recommendations in the development of field
crop rotations in most agricultural organizations in the region and the unreasonably low level
of mineral and organic fertilizer application. This is noticeably lagging behind the removal of
nutrients from the soil along with the harvest. This problem in the region cannot be solved
without the speedy development of animal husbandry, which is not only a source of valuable
organic fertilizers but also the main consumer of green fodder and hay of perennial and annual
grasses, which share in the region’s current crop structure is significantly lower than
recommended.

4. In the livestock sector of the Krasnodar region, the least developed sub-sectors of dairy and
beef cattle breeding require immediate improvement. It is necessary to transfer agricultural
producers in the production of cattle live weight gain to raising and feeding animals of
specialized meat breeds that have advantages over dairy breed gobbies in terms of productivity
and taste of meat. Improving the efficiency of dairy cattle breeding should also be carried out
by improving the pedigree composition of dairy herds with an increase in the proportion of
high-yield dairy cows, using innovative technology of artificial insemination divided by sex,
atomation, and robotization of production.

5. Crop production in the region also needs to be improved. It is necessary to ensure an increase
in the level of technical and technological development of the industry, including the use of
elements of precision farming technology based on information technology, electronics, and
robotics. The development of horticulture, viticulture, and vegetable production should
include an increase in the areas of orchards, vineyards, and greenhouses, the mechanization
and automation of production processes, the improvement of the varietal composition, the
development of a system for storing and processing products, etc.

6. It is necessary to strengthen the system of state support for the domestic agroeconomy, the
priority areas of which should be the growth in the volume of direct state support for
agricultural subsectors lagging behind in implementing the import substitution strategy, a
significant increase in the financing of sectoral science, and other measures that contribute to
the development of domestic cost-effective sectoral innovations adapted to zone conditions.
Currently, the most effective direction of direct state support for the region’s agroeconomic is
to subsidize part of the interest rates on investment loans raised for renewal and replenishment
of fixed assets of agricultural producers.

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