

The agricultural sector of the Russian economy and innovative technologies: evolution, problems and directions of development

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Abstract. The article examines the processes of development of agricultural production in modern Russia. It is noted that the problems of rural development and agricultural sectors became especially acute with the beginning of the processes of market transformation of the country's economy in the 1990s of the 20th century. A significant decline in production volumes in this sector of the economy during the period under review was primarily reflected in a sharp decline in wages and employment in the agricultural sectors. Many workers of agricultural enterprises were forced to move to personal subsidiary plots. As the authors point out, the agricultural policy of those years was actually aimed at maintaining large forms of production in this area, to the detriment of the interests of small companies. In practice, large agricultural producers received funds from the federal budget for the development of the industry. It is noted that the unfavorable ecological situation in the landscapes of various natural zones of the Russian Federation is a consequence of the intensive use of land resources without complying with the necessary environmental requirements. Digital technologies in the agricultural sector of the country's economy are used only in individual farms, which indicates an "island" type of informatization. The reasons for this phenomenon are that software developers for the needs of the agro-industrial complex do not have the necessary database for the creation and operation of specific production technologies.

1 Introduction

According to scientists' forecasts, by 2050 more than 9 billion people may live on planet Earth, and in this regard, the problems of ensuring food security are becoming the most important tasks of humanity that require immediate solutions today.

Modern society is usually considered as "post-industrial", "information", etc., at the same time, providing the population with necessary food products is a necessary condition for its life. In turn, to successfully solve the problem of food supply for people, effectively developing agricultural production is required. Therefore, the agricultural sector is one of the most important components of the national economy, which largely determines the level of socio-economic development of society.

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Agricultural production, therefore, plays an important role in meeting the country's needs for both raw materials and various food products. Today, the problem of producing environmentally friendly products, providing the country's population with safe food, has become particularly relevant, thereby preventing many diseases caused by the consumption of low-quality food products.

2 Research Methodology

According to Belousov R., there are six basic reasons on the basis of which the process of voluntary integration proceeds to one degree or another, among which we can note the presence of common economic interests. In most cases, integration is built by combining several factors simultaneously.

As Emelyanov A. notes, in the sphere of production and sale of agricultural products one can observe the activity of many pre-market or archaic commodity forms of economic relations.

Kozlov M. in his work points out the great importance that is attached, when implementing the main development indicators, to choosing an option for assessing state support, built in accordance with the principles that ensure its reliability and effectiveness.

Kashepov A. notes that unemployment leads to an exacerbation of social problems and social tension, causing mental trauma to a person, accompanied by severe stress.

Basalaeva E. notes the importance of forming a clear agricultural policy, which will present the results of an analysis of the state of agricultural sectors, long-term tasks, and also discuss ways to solve them.

Uzun V. believes that in agriculture the most efficient is large-scale production in the form of agricultural holdings or independently operating large enterprises, which can use new equipment with great success and actively apply resource-saving technologies in production.

Glazyev S.Yu., Kara-Murza S.G. and Batchikov S.A. note that as a result of the crisis in agricultural production and the reduction in its production, the Russian economy has lost a large amount of free natural resources, which have to be paid for when importing food products.

According to Volkonsky V.A., the solution to the problem of the revival of Russia must be sought in the restoration of its spiritual and ideological unity.

Bogdanovsky V. believes that the institutional reforms of the 90s of the 20th century in Russia led to significant changes in both the structure and level of employment of rural residents of the country, and the landscape of agricultural employment itself has changed dramatically.

Malyuk L.I., Ignatov V.S. and Pavlov A.Yu. note that the development of non-agricultural areas of employment should be considered as an effective means of increasing the viability of rural areas.

According to K.M. Petrov, a prerequisite for the process of sustainable development is the formation of a new worldview and environmental ethics.

According to Abrashkin E.D. etc., the modern agro-industrial complex needs new forms in the development of inter-organizational cooperation, the development of new targeted strategies for planning the development of the agricultural sector and the entire agri-food market.

Zelenskaya T.G. and others believe that due to a significant increase in the negative anthropogenic impact on the environment, it is necessary to robotize production, switch to digital technologies, and reduce the volume of hydrocarbon raw materials used in various sectors of the economy.

During this scientific research, various scientific methods were used, among which are statistical and comparative analysis, and functional analysis. The scientific research was carried out in accordance with such principles as the principle of scientific objectivity, the problem-chronological principle, and the principle of consistency.

3 Results and Discussions

For Russia, particularly severe consequences of market reforms of the 90s of the 20th century were observed in the agricultural sectors. Thus, if this sector of the country's economy accounted for 8.3 million people employed in 1990, then by 1995 their number decreased to 6.7 million, in 2000 - to 4.7 million people, and by the beginning of 2006 it reached only 2.5 million [1, p. 10] The number of sown areas from 1990 to 2005 decreased from 112.1 million hectares to 51.4 million hectares, i.e. more than 2 times; over the same years, the number of cattle decreased by almost 4 times - from 45.3 to 10.9 million heads. [1, p. 10]

If the level of average wages for workers in the country's agricultural sector in 1990 reached 95% of the same indicator for the economy as a whole and 93% compared to the indicator in industrial sectors, then already in 2003 it was approximately 40% and 30%, respectively. [2, p. 125] The decrease in wages and employment in the country's agricultural sectors was due to a significant drop in production volumes in this sector of the economy, sown areas, grain harvests, and a reduction in the number of livestock.

Since the beginning of 2000, the employment rate in the agricultural sectors of the Russian economy began to grow, so from 2000 to 2001 it grew by 46.6% and by 35.4% by 2002 relative to 2001. [3, p. 145] The share of those employed in rural production in 2004 accounted for 10.3% of all employees in the country's economy [4, p. 65], while the level of average wages of these workers compared to the same indicator for urban residents was only 43%. [5, p. 47]

In the years under review, many workers in agricultural enterprises were forced to switch to personal subsidiary plots due to the above-mentioned processes of a significant drop in wages in agricultural production sectors, which today are not distinguished by their high level. In 2002, the number of people working in commercial agricultural production in households was 3 million people, which was comparable to the number of people employed in large and medium-sized agricultural firms, but still more workers were in non-commercial households. [6, p. 112] In total, there were about 10 million people employed in agricultural households on an average annual basis. Consequently, the total number of workers in households reached approximately 13.3 million people, which was more than three times the same figure for other types of production combined. [6, p. 115]

Also, during the years of market reforms in Russia, one could observe the process of fragmentation and changes in the organizational forms of the overwhelming majority of state farms and collective farms, which were among the large enterprises of rural production. [7, p. 56] With the beginning of the reforms, retail prices for such important products as meat and milk increased by approximately 4 times relative to the prices paid to rural residents by meat processing plants, dairies, and various intermediaries. [8, p. 69]

Although the process of reforming the agricultural sector at the beginning of its implementation was supposed to take place, according to the development programs of the country's agro-industrial complex (AIC), on the basis of a policy of diversification of the agricultural sector and providing all forms of farms with equal production conditions, but for many years, except for declarations, these conditions were not met. In fact, the country's agricultural policy helped large forms of production, while infringing on the interests of small companies in this sector of the economy. In practice, federal budget funds, such as

subsidies and compensation, were spent on the development of large agricultural producers. [6, p. 118]

It should be noted that personal subsidiary plots did not play such a significant role in compensating for low wages in the agricultural sector of production, which confirms the continuous growing gap in the living standards of rural and urban residents of the country, which in terms of available resources in 1999 compared to 2003 increased from 30% to 37%. [9, p. 76] After 1999, every year on average in the field of education and health care, real wages began to grow by 12% compared to 1991, and in agricultural production - by only 4%. [9, p. 77]

We also note that the low level of income received by workers in the agricultural sector had a negative impact on the professional composition. This is confirmed by the fact that by the beginning of 2003, 16.9 thousand out of 86 thousand people who graduated from full-time agricultural universities, technical schools and colleges in 2002 began working on farms, while there were about 30 thousand vacancies, i.e. . approximately every fifth, and only 18% worked in their specialty. [9, p. 78]

The current situation in rural areas in the field of employment in agricultural production, as well as the higher unemployment among rural residents compared to urban residents, pushed the state to take decisive measures that would lead to an increase in wages in the agricultural sector, an increase in the professionalism of those employed sector of the economy, expansion, including non-agricultural, rational forms of employment for residents of rural areas of the country. To solve these problems, it was necessary to develop both federal and local programs for the development of various types of non-agricultural employment in rural areas, which required large expenses for their implementation, as well as the use of preferential taxation for lending to producers and other effective means to stimulate rural economic activity.

It should be noted that in rural areas on a global scale there is an increase in non-agricultural production. Thus, about 40-45% of the income of the population of Central and Eastern Europe living in rural areas came from non-agricultural sources. [10, p. 14] The volume of non-agricultural income received by farmers in countries belonging to the Organization for Economic Cooperation and Development began to exceed income received from purely agricultural activities. [10, p. 14] Today, the existing demand in the labor market in rural areas is influenced not only by employment in agricultural sectors, but also by employment not related to agricultural production. [10, p. 14]

With the observed general degradation of rural areas in the Russian Federation, workers in the agricultural sector have become unemployed due to lack of demand in the labor market, and in this case, the development of non-agricultural activities and the growth of employment in it, which in scientific research literature are considered as an alternative activity.

It is worth noting that despite the efforts of Russian government agencies pursuing the goal of developing rural areas, the most important problem remains the lack of labor for rural areas. And currently, there is a massive migration to the cities of the most able-bodied and literate part of the rural population, mainly young people from 18 to 35 years old; only less than 10% of people who are graduates of agricultural educational institutions in the country remain to work in the countryside. [10, p. 15] Identification of the reasons for this process during the survey, the low quality of housing and often its absence are noted, also one of the main reasons is that many workers do not recognize rural work as suitable for themselves. [10, p. 15]

The current unfavorable environmental situation in the landscapes of various natural zones of the Russian Federation is a consequence of the intensive use of land resources without complying with the necessary environmental requirements. On the territory of the country there are approximately 6 million hectares of irrigated land (lower Don, Volga

region, North Caucasus), and more than 5 million hectares of land are drained. In most of these territories, processes of secondary salinization, soil drying, and waterlogging are observed, indicating their unsatisfactory condition. When carrying out various mining, geological exploration and engineering and construction works, significant areas of fertile land are lost. The existing omissions in agricultural technology were the result of the accumulation of various types of toxic substances in the soil, exceeding in some places tens of times the maximum level. Losses of fertilizers during their transportation and storage, when only 30–40% of fertilizers go to plants, and the rest goes into the environment, accordingly, polluting it, further complicate the current situation. [11, p. 224]

In Russia, the volume of agricultural water intake reaches 40 km³/year, 32 km³/year of which is for irrigation. Return water is up to 40%, part of which is classified as polluted wastewater, such as, for example, from rice fields. The discharge of household wastewater into open reservoirs without purification has in some cases caused chemical and bacterial contamination. The absence of a centralized water supply system in many areas of the country, when 60% of rural residents take water from open reservoirs for drinking, increases the observed environmental violations. [11, p. 225]

The concept of agriculture within the framework of “Agriculture 4.0” provides for the use of new approaches in organizing management in the agricultural sector. These changes provide for the automation and digitalization of business processes, which will provide agricultural producers with the opportunity to optimize their land, equipment, resources and materials in accordance with conventional subzones.

The use of digital technologies in agricultural sectors leads to increased labor productivity and production profitability. Thus, in Israel, which is actively introducing digital technologies in the agricultural sector, the level of food security of the population reaches 95%, and this in a country where only 20% of the available land is suitable for agricultural activity. Using the opportunities provided by these technologies makes it possible to compensate for the lack of favorable natural and climatic conditions for agricultural production.

One can also note the increase in the efficiency of this production with the introduction of digital technologies in the form of “smart” farms. In this case, one can observe an average increase of 30–40% in milk production, a 20% reduction in fuel costs when using modern methods of transport management. [12, p. 460]

It should be noted that in Russia the use of digital technologies does not occur everywhere, but only in individual farms, which indicates an “island” type of informatization. The reasons for this phenomenon are that software developers for the needs of the agro-industrial complex do not have the necessary database on the formation and functioning of specific production technologies.

The Digital Agriculture project, supervised by the Ministry of Agriculture, began to be implemented in Russia in 2019. This program provides for the following directions for intensifying the country’s agro-industrial complex:

- “Effective hectare”, which is a unified database of land with characteristics of the current state of the site and features of its operation.

- “Smart contracts” - providing for the formation of a network of personal accounts on electronic resources, providing the opportunity to apply for government subsidies to manufacturers.

- “From field to port” - this program is aimed at creating effective export models of domestic products, based on forecasts of plant yields and the planned loading of vehicles.

- “Agricultural solutions for business” - the project is aimed at intensifying the process of introducing innovative developments in agricultural production.

- “Land of Knowledge” - provides for the creation of a unified base with educational materials and the construction, based on the needs of the modern agricultural sector, of an appropriate system for training specialists.

The most important areas for the use of “green” technologies for agricultural production in Russia include:

- Restoration of soil fertility, which is the main wealth and basis for ensuring the economic and food security of the country. The replacement technologies used today with the massive application of various fertilizers, pesticides and other agrochemicals of artificial origin into the soil have a harmful effect not only on soil biogeocenoses, but also on end consumers, and above all on people. When using these means, after a temporary effect in the form of an increase in plant productivity, soil degradation and a decrease in the natural potential for the revival of fertility are noted. Due to the high cost, preparations containing microflora with a wide spectrum of action such as Baikal-EM-1, Tamir and others, developed to restore soil fertility, are not widely used in production;

- Processes of pollution of the environment by waste from agricultural production of plant and animal origin, taking into account the fact that these types of waste can be the most valuable raw materials during their appropriate processing;

- In the context of import substitution in the country, there is a need to significantly reduce the cost of meat and dairy products with an increase in its production volumes. Given the continental climate of Russia, livestock farming technologies based on stall housing require high costs for heating livestock complexes. Specialized feed is also needed to achieve rapid weight gain in animals, which ultimately increases the cost of production in this area.

Today, in world practice, technologies are used that make it possible not only to solve the above problems, but also to obtain significant benefits from their use. These include vermiremediation, vermicomposting and others, using earthworms and various insects as the basis for the production process. [13, p. 34] Vermicompost created by worms from biomass of both plant and animal origin is a high-quality organic fertilizer that leads to increased productivity and restoration of soil fertility. Vermiremediation, in which earthworms are used to restore organically and chemically contaminated soils, is considered an effective and environmentally friendly technology. [13, p. 35] In this case, providing aeration, loosening the substrate, releasing biologically active substances and promoting the effective work of microorganisms as a result of their vital activity, earthworms can be considered as the optimal option. This symbiosis is aimed at the survival of both species, leading to the restoration of biocenoses with a fairly stable species composition and resistant to various types of soil pollutants. Also, worms and certain types of insects, due to the fact that they contain significantly more easily digestible protein than is found in the meat of cattle, pigs and poultry, can be excellent raw materials for processing into feed and feed additives. Locusts, moreover, contain valuable chitin. At the same time, the production of vermicompost and biomass from worms and insects does not require expensive equipment and high costs. What makes this business highly profitable and long-term stable is the availability of large volumes of raw materials and high market demand.

4 Conclusions

The greatest return from both labor and other resources in rural areas is possible in rural industrial-type enterprises, thereby making it possible to consider the creation of such structures as an important area for increasing employment and wages for rural residents. Such structures can be both small and medium-sized industries that are engaged in various industries; processing of agricultural products, their transportation and storage; associated with the recreational sector and the construction of various facilities; develop rural tourism,

etc. In the conditions of interaction of agricultural processes with industrial processes, there is a multiple increase in production efficiency, and throughout the year, unevenness in the use of labor of agricultural workers is smoothed out due to a more rational use of all types of resources involved in production. It is also important, in order to develop the country's rural areas, to improve the legislative framework in the field of preferential lending and financing of rural industrial companies; budgets at the local and regional levels should be formed based on the necessary amounts of funds to provide the required support.

The socio-economic development of society by preserving and increasing material wealth without damaging the environment requires the formation of a new economic paradigm. This paradigm should be based on the widespread use of environmental technologies, and primarily biotechnologies, based on the laws of nature and using the full potential of biological adaptation and transformation.

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