Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development
Vol. 24, Issue 3, 2024
PRINT ISSN 2284-7995, E-ISSN 2285-3952

IMPLEMENTATION OF SUBPROGRAMS OF THE FEDERAL SCIENTIFIC AND TECHNICAL PROGRAM FOR THE 2030 DEVELOPMENT OF AGRICULTURAL ECONOMY IN RUSSIA

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Abstract

Increasing the efficiency of agricultural production and the need to ensure the technological sovereignty of the country in the current geopolitical conditions is of particular relevance. The purpose of the work is to study the impact of the implementation of subprograms of the Federal Scientific and Technical Program for the Development of Agriculture for 2017–2030 on technological changes in agricultural production of individual subsectors. As a result of the analysis of the effectiveness of the implementation of the subprograms of the Federal Scientific and Technical Progress of Russia for 2018-2022, trends in significant positive scientific and technological achievements in the production of sugar beets, potatoes, beef cattle breeding and feed production were identified. expansion of the domestic research base in the field of genetics, biotechnology, selection and breeding. Promising directions for the development of agricultural sectors for the long term have been developed, taking into account the implementation of the FNTP for the development of Russian agriculture. Various business models have been substantiated and mechanisms for stimulating the introduction of technologies have been created, taking into account the specific features of innovation processes in various industries.

Key words**:** *state support, FNTP, agriculture, neo-industrial development, indicators, subprograms, industry regulation, efficiency*

INTRODUCTION

Scientific and technological development of the Russian agro-industrial complex using innovative solutions and developments of domestic science are the most important conditions for achieving technological independence [24, 25]. In Russian agricultural production, digital technologies, artificial intelligence and big data processing systems are widely used, and innovative projects are being implemented in the field of precision farming and smart agriculture. In the mechanical engineering industry for the food and processing industries, the share of domestic machinery and equipment increased from 12% in 2014 to 49% in 2021. Exports of mechanical engineering products for the food industry in 2018-2021 increase annually by an average of 10%. New models of tractors and combines have built-in systems for monitoring and forecasting the condition of farmland. Innovative technologies for cultivating potatoes, beets, and flax are being actively introduced [20].

The Federal Scientific and Technical Program for the Development of Agriculture (FSTP) is the leading instrument of state support for Russian agriculture. With the help of this program, the Doctrine of Food Security is being implemented. Combining the financial resources of the state and business based on co-financing of specific projects with active interaction with scientific organizations will make it possible to successfully solve the problems of the Federal Scientific and Technical Commission and significantly increase the innovation and investment potential of agricultural production. An effective mechanism for stimulating the creation or modernization of new industrial production is a special investment contract [5, 34].

The developed FSTP subprograms for specific areas of agricultural activity include activities for personnel training and scientific support. A special role in the development of agricultural production based on the introduction of effective innovative solutions is assigned to domestic science.

Research and production cooperation has a significant role to play as an effective form of innovative entrepreneurship, aimed at creating high-tech products, introducing and disseminating the results of scientific and intellectual activity and innovative products [33].

Theoretical and methodological approaches to the development of agriculture in the conditions of neo-industrialization are associated with the convergence of information resources, biotechnologies, nanotechnologies, as well as modern transport and logistics systems [27].

So, T.C. Devezas substantiated the evolutionary theory of technological change, the followers of which are scientists from the world scientific community. The issue of recognizing universal Darwinism as a theoretical basis for the analysis and evolutionary programming of technological transformations of socio-economic systems continues to remain controversial. In particular, the diffusion of technologies is proposed to be considered as a natural law, reflecting the constant transformation of innovative technologies, products and markets. The proposed scientific paradigm of biosocioeconomics is based on the convergence of various scientific fields, for example, information and molecular technologies [6].

A significant number of foreign publications are focused on the problem of studying the conditions for the introduction of digital technologies and innovations in agribusiness [2, 15].

Technological innovations of agricultural enterprises are considered as the most important prerequisite for the dynamic development of China's agricultural sector [36], and the industrialization process has a multiplying effect in the development and implementation of fundamentally new technologies [18, 23].

The theory of endogenous growth identifies technological innovation as the most important factor in the formation of competitive advantages [38,39].

The positive role of state support in enhancing innovation activity and creating a favorable innovation and investment image of agricultural enterprises to attract new stakeholders has been reflected in a number of studies by Chinese scientists [40, 41, 42].

In development of this topic, Li, L., Gao, Y., & Wang made relevant conclusions based on the results of a study of the totality of agricultural enterprises in China in 2007-2021. The impact of government support for technological innovation is greater for state-owned agricultural enterprises than for private businesses [35]. The multiplier effect of subsidies is more typical for agricultural business organizations than for manufacturing enterprises. The authors' recommendations for Chinese agriculture boil down to adhering to the principle of targeting and supporting specific projects or individual enterprises; flexibility of economic policy in order to strengthen the innovative susceptibility of agricultural enterprises [16].

Taking into account the above, the assessment of technological transformations of agricultural production in Russia is characterized by high practical significance, since the scientific and technological support activities for the declared projects implemented within the framework of the Federal Scientific and Technical Commission characterize the qualitative level of economic policy and can be changed in accordance with the objectives of innovative development.

The purpose of the work is to study the impact of the implementation of subprograms of the Federal Scientific and Technical Program for the Development of Agriculture for 2017–2030 on technological changes in agricultural production of individual subsectors.

MATERIALS AND METHODS

The methodological basis of the study is regulatory documents, acts and resolutions in

the field of agricultural development, as well as documents in the field of development of innovations and investments at the federal and regional levels, information from the Ministry of Agriculture of the Russian Federation and Rosstat on the results of production activities of agricultural sectors.

Based on the use of information data from such subprograms as the production of sugar beets, potatoes, beef cattle breeding and feed production, an analysis of the effectiveness of these subprograms was carried out, directions and mechanisms for stimulating the introduction of innovations in the agricultural sector were determined.

RESULTS AND DISCUSSIONS

Federal scientific and technical program for the development of agriculture for 2017-2030based on fundamental technological transformations and wider use of new domestic technologies. In addition to the program in 2018-2021. subprograms have been developed for specific types of activities with the aim of achieving technological sovereignty and strengthening food security, the validity of which has also been extended until 2030 [22].

In 2018, the subprogram "Development of selection and seed production of sugar beets in the Russian Federation" and the subprogram "Development of selection and seed production of potatoes in the Russian Federation" were adopted.

Table 1 presents the main indicators of the FSTP subprogram for sugar beets. According to the analysis, a paradox was revealed, despite the leading values in terms of sugar beet production in Russia, its yield indicators remain insufficiently high compared to other countries.

Table 1. Indicators of FSTP subprograms for potatoes and sugar beets (2025)

Name ofindicators	Potato	Sugarbeet
Level of innovative activity of breeding and seed production organizations, %	50	25
Investments in selection and seed production, billion rubles.	8.1	2.4
Level of provision of breeding and seed production organizations with innovative infrastructure facilities, %	25	40
Number of new domestic hybrids (varieties) used in production	12	8
The share of seeds produced within the framework of domestic breeding subprograms,%	25	20

Source: Own calculations based on the data from [28,30].

The results of the implementation of the subprogram "Development of selection and seed production of sugar beets in the Russian Federation" show the positive effect of the contribution of the development of scientific support to the results of production activities.

13 new technologies were developed for selection, seed production, storage and processing of sugar beets, and over 30 new sugar beet hybrids were created. Import substitution of selection achievements was actively carried out: the share of produced seeds of domestically selected hybrids in the total volume of domestic consumption exceeded 8%; the share of organizations using domestically selected sugar beet hybrid seeds was 17 % [30].

The sugar beet subprogram is being implemented in the Voronezh and Oryol regions, as well as the Krasnodar Territory. In 2023, the gross harvest of sugar beets in Russia increased by 8.6% compared to 2022; in Voronezh - by 10.5%; Orlovskaya - by 18.4percent. The increase in production volumes was achieved both due to the expansion of sown areas and as a result of increased yields through the creation of new sugar beet hybrids. According to the Ministry of Agriculture, the area sown with sugar beets in 2023 increased by 1.6% compared to the previous year and reached over 1,063 thousand hectares. In 2022-2023 the yield in Russia as a whole increased by 3.7% and amounted to 504.7 c/ha [3].

In the Progress agricultural company in the Krasnodar Territory, which uses domestic breeding achievements, the sugar beet yield is 780-800 c/ha [19].

According to experts, increasing the yield of the final product to 10-12 tons of sugar per hectare will require increasing the yield of sugar beets to 800-1,000 centners per hectare, which will allow reaching the level of Germany and France [11].

Fig. 1 reflects production and yield of sugar beet in Russia compared to other producing countries.

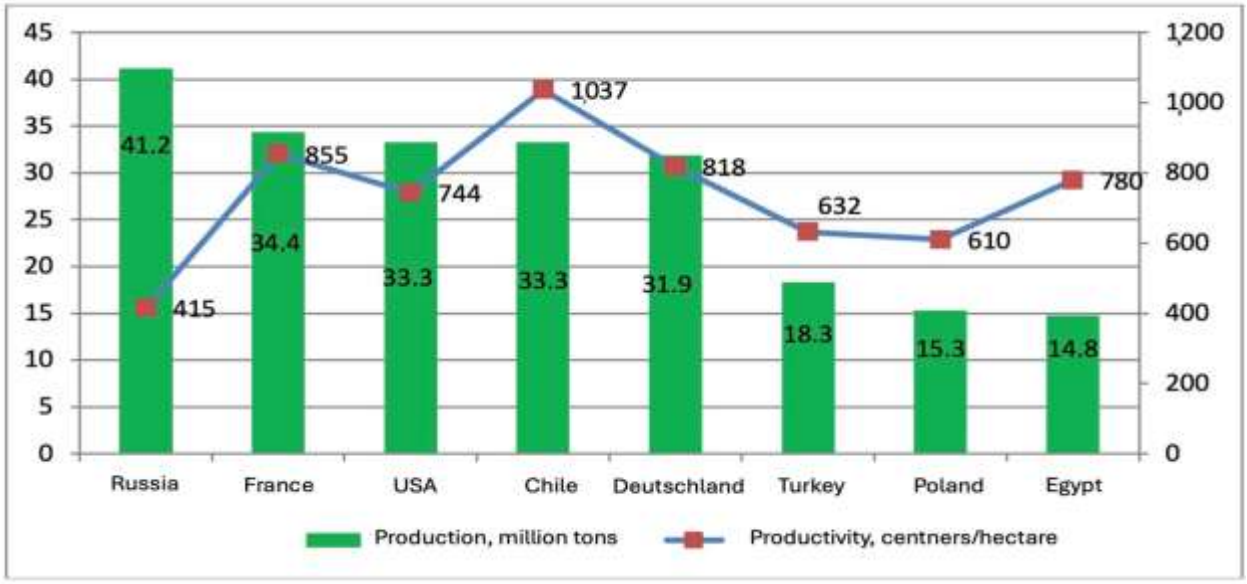

Fig. 1. Cross-country comparisons of sugar beet production and yield (2021)
Source: Own calculations based on data from [26].

The imposed sanctions restrictions have significantly complicated the import of necessary resources and the export of granulated beet pulp to the markets of European countries. It is necessary to build new terminals for the transportation of raw sugar and by-products of sugar beet processing.

Solving the problem of achieving technological sovereignty in the production of sugar from our own raw materials actualizes the task of further developments in the field of sugar beet breeding, since the supply of domestic seeds, according to experts, ranges from 1.8% to 3%. Positive results have already been achieved in the regions participating in the implementation of the subprogram. For example, in the Krasnodar Territory in 2024 it is planned to sow almost half of the sown areas with domestic seeds; in Voronezhskaya - about 16 percent of the allocated area.

Russian breeders receive government support in the form of financing and preferential lending. In 2024, the share of state subsidies for investments in the construction of selection and seed production centers will increase from 20% to 50%.

In order to stimulate demand for seeds produced during the implementation of the Federal Scientific and Technical Program, it is expected to reimburse from 50 to 70% of the costs of their purchase.

According to the expert opinion of agricultural scientists, to stimulate the introduction of innovation, grant support is needed for the creation of new varieties, placing a state order for the production of seeds, as well as subsidizing funds for the development of the material and technical base of agriculture, improving the institutional framework for protecting the rights of domestic breeders, state support at the stage of refinement, promotion, logistics and storage of seeds[12].

The Potatoes subprogram of the FNTP is aimed at increasing production volumes and creating new competitive varieties. Currently, comprehensive scientific and technical programs are being implemented in 19 Russian regions on the basis of scientific organizations at the regional and industry level, as well as selection and seed production centers.

As a result of the implementation of the subprogram, about 40 new potato varieties were created and over 36 thousand tons of elite seeds were obtained. As a result, the share of produced elite seed potatoes amounted to 18% of total domestic consumption [28].

In terms of production volumes, Russia is among the top five largest countries, although crop yields are 2-3 times lower compared to countries such as Belgium, Germany, Denmark, Spain, the Netherlands, and Norway. One of the objectives of the subprogram is to reduce the volume of imports of both food and seed potatoes. In 2018-2022 Imports of ware potatoes ranged from 300 thousand tons to 570 thousand tons [17].

In 2023, the gross potato harvest in farms of all categories was equal to 20.1 million tons, an increase of 6.6% compared to 2022. In certain regions of the FNTP subprogram, the growth rates of both production volumes and yields were significantly higher than all-Russian indicators (Fig. 2).

Important priorities for ensuring the country's food security are the creation of a domestic system for growing seed potatoes and technological re-equipment of the production process. In 2022, imports of seed potatoes decreased by 24.4% compared to 2018 [32].

The introduction of new competitive potato varieties will improve its taste and increase processing volumes. As a result of the subprogram, 5% of new varieties are dietary, and about 10% of the total number of created varieties is intended for processing [37].

There is positive experience in expanding the potato product chain based on the formation of mutually beneficial contractual relationships between production and processing. For example, the Tambov Farms company grows industrial potatoes intended for the production of chips. In 2023, investment projects for potato processing were implemented in the Lipetsk, Novosibirsk, and Oryol regions. Further development of processing will be determined by the availability of effective measures to support investors [17].

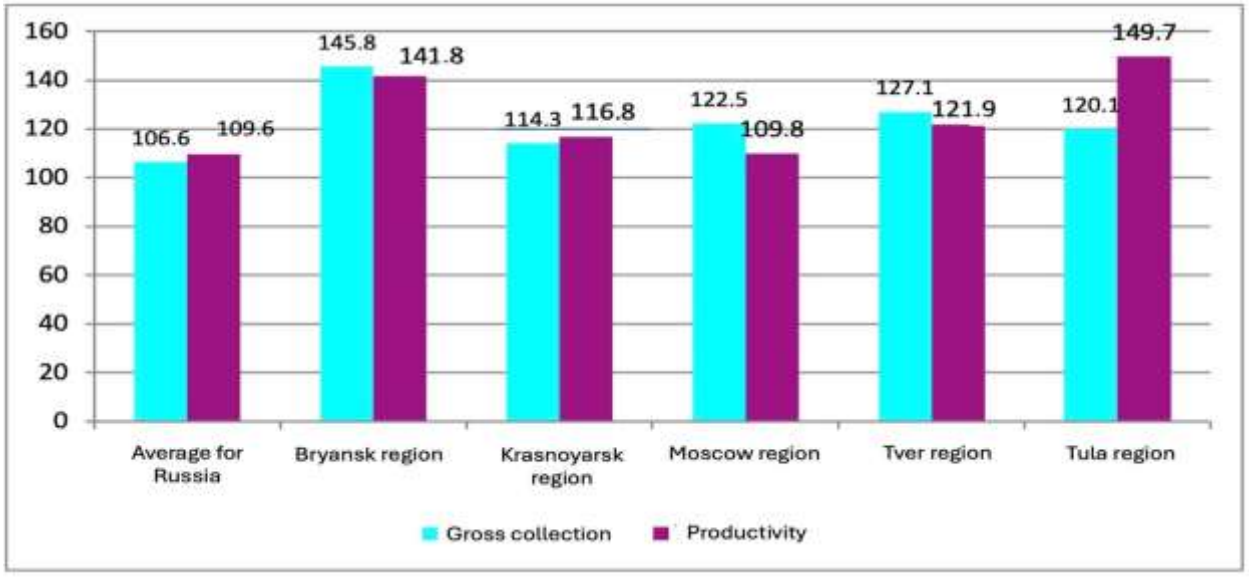

Fig. 2. Indices of physical volume of gross value added by economic sectors, %
Source: Own calculations based on the data from [3].

Foreign experience of European countries confirms the effectiveness of interfarmer cooperation in the production of seed and food potatoes [1].

The development of livestock farming is largely determined by the action of the subprograms of the Federal Scientific and Technical Commission for the development of meat and dairy cattle breeding, broiler poultry farming and feed production. According to official statistics for 2018-2022. the share of livestock breeding organizations carrying out technological innovations increased from 4.7% to 10.8%; the volume of newly introduced or

technologically improved innovative goods, works, and services has increased more than 4 times. Figure 3 shows the dynamics of newly introduced innovative products per head of various types of livestock.

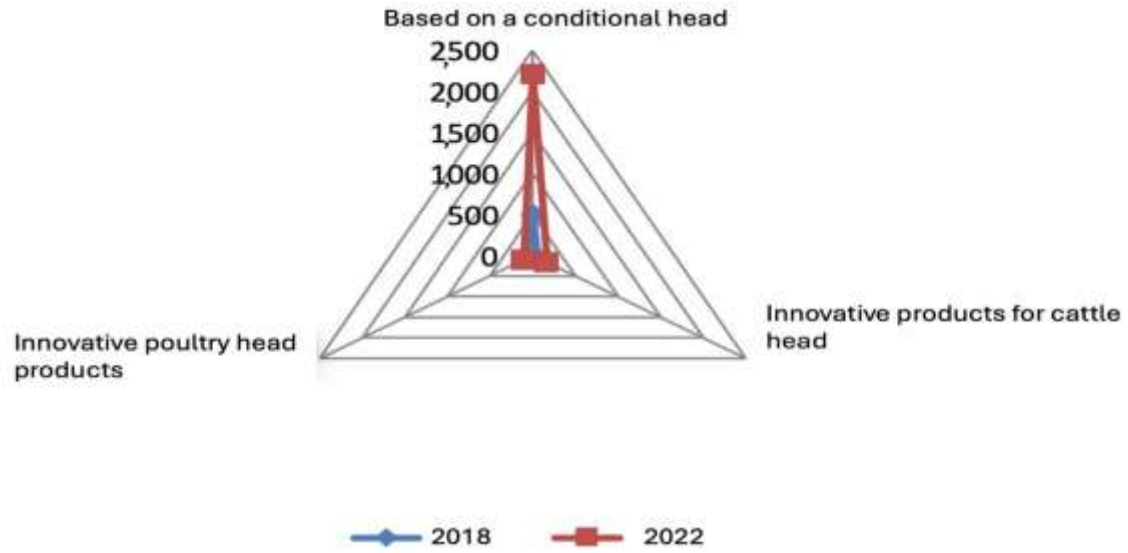

Fig. 3. Dynamics of newly introduced innovative products per head of various types of livestock, rub.
Source: Own calculations based on the data from [9].

In the livestock industry, the cost of introduced innovative products per head of livestock has increased more than 4 times over the past 5 years and amounted to 2,200 rubles, per head of cattle - 166 rubles, showing an increase of up to three times the size, per head of poultry the cost of production amounted to 103 rubles, there was an increase of about 20 percent.

The subprogram "Increasing the genetic potential of beef cattle" was included in the FNTP in 2021, within the framework of which 10 technologies will be created in the field of genetics, biotechnology, selection and breeding work for the development of the domestic breeding base of beef cattle.. The main financing tools are infrastructure development, subsidies, funding of scientific research. These measures are aimed at improving the structure of the livestock population and increasing the production and economic indicators of beef cattle breeding [31].

In the world market, more than half of the total beef production is provided by beef cattle. In terms of the share of beef cattle, countries such as Australia (more than 90%), Canada (over 80%), and the USA (about 80%) dominate. According to experts, the share of beef cattle in Russia is 15%, and the number of beef cows is estimated at 1.2 million heads. About 30% of beef is produced in the country's beef cattle industry, and over 400 thousand tons of beef are imported annually. To achieve self-sufficiency in beef, the cattle population for meat production must increase 2.5-3 times [13].

An important reserve for the development of beef cattle breeding in Russia is the presence of unused agricultural land. According to the National Meat Association, in 2020-2022. gross production of specialized meat and crossbred cattle for slaughter increased by 8% and reached almost 600 thousand tons in live weight. In the total production volume, the share of specialized meat and crossbred cattle for slaughter is more than 20%.The largest number of beef cattle is concentrated in the Bryansk and Oryol regions, the Republic of Kalmykia, the Republic of Buryatia, and the Trans-Baikal Territory. In 2022, the above-mentioned regions produced more than 40% of beef and crossbred cattle for slaughter. During the analyzed period, 78 facilities were built, reconstructed and modernized for almost 100 thousand cattle places and an additional 7.6 thousand tons of meat were produced [21].

The FSTP subprogram to improve the genetic potential of beef cattle is being implemented in

the Bryansk, Oryol, Tula, Moscow, Kaliningrad, Kaluga, and Smolensk regions.

State support includes such measures as reimbursement of part of the costs of beef cattle breeding, including breeding; preferential short-term and investment lending with an interest rate of up to 5%; reimbursement of part of the costs of producing cattle up to 2 years old, shipped to processing organizations. Promising forms of support include subsidizing farmers participating in the technological chain of forming breeding stock and raising young animals; The expansion of the forage base for beef cattle breeding predetermines the need for state subsidies for the costs of creating cultivated pastures, as well as the costs of purchasing forage harvesting machines. In Russia, the distribution of beef cattle throughout the country is characterized by its high concentration in large farms and dispersion in the small-scale sector. The main livestock of beef cattle is raised in the regions of the Southern, Central and Volga Federal Districts. More than 40% of beef cows are concentrated in the Miratorg agricultural holding; less than 200 enterprises raise from 500 to 1,000 heads; the rest of the livestock is kept in households and private farms. The Miratorg agricultural holding unites more than 100 farms, 3 feedlots and a slaughter and processing complex [8,13].

A study of models for organizing beef cattle breeding in Russia and a number of foreign countries showed significant differences both in growing technology and in business processes within the chain of creating the final product [4, 7, 10].

In North America, participants in the meat product chain include calf farms, industrial feedlots, livestock markets and auctions, and large meat processing plants. In Russia, on the contrary, the small-scale nature of production and processing predominates, the development zone is the industrial fattening system, and in some cases it is necessary to improve the specialized infrastructure. According to experts from the National Meat Association, the optimal business model is based on the formation of a farming cluster around a fattening enterprise with the mandatory inclusion of an integrator company that provides consulting assistance to farmers in obtaining grants and loans, as well as provides accounting and veterinary services. Similar clusters are organized in the Vladimir, Tomsk and Leningrad regions; A large project is currently being implemented in the Republic of Buryatia with the participation of 30 farms, a feedlot and a service center.

The functions of the created service center are to manage and control the activities of farmers supplying livestock for further fattening.

A similar model of cooperation with farms and other small agricultural business organizations can be implemented in the Miratorg agricultural holding [21].

The subprogram for the development of production of feed and feed additives for animals is aimed at strengthening the country's feed base and reducing import dependence by stimulating Russian developments and technologies.

According to the Ministry of Agriculture, the share of imported amino acids for feed production is 80%, enzyme preparations - over 70%; 70-90%, protein feed of animal origin - about 30%, microelements – 90% [14].

The first direction of the subprogram is focused on the development of feed production technologies, as well as the development of selection and seed production of feed crops.

The second direction is related to the development and implementation of technologies for the production of balanced feeds and their components, including microbial protein.

It is expected that feed digestibility will increase by at least 10%.

The third direction of the subprogram is related to the organization of production of enzymes, probiotics, and feed antibiotics necessary for increasing livestock productivity.

Certain projects can only be implemented by large enterprises-agricultural holdings, which should be taken into account when justifying their financial support.

By 2025 it is expected to increase the innovative activity of feed production organizations by 25%; develop 10 new improved competitive technologies for the production of feed and feed additives and 3 new technologies for balanced feed.

The implementation of the subprogramme's activities will increase the share of high-quality domestic roughage and succulent feed by 18 percentage points [29]. According to Rosstat, in 2022 the volume of feed production in Russia amounted to 34.2 million tons, an increase of more than 6% compared to 2021.
The production volume of premixes for cattle increased by 6.1%. Innovative transformations in the industry in 2018-2022 were empirically studied (Table 2). Thus, significant results of the implementation of the FSTP subprograms for agricultural development are presented. Increasing the efficiency and competitiveness of the domestic agricultural sector of the economy in modern geopolitical conditions is inextricably linked with the development of innovation and investment processes, digital support of agricultural production, harmonization of federal and regional scientific and technical policies and popularization of the results of the Federal Scientific and Technical Commission.

Table 2. Dynamics of indicators of innovative development of feed production

Innovation Profile Indicators	2018	2022	2022 to 2018
Share of innovative goods, works, services in the total volume of shipped goods, works, services, %			
Production of prepared feed for farmed animals	3.9	7.6	1.9
Production of feed microbiological protein, premixes, feed vitamins, antibiotics, amino acids and enzymes	7.2	31.0	4.3
Innovative goods, works, services, newly introduced or subjected to significant technological changes over the past three years, billion rubles.			
Production of prepared feed for farmed animals	12.6	26.7	2.1
Production of feed microbiological protein, premixes, feed vitamins, antibiotics, amino acids and enzymes	7.2	16.0	2.2
Innovative goods, works, services, newly introduced or subjected to significant technological changes over the past three years, per conventional head of livestock, rub.			
Innovativeready-madefeeds	366.7	917.5	2.5
Innovativefeedprotein	209.9	549.8	2.6

Source: Own calculations based on the data from [9].

CONCLUSIONS

The study analyzed the implementation of FSTP subprograms of Russian agriculture for 2018-2022 made it possible to state noticeable technological changes in the production of sugar beets, potatoes, beef cattle breeding and feed production. The scientific support of FSTP, supported by appropriate financial support from the state, resulted in the expansion of the domestic research base in the field of genetics, biotechnology, selection and breeding. This made it possible to significantly increase the production and economic indicators of the analyzed types of activities, strengthen the breeding base and improve the innovative profile of agricultural enterprises, which indicates an increase in the country's food security. A compilation of the theory and practice of technological shifts in agricultural production in foreign countries has confirmed the possibility of using various business models and mechanisms for stimulating the introduction of technologies. The work proposes to use a model of interfarmer cooperation to develop contractual relations between production and processing in the production of food and seed potatoes. Taking into account the predominantly small-scale nature of beef cattle breeding, a farming cluster with a fattening enterprise and an integrator company providing consulting and financial support, as well as veterinary services, was recognized as the optimal business model.
Improving mechanisms for stimulating the development and implementation of new technologies should develop in the direction of strengthening grant support for the development of individual varieties; placing government orders for seed production; subsidizing the costs of developing the material and technical base; improving the institutional framework for protecting the rights of domestic breeders.
The study proposes improving mechanisms for stimulating the development and implementation of new technologies based on the development of grant support for the

development of certain varieties, placing government orders for seed production, as well as the development of subsidiary support and the regulatory framework for the protection of intellectual property rights of Russian breeders. Global trends justify the need for government funding of interdisciplinary agricultural production projects based on the synthesis of information technologies, biotechnologies and (or) nanotechnologies to predict technological changes.

ACKNOWLEDGEMENTS

The reported study was funded by the Russian Science Foundation, project №23-18-00236 «Structural transformation of accumulation and consumption in order to neo-industrialize the agricultural sector of the Russian economy in modern geopolitical conditions».

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