

# Innovative development of cattle breeding: status, problems and prospects

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**Abstract.** At the present stage of economic development, the main factor that ensures the stability and competitiveness of agricultural production is the development of scientific and technological progress. Analysis of cattle breeding in Russia is the evidence of the need for comprehensive technological modernization of production, introduction of advanced scientific achievements in practical activity and the overall industry transition to innovative way of development. The key factors hindering the development of national cattle breeding on innovative basis are noted, in particular, the lack of own financial resources, the high cost of innovations and the low investment attractiveness of the agricultural sector. It is indicated that a new level of development of national cattle breeding is the widespread use of digital and information and communication technologies in the production process. The author substantiates the defining role of the state in activating innovative activities in cattle breeding and the importance of implementing direct and indirect measures of state support at all stages of innovative development of the industry. Due to the limited budget support, it is important to attract private capital to the industry and create the industry investment fund to finance innovative projects in the dairy and beef cattle breeding.

## 1. Introduction

In modern economic realities, innovative development of agricultural production is considered as a key condition for ensuring food security of the country and increasing the competitiveness of national agricultural producers. The innovative way of development of the agricultural sector of the Russian economy is a real opportunity to adapt to the global economy [1].

At the same time, despite the measures taken by the state to activate innovative activities in agriculture in our country, the level of use of advanced scientific achievements in the process of agricultural production in Russia is still significantly inferior to countries with a highly developed agricultural sector. The susceptibility of economic entities to technological and organizational innovations remains at a fairly low level, which does not allow for stable extended reproduction on an effective basis. This problem is particularly acute in the livestock industry, where there is a high dependence on imported supplies.

These circumstances actualize the importance of carrying out a comprehensive technical and technological modernization of cattle breeding, introduction of advanced scientific and technological progress into production and, in general, the transition of the industry to an innovative path of develop-



ment. At the same time, we understand the innovative development of cattle breeding as a continuous process of improving the production of milk and cattle meat based on the use of scientific achievements, advanced technologies, new machines and equipment in the process of economic activity in order to ensure sustainable growth of production, increase its efficiency and competitiveness.

## 2. Materials and methods

In the course of the research, an analysis and generalization of scientific works of scientists-economists devoted to the effective functioning and innovative development of dairy and beef cattle breeding in Russia, as well as the agricultural sector of the country's economy as a whole was carried out. The information base of the study was made up of data from the Federal State Statistics Service and the Ministry of Agriculture of Russia concerning the state of cattle breeding in Russia, innovation and investment activity of agricultural entities, in particular, organizations engaged in the breeding of dairy cattle and the production of raw milk, materials from periodicals. In the course of the work, traditional methods of economic research were used: monographic, abstract-logical, analysis and synthesis, expert assessments. Generally accepted methods of economic analysis were used for mathematical and statistical data processing.

## 3. Results

Cattle breeding is the most important branch of agriculture in the country, the state of which has a direct impact on national food security, as livestock products are included in the list of socially important food products. In addition, this industry provides permanent employment for the rural population, which contributes to the preservation of rural settlements.

The analysis of the current state of domestic cattle breeding shows a continuing decline in the number of cattle in the country – a decrease of 2.7% in 2015-2019, including cows – by 1.2%. At the same time, there was an increase in dairy productivity of cows from 4.1 tons in 2015 to 4.6 tons per cow per year in 2019, which contributed to an increase in milk production to 31.4 million tons in all categories of farms (+5.0% to 2015). At the same time, the volume of production of cattle meat in Russia over the past years had not changed much and was in the range of 2.7-2.8 million tons in live weight [2] (table 1).

**Table 1.** Production of livestock products in Russia in farms of all categories.

Indicators	Years								2019 to 2015, in %
	1990	2000	2010	2015	2016	2017	2018	2019	
Number of cattle, million heads	57.0	27.5	19.8	18.6	18.3	18.3	18.2	18.1	97.3
including cows	20.6	12.7	8.7	8.1	8.0	8.0	7.9	8.0	98.8
Milk yield per 1 cow per year, tons	2.7	2.5	3.8	4.1	4.2	4.4	4.5	4.6	112.2
Milk produced, million tons	55.7	32.3	31.5	29.9	29.8	30.2	30.6	31.4	105.0
Produced meat of cattle for slaughter in live weight, million tons	7.3	3.3	3.0	2.8	2.8	2.7	2.8	2.8	100.0

Source: data from the Federal State Statistics Service of Russia [2].

It should be noted that in recent years, national beef cattle breeding has been actively developing in Russia. Statistics show that in 2019, the number of beef cattle in the country reached 3.85 million heads (+33.8% compared to 2013), and the volume of meat production received from beef cattle amounted to 516.5 thousand tons [3]. However, the achieved level of development of beef cattle breeding has not allowed for a steady increase in beef production in the country yet.

Generalization of scientific sources shows that the current level of dairy and meat productivity of cattle, labor productivity, technical equipment of production and its economic efficiency is insufficient to ensure the competitiveness of Russian agricultural producers. Innovation activity in the industry as well as in the agricultural sector of Russia as a whole remains at a low level despite positive trends. The share of organizations that implement technological innovations in the total number of organizations engaged in the production of livestock products in 2018 was 4.7% (+0.8 percentage points compared to 2016) (table 2).

**Table 2.** The level of innovative development of livestock organizations in Russia.

Indicators	Years			2018 to 2016, in %
	2016	2017	2018	
Expenditures of organizations on technological innovations, billion rubles	5.7	6.4	6.5	114.0
The share of organizations that implement technological innovations in the total number of surveyed organizations, %	3.9	4.4	4.7	0.8 p.p.
The share of innovative goods, works performed, and services in the total volume of goods shipped, works performed, and services provided by organizations, %	1.6	1.7	2.1	0.5 p.p.

Source: data from the Federal State Statistics Service of Russia [2].

V.I. Nechaev and P.V. Mikhaylushkin note that the current stage of scientific and technological development of Russian agriculture is characterized by underfunding of agricultural science, the purchase of mainly imported technologies, and a low level of implementation of national scientific developments and technologies [4]. Overall, the level of involvement of business entities in innovation processes remains low. During 2018, organizations engaged in the breeding of dairy cattle and the production of raw milk purchased 25 units of new technologies (technical achievements). A year earlier, this indicator was 70 units. The expenditures of these organizations on technological innovations reached 2.0 billion rubles (against 1.2 billion rubles in 2017), which corresponds to 9.2% of the total expenditures on technological innovations carried out by agricultural organizations. At the same time, the share of innovative products in the total volume of shipped goods of organizations engaged in the breeding of dairy cattle and the production of raw milk remains at a fairly low level – 0.7% in 2018. For livestock organizations, this indicator is slightly higher – 2.1% [2].

The analysis shows that the key factors hindering the development of cattle breeding on an innovative basis are the lack of their own financial resources, the high cost of innovations, the significant risk of introducing innovations into production, the insufficient level of awareness of subjects about created or developed innovations, and the shortage of qualified personnel. In addition, such general economic factors as the uncertainty of the economic situation, inflationary processes, a decrease in the effective demand of the population, price disparity, and low investment activity of economic entities have a negative impact on innovation processes in the industry.

At the same time, it should be noted the factors that have a stimulating effect on the process of innovative development of cattle breeding. In particular, it is the presence of huge areas of pasture land, significant scientific and educational potential, the need to increase self-sufficiency in milk and meat of cattle, the ability to produce environmentally friendly food.

In cattle breeding, as a rule, there are three main types of innovation: breeding and genetics (which, for example, is breeding new types and breeds of cattle with high indices of productivity), technological (the use of modern equipment, robotics, automation and computerization of production), organizational and economic (introduction of new forms of organization and production management).

Depending on the level of perception of innovative products and technologies, several groups of economic entities can be distinguished. The first group consists of organizations that use innovations

locally, for example, introduce new equipment for the production of feed. Organizations of the second group apply improving innovations, in particular, introduce a modern set of technologies for keeping cattle. The third group includes organizations that aim to take leading positions in the industry by introducing technological and process innovations into their business activities on a permanent basis. However, practice shows that the third group includes a small number of national agricultural organizations engaged in the production of livestock products.

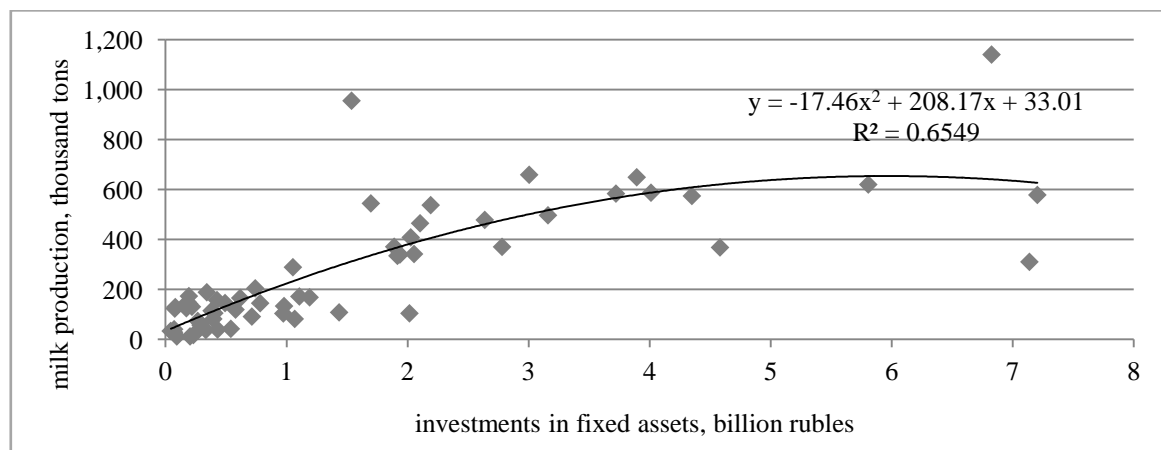
It should be noted that to solve the problem of backlog of Russia in the level of development of the technological base of the agricultural sector the Federal scientific-technical program of development of agriculture for 2017-2025 was adopted by the authorities, which gives new impetus to the development of agrarian educational and scientific institutions and the solution of the problem of import substitution in the priority areas of the national agro-industrial complex [5].

Together, the process of innovative development includes the development of innovative products, their promotion to the agricultural producer, where the key role is played by information support and agricultural consulting, and direct implementation of innovations in the production process.

It is well known that the development and implementation of innovations requires a significant amount of investment funds. However, in modern conditions, innovative activities in cattle breeding as well as in the agricultural sector in general are not sufficiently attractive for investors to invest capital. Thus, the fixed capital of agricultural organizations accounts for only 3.2% of the total investment in fixed capital in the Russian economy in 2018 [2].

As I.G. Ushachev noted, the reason for the insufficient inflow of investment in the agricultural sector is the low level of profitability of the vast majority of agricultural producers, their significant indebtedness and very limited access to preferential credit resources [6].

However, the results of the study indicate a significant positive impact of investment on the result of production activities. The construction of a regression relationship based on data from Russian regions indicates that there is a significant relationship between the volume of investment in fixed assets of organizations that breed dairy cattle and the volume of raw milk production in agricultural organizations – the coefficient of determination is 0.65 (figure).



**Figure 1.** Influence of the volume of investments in fixed assets to organizations engaged in breeding dairy cattle on the volume of raw milk production.

Source: author's calculations based on data from the Federal State Statistics Service of Russia [2].

Statistics show that in 2018, investments in fixed assets of organizations engaged in the breeding of dairy cattle and the production of raw milk amounted to 108.0 billion rubles, which is 20.0% higher than in 2017. By type of fixed assets, investments in machinery and equipment, including household inventory, amounted to 31.6%; in buildings (except residential) and structures, as well as land improvement – 28.6%. At the same time, the volume of investments in fixed assets of organizations en-

gaged in breeding beef and other cattle was at the level of 15.5 billion rubles (+3.8% compared to 2017).

The main source of investment into fixed capital of livestock organizations, with the exception of small business entities are equity – 54.2% in 2018, in particular, is the net profit obtained at the end of the year, which is partly or fully directed to the expansion of production, introduction of new technologies, and depreciation. At the same time, the authorities should encourage agricultural producers to reinvest their profits not only in the development of their production activities, but also in the social sphere [7].

In conditions of lack of equity capital, economic entities are forced to use borrowed funds, the key role among which belongs to bank loans. At the end of 2018, bank loans accounted for 42.1% of the volume of sources of financing investments in fixed assets of livestock organizations, and the share of budget funds is insignificant – 1.4% [2].

The study of advanced foreign experience shows that the key condition for high innovation activity of economic entities in the agricultural sector is the implementation by the state of a set of systemic measures to stimulate innovation in the agro-industrial complex and the economy as a whole. The most significant role of state support in conducting fundamental and applied research, production, introduction and implementation of innovations in the practical activities of agricultural producers, organization of information support for innovation entities, training and retraining of personnel. At the same time, rapidly changing production conditions caused by the development of innovative products and technologies require improving approaches to education, its forms and methods [8].

The state can exert a stimulating influence on the innovative activity of economic entities both by providing budget funds to agricultural producers who introduce innovations in production (direct influence), and by providing preferential lending and taxation, allocating funds for the development of science and market infrastructure (indirect influence). The implementation of indirect incentives usually involves a greater number of subjects of the innovation process than direct support measures and contributes to the creation of a favorable economic climate for innovation.

Accordingly, in the process of innovative development, the state performs different roles, in particular, it is a legislator and a business entity; it can act as a customer and buyer of innovative products, as well as a guarantor and insurer of risks that accompany innovation [9].

The analysis shows that a new level of development of national cattle breeding is the widespread use of digital and information and communication technologies in economic activities. In particular, for national agricultural producers, the introduction of digital technologies in the field of herd management and monitoring of the physiological state of cattle is promising, which will allow them to reach a higher level of production arrangement.

It should be noted that one of the main technological trends that form the agricultural revolution at the present stage of development is the use of robotics in agriculture [10]. In this regard, the most important direction of innovative development of national dairy cattle breeding is the introduction of robotic systems in the field of feeding (feed mixers, feed trimmers), milking (milking robots) and manure harvesting. In Russia, the level of implementation of robotic systems on dairy farms is quite low; they are usually used only in large livestock complexes. In particular, imported equipment from such companies as “DeLaval”, “Gea Farm Technologies”, “Full-wood”, “Lely” and others became the most popular [11].

In modern conditions, biotechnologies acquire special significance in cattle breeding, the use of which is expressed in the molecular selection of cattle, the development of biologics, biological components for veterinary and feed production [12]. At the same time, to realize the genetic potential of cattle, it is necessary to apply innovative technologies in the design and construction of livestock facilities in order to provide appropriate conditions for keeping and feeding highly productive livestock [13].

However, due to the high share of households in the structure of milk and cattle meat production in Russia, the spread of innovative products and technologies is quite limited, which will not allow to overcome the current technological backwardness in the industry in a short time [14]. In addition,



there is still a shortage of qualified personnel who are able to implement and apply advanced science and technology in practice.

#### 4. Discussion

The research made it possible to prove that without the activation of the investment process in cattle breeding and the agricultural sector of Russia as a whole, the development of innovative activities is impossible. Investing in high-tech innovative projects is the foundation for sustainable and effective development of the industry.

Due to the limited state support, it is important to attract private capital to the industry and implement measures to stimulate investment activity. In this regard, we consider it appropriate to create an industry investment fund to finance innovative projects in the dairy and meat cattle industry. We believe that the funds raised by investment funds can become a significant source of financing for innovative activities in cattle breeding. At the same time, innovative projects must pass a comprehensive economic examination. Priority should be given to those projects that are being implemented in the most favorable regions of Russia for raising cattle, aimed at developing and (or) implementing innovative products and technologies that will allow agricultural producers to achieve high production efficiency and successfully compete in national and foreign markets. The key is to provide state guarantees to investors who invest their money in these funds.

Thus, to ensure the innovative development of national cattle breeding, it is necessary to develop scientific activities, improve infrastructure, activate the investment process, and develop the institutional environment and training system. In addition, the need to improve the existing organizational and economic mechanism for the development of innovative products and technologies, to study the demand for innovations, to develop a system of marketing and information and consulting support should be noted.

The main directions of the state policy in the sphere of innovative development of national cattle breeding should be: improving the legal regulation of the innovation process and ensuring the protection of the interests of all its participants; implementing direct and indirect support measures at all stages of innovative development of cattle breeding, from the moment of creation of innovations to their dissemination; developing effective forms of interaction between subjects of innovation; training and retraining of personnel; creating a favorable investment climate.

#### 5. Summary

Innovative development of cattle breeding involves changing the nature of economic activity through the transition to a new organizational and technological structure of production, which will help to increase the production of high-quality products, increase the competitiveness of national agricultural producers and reduce dependence on imports of milk and cattle meat. The key to the implementation of this provision is the systematic stimulating effect of the state on innovation in the industry and the activation of the investment process in the agricultural sector of the Russian economy.

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