The state and problems of increasing milk production in Russian Federation

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Abstract. Milk production in the implementation of a competent management approach is a profitable agricultural business. To improve management decision making, regular monitoring of the situation on the milk market is needed. Our analysis showed that, despite the reduction in the number of dairy cows in all forms of management and despite the decline in milk production, in the period from 1990 to 2016 in the agricultural organizations of the country, the productivity of dairy cows increased by two folds. Secondly, the cost of producing one center of milk decreased four-fold, which indicates the processes, innovations, mechanization and automation of production are in place and working well. Thirdly, labor costs per cow, in man-hours decreased by 2.5 times. Fourthly, it is positive that the loss of milk decreased by half. Fifthly, the export of milk, which includes exports both to non-CIS countries and the CIS, has increased by 93%. In order to identify the factors that affect the productivity of dairy cows, we performed a special correlation regression analysis. Our analysis allows us to conclude that the most significant factors affecting the productivity of dairy cows are: (1) the cost per year for the maintenance of one cow, in thousands of rubles; (2) labor costs for the production of one center of milk, man-hours; (3) the number of livestock per 100 hectares of agricultural land, heads; (4) the mass of one calf at birth, in kilograms; (5) the load per operator of machine milking, heads; (5) average monthly salary of a machine milking operator, rubles. The state regulation of dairy cattle breeding should be carried out on the basis of competent economic mechanisms, it presupposes rationalization of the structure of agricultural production, inter-industry and inter-farm relations, the creation of stable economic, legal and social conditions for the development of agriculture, taking into account the already achieved production results, available and potential resource base, especially availability of basic production assets.

1. Introduction
Dairy cattle breeding performs an important socio-economic and national-economic task, providing the population with valuable food products. World milk production is characterized by stable growth dynamics. Since 2000, its annual increase in milk production amounts to 10-20 million tons. Foreign experts and analysts predict a further increase in milk production at a rate of 12-14 million tons per year. The main increase is expected in India, China, Pakistan and others. The largest volumes of milk production are forecasted in the countries of the European Union, India, the USA, China, the Russian Federation.

In different time periods of the development of the history of the Russian Federation, dairy cattle breeding has developed both on an extensive basis, by increasing the gross production of milk by increasing the number of dairy cows, and on an intensive basis, by making fuller use of achievements
in breeding, improving the quality of feeding and care, realization of advantages of large-scale productions and industrial technologies. The urgency of this topic is also conditioned by the need to timely identify the existing problems in the development of the dairy cattle breeding industry in order to regulate the processes of intensifying milk production in the conditions of urbanization of the society in order not to allow a further reduction in the number of dairy cows and the production of quality milk produced in the country and its regions. To fulfill this task, there is a strong resource and breeding base, significant experience and traditions of milk production in the region, as well as skilled labor resources prepared for work in this industry.

2. Materials and methods of research
In this study we used monographic, statistical, methods of analysis and synthesis, induction and deduction methods, economic-statistical methods of correlation-regression analysis, tabular, graphical methods and others. Information basis for this study was the works of foreign scientists, as well as official data of the Federal State Statistics Service of the Russian Federation for the period from 1990 to 2016.

3. Literature review
The scientific works of various scientists are devoted to the problems of the development of the dairy cattle breeding industry. In the work of Dijkhuizen, A.A., Renkema, J.A., Stelwagen, J. (1985), the authors presented a study detailing the economic aspects of reproductive failure in dairy cattle. As a result, they came to the conclusion that «the calculated critical levels of production were virtually independent of the price of milk, but depended on the longevity of cows and the duration of their calving». The study was conducted in a herd with an average herd of life in 4 lactations, with an average milk production of just over 5,300 kg per cow per year and a genetic increase in milk production by 1% per year [4].

In his work Ooms, D.L., Peerlings, J.H.M. (2005) note that «the decline in milk prices by 21 percent, profit on average is reduced by 22 percent» [9]. Direct payments by the European Union compensate for about 53% of this profit. The decline in profits means that 69% of all small farms have a negative income from agriculture, compared to 15% in the initial stage.

Bell, M.J., Wilson, P. (2018) provides a detailed analysis of the evaluation of milk production efficiency based on half a million dairy cows, milk from which is supplied to the UK. The authors found differences in the performance of dairy farms in England, Scotland, Wales and Northern Ireland. As a result, they found that "in the UK, improving the health of cows, fertility (calving intervals) and survival in aggregate contribute to increased profitability and reduced emissions from dairy production. In Scotland, the herds had higher volumes of milk production. But a low survival rate, which could potentially be due to poor fertility, marked by a longer calving interval compared to other regions. The herds in Northern Ireland had the shortest average calving interval, but the highest number of somatic cells, therefore, a higher estimate of cases of mastitis and loss of milk (waste)» [3].

In the work of Bell, M.J., Eckard, R.J., Haile-Mariam, M., Pryce, J.E. (2013) notes that various factors can influence the net income from milk production and greenhouse gas emissions. Scientists selected factors such as milk volume, fat, protein, live weight, survival, dry matter intake, somatic cell count and calving interval. As a result, they found that the desired increase in net income and a decrease in the intensity of emissions per cow may result in: an increase in the longevity of cows, a reduction in the production of milk, a reduction in the body weight and calving interval [2].

In the work of Bell, MJ, Wall, E., Russell, G., Simm, G., Stott, AW. (2011) on the environmental impact of a number of dairy production systems in terms of their global warming potential, the authors succeeded in establishing that «genetic selection for the effective use of feed for milk production in accordance with the feeding system can lead to a reduction in nutrient requirements system, as well as carbon dioxide emissions and rational land use per unit of output» [1].

In the work of Garnsworthy, P.C. (2004) notes that «dairy cows account for about 20% of total methane emissions in the UK and 25% of total ammonia emissions». The authors conducted a special
study evaluating the «impact of changes in fertility parameters on the projected total gas emissions at the herd level». With the help of this study, they found that «changes in fertility in the herd structure, number of substitutions, milk income, nutrient requirements and gas emissions» are interrelated. They determined that «fertility has a big impact on the number of replacing heifers needed to maintain the size of the herd, given a certain milk quota or the number of cows» [6].

Increasing the level of competitiveness of milk can be achieved through the implementation of a set of measures. On the one hand, this is an active fight against falsification. Secondly, it is a consideration of changing weather-and-natural phenomena associated with global warming and increasing arid situations. Thirdly, it is a reference point for the production of high-quality organic agricultural products in both large-scale and small-scale production. Fourth, the use of scientifically based approaches for smoothing seasonal fluctuations in the concentrations of the main components and the composition of lactic fatty acid. Fifthly, this is the quality of care and the timeliness of milking cows.

According to a study by another group of scientists, "in 2008, the largest food crisis broke out in China, once it was discovered that milk suppliers are adding melamine (a colorless crystalline compound) to it, in order to artificially raise the protein's milk content" (Swinnen Johan, Rozelle Scott, Jia Xiangping, Huang Jikun, Luan Hao (2012)) [11].

Nardone A., Ronchi B., Lacetera N., Raneri M.S., Bernabucci (2010) studied in detail the effects of climate change on livestock in accordance with the theory of global warming. The authors argue that due to the increased drought the production of fodder and agricultural crops will decrease, as the basis of the feed base for animals. And this, in turn, will affect not only the quantity and quality of milk, the degradation of pasture lands, accessibility and cost of feed, but also the immunity of animals. In this regard, the primary tasks will be the management of water and soil. To manage the evolution of livestock production systems, with rising temperatures and extreme events, better information is needed regarding biophysical and social vulnerability, and this needs to be integrated with agricultural components and livestock components [5].

According to scientists Schwendel B.N., Wester T.J., Morel P.C.H., Tayendale M.N., Deadman C., Shadbolt N.M., Otter D.E. (2015), the qualitative properties of organic and inorganic milk produced on small farms and in large-scale production vary significantly. The authors note that in most countries of the world traditional dairy farming is associated with a high level of grain feeding, the use of highly productive breeds of cows and the use of a large number of feed concentrates ("high-fermentation"). At the same time, organic dairy production is tied to pasture and fodder, less fertilizer application and the use of mixed breeds of cows or minority breeds ("low entry"). Therefore, from the point of view of nutrients in organic milk, there is nothing special that would make it unique. The composition of the produced milk largely depends on the genetics of animals, health, breed, the system of feeding, care of animals and the state of the environment [9].

According to the studies of Heck J.M.L., Valenberg H.J.F., Dijkstra J., Hooijdonk A.C.M., it was found that in the milk content of cows, there are large seasonal variations in the concentrations of the main components and the composition of the lactic fatty acid. The results of their research are based on the analysis of samples of raw milk collected weekly from February 2005 to February 2006. The authors note that the concentration of lactose was constant throughout the season. The protein content in milk was more susceptible to the season, with the lowest content in June (3.21 g / 100 g.) And the highest content in December (3.38 g / 100 g.). The concentration of milk fat increased from a minimum of 4.1 gr. / 100 g. in June to a maximum of 4.57 grams. / 100 g. in January. The indicators of non-saturation of milk, which were used as an indicator of desaturate activity, were the lowest in spring and the highest in autumn [7].

In this study, Zhong, Z., S. Cheng, S. Kong and M. Tracy (2014) discuss the main reasons why Chinese small dairy farms adopt a new organizational structure for milk production in large-scale formations. On the one hand, this is an organized process of preventing diseases in animals. The results showed that 47% of US farmers changed the style of production and adopted more advanced technologies, more than 90% of them paid more attention to food safety of raw milk, use of high-
quality feeds to improve the quality of milk. Only 27% of farmers realized that the price of milk sales increased due to joining the cooperatives. The scientists state that the effect of the cooperative association on improving the selling price is very limited. Cooperatives do not help in organizing a lower cost of feed, because farmers still produce their own [10].

Thus, different authors approach the choice of ways to increase the economic efficiency of the dairy farming industry in different ways. In this case, much depends on the country in which the authors work. It should take into account the existing experience in agricultural production, the availability of resources, natural and weather conditions, the availability of the market and many other factors.

In the work of Dijkhuizen, A.A., Renkema, J.A., Stelwagen, J. (1985), the authors presented a study detailing the economic aspects of reproductive failure in dairy cattle. As a result, they came to the conclusion that «the calculated critical levels of production were virtually independent of the price of milk, but depended on the longevity of cows and the duration of their calvings». The study was conducted in a herd with an average herd of life in 4 lactations, with an average milk production of just over 5,300 kg per cow per year and a genetic increase in milk production by 1% per year.

Dairy cattle breeding is one of the most important branches of animal husbandry. At all times, the interest of scientists and researchers to the problems of dairy cattle breeding does not die out, since it is thanks to milk that the population receives valuable dairy products (whole milk, skimmed milk, kefir, cottage cheese, sour cream, cheese, cheese, butter, etc.) containing useful health microelements.

4. Results of the study
Milk production in the country is carried out in three forms of management: in agricultural organizations, in peasant (farm) and households. According to the Federal State Statistics Service of the Russian Federation, for the period from 1990 to 2016, in the country there was a decrease in the number of cows in all types of farms (figure 1).

![Figure 1. Dynamics of changes in the number of cows in the Russian Federation by forms of management for the period from 1990 to 2016 (thousands of heads).](image)

The total number of cows in the country decreased by 69% (amounting to 8,264 thousand heads), including in agricultural organizations - by 78% (3,359 thousand heads in 2016), in households - by
29% (2,717 thousand in 2016). In peasant farms, the number of cows in 2016 amounted to 1,239.7 thousand heads.

The number of cows in agricultural organizations in the federal districts of the country is not the same. Consider its change in the dynamics from 1990 to 2016 in Table 1.

Table 1. Number of cows in the agricultural organization of the federal districts of the Russian Federation for the period from 1990 to 2016. in farms of all categories (thousands of goals) [9].

| Indicators          | 1990 Year | 2000 Year | 2010 Year | 2015 Year | 2016 Year | 2016 Year in % to 1990 Year | 1990 Year to 2016 Year in Times |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------------------------|---------------------------------|
| Russian Federation  | 15 322.1  | 6 486.5   | 3 712.7   | 3 387.4   | 3 359.5   | 21.9                        | 4.6                             |
| Privolzhsky         | 3 845.7   | 2 031.3   | 1 206.6   | 1 050.8   | 1029.9    | 26.8                        | 3.7                             |
| Central             | 4 086.3   | 1 774.7   | 862.8     | 863.8     | 879.0     | 21.5                        | 4.6                             |
| Siberian            | 2 619.6   | 1 093.7   | 684.0     | 581.7     | 566.0     | 21.6                        | 4.6                             |
| Southern            | 2 169.2   | 680.0     | 401.2     | 392.9     | 390.6     | 18.0                        | 5.6                             |
| Northwestern        | 1 085.4   | 405.5     | 266.5     | 248.3     | 253.7     | 23.4                        | 4.3                             |
| The Urals           | 1 038.2   | 404.7     | 236.1     | 196.2     | 192.4     | 18.5                        | 5.4                             |
| Far Eastern         | 477.7     | 96.6      | 55.5      | 49.2      | 47.8      | 10.0                        | 10.0                            |
| North-Caucasian     | no data   | no data   | 112.5     | 150.3     | 142.6     | -                           | -                               |

1 The North Caucasus Federal District was established in 2000. Therefore, there is no data in the Federal Service for State Statistics of EMISS for this district.

From the data presented in table 1 it follows that in none of the federal districts there was an increase in the number of cows. During the analyzed period, the largest reduction in the number of cattle in agricultural organizations occurred in the federal districts: the Far East - by 90.0% (10 times), the southern - by 82% (5.6 times), the Urals - by 81.5% (5.4 times), Central - by 78.5% (4.6 times), the North-West - by 76.6% (4.3 times), the Volga Federal District - by 73.2% (3.7 times), Siberian - by 78.4% (4.6 times).

We will consider the overall structure of milk production by economic forms in the Russian Federation for the period from 1990 to 2016 (figure 2).

![Figure 2](image_url)

Figure 2. Structure of milk production by forms of management in Russian Federation [8].
From figure 2 it follows that in the Russian Federation the ratio of the level of milk production in agricultural organizations and households of the population has undergone significant changes for the analyzed period. If in 1990 the main milk producers were agricultural organizations that produced 76.2% of the gross milk production, then in 2016 the share of milk produced in the public sector fell to 49%. The share of production of milk produced by households in 1990 was 23.8%, and in 2016 it was 43.9%. By 2016, peasant (farm) farms began to produce 7.1% of the country's gross milk production.

For the period from 1990 to 2016, total milk production in the Russian Federation decreased by 44.8%, including in agricultural organizations - by 64.5%, in households, on the contrary increased by 1.8%.

The volumes of milk production in the federal districts of Russia are not the same. The largest share of milk production on a national scale throughout the entire analyzed period belongs to the Volga Federal District. Between 1990 and 2016 years, the contribution of the Volga Federal District to the development of the dairy cattle sector was the highest and increased from 26.1% to 30.6% (figure 3).

![Figure 3. Structure of milk production by federal districts in farms of all categories of the Russian Federation for the period from 1990 to 2016](image)

It follows from the figures in figure 3 that throughout the analyzed period, three districts are clearly distinguished in Russia: the leader in milk production: the Volga, Central and Siberian Federal Districts. The share of milk production in the Central Federal District decreased by 8.3 pp: from 26% to 17.7%; in the North-West Federal District decreased by 1.5 percentage points. (from 7.4% to 5.9%), in the Far Eastern and Ural federal districts, the share of production volumes decreased, respectively, by 1.1 percentage points. and by 0.8 percentage points. The specific weight of milk production in the Siberian Federal District increased by 0.3 percentage points, in the Southern Federal District the growth was 2 pp. In the North Caucasus Federal District, the share of milk production increased by 4.9 pp.
In 2016, the largest share in milk production belonged to the Volga Federal District - 30.6%, the Central Federal District - 17.7%, the Siberian Federal District - 17.2%, the Southern - 11.6%, the North Caucasus - 9.1%, The Urals - 6.2%, the North-West - 5.9%, the Far Eastern - 1.7%.

One of the most important indicators of the success of the development of the dairy cattle breeding industry, the growth of labor productivity, are milk yields per cow. Consider these data in figure 4 in more detail.

![Figure 4](image)

**Figure 4.** The average level of productivity of cows in farms of different categories in the Russian Federation for the period from 1990 to 2017 (in kilograms per cow).

It follows from the data in figure 4 that the highest growth rate of cow productivity is observed in agricultural organizations. This is due to the fact that due to the presence of a significant number of financial, natural and other risks, the process of organizing milk production at large-scale enterprises is easier to organize in a rational scientific and justified way. Milk yields per cow on average in farms of all categories for the period from 1990 to 2016 increased by 54.5%. Including in agricultural organizations - by 93%, in households - by 35.2%, in peasant (farmer) households, on the contrary, - decreased by 21%. In agricultural organizations, where in 2016, 49% of milk was produced, milk yield per cow, which is a maximum of 5,660 kg per cow. Thus, large-scale production of milk is more intensive.

Let's compare the milk yields per cow in the federal districts of the Russian Federation in figure 5.
From the data in Figure 5 it follows that, in general, the dynamics of cow productivity is positive. At the same time, leadership in terms of "milk yield per cow" belonged both in 1990 and in 2016 to the North-West Federal District. In 1990, this district produced only 7.4% of Russia's gross milk production, and in 2016 its share became 5.9%. In 2016, the number of cows in the county per 100 hectares of CFS in the North-West Federal District was the highest in the country - 21 head per 100 hectares of CFS. In 2016, in the North-West Federal District, 105.4 thousand tons of milk were produced per 100 hectares of CFS, which is 5.6 times higher than the national average. These figures show that over the years of reforms in the North-West Federal District milk production is carried out on a high-intensity basis, and the scientifically sound experience in organizing the dairy industry requires study and adaptation for other federal districts, regions, enterprises.

Consider one of the most important indicators of the intensification of milk production - the number of heads of cows per 100 hectares of agricultural land in all forms of management for the period from 1990 to 2016 in Table 2.

| Federal Districts      | 1990 year | 2000 year | 2010 year | 2015 year | 2016 year | 2016 year in % to 1990 year | 1990 year to 2016 year, time |
|------------------------|-----------|-----------|-----------|-----------|-----------|----------------------------|----------------------------|
| Privolzhsky            | 11        | 7         | 5         | 4         | 4         | 39,8                       | 2,5                        |
| The Urals              | 12        | 7         | 4         | 4         | 4         | 30,1                       | 3,3                        |
| Central                | 13        | 8         | 5         | 4         | 4         | 32,3                       | 3,1                        |
| Siberian               | 11        | 7         | 5         | 4         | 4         | 33,6                       | 3,0                        |
| Far Eastern            | 17        | 7         | 4         | 3         | 2         | 14,8                       | 6,7                        |
| Southern               | 11        | 5         | 3         | 3         | 2         | 18,1                       | 5,5                        |
| Northwestern           | 5         | 2         | 2         | 2         | 2         | 36,0                       | 2,8                        |
| North-Caucasian        | no data   | no data   | 6         | 7         | 7         | -                          | -                          |
From the data presented in table 2 it follows that practically in all federal districts there is not a progressive intensification, but de-intensification of milk production due to a reduction in the number of cows per 100 hectares of agricultural land. In the Far Eastern Federal District, the decrease was 6.7 times (85.2%), in the Southern - 5.5 times (81.9%), in the Urals - 3.3 times (almost 70%), in Central - 3.1 times (almost 67.7%), in Siberia - 3 times (66.4%), in the North-West - 2.8 times (64%), in the Volga - in the 2.5 times (by 60.2%). In the Central, Volga, Urals, Siberian Federal Districts in 2016, the number of cows' heads per 100 hectares of agricultural land was on average the same and amounted to an average of 4 g. per 100 hectares of agricultural land, in farms of all categories. In the Far-Eastern, North-Western, Southern Federal Districts - 2 goals each per 100 hectares of agricultural land.

Another indicator of the intensification of milk production is the yield of milk per 100 hectares of agricultural land. Consider its values in the context of federal districts for the period from 1990 to 2016 in table 3.

Table 3. Milk output per 100 hectares of agricultural land in agricultural organizations by Federal districts the Russian Federation for the period from 1990 to 2016 (thousand tons per 100 hectares of agricultural land) [9].

| Indicators                        | 1990 year | 2000 year | 2010 year | 2015 year | 2016 year | 2016 year in % to 1990 year | 1990 year to 2016 year, in times |
|-----------------------------------|-----------|-----------|-----------|-----------|-----------|----------------------------|----------------------------------|
| Russian Federation                | 36.1      | 18.0      | 19.0      | 18.6      | 18.8      | 52.2                       | 1.9                              |
| North-West Federal District       | 95.4      | 50.8      | 91.0      | 103.8     | 105.4     | 110.5                      | 0.9                              |
| Central Federal District          | 49.6      | 26.5      | 26.4      | 24.9      | 25.7      | 51.7                       | 1.9                              |
| Volga Federal District            | 29.4      | 16.8      | 20.0      | 19.9      | 20.2      | 68.9                       | 1.5                              |
| Ural federal district             | 34.6      | 16.2      | 17.8      | 19.1      | 19.4      | 56.2                       | 1.8                              |
| Siberian Federal District         | 29.7      | 14.0      | 15.4      | 14.4      | 14.2      | 47.6                       | 2.1                              |
| North-Caucasian Federal District  | no data   | no data   | 6.4       | 8.4       | 8.4       | -                          | -                                |
| Southern Federal District         | 28.5      | 11.2      | 9.3       | 8.6       | 8.0       | 28.0                       | 3.6                              |
| Far Eastern Federal District      | 42.5      | 12.2      | 10.6      | 7.9       | 7.7       | 18.2                       | 5.5                              |
| Crimean Federal District          | no data   | no data   | no data   | 2.7       | no data   | -                          | -                                |

From the data presented in table 3 it follows that the highest milk yield per 100 hectares of agricultural land is traditionally observed in agricultural organizations of the North-West Federal District. In 2016, in the North-West Federal District, 105.4 thousand tons of milk were produced per 100 hectares of CFS, then in the Central - 25.7 thousand tons, in the Volga - 20.2 thousand tons, in the Urals - 19.4 thousand tons, and on the average in Russia - 18.8 thousand tons. The lowest values of this indicator are registered in the Far Eastern Federal District - 7.7 thousand tons and in the Southern Federal District - 8 thousand tons, in the North Caucasus - 8.4 thousand tons, in the Siberian - 14.2 thousand tons per 100 hectares of CFS. The difference between the maximum (in the North-West Federal District) and the minimum value (in the Far Eastern Federal District) of the level of gross milk production per 100 hectares of agricultural land is almost 14 times. We will consider the values of milk yield per 100 hectares of CFS in some advanced Russian regions in table 4.

Table 4. Milk output per 100 hectares of agricultural land in agricultural organizations of successful regions of the Russian Federation with developed dairy cattle for the period from 1990 to 2016. (thousand tons per 100 hectares of agricultural land) [9]

| Indicators                        | 1990 year | 1995 year | 2000 year | 2005 year | 2010 year | 2015 year | 2016 year | 2016 year in % to 1990 year | 1990 year to 2016 year |
|-----------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|----------------------------|------------------------|
From the data presented in table 4 it follows that the highest milk yield per 100 hectares of agricultural land is registered in the Leningrad Region (in 2016, 268.8 thousand tons per 100 hectares of agricultural land), in the Republic of Karelia (230.8 thousand tons (121.4 thousand tons per 100 hectares of agricultural land), in the Moscow Region (107.9 thousand tons per 100 ha of agricultural land), in the Kaliningrad Region (47.1 thousand tons), in the Kaliningrad Region in the Krasnodar Territory (35.2) and in the Belgorod Region (34.1 thousand tons). At the same time in the dynamics from 1990 to 2016 in the Leningrad Region, the growth rate of this indicator was 12.9%, exceeding the indicators of 1990 and amounting in 2016 to 268.8 thousand tons per 100 hectares of agricultural land. In Karelia, the growth rate of milk yield per 100 hectares of agricultural land to the level of 1990 was 10.2%, amounting to 230.8 thousand tons of milk per 100 hectares of agricultural lands in 2016. Thus, it should be noted that there is a successful example in the country intensification of milk production. The experience of the advanced regions should be taken into account when developing regional programs and plans.

The main goal of milk production, as already mentioned, is to meet the needs of people for valuable trace elements contained in milk and dairy products. The volume of milk production per capita on the national scale decreased from 387 kg in 1990 to 236 kg in 2016 (figure 6).

![Figure 6](image-url)
The level of actual milk consumption, calculated from the minimum consumption rate, decreased from 117.3% in 1990 to 71.5% in 2016. The lack of food protein is not only an economic, but also a social problem of the modern world. Because of the low purchasing power of the majority of social groups of the population and, consequently, in view of the lack of paid demand, the development of livestock sectors is restrained and the number of dairy cattle continues to decline. At the same time against the background of a sharp rise in the cost of high-grade proteins (in 4 years milk protein - more than 60%), in Russia there was a shortage of production of high-grade proteins. Import consumption of animal protein in 2016 was 16.8%, and this deficit is likely to continue until 2020. Evaluating all types of products of animal origin through the yield of high-grade protein, one can draw a conclusion about the role and significance of dairy cattle breeding in the formation of the country's food market. Insufficient level of self-sufficiency (3/4 of the minimum requirement) poses new tasks for domestic cattle breeding to intensively increase milk production.

Consider the information on the resources and use of milk and dairy products in the Russian Federation for the period from 1990 to 2016 in table 5.

Table 5. Resources and use of milk and dairy products in the Russian Federation.

| Indicators                                  | 1990 year | 2000 year | 2005 year | 2010 year | 2015 year | 2016 year | 2016 year as % to 1990 year |
|---------------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------------------------|
| Resources                                   |           |           |           |           |           |           |                             |
| Inventories at the beginning of the year    | 3450      | 1322      | 1693      | 1857      | 2120      | 1948      | 56.5                        |
| Production                                  | 55 716    | 32259     | 30826     | 31847     | 30797     | 30759     | 55.2                        |
| Import                                      | 8043      | 4718      | 7115      | 8159      | 7917      | 7544      | 93.8                        |
| Total resources                              | 67209     | 38299     | 39634     | 41863     | 40834     | 40251     | 59.9                        |
| Using                                       |           |           |           |           |           |           |                             |
| Production consumption                      | 7314      | 5205      | 4097      | 4271      | 3312      | 3163      | 43.2                        |
| Losses                                      | 62        | 31        | 17        | 29        | 34        | 31        | 50.0                        |
| Export                                      | 335       | 507       | 493       | 460       | 606       | 645       | 192.5                       |
| Personal consumption                        | 57233     | 31317     | 33250     | 35237     | 34934     | 34666     | 60.6                        |
| Inventories at the end of the reporting year| 2265      | 1239      | 1777      | 1866      | 1948      | 1746      | 77.1                        |

From the data presented in table 5 it follows that the volume of milk resources for the period from 1990 to 2016 decreased by 40%, stocks at the beginning of the year decreased by 43.5%, milk production decreased by 45%, the volume of imports decreased by 6, 2%, the volume of industrial consumption for this period decreased by 56.8%. Positively, the volume of milk loss decreased by 50%. Unfortunately, there is a reduction in personal consumption - by 39.4%, as well as a decrease in inventories at the end of the year - by 39.4%. The volume of exports increased by 92.5%. In 1990, the volume of imports exceeded exports by 24 times, in 2016 - by 11.7 times.

In order to identify the factors that affect the productivity of dairy cows (unit of measure - kilograms per year), we performed a special correlation regression analysis. To construct a correlation-regression model on the basis of a qualitative analysis of cause-effect relationships, we selected the following factors: \( Y \) - productivity of dairy cows, kg; \( X_1 \) - labor costs per cow, person-hour; \( X_2 \) - labor costs for the production of one centner of milk, person-hour; \( X_3 \) - weight of one calf at birth, kg; \( X_4 \) - the number of livestock per 100 hectares of farmland, heads; \( X_5 \) - load per operator of machine milking, heads; \( X_6 \) - average monthly salary of the operator of machine milking,
rubles; $X_7$ – profitability, %; $X_8$ – fat content of milk, %; $X_9$ – specific weight of feeds of own production, %; $X_{10}$ – the output of calves, heads per 100 cows; $X_{11}$ – cost per year for the maintenance of one cow, thousand rubles; $X_{12}$ – specific weight of proceeds from sales of milk in gross output, %; $X_{13}$ – specific weight of feed costs, %.

Selection of the most significant and screening collinear factors will be carried out on the basis of a matrix of pair correlation coefficients. As information base for the study, the data of the Federal State Statistics Service of the Russian Federation were used. The coefficient of multiple correlation was 0.84. The coefficient of multiple determination is 0.70. This means that the tightness of the connection between the selected factors is quite high. The regression equation took the form:

$$y = 1077.95 - 156.67x_2 + 36.12x_4 - 16.51x_5 + 0.14x_6 + 5.66x_{10} + 47.38x_{11}$$

Our analysis allows us to conclude that the most significant factors affecting the productivity of dairy cows are: (1) the cost per year for the maintenance of one cow, in thousands of rubles; (2) labor costs for the production of one center of milk, man-hours; (3) the number of livestock per 100 hectares of agricultural land, heads; (4) the mass of one calf at birth, in kilograms; (5) the load per operator of machine milking, heads; (5) average monthly salary of a machine milking operator, rubles. Thus, the motivation of workers to work occupies an important place in achieving high production indicators [13, 14].

During the years of transformation, numerous changes in the forms of ownership in agriculture, the restructuring of the agrarian economy, in general, the country managed to maintain its production potential. It is important to highlight the significant positive aspects in the development of dairy farming and the intensification of milk production in the Russian Federation.

First, despite the reduction in the number of dairy cows in all forms of management, and despite the decline in milk production, it is positive that for the period from 1990 to 2016, in agricultural organizations of the country, the growth in the productivity of cows was two-fold.

Secondly, the laboriousness of producing one center of milk decreased four-fold, which indicates the processes of mechanization and automation of production.

Thirdly, for the period from 1990 to 2016, the dynamics of labor costs per cow, in man-hours decreased by 2.5 times.

Fourthly, it is positive that the loss of milk decreased by half.

Fifth, the export of milk, which includes exports to non-CIS countries and the CIS, has increased by 93%.

5. Conclusion
In any country, there are problems in the development of agriculture, especially in the livestock sector. Unfortunately, it is necessary to state the general key problems of the development of the dairy industry and the intensification of milk production:

- Total decrease in the number of cows.
- Some reduction in gross milk production.
- Insufficient opportunities to use the genetic potential of animals and the development of breeding livestock.
- Potential for increasing the level of milk marketability.
- The need to increase the level of technical and technological equipment of milk production processes.
- Presence of reserves in increasing the density of cows.
- Reserves in increasing the fat content of milk produced.
• A high gap in the level of remuneration of workers in the agricultural sector and other sectors of the economy, a low level of motivation of workers to work because of low wages for workers in milk production, high turnover of staff (especially working professions), and low skill level of employees.

• Disparity of prices between different sectors of the economy leads to the fact that agricultural commodity producers do not receive enough money for their labor, which does not contribute to the conduct of expanded reproduction.

• It is important to strengthen state control over the prices of processing plants so that the price of milk sales is significantly higher than the cost of milk production and cover all costs for the production of raw materials and some others.

It is very important to note that the development of the milk industry should be carried out on an integrated and systemic basis, taking into account the impact external and internal factors affecting milk production. Among the external factors are: the availability and quality of the land; natural and climatic and weather phenomena; ecological situation; sanitary and epidemiological conditions; psycho-emotional state of animals; competitors; legislation and legislative bodies; consumers; social and economic state of the external environment (availability of jobs, unemployment, crime, etc.). Internal factors include technical and technological innovations; level of mechanization and automation of production; energy supply; financial provision; genetic engineering and biological potential (selection, hybridization, etc.); zootechnical potential (crossing, insemination, terms of growing repair young animals, etc.); preventive measures of veterinary medicine; biological potential (selection, hybridization, etc.); zootechnical potential (crossing, insemination, terms of growing repair young animals, etc.); preventive measures of veterinary medicine; biological potential of cows' age productivity (longevity of cows); level and usefulness of feeding; conditions of keeping animals; microclimate; load on one machine milking operator and many others.

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