Assessment of technical support for dairy industry in agricultural enterprises

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Abstract. The effectiveness of agricultural production in dairy farming and the degree of its intensity are directly related to the organizational and economic mechanism of reproduction and the appropriate use of the material and technical base of agriculture. For agricultural producers, the material and technical security, as well as the methods of reproducing the material and technical base in current economic conditions, directly depend on the financial situation, the size of the enterprise, and many other factors affecting the availability of borrowed funds and state support funds. The article discusses the state of technical equipment of dairy cattle breeding, the impact of new, modern, innovative equipment on the efficiency of production. The estimation of technical support of the dairy industry in agricultural enterprises of Russia and the Omsk region is given. The methodological basis of the study was the provisions of modern concepts of analysis of agricultural economics, formalized and intuitive methods for modelling the economic development of the dairy industry. The assessment showed that the technical equipment of dairy farming and its supporting engineering base are at a relatively low level. The solution to these problems is not possible without attracting investment resources for technological and technical re-equipment of the industry.

1. Introduction

Livestock farming is the leading agricultural sector of the Omsk region: it provides more than 49% of gross output, accumulates 75% of fixed assets and 70% of labour resources in agriculture.

In the Russian Federation, the Omsk region as a whole takes 24th place in livestock production, and 16th out of 85 Russian regions in cattle production. The share of livestock products in agricultural products for 2018 in the Omsk region is 48%.

As of January 1, 2019, the number of cows on farms of all categories amounted to 153 thousand heads, including 16.9 thousand heads in collective farms (114.1% compared to the previous year).

According to the results of 2019, the milk productivity of cows in agricultural organizations increased by 2% to the level of 4,817 kg, in large and medium enterprises – up to 5,065 kg. In 2019, farms of all categories produced: milk – 609.3 thousand tons. In 2020, it is planned to begin the implementation of such large investment projects as Omsk Tribal Stud Farm OJSC – construction of a livestock breeding complex for the dairy sector for 1,500 cows with the installation of a milking parlour; Luzinskoye Milk LLC – construction of a livestock complex for 1,800 heads of cows with the installation of a milking parlour. The commissioning of new production facilities will contribute to the growth of livestock production in subsequent years. The main tasks facing agricultural producers of the Omsk region this year are: increasing the volume of milk production by 1.0% compared to the
level of 2019 and the genetic improvement of the herd, including through the improvement of breeding and breeding [1].

2. Materials and methods
The methodological basis of the study is the provisions of modern concepts of analysis of agricultural economics, formalized and intuitive methods for modelling the economic development of the dairy industry. The information base of the study is made up of statistical directories of state and regional statistics, expert databases.

3. Problem statement
The effectiveness of mechanization of dairy farming is expressed with particular power with modern advances in the development of agricultural machinery [2, 3]. The emergence of new, more productive equipment transforms agricultural technology, and the entire technological process in animal husbandry makes it possible to reduce the labour intensity of products, to carry out all production processes with minimal manual labour, thereby increasing labour productivity. The mechanization of production processes contributes to the introduction of modern animal feeding technologies, methods of keeping livestock, improving the quality of work performance and replacing unproductive manual labour with the high-performance machine [4]. One of the main conditions for increasing and reducing the cost of livestock production is to increase the productivity of animals, which depends on the quality of machinery and equipment. The development of agriculture is determined by the degree of its technical capabilities and technical equipment.

4. Discussion of results
The technical potential is a component of the material and technical support for dairy farming, which is a mechanized production covering almost all industries, all workers, using the latest scientific and technical achievements [5]. The technical potential is the basis for the production of material goods. The primary importance is attached to the technical feasibility associated with the qualitative change and development of technical means based on the use of new types of materials, modern design solutions, energy sources caused by the modern stage of scientific and technological progress (electronization, complex mechanization and automation of animal husbandry) (Table 1, Table 2).

| Table 1. Commissioning of new production facilities [6] |
|-------------------------------------------------------|
| **Introduced:**                                       |
| livestock complexes, thousand places: for cattle      |
| feed mills, thousand tons of feed per day              |
| production capacity: whole milk products, thousand tons per shift |
| 2000 | 2014 | 2015 | 2016 | 2017 | 2018 |
| 102.8 | 104.1 | 102.6 | 120.7 | 275.1 | 145.4 |
| 0.06 | 2.3 | 3.1 | 2.5 | 1.4 | 1.1 |
| 0.6 | 0.4 | 0.2 | 0.3 | 0.5 | 0.3 |

| Table 2. Production of the main types of agricultural machinery (thousand pieces) [6] |
|-------------------------------------------------------|
| **2016 | 2017 | 2018 |
| Tractors for agriculture | 6.3 | 7.3 | 7.1 |
| Mowers | 6.8 | 6.8 | 5.7 |
| Presses for straw or hay, including balers | 2.8 | 3.3 | 3.3 |
| Milking Plants | 3.8 | 3.9 | 3.3 |
| Feed crushers | 99.3 | 107 | 116 |

The presence, composition, and technical level of agricultural machinery mainly have a significant impact on the technological level of agricultural production, production costs, and animal productivity.
indicators (Table 3). The production of the main types of agricultural machinery in 2017 compared to 2016 tended to increase, and in 2018 there was a decrease in almost all types of machinery.

**Table 3.** The presence of the main types of agricultural machinery in organizations (at the end of the year; thousand pieces) [6]

|                  | 2000  | 2014  | 2015  | 2016  | 2017  | 2018  |
|------------------|-------|-------|-------|-------|-------|-------|
| Tractors         | 746.7 | 247.3 | 233.6 | 223.4 | 216.8 | 211.9 |
| Harvester: forage harvesting | 59.6  | 15.2  | 14.0  | 13.3  | 12.7  | 12.3  |
| Mowers           | 98.4  | 33.9  | 32.2  | 31.0  | 30.5  | 30.1  |
| Balers           | 44.0  | 21.9  | 20.9  | 20.4  | 19.9  | 19.6  |
| Milking installations and units | 88.7  | 26.3  | 25.1  | 24.1  | 22.9  | 22.4  |

The annual cost of repair and maintenance of equipment in dairy farming is at the level of 7.23 billion rubles. These costs make up 3.9% in the structure of the cost of livestock production, and in farms where physically and morally obsolete equipment predominates, it reaches 12%. At the same time, the complexity of milk production increases to 24%.

**Table 4.** Introduction of new equipment in agricultural organizations (as a percentage of availability at the end of the year) [6]

|                  | 2000  | 2014  | 2015  | 2016  | 2017  | 2018  |
|------------------|-------|-------|-------|-------|-------|-------|
| Tractors         | 1.9   | 3.1   | 3.0   | 3.3   | 3.6   | 3.4   |
| Harvester: forage harvesting | 3.3   | 4.5   | 4.1   | 5.0   | 5.0   | 4.6   |
| Milking installations and units | 1.1   | 3.8   | 4.1   | 3.1   | 3.0   | 2.8   |

In dairy farming, technical equipment is significantly reduced (Table 4), the annual technical update does not exceed 0.6. The base of repair and maintenance of machines has been destroyed.

**Table 5.** Write-off of equipment in agricultural organizations (as a percentage of availability at the beginning of the year) [6]

|                  | 2000  | 2014  | 2015  | 2016  | 2017  | 2018  |
|------------------|-------|-------|-------|-------|-------|-------|
| Tractors         | 6.2   | 5.1   | 4.6   | 4.1   | 3.7   | 3.6   |
| Harvester: forage harvesting | 9.5   | 7.4   | 7.3   | 6.5   | 6.2   | 5.9   |
| Milking installations and units | 7.9   | 5.6   | 4.6   | 4.1   | 3.8   | 4.0   |

The technical equipment of dairy farming and its maintenance engineering base are relatively low (Table 5). The use of obsolete and physically worn-out equipment in animal husbandry is over 72%. In this regard, the efficiency decreases, the optimal technological modes of keeping and feeding animals are violated and, as a result, their productivity decreases. The industry is provided with technological equipment that meets modern requirements by only 11%.

However, it should be noted that over the past period, more powerful and productive mechanisms began to appear in the material and technical base of the livestock industry in terms of keeping animals and feed production.

In order to fully assess the technical support of the dairy industry in agricultural enterprises, the degree of depreciation of fixed assets in the agricultural sector should be studied [7, 8].

From the data of the Federal State Statistics Service, the accounting depreciation of fixed assets increased almost two times, from 4.3 to 8.6%. This fact is due to a significant part of the machinery and equipment, as well as buildings and structures put into use in the late 80s. Also, the subsequent weakening of state aid and increased price disparity contributed to a reduction in the level of material and technical renewal of the industry. At the beginning of the period under review, the degree of depreciation of fixed assets of agricultural enterprises was significantly lower than the depreciation of fixed assets of the country. However, the situation has changed since 2010.
Table 6. The presence of agricultural machinery in large, medium and small agricultural organizations (the value of the indicator for the year), pcs [9]

|                                   | Russian Federation | Omsk region | Russian Federation | Omsk region | Russian Federation | Omsk region | Russian Federation | Omsk region | Russian Federation | Omsk region | Russian Federation | Omsk region |
|-----------------------------------|--------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|-------------|
| Milking installations and         |                    |             |                    |             |                    |             |                    |             |                    |             |                    |             |
| aggregates, total                 | 27 252             | 26 282      | 25 082             | 24 068      | 22 921             |             |                    |             |                    |             |                    |             |
|                                   | 896                | 897         | 906                | 890         | 859                |             |                    |             |                    |             |                    |             |
| Milking installations and units   | 14 518             | 14 335      | 14 210             | 14 160      | 13 814             |             |                    |             |                    |             |                    |             |
| with a milk line                  |                    |             |                    |             |                    |             |                    |             |                    |             |                    |             |
|                                   | 513                | 505         | 512                | 509         | 490                |             |                    |             |                    |             |                    |             |
| Forage harvesters                 |                    |             |                    |             |                    |             |                    |             |                    |             |                    |             |
|                                   |                    |             |                    |             |                    |             |                    |             |                    |             |                    |             |
|                                   | 16 131             | 15 165      | 14 042             | 13 260      | 12 681             |             |                    |             |                    |             |                    |             |
|                                   | 452                | 406         | 387                | 330         | 314                |             |                    |             |                    |             |                    |             |
| Mowers                            |                    |             |                    |             |                    |             |                    |             |                    |             |                    |             |
|                                   |                    |             |                    |             |                    |             |                    |             |                    |             |                    |             |
|                                   | 35 574             | 33 852      | 32 168             | 30 959      | 30 483             |             |                    |             |                    |             |                    |             |
|                                   | 526                | 509         | 473                | 403         | 439                |             |                    |             |                    |             |                    |             |
| Balers                            |                    |             |                    |             |                    |             |                    |             |                    |             |                    |             |
|                                   |                    |             |                    |             |                    |             |                    |             |                    |             |                    |             |
|                                   | 22 730             | 21 893      | 20 883             | 20 370      | 19 912             |             |                    |             |                    |             |                    |             |
|                                   | 306                | 322         | 322                | 294         | 309                |             |                    |             |                    |             |                    |             |
| Tractors                          |                    |             |                    |             |                    |             |                    |             |                    |             |                    |             |
|                                   |                    |             |                    |             |                    |             |                    |             |                    |             |                    |             |
|                                   | 282 991            | 269 987     | 255 069            | 243 993     | 236 733            |             |                    |             |                    |             |                    |             |
|                                   | 5 546              | 5 289       | 5 051              | 4 729       | 4 597              |             |                    |             |                    |             |                    |             |

The main reason for the decline in the dairy industry is the unsatisfactory state of the material and technical base.

A significant level of wear and low productivity of the equipment reduces the effectiveness of the activity and, as a result, makes the domestic agricultural producers uncompetitive. Manufacturers of dairy livestock products need technical equipment, since during the period from 2014 to 2018 the number of milking plants and aggregates in the Russian Federation decreased by 16%, in the Omsk region by 4%, the number of tractors decreased in the Russian Federation by 16%, in the Omsk region by 17%. A similar situation is observed with mowers and balers; the number of forage harvesters has decreased by a third.

5. Conclusion

Solving problems to increase milk production is impossible without further investments in the construction and modernization of livestock complexes [10, 11]. The use of automated technological lines for keeping animals will make it possible to reduce the direct participation of people in the production process and thereby increase milk production and obtain high-quality products [12, 13]. The use of high-tech equipment will make it possible to optimize the number of jobs and, as a result, increase labour productivity and raise the level of wages. Maintaining the achieved results of livestock production both in Russia and the Omsk region, their further increase are possible due to the use of advanced technologies. Technological and technical re-equipment of dairy cattle breeding at the current level should be implemented using the latest scientific and technological progress, which should be oriented towards increasing livestock productivity, resource and energy saving, increasing labour productivity, reducing the cost of production and increasing its profitability. There is a need for targeted state support for the dairy industry in the following areas: subsidies for the financial provision of part of the costs of the comprehensive modernization of livestock farms for breeding cattle in the dairy sector of the Omsk region; subsidies to stimulate the development of dairy farming.

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