

# Assessment of Economic Efficiency of Production and Sale of Raw Milk by Dairy Farms Within an Agroholding

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**Abstract** — The article presents the assessment with the justification of the economic efficiency of the dairy farms in the conditions of an agricultural holding, which has a technologically interconnected mechanism connecting the production, processing, and sale of raw milk and dairy products. A model of structural and logical production factors affecting the volume of raw milk production, as well as the level of its consumer properties, is proposed. This model is applied for the production technology and is a part of the overall quality management system for raw milk. During the period of 2017–2019 the profit of the agrarian complex of EcoNivaAgro, LLC, was  $n_{\text{average}} = 2513836$  ths rubles. Profit per 1 hectare of agricultural land was  $n_{\text{average}} = 22874.1$  ths rubles, and per 1 man-hour  $n_{\text{average}} = 2376.0$  ths rubles, correspondingly. Milk productivity per 1 forage-fed cow was  $n_{\text{average}} = 24.8$  kg daily during the period of the study. Profit from the sale of the raw milk per 1 forage-fed cow was – 93424.6 rubles. The efficiency of the produced raw milk at cattle-breeding companies within the agricultural holding at the initial stage of its organization was unprofitable, however, later and to the present moment, the profitability indicator of milk production and sale is relatively high and is respectively  $n_{\text{average}} = 60.6$  and 38.8 %. The profitability level, as an economic efficiency indicator, is affected by technological factors that determine the cost of production of raw milk. Based on the work carried out, it can be noted that agricultural holdings have a high potential for competitiveness and development in their area of activity, both dairy cattle breeding and other agricultural sectors, while saving resources, taking into account joint and effective work due to a balanced mechanism.

**Keywords** — dairy farms, raw milk, dairy products, economic efficiency, agricultural holding.

## I. INTRODUCTION

The effective work of the country's agricultural industrial complex has an impact on the welfare and living standards of its population. Sustainable development of the agricultural business in its various sectors creates the conditions for the food security of the population and the preservation of food sovereignty in the face of permanent sanctions and an unstable balance of the food market.

Agriculture plays an important role in the provisions for human activity. Major problems, such as overpopulation, competition for resources, pose a threat to the food security of the planet. To solve the constantly arising complex problems in agricultural production systems and to achieve some progress in the field of technologies for the intellectual management of its industries, important tools should be chosen to solve the problems of production stability of agricultural companies with the aim at their economic growth. An analytical analysis of quality management in the implementation of high technology in various sectors of agriculture is the main guarantee of ensuring food security in the future, safety of food, and natural environmental balance [1, 2].

Financial results, as an illustration of the performance of dairy companies engaged in the production of raw milk, are facing problematic factors that adversely affect its effective growth. These factors include the seasonality of raw milk production, increase in the production cost due to the influence of external economic reasons, as well as the growth of wages with the objective of bringing it to the subsistence level and a number of others, which have a significant role in calculating the production cost.

During the crisis period in the period of the 1990s, a number of agricultural industrial companies and associations was liquidated. After overcoming it, the reorganization took place in the remaining agricultural organizations. As a result, a number of federal programs aimed at ensuring the development of agriculture was formed. The main priority areas included the development of dairy cattle breeding. Based on the current situation in the dairy companies with the production of raw milk and as a result of the implementation of federal projects, the change took place in the existing technological principles of the dairy industry based on the ongoing complex integration processes of the Russian agricultural industrial complex. The emergence of large agricultural industrial groups in the current market relations is a consequence of the formation of sustainable competitiveness of producers.

Large agricultural holdings represent a complex organizational structure monopolizing food markets on a regional scale. The appearance of agricultural holdings in the market in the course of their large business may adversely affect the stable operation of small local structural companies, whose economic potential can not fully compete with these structures. Therefore, the bankruptcy of small companies has a negative impact on the socio-economic situation of the population.

Throughout the European Union, medium and large, highly specialized intensive farms play the key role in milk production. Despite the fact that their economic profitability is limited, however, the production and technological potential at these dairy companies has a high level of labor productivity. In turn, the insufficiently developed production and technological potential is one of the main restrictions for the level of economic growth faced by other dairy farms in the European Union [3].

The potential of modern technological features of dairy farming is currently not fully implemented. Based on this, it is necessary to develop and improve a system due to which it is possible to collect, integrate, control, and analyze data in real time both in and outside the dairy farm for further practical and relevant actions [4, 11].

In the Voronezh region, the principle of cluster management of the agricultural dairy business is applied for the objective of effective growth of dairy farming and ensuring a stable socio-economic situation in its various districts. Due to the certain level of effective development of dairy cattle, this result, as a rule, is achieved through the formation of the cluster technological approach with the harmonious interaction of all its participants. The leading representatives of the companies included in the dairy cluster of the Voronezh region are EcoNivaAgro LLC, Molvest Group of Companies, Don-Agro Group of Companies agricultural holding and others. The main advantages of the functioning of the dairy cluster is the provision of state benefits to a company, which due to its production status influences the socio-economic indicators of the region. There is also a tendency for the development of dairy companies based on the principle of effective synergy, taking into account cooperatively competing business activities in a market

economy. This allows each company to have a more stable external position despite the unstable market situation.

Based on the main direction of the ongoing research work, which includes the scientific justification of the technological features of raw milk production, we set the goal to analyze the economic efficiency of the produced and sold milk in the conditions of EcoNivaAgro LLC, as the main producer in the dairy cluster group within the territory of the Voronezh region and part of the group of large agricultural holding EcoNiva-APK in Russia.

## II. MATERIALS AND METHODS

The analysis of the efficiency of production and sales of raw milk was carried out in the conditions of the agricultural industrial holding EcoNivaAgro LLC, Voronezh region, Liskinsky district. The initial data for obtaining the necessary material was the data of the primary accounting report, as well as the report forms on the financial and economic condition of dairy farms and cattle breeding complexes for 2017 – 2019, the existing production and financial plans of the companies within the holding, as well as the regulatory acts of the legal and accounting departments.

In the process of the work, we used the data from reports on zootechnical analysis of herd turnover among reconstructed dairy farms and modern dairy complexes in relation to the technology of tie-up and yard housing of dairy cows (red-and-white and Holstein) and meat and dairy cows (Simmental). The obtained production data from the economic and zootechnical departments were subjected to statistical processing using computer computing programs.

## III. RESULTS

The technological features of raw milk production are unique and require special attention when organizing management accounting of its production costs, as well as monitoring of individual technological factors aimed at the economic efficiency of the manufactured products.

EcoNiva-APK is currently a large agricultural holding in Russia. The company's agricultural units are located in Voronezh, Kursk, Ryazan, Kaluga and several other regions of Russia; the occupied area is more than 603,000 ha. The main or priority area in the company's performance is dairy production. EcoNiva-APK is one of the leaders in raw milk producers in Russia and Europe. Livestock companies produce more than 2520 tons of milk daily (as of January 27, 2020). Gross milk yield in 2019 amounted to 758 thousand tons. The total number of cattle is about 184,180 heads, of which 98610 heads are forage-fed cows (as of January 27, 2020). Modern technological methods of housing, as well as the effective work on herd management, ensure the dynamism of increasing the production volumes of livestock companies. The number of cattle bred in livestock companies producing raw milk is represented by breeds such as Simmental, Holstein black-and-white, red-and -white, brown Schwyz.

The agricultural company EcoNivaAgro, LLC, was formed and has been functioning independently since 2002 in the

territories of several districts of the Voronezh region. The total area of farmland is 149,000 ha (as of April 1, 2020).

The company is the largest raw milk producer in the Voronezh region. The total amount of raw milk produced is 1013 tons daily. The total number of cattle is about 72,100 cows of the dairy and meat and dairy breeds, of which 40,250 heads form the share of forage-fed cows (as of April 1, 2020). The agrarian holding represents a single dynamically functioning structure of the business mechanism of financial management. Long-term investments are made with centralized funding, taking into account the characteristics of current costs in the transfer resource management system.

The main direction or constituent core of the agrarian holding is agricultural production in the livestock dairy industry, as the priority. Based on the specifics of agricultural production, this area represents a structure that is affected by natural, seasonal, and a number of other factors that form the elasticity of manufactured products, in accordance with its demand and supply, taking into account the peculiarities of the country's socio-economic situation. The livestock sector in our country is the most vulnerable under the influence of the external socio-economic environment. Under these conditions, companies have to adapt to the task of regulating the economic efficiency of products. At the moment, this is one of the main conditions for the development and functioning of the business, however, the governmental management of the structure of the agricultural industrial complex must take these features into account so that the economic condition of organizations remain at a stable level.

A number of technological factors that determine the production cost and ultimately the result of the production process, affect the performance of livestock complexes and farms for the production of raw milk. It is important to consider the economic feasibility of performing dairy farming by building consensus with consumers, by studying marketing preferences when interacting with possible changes in technological operations, making products with higher consumer properties to ensure a stable level of the production and economic process of the industry and increase the product competitiveness [5, 10].

Figure 1 presents the model of structural, logical, or technological factors that affect the volume and level of consumer properties of raw milk produced in livestock companies.

The volume and consumer properties of raw milk depend on the number and breed of animals, the milk productivity of cows, as well as the laboratory assessment carried out in accordance with the requirements of the Technical Regulation of the Customs Union "Concerning the Safety of Milk and Dairy Products" (as amended on December 19, 2019).

Recommendations for improving the efficiency of the dairy business are reduced to the following areas: the increase in the productivity of dairy cows while improving the quality of the herd, modernization of farms and the introduction of innovative technologies, improving the quality of milk produced that meets the requirements for natural products, which ultimately makes it attractive to consumers [9].

The main reserves that determine the efficiency of production and profitability in an agricultural holding are as follows: the number of modern or reconstructed livestock buildings and constructions, breeding base, innovative technological features of fodder provision, its storage, as well as feeding to animals, livestock housing technology, highly qualified personnel, etc. The main factors must be taken into account and justifiably directed towards efficient production of resource saving, as well as the increase of the labor productivity, obtaining environmentally friendly products, environmental protection and a number of others that could affect the modernization of the material and technical base and ensure the competitiveness of the products obtained.

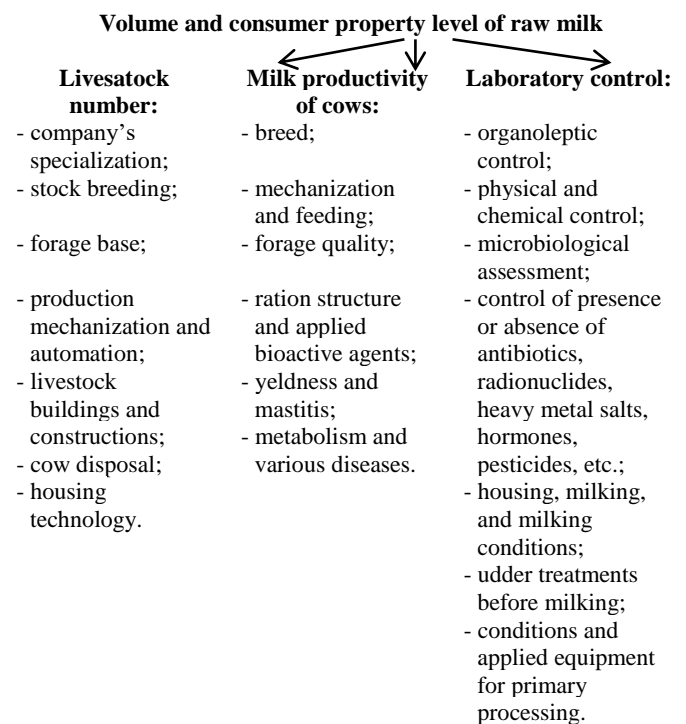


Fig. 1. The model of structural and logical production factors affecting the volume and level of consumer properties of raw milk

The production profitability is particularly affected by the selling price of raw milk, which depends on the level of consumer properties. Therefore, the organization of the quality management system, as a way of economic efficiency in the production of raw milk, is of great importance. Market fluctuations in the raw milk prices are natural, this is the main reason that affects the economic efficiency of production, i.e. it is the seasonality of consumer demand and seasonal price fluctuations. With the transition to intensive industrial production of raw milk, seasonal fluctuations in its price are smoothed out, but in the Russian Federation the production cost of raw milk is higher than in other countries, due to the high cost of feed, fuels and lubricants, electricity, maintenance of imported equipment, the cost of imported veterinary drugs, etc. In addition, the income level of the population affects the consumption of dairy products, so the demand for some dairy products, such as cheese, butter, has decreased, due to the decrease in consumer solvency.

During the implementation of the state programs for the development of the agrarian industrial complex of Russia and provision of food security of the country, the necessity of developing holding structures with the ability to introduce effectively innovative technological elements is substantiated taking into account the development of the socio-economic level of the regions. It is explained by the fact that they are the most important condition in the system of structural and logical production factors of conduct industrial dairy cattle breeding.

In the technology of dairy cattle breeding, its intensification with the aim of increasing the level of milk yield per cow and the quality of raw milk is of particular importance, which ultimately increases the economic condition of the dairy farm by obtaining higher dairy gross profit. The technical and economic characteristics and cost analysis of the milk production system are important for improving and increasing the profitability of dairy farming [6, 8].

The analysis of production resources owned by EcoNivaAgro, LLC, showed that the average annual cost of production assets increased by 8.3 million rubles over the period of 2018-2019, as a result of revaluation of fixed assets. The increase in the working capital value over the past three years amounted to 5.1 million rubles. The main part of the revenue structure is the production and sale of raw milk – 70.41 %, as the company is specialized in dairy farming.

Table 1 presents the performance indicators of the raw milk production in the conditions of dairy complexes and reconstructed livestock farms of EcoNivaAgro, LLC.

TABLE I. KEY PERFORMANCE INDICATORS OF THE RAW MILK PRODUCTION

Indicators	2017	2018	2019	2019 in % of 2017
Milk productivity per 1 cow, kg/day	24.3	24.6	25.5	105.3
Raw milk yield per 100 ha of farmland, centners	1776	2307	2514	141.5
Total cost of 1 c of raw milk, rubles	1933.91	1480.76	1774.17	91.7
Sale price of raw milk, rubles per c	2940.69	2608.46	2917.81	99.2
Marketability of raw milk, %	94.0	94.2	95.0	101.1
Profit (loss) from the raw milk sales per 1 cow, rubles	83792.46	95200.97	101280.6	120.9
Raw milk pay-off level, %	152.1	176.2	164.5	108.2

Based on the data presented in table 1 it is seen that milk productivity is on average  $n_{\text{average}} = 24.8$  kg / day during the period of study. The raw milk yield per 100 hectares of agricultural land averaged at  $n_{\text{average}} = 2199$  centners, based on the fact that the total cost was  $n_{\text{average}} = 1729.6$  rubles per 1 centner of raw milk. The level of milk marketability for the period of study is stable; this indicator was  $n_{\text{average}} = 94.4$  %. The profit from the raw milk sale per forage-fed cow was  $n_{\text{average}} = 93,424.6$  rubles, as the analysis of the results showed, this indicator tends to increase over the period, as well as the pay-off rate for investment, which is respectively equal to  $n_{\text{average}} = 164.3$  %.

The analysis of the change dynamics in ownership patterns and production capacities of dairy cattle breeding in Russia showed, that due to the reduction in the number of cows there was the increase in large dairy companies with the decrease in dairy farms in the agricultural dairy business, as a sector of small and medium capacity milk production. The dependence of the economic efficiency of milk production on the increasing of the livestock number is relevant, but now it is not effective enough due to insufficiency of the investment projects being introduced into the dairy business [9].

Based on the performance indicators of dairy companies included in the group of agricultural holdings, we can consider the dynamics of the dairy production profitability, the results of which are presented in table 2.

TABLE II. DYNAMICS OF THE PROFITABILITY INDICATORS IN DAIRY PRODUCTION

Indicators	2017	2018	2019	2019 in % of 2017
Profit (loss), ths rubles	1617781	2364221	3559506	220.0
Profit (loss), rubles per:				
- 1 ha of farmland	16806.19	24502.24	27313.79	162.5
- 1 man-hour	2643.43	1986.74	2497.90	94.5
- 100 rubles of production cost	48.92	71.72	61.23	125.2

The production of livestock products under the conditions of the agricultural holding at an early stage of its organization has been unprofitable since the period 2014–2016. After that, the profit amounted to about 206638 thousand rubles, which was confirmed by the growth of profit per 1 hectare of farmland and profit by 1 man-hour, as well as a slight increase in production profitability – from 15.62 to 9.13 %. During the period of study the profit amounted  $n_{\text{average}} = 2513836$  ths rubles. The profit per 1 ha of farmland was  $n_{\text{average}} = 22874.1$  ths rubles, and per 1 man-hour  $n_{\text{average}} = 2376.0$  ths rubles.

In recent years, milk production in the country was ensured mainly by increasing the productivity of cows in agricultural organizations while reducing their numbers, the trend towards the decrease in milk production in households or farms has been remaining steady. One of the reasons for this is the low level of technical equipment of the facilities, due to the lack of specialized companies in the country manufacturing innovative equipment, the slow pace of machine renewal and the use of inefficient technologies in the area of dairy cattle breeding, product storage, and animal feeding [7, 13].

The dynamics of profitability indicators for dairy production has relatively favourable, the raw milk production has an unstable industrial and economic character, taking into account the market situation in the country and the world. Table 3 presents the results of the calculation of production and sales of raw milk produced in the conditions of EcoNivaAgro, LLC.

TABLE III. EFFICIENCY INDICATORS FOR THE RAW MILK PRODUCTION AND SALES

Indicators	2017	2018	2019	2019 in % of 2017
Commodity output, c	1606884	2096505	3112452	193.7
Prime cost, ths rubles	3107569	3104421	5522034	177.7
Revenue, ths rubles	4725350	5468642	9081540	192.2
Marketability level, %	94.0	94.2	95.0	101.1
Total cost of 1 c, rubles	1933.91	1480.76	1774.175	91.7
Sales price of 1 c of product, rubles	2940.69	2608.46	2917.81	99.2
Total profit (loss), ths rubles	1617781	2364221	3559506	220.0
Profit per 1 c of product, rubles/c	1006.78	1127.70	1143.63	113.6
Profitability of milk production, %	48.92	71.72	61.23	125.2
Profitability of milk sales, %	34.24	43.23	39.19	114.5

Based on the data obtained, it can be noted, that the efficiency of sales of livestock products is not high. As shown by the calculation presented in Table 3, the total volume of marketable products amounted to  $n_{\text{average}} - 2271947$  centners, sales cost respectively amounted to  $n_{\text{average}} - 3911341.3$  thousand rubles. The revenue indicator for the study period was at the level of  $n_{\text{average}} - 6425177.3$  thousand rubles. The total profit amounted to 2513836 thousand rubles, respectively, the profitability of milk production was  $n_{\text{average}} - 60.6$  %, and the profitability of sales  $n_{\text{average}} - 38.8$  %. The economic analysis showed that the raw milk production and sale under the conditions of EcoNivaAgro agricultural holding has the positive growth dynamics.

#### IV. CONCLUSION

The experience of the developed countries indicates that the introduction of advanced information technologies in traditional business processes can increase the profitability of agriculture. The profitability of these companies will be the key to sustainable business in an unstable market. The introduction of innovative technologies will improve animal health and create industrial conditions under which their behavior will be close to the natural environment [13].

The developed scientific and technical program for the development of agriculture for 2017–2025 provides an opportunity to increase profitability and step up the initiative to create high-tech companies for the production of milk in the agricultural sector of Russia. Evaluation of the implementation of this program showed that today 3 types of activities are being financed: the creation of scientific and technical results and products; introduction of scientific and technical results and products into production; and the commercialization of scientific and technical results and products. The systematic study of various aspects of increasing the competitiveness of dairy farming in Russia made it possible to develop theoretical and methodological foundations for studying this problem. Based on the economic essence of the concept of “competitiveness”, only with profitable management of the sector as a whole, we can raise the question of the competitive advantages and competitiveness of each type of livestock production [10, 12].

Technological analysis in calculating the economic efficiency of the raw milk production and sale in large dairy complexes and modernized dairy farms in an agricultural

holding company showed that this type of business has a stable position in the market. Organization of its work is a single structure for the dairy business, which allows combining the capital of the agricultural sector, industrial companies, and trade organizations. Organization of the work of companies of an agricultural holding having a closed cycle for the production of raw milk, its processing and production of dairy products allows reducing the costs of production and sale of dairy products, smoothing production and economic conditions between their companies as a result of a balanced distribution of profits or own revenues. In this case, this is the main factor in the sustainable development of dairy cattle breeding in general, as well as in particular agricultural organizations; work in some of them was previously not effective in the production of dairy natural products providing stable consumer demand for the population.

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