Economic efficiency and development of the third domain of reindeer husbandry (in the republic of Sakha)

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Abstract. As is known, the concept of economic efficiency is one of the important categories characterizing the performance of reindeer herding farms. From the point of view of the theory of economic analysis, there is no unified definition of economic efficiency, which means that, as seems to us, the success of reindeer herding farms is still not determined sufficiently. In the article, we also prove that defining the economic efficiency of reindeer husbandry only by the meat production efficiency is not sufficient because the meat production process is not integrated with the processing of reindeer herding products and its sales. As a result, the economic efficiency of reindeer herding production is severely underestimated and leads to low profitability or even losses. The economic efficiency of production can be determined at the national, branch, enterprise and on-farm subdivision, i.e. there is a multilevel approach to the criteria of efficiency or duality of the criteria of efficiency. It is known that indicators of economic efficiency include cost recovery, net production, profit, profitability, rate of return, productivity of live labour, that is, economic efficiency of production is characterised by the ratio of economic effect to costs, which caused this effect. Analyzing the approaches to assessing the efficiency of reindeer herding farms, we came to the conclusion that an integrated approach should be added to the existing ones, as the meat production process is not integrated with the processing of reindeer herding products and their sales, as a result, the economic efficiency of reindeer herding products is greatly underestimated. However, reindeer breeding farms, which receive essentially ecologically pure meat, do not have special prices for it established by the Government of the Republic of Sakha (Yakutia). The establishment of such prices at the regional level would significantly raise the efficiency of reindeer breeding as a branch of economy as a whole. The main task of reindeer farms in the North-East of Russia, which includes the Republic of Sakha (Yakutia) at the present stage is a high average slaughter meat of reindeer carcases, equal to 65-90 kg and higher. This main indicator should not be bypassed or denied by zootechnicians, scientists, and heads of agricultural production. Production of cheap high-quality venison meat - is the key to success.
1 Introduction

The Republic of Sakha (Yakutia) is rich in history and traditions, and here one of the most important branches of agriculture, the domestic herding of northern reindeer, has been preserved. The indigenous small peoples living in the North are mainly the Sakha people. "... The peculiarity and specificity of reindeer husbandry in Yakutia is a seminomadic way of life, herding reindeer in pastures remote from populated areas where there are no comfortable housing and living conditions for modern people..."

This study is conditioned by the fact that the high economic efficiency achieved in the late 1980s in domestic reindeer herding in Yakutia began to decline due to the reduction in the number of reindeer by more than 2.5 times. The key factors were the following: the state's withdrawal in the 1990s due to the crisis state of the economy, the lack of a scientifically grounded protectionist economic and social policy for the development of the northern regions, and the farms themselves by that time were in extremely unfavourable living conditions, the violation of the unique way of life of reindeer herders caused by sociodemographic problems.

The purpose of our research in this short article is to present our approach to assessing the efficiency of reindeer herding farms in the Republic of Sakha (Yakutia).

The novelty of the research consists in revealing the concept of economic efficiency as one of the important categories characterizing the performance of reindeer breeding farms and the possibility of implementing one or another business project aimed at improving its work. The article shows the peculiarities of domestic reindeer herding in the Northern Sakha (Yakutia), which is one of the northern regions of the Russian Federation.

2 Research methodology

In our work on the issues of improving the economic efficiency of reindeer husbandry products, we relied on the scientific works of authoritative domestic regional scientists and major specialists in northern domestic reindeer herding, A.D. Kurilyuk, D.I. Syrovatsky, L.N. Vladimirov, M.P. Neustrov and others. General scientific and methodological approaches were used as tools. The analysis and generalisation of specific empirical material on northern domestic reindeer herding was based on. Methods of statistical and comparative analysis were used, and information was presented in the form of tables and graphs.

3 Research results

3.1 Assessing the efficiency of reindeer herding farms

Economic efficiency has a multi-level approach in terms of efficiency criteria, which can be defined at different economic levels, this may be an industry or a division within the farm, a particular activity.

It should be understood that efficiency at the enterprise level takes into account only the effects occurring at the enterprise level - there is a hidden inter-sectoral redistribution of the value newly created in agriculture through underpricing of agricultural products and overpricing of inputs supplied to agriculture, underpricing of agricultural workers, etc. There are several approaches to assessing the economic efficiency of an enterprise (Table 1).
Table 1. Assessment of economic approaches to determining cost-effectiveness for the reindeer herding industry.

<table>
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<tr>
<th>Index</th>
<th>Efficiency</th>
<th>Features</th>
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<tbody>
<tr>
<td>Resource</td>
<td>Comparison of the finished product with the inputs used, expressed in terms of productivity</td>
<td>In this approach, there is a problem of balancing the returns of heterogeneous resources</td>
</tr>
<tr>
<td>Net cash flow (NFC)</td>
<td>( NFC = net \text{ profit} \pm \text{ change in working capital} + \text{ depreciation} \pm \text{ change in long-term debt} - \text{ capital expenditure} )</td>
<td>One of the most important indicators of financial performance</td>
</tr>
<tr>
<td>Integrated profit</td>
<td>Profit generated from the sale of both fresh meat and processed meat products</td>
<td>In this approach, the full economic efficiency of reindeer herding products is determined</td>
</tr>
<tr>
<td>Free cash flow</td>
<td>Cash flow represented by the sum of the enterprise's marginal revenue cleared of its fixed costs of maintenance</td>
<td>–</td>
</tr>
<tr>
<td>Contemporary</td>
<td>Business efficiency is the amount of revenue generated by an enterprise's business processes, less the costs required to implement them; or efficiency is the performance of employees' actions that determine future financial results expressed in cash flows</td>
<td>However, people do not always work efficiently (X-efficiency theory). Growing the value of a business by increasing its capitalisation is a fundamental criterion of business performance</td>
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Considering approaches, concepts, and the production process as a whole, we have come to define the economic efficiency of reindeer husbandry by assessing possible approaches to assessing the efficiency of the enterprise.

In our opinion, it is necessary to add an integrated approach to the approaches already presented in Table 1, which most fully reflects the efficiency of the reindeer herding industry.

Determining the full value of reindeer husbandry meat production is inefficient. The production process in reindeer husbandry is not integrated and this is a very large gap (the slaughtering is primarily all parts of the reindeer carcass, not just the meat). Maximum economic efficiency can only be achieved by integrating the production process with the processing of reindeer herding products and their marketing.

Reindeer herders, who do not receive any additional revenue for the processed and sold products, mostly operate production with low profitability or even at a loss. This requires special means and tools from the state (subsidies, additional programmes) in order to bring reindeer husbandry to work effectively.

However, reindeer herding farms, while receiving essentially environmentally friendly meat, do not have special prices for it established by the Government of the Republic of Sakha (Yakutia). Although the establishment of such prices at the regional level would significantly increase the efficiency of reindeer herding.

The logic of the selection of economic indicators derives from the purpose of the functioning of the system under study. For example, it is necessary to establish indicators for the comparative economic assessment of reindeer husbandry in certain farms. It is known that the goal of reindeer husbandry is to ensure an increase in the volume of production, high labour productivity, and a return on the feed and costs used. Based on this, the following
A system of indicators can be established: gross output and marketable products per animal, labour productivity, feed payment and cost recovery [2].

The economic efficiency of the production process can be characterised by the following indicators:

1. **Cost recovery** - the ratio of marketable income to the total expenditures of man and material labour; it is a generalized indicator.

2. **Net output (gross income)** includes net income and payroll. It is a source of consumption and accumulation. Since some of the net production created in agriculture is sold in industry, it can only be determined by calculation. Therefore, net production does not always accurately reflect the actual level and dynamics of production efficiency.

3. **Profit** is the realised part of net income and is one of the most important synthetic indicators of the efficiency of enterprises. Different concepts of costs imply different concepts of profit.

4. **Profitability** - the ratio of profit to costs of marketable products; as a rule, it is determined by marketable products, but it can also be determined by gross output.

5. **Profit margin** is the ratio of profit to the value of fixed and current assets.

Items 4 and 5 are indicators of economic efficiency of the enterprise, but for agricultural enterprises do not always reflect the trend of the whole, as they are only a part of net and gross output.

6. In enterprises, the form of expression and recording of production costs is the cost of production, which is one of the important indicators of production efficiency.

7. **Productivity of live labour** - output of gross and net production per unit of labour input. For a more accurate assessment of efficiency, along with productivity of live labor, it is important to evaluate the stock intensity (the ratio of the average annual value of fixed assets of agricultural purposes to the value of gross output), return on working capital (output of gross output per unit of working capital costs) and material intensity (the inverse indicator of return on working capital).

Agriculture is always about natural, organic products, of course the determination of cost-effectiveness will be based on value and in-kind indicators such as productivity, yields.

### 3.2 Achievement of potential reindeer meat productivity

The potential productivity of reindeer is the main task of reindeer husbandry today. Profitability can be characterised by the production of quality products (meat and sub-products).

The main task of reindeer farms in the North-East of Russia, which includes the Republic of Sakha (Yakutia) at the present stage is the production of high-quality, cheap meat and reindeer meat. Nowadays, reindeer breeding is an extensive branch of animal husbandry, the well-being of which depends primarily on natural-climatic conditions, and not only.

One of the main indicators for analysing, monitoring and comparing the levels of agricultural production is the achievement of the highest possible carcass slaughter weight, or the realisation of the reindeer's potential meat productivity. The achievement of reindeer meat production potential is the realisation of the biological growth potential of a reindeer, depending on the age, sex, breed and natural climatic conditions.

Reindeer meat production potential (RMPP) by carcass slaughter weight is determined according to the generally accepted formula:

\[
M_{RMPP} = \frac{L \times Y}{100}
\]
here:
$M_{RMPP}$ - carcass slaughter weight, kg;
$L$ - reindeer live weight, kg;
$Y$ - meat yield, %.

Intensification of reindeer husbandry consists in the rational use of pastures, improvement of the productive and breeding qualities of reindeer, improvement of the system of reindeer husbandry, strengthening its material and technical base, specialisation and strengthening of reindeer farms, wide introduction of the achievements of science and best practices into production, material incentives for reindeer farms and employees, increase in the profitability of reindeer husbandry.

Reindeer breeding enterprises in Russia, including those in Yakutia, belong to two main types. In the first type, reindeer husbandry is the main branch of the economy, and such farms are mainly located in the tundra. In the second type, which is located in the taiga, reindeer husbandry performs auxiliary (transport) functions [4].

The economic efficiency can be substantiated by two measures, namely the amount of meat and additional products obtained from the slaughtering of reindeer per year and the profit obtained from the sale of the aforementioned products.

The amount of meat and other products the reindeer herding cooperative receives from its herd per year depends on one hand on the external conditions (including the condition of the pastures, weather, predators, wild reindeer, etc.), and on the other hand on the reindeer herders' skills and experience and material and technical resources, i.e., the use of internal production factors (which we shall call the intensity level for the sake of brevity).

The overwhelming part of the territory of the Republic of Sakha (Yakutia) (more than 75%) consists of tundra, forest-tundra and rugged mountain-taiga areas with forest-tundra and tundra climate, where farming is impossible, cattle breeding and even herd horse breeding is difficult. Only reindeer are able to use as forage the lichens (jagel), bushes and some kinds of grasses which are not eaten or are badly eaten by other domestic animals.

There is a particular breed of reindeer, the argali, that is able to feed on grass, bushes and herbaceous remains of tundra all the year round.

Reindeer fills an ecological niche in which no other animal species can exist. This is an exceptional value of reindeer in further development of biological resources of the Far North of the country.

Three main factors influence the effectiveness of reindeer husbandry in the Republic of Sakha (Yakutia): the size of the herds, which is determined primarily by natural and climatic conditions, the condition of the pastures, and the availability of qualified herding staff [5].

In addition, scientist A.D. Kurilyuk has identified such features of reindeer husbandry in Yakutia as the relatively small size and wide economic specialisation of herds, the low proportion of cows in the herd structure [6].

3.3 Specialisation

Intensification of reindeer breeding depends on improvement of investments in the sector, rational conduct of sectoral specialization, deepening of cooperation, implementation of large-scale works in the field of preservation and support of reindeer breeding in order to develop, preserve the traditional sector, which is vital for indigenous minority peoples living in remote hard-to-reach northern areas.

Taking into account high capital intensity, as well as significant lagging of material and technical base of agriculture, especially cattle breeding in the Republic of Sakha (Yakutia), it is necessary to determine the directions of capital investments and material and technical means to ensure their maximum return in farms of different specialization.
According to the order no. 483 from 03.09.2003, the Ministry of Agriculture approved the standards of flocks’ size of BFS according to zones of specialization in the following directions.

- breeding: tundra - 1200 heads, taiga - 900;
- marketable: tundra - 1000-3000 cows; (optimally 1600-1800 cows); - marketable: tundra - 1000-3000 cows. (optimal 1600-1800), taiga - 1500-2000 (optimal 1000-1200 heads);
- Fattening: tundra - 1000-1500 animals, taiga - up to 1000 animals
- Fattening: tundra - 400-450 animals, taiga - 300;
- Transport: determined by the volume of freight - 100-300 cows.

All agricultural enterprises operate according to their level of specialization. Basically, in Yakutia, reindeer breeding enterprises are divided into commodity and breeding enterprises (Fig. 1).

**Fig. 1.** Scheme of reindeer herd specialisation.

Figure 1 shows the specialization of the reindeer herd in the Republic of Sakha (Yakutia), depending on the production direction (destination) and breed of reindeer, their age and sex composition, breeding qualities, housing system, condition of forage, water supply, availability of facilities and means of mechanization. The number of reindeer in the herd determines the main production indicators and indicators of economic efficiency of the industry.

For instance, there shall be no more than 1,000 reindeer in breeding herds. The breeding herd is systematically supplemented with the best animals from the breeding herds of other farms and selected reindeer from its own farm, and supplies itself with young animals and commercial herds for reproduction.

The commercial herds have the largest herds, as the reindeer are mainly reared here for meat. It is estimated that two-thirds of the reindeer herd's income comes from the sale of meat.

The transport herd is created as required by the farm and mainly contains reindeer that are used to transport goods, such as firewood, postal routes, expeditions, and transport for hunters and fishermen.

Depending on the reindeer herd's production purpose, reindeer husbandry direction and form of management, a certain proportion of sex and age groups is established in each herd, which is known as the herd structure.

When forming breeding stock, the age of the sows should be taken into account, as they are central to the production of offspring and to the reproduction of animals.
3.4 The reindeer herding brigade - the main factor in the development of the reindeer industry

In recent years, it has often been the family of a reindeer herder. As researcher A.V. Chugunov, Doctor of Agricultural Sciences, Professor of the Department of General Zootechnics of Arctic State Technical University notes: "... the reindeer breeding team in the course of its production activities completes the whole technological cycle of production of the final product of the industry - reindeer meat within a year" [9].

The reindeer herding brigade, like any other agricultural brigade, is assigned land (grazing land), a certain number of livestock (herd of reindeer), production facilities, machinery and equipment for performing production tasks, as well as the necessary table equipment for the life of the brigade members in production conditions.

The Ministry of Agriculture of the Republic of Sakha (Yakutia) approved the number of employees in the reindeer herding brigade as 13 people: 9 reindeer herders (including 1 reindeer breeder and 1 reindeer breeder - livestock specialist) and 4 chum workers. The main rated work in the reindeer herding cooperative is guarding and herding the herd. The shepherd does not leave the herd unattended during the entire 12-hour shift, which does not include lunch or rest breaks.

A significant difference in the management of domestic reindeer from the established practice of other domesticated animal species (cattle, horses, pigs, etc.) is that in the Far North regions (tundra, forest tundra, taiga and mountain taiga zone), herd grazing of large numbers of reindeer over vast areas of land is applied in conditions of constant year-round migrations of reindeer herding teams along new grazing routes. The practice of reindeer husbandry has shown that larger herds are kept in the tundra zone with a herd of 1,000 to 2,000 animals, rather than in the forest-tundra, taiga and mountain-taiga zones. The necessity of rational use of pastures is first of all determined by the natural and climatic conditions of the Republic. Peculiarities of reindeer husbandry in extreme natural conditions are connected with high risk of industry and natural disasters.

The need for gradual transfer of reindeer to seasonal outbreeding is dictated by improvement of breeding and veterinary work, as well as modernisation of reindeer herders' housing and living conditions to solve the staffing problem and other organisational and managerial issues.

4 Discussion and conclusion

The domestication of reindeer is one of the most important achievements of the peoples of the North. Unfortunately, the time of the beginning of this period has not yet been conclusively established due to the lack of writing and sufficient archaeological material, and there is no reliable information about the distant past of the northern peoples. It is known that in the post-glacial epoch, reindeer were the main hunting object of primitive man on vast territories of Eurasia. At that time, a peculiar nomadic form of primitive economy was formed, connected with the fact that reindeer made seasonal migrations from the north to the south and back.

The emergence and development of reindeer husbandry covers a huge period of historical development of the northern peoples, as a result of which this industry became the basis of their economy, way of life, development of a special culture (10).

Currently, according to statistics, in the Russian Federation the number of reindeer in farms of all categories is 1779.9 thousand heads, including in the Northwestern Federal District - 335.3 thousand heads. Ural FD – 957.4 thousand heads, Siberian FD – 132.7 thousand heads, Far Eastern FD – 354.5 thousand heads [11].
The more convenient system is used for each area. Russia is the only country in the world that maintains a herding system, in which reindeer herders herd reindeer around the clock throughout the year, not losing the herd from their overview area for a single minute, and roam the pastures with the herd in search of forage [12].

Compared to other countries, four breeds of reindeer are common in Russia: Even, Evenki, Nenets and Chukchi. And, as we have written above, all breeds are considered in the scientific works of scientists. A.D. Mukhachev, M.V. Safronov, I.S. Reshetnikov, A.K. Akhremenko, D.I. Syrovatsky, A.F. Abramov, N.D. Alekseev, D.E. Afanasyev, L.N. Vladimirov, and others.

We would like to emphasise that there is an increasing demand worldwide, including in Russia, for products made from ecologically pure natural raw materials, be they medicines or foodstuffs. Reindeer husbandry is one of the suppliers of such products.

Furthermore, it is recommended to create production shops for the preparation of raw materials for preparations and the production of biostimulants from reindeer liver and blood. The by-products of the second category (hides, wool, etc.) could be used not only for sewing clothes for reindeer herders, but also as stuffing material on a larger scale.

Domestic reindeer breeding in the territory of the Republic of Sakha (Yakutia) is a rather promising area of livestock breeding. This will be facilitated by the development of natural resources and the construction of industrial enterprises, which will increase the market for agricultural products.

Yakut scientists studying reindeer breeding since the 50s and 60s of the twentieth century (L.N. Vladimirov, I.S. Reshetnikov, D.I. Syrovatsky, M.P. Neustroyev) believe that promising development of domestic reindeer breeding involves transferring to keeping animals in fences built without using natural obstacles (mountains, lakes, rivers). There is a need to invest in the formation of reindeer herding brigades and significant improvements in the working and living conditions of reindeer herders.

We are also of the opinion that in the Republic of Sakha (Yakutia), it is advisable to develop relatively large reindeer farms based on the cooperation of family-kin and community-kin cooperative farms. Such farms will meet the needs of the indigenous population, and will also be a source of valuable raw materials for the production of biopharmaceuticals and biologically active food supplements. In the future, national cultural-recreational and tourist centres will be created on the basis of reindeer farms, which will allow for considerably increased economic efficiency of reindeer breeding. Once again, the main indicator of reindeer husbandry is an increase in the average slaughter weight of a carcass. Today it is encouraging to note that Yakutia has steadily achieved keeping reindeer in its expanses with the highest live weight up to 87.2 kg. Achieving this key indicator in the industry will increase the number of reindeer by mass rearing young animals to maturity, which, in turn, contributes to the accelerated renewal of the main herd stock, increasing the business yield of tugut, achieving a marketable type of venison and, ultimately, increasing the market price of venison and increasing the income of farms, transport and trade.

Our research confirms that a significant increase in the profitability of reindeer husbandry comes from the processing of products, production of high-quality meat, sales of by-products, hides, furs, heads, dry horns, antlers, musk ox, etc. The total value of additional production can be approximately 50% of the value of meat. Thus, the total income can be increased by 1.5 times.

Scientists in the Republic of Sakha (Yakutia), specialising in the agricultural sector, have for decades substantiated the rational organisation of pastures, which at the moment is practically not being implemented and could lead to a reduction in the herd of reindeers. It is no secret that in most districts (uluses) there is no well-organised base for slaughtering, processing and storage of products. Another big problem is unproductive waste, which is the loss of animals, predation by predators in the vast expanses of the tundra.
The development of new economic processes in reindeer herding requires adequate and purposeful impact on production with new management guidelines, determining the measure and possibilities of their development.

The issues of organization of reindeer breeding farms in Yakutia should be constantly in the sight of the leadership of the Republic of Sakha (Yakutia) at all levels, specialists of agricultural production, scientists, since the fate of this industry requires urgent study of the situation, identification of the true situation established in reindeer breeding farms and timely state protectionism in achieving the increase of reindeer herds and creation of commodity production.

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References

4. O. M. Val, Improving economic efficiency of northern domestic reindeer herding (on the materials of the Republic of Sakha (Yakutia), Novosibirsk State Agrarian University, Novosibirsk, 2017)
7. N. Y. Kovalenko, Economics of agriculture: textbook for secondary vocational education (Yurait, Moscow, 2019)
8. A.D. Kurilyuk, Reindeer breeding of the Yakut ASSR (Kn. izdvol, Yakutsk, 1982)
9. Republic of Sakha (Yakutia), Program of socio-economic development of the Republic of Sakha (Yakutia) for the period up to 2025 and main directions up to 2030, Resolutions (2011)
10. Republic of Sakha (Yakutia), Strategy of socio-economic development of the Republic of Sakha (Yakutia) for the period until 2030 with the definition of the target vision until 2050, Resolutions (2016)
11. A.V. Chugunov, Productive livestock breeding in Yakutia: textbook for students of higher educational institutions studying in the specialties 110401 "Zootechniya" and 111201 "Veterinary" (Kolos, Moscow, 2010)
