# ECONOMIC ASSESSMENT OF EQUIPMENT APPLICATION IN MODEL MEAT FARMS IN THE LIVESTOCK INDUSTRY OF THE WEST KAZAKHSTAN REGION

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*Abstract: Based on the purpose of the study - to develop recommendations on the introduction and use of new technologies and equipment in beef cattle breeding, allowing the most complete use of the biological characteristics of animal meat breeds to reduce labor-intensive work on feeding and keeping, the research objects were selected - two livestock farms. According to the results of studies on these farms, the necessary instruments and equipment were purchased - latches, scanner readers, "smart" RFID tags, electronic scales, electric hedges, electric drinkers with electric heating, a wind-solar power station, automated machines, plants, apparatus and equipment for cooking and distribution of feed, providing a source of electricity for watering animals and for other technological, veterinary and livestock events. As a result of the calculations, it can be concluded that the introduction of new equipment allowed to reduce the cost by 675.45 thousand tenge. Additional capital investments in the amount of 15212 thousand tenge to increase the level of automation of technological processes in the basic economy will pay off in more than 2 years.*
*The increase in capital investments and current material and monetary costs should be paid off by increasing productivity, ensuring stable sales of products, reducing costs per unit of production and increasing its profitability.*
*Keywords: meat cattle breeding, technology, machinery, equipment, agriculture, model farm, "smart farms", digitalization of agro-industrial complex, animal husbandry, efficiency of meat cattle breeding*

## 1. Introduction

In the Republic of Kazakhstan's livestock industry, one of the tools is the introduction of modern resource-saving technologies for feeding, keeping, and improving meat breeds used exclusively for the production of high-quality beef.

In recent years, the Republic has paid considerable attention to the development of beef cattle breeding, the transfer of the industry to an innovative development path that allows maximum use and improvement of the genetic potential of bred livestock breeds. At the same time, these technologies require a certain set of technical equipment that allows for automation and digitalization of technological processes.

In Kazakhstan, the main number of cattle is concentrated in the farms of the population, which provide most of the products of cattle breeding. Using low-yielding livestock, they also use low-yielding traditional livestock raising technologies. In this regard, Kazakhstan's science is faced with the urgent task of studying regional practices of cattle breeding, taking into account existing programs for the development of the industry, increasing the productivity of livestock and the production of environmentally friendly and safe products.

## 2. Purpose of research

The purpose of our research is to develop recommendations on the use of new technologies and equipment in the meat cattle breeding of the Republic. To achieve this goal, the following tasks were solved: we collected, processed and analyzed official statistics on beef cattle breeding, studied official documentation on this issue; selected farms that were later used to create "model" cattle farms on their basis; equipped the selected farms with appropriate equipment, trained employees in the elements of the technology being implemented, and the use of new equipment; we determined the effectiveness of the technology being implemented.

## 3. Conditions, materials, and methods

Based on the purpose of the work – to develop recommendations for the introduction and use of new technologies and equipment in meat cattle breeding, allowing the most complete use of the biological characteristics of meat breeds to reduce labor – intensive work on feeding and maintenance, the research objects were selected-two livestock farms specializing in the cultivation of meat breeds of cattle. One of them is a livestock farm "Ural agricultural experimental station" LLP in the West Kazakhstan region, specializing in breeding and growing beef cattle of the Hereford breed. The second farm is the farm of an individual entrepreneur Amanbekova A. E. the Farm operates under the name "IE" Amanbekova A. E.", located in the Kostanay district of the Kostanay region. The farm specializes in raising beef cattle of the Aberdeen-Angus breed (200 heads).

In order to ensure the prevention of infectious, invasive and mass non-infectious diseases of animals on the created model farms, veterinary and preventive measures were carried out. The purpose of these measures is to identify the provision of farms with veterinary and sanitary facilities and technological systems for veterinary and preventive measures.

An epizootic survey was conducted on the model farms to determine the conditions of keeping, organization and implementation of anti-epizootic measures that contribute to the prevention of the occurrence and spread of infectious pathologies among the animal population.

At the next stage of the work, studies were conducted on the selected farms on the availability of equipment to provide elements of the implemented technology of beef cattle breeding, in particular, for managing the herd, providing energy and water supply, for weighing and identifying livestock and other technological processes in the cattle farm. These studies allowed us to identify the degree of provision of farms with technological equipment and determine the necessary technical resources for creating model farms.

According to the results of the research, the necessary devices and equipment were purchased at the farms. In particular, new technological equipment and devices were purchased - retainers, scanner-readers," smart " RFID tags, electronic scales, electric fences, electric-heated car waterers, wind and solar power plants, automated machines, installations, devices and equipment for preparing and distributing feed, providing a source of electricity for watering animals and for other technological, veterinary and zootechnical events. They were necessary to provide elements of technology for growing beef cattle in model farms, as well as a comprehensive study of the impact of technologies for raising livestock on the final result of the studied farms. As a result of these measures, the total cost of the production potential of the model farm "Ural agricultural experiment station" LLP

amounted to 89662.00 thousand tenge, of which 74450.00 thousand tenge own funds, 15212.0 thousand tenge-attracted funds for the project. The total cost of the production potential of the model farm of IE "Amanbekova" was 108862,0 thousand. tenge, of which 93650,0 thousand tenge own funds, 15212,0 thousand tenge-attracted funds for the project.

At the final stage, based on the analysis and generalization of the data obtained, the efficiency of model farms was calculated, and recommendations were developed for spreading the experience of creating such farms in the Republic, where technological processes are carried out on the basis of modern technologies that will guarantee a consistently high quality of environmentally friendly and safe products.

### 4. Results and discussions

Today, one of the most urgent problems in the development of agro-industrial sectors is a low level of labor productivity due to low automation and digitalization of production processes. The need to meet the demand for livestock products in the domestic market of the Republic of Kazakhstan, as well as to increase the export resources of livestock products, puts before the Kazakh science and practice the task of developing, scientific justification and introduction of modern technologies for the production of low-cost, environmentally friendly, competitive products in the industry. These technologies should be resource-saving and aimed at maximizing the use and improvement of the genetic potential of farmed animals, be adapted to the specific natural and economic conditions of the regions of the Republic. Also, the development and application of energy-saving technologies in the industry will improve the impact of production on the environment, reduce the cost of material resources, and effectively use the available land and water resources. The introduction of technologies for creating winter cultural pastures in model farms will increase the efficiency of agricultural land use.

Numerous studies show that in the modern world, one of the ways to intensify the development of beef cattle breeding is the transfer and adaptation of modern technologies [1, 2].

Our research shows that the presence of significant areas of agricultural land in the Republic of Kazakhstan – arable land, hayfields, pastures, as well as agro – climatic specifics, allow agricultural production, in particular, animal husbandry, to develop in all regions of the country.

Modern agriculture of the country provides more than 4% of GDP (in 2018, the share of the industry's products amounted to 4.4% of the national GDP). In the structure of gross agricultural output in 2018, the share of livestock products accounted for 45.6%, for example, in 1990, livestock provided 62% of the country's agricultural output [3].

In the Republic, as the basis for the development of animal husbandry, its priority task is to modernize the industry, transfer it to an innovative path of development. One of the tools of modernization is the introduction of modern digital, information and intellectual technologies in the agricultural sectors [4].

The results of studying the dynamics of indicators for the development of cattle breeding in the Republic for 1991-2018 indicate that until the end of the 90s, the number of livestock and meat production in the Republic decreased. For the years 1991-1999, the number of cattle in the Republic decreased by 2.4 times, and despite the fact that since 2000 their number has increased significantly in 2018 it was only 74.5% of the number of cattle in 1991.

The structure of meat production by categories of producers has changed. Thus, in 1991, agricultural enterprises contained 67.1 % of livestock and produced 66.6 % of cattle meat. Farms of the population provided 30.1% of livestock and produced 33.3% of beef produced in the Republic.

In 2018, the main number of cattle in the Republic – 56.5%, was kept in households of the population. This category of farms provided 58.4% of the country's beef production. Another category of commodity producers – individual entrepreneurs and farms and farms contained 33.7% of livestock and produced 20.6% of beef [3]. The distribution of cattle herds by categories of producers in the Republic in 2014-2018 is shown in table 1.

Indicators of the number of cattle in the farms of the population in the regions of the Republic are different: thus, in the West Kazakhstan region, 35.2% of the population is contained in farms, 55.3% in Kostanay, and 46.8% of the number of cattle in the region in Karaganda. As a rule,

households use low-productivity livestock based on primitive technologies. Manufactured products are not competitive not only in the external market, but often in the domestic market as well.

Table 1-Structure of distribution of cattle herds and meat production by categories of farms in the Republic of Kazakhstan, %

| Category of farms | 2014 y. | 2015 y. | 2016 y. | 2017 y. | 2018 y. |
|---|---|---|---|---|---|
| Number of cattle | | | | | |
| Farms of all categories | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 |
| Including: agricultural enterprises | 7,6 | 8,2 | 9,1 | 9,8 | 10,0 |
| Small interpreners | 27,5 | 29,0 | 31,7 | 32,9 | 33,7 |
| households | 64,9 | 62,8 | 59,2 | 57,3 | 56,5 |
| Meat production | | | | | |
| Farms of all categories | 100,0 | 100,0 | 100,0 | 100,0 | 100,0 |
| Including: agricultural enterprises | 17,0 | 17,4 | 18,1 | 19,7 | 20,6 |
| Small interpreneurs | 15,8 | 17,4 | 18,9 | 20,4 | 21,0 |
| households | 67,2 | 65,2 | 63,0 | 59,9 | 58,4 |

Low-income households are almost unable to use even certain elements of modern resource-saving technologies for a number of reasons, such as their high cost (artificial insemination, constant veterinary control, etc.), lack of knowledge and skills in their use, etc. This leads to underutilization of the genetic potential of species and breeds of farm animals bred in the Republic, in particular cattle, reducing the quality and volume of production.

When creating model farms, it was assumed that the technology of beef cattle breeding is the science of methods of feeding, keeping, and improving meat breeds used exclusively for the production of high-quality beef. To characterize the implemented technology, we used indicators of the target standard for reproduction of the main herd, indicators of turnover and structure of the herd, indicators that characterize the way of keeping, feeding animals, and managing the herd [1].

Representatives of livestock breeds raised in model farms have a set of the following genetic advantages: comoleness, adaptability to climate, ease of calving, precocity (occurs at 12 months) and a pronounced maternal instinct. The animals of these breeds are given a primary role in the breed transformation, since they are able to transmit their best qualities to their offspring. Weight of calves at birth is 30 kg; weight at weaning at 7 months-184 kg; average daily weight gain-823 g; weight at 12 months-295; slaughter yield-58%.

The conducted research has revealed that in the Republic, with insufficient technical equipment of farms, the indicators of productivity and reproduction of the herd remain low. For example, an important point in the management of beef cattle is the effectiveness of the operation "cow-calf". In beef cattle breeding, the critical feature after which production becomes inefficient is the yield of calves less than 75-80 heads for every 100 available cows or 80-85 calves from 100 cows and heifers [1]. In the Republic according to official statistics in 2018 on average, 78 calves were received per 100 Queens, 66 calves in the West Kazakhstan region, and 61 calves in the Kostanay region [3].

In the created model farms, technological processes are carried out on the basis of the use of modern technologies: automated feed and water supply, the use of software for feeding and herd management, which will guarantee a consistently high quality of products. These technologies provide the farmer with an additional effect, allowing to ensure prompt decision-making and increase the efficiency of the organization and management of the farm [5].

Research has shown that overspending of resources is an important problem when raising and fattening cattle. The largest overspending occurs when using feed and labor resources, which reduces production efficiency. Therefore, even in established model farms, resource-saving measures are necessary.

The introduction of new machinery and equipment for organizing technological processes in model livestock farms has led to an increase in the indicators of stock availability and stock availability of the economy, as well as a reduction in the number of employees. Table 2 shows the assessment of the production potential of the model economy of the IE "Amanbekova" (table 2).

Table 2-Economic assessment of the production potential of the model economy of IE "Amanbekova"

| № | Name | Unit | Evaluation | | Rate of change, % |
|---|---|---|---|---|---|
| | | | basic economy | model farm | |
| 1 | Number of employees | human | 4 | 3 | -25,00 |
| 2 | The area of farmland | ha | 2774,00 | 2774,00 | 0 |
| 3 | Average annual cost of material and technical means | Thousand tenge | 93650,00 | 108862,00 | 16,24 |
| 4 | Labor capital strength | Thousand tenge / human | 23412,50 | 36287,33 | 54,99 |
| 5 | Fund availability | Thousand tenge / human | 33,76 | 39,24 | 16,24 |

Thus, the indicator of labor stock availability in the model farm "Amanbekova" increased by 54.99% and amounted to 36287.33 thousand tenge, the indicator of stock availability increased by 16.24%.

In animal husbandry, the development and implementation of automation tools is carried out according to different technological processes: preparation and distribution of feed, watering, water supply, manure cleaning, primary processing of products.

To assess the economic efficiency of the new technology comparison of indicators "before" and "after" implementation of appropriate equipment and the indexes of efficiency of the introduction of new equipment.

The calculation of the efficiency of capital investment in the modernization of the basic economy of IE "Amanbekova" is presented in table 3.

Table 3-Comparative economic assessment of the effectiveness of the introduction of new equipment in the IE "Amanbekova"

| № | Indicators | Unit | Value | | Rate of change, % |
|---|---|---|---|---|---|
| | | | before the introduction | after implementation | |
| 1 | Investment in new equipment | thousand tenge | - | 15212,00 | - |
| 2 | Labour productivity | thousand tenge | 4201,46 | 6078,27 | 44,67 |
| 3 | Costs per 1 head of young animals | thousand tenge | 159,80 | 149,24 | -6,60 |
| 4 | Return on investment | years | - | 2,64 | - |
| 5 | The planned cost reduction from the introduction | thousand tenge | - | 675,45 | - |
| 6 | Annual economic benefit | thousand tenge | - | 5756,33 | - |

The planned cost reduction from the introduction of new equipment was determined by the formula:

$$\Delta C = (C\text{б} - C\text{пр}) \times В\Pi\text{пр}$$

where

Сб, Спр - cost of a unit of production for the basic and project versions, respectively, thousands tenge;

ВПпр - sales of products according to the project version.

Resulteing as:

$$\Delta C = (159{,}80 - 149{,}24) * 64 = 675{,}45 \text{ thousand tenge}$$

The annual economic effect of new equipment and technology was determined by the formula:

$$Эг = (Збаз – Знов) \, Нов = [(Сбаз + ЕнКбаз) – (Снов + ЕнКнов)] \, Нов$$

where

Эг – economic effect of new equipment, thousand tenge;

Збаз – the given costs for production of a unit of production using the basic version of equipment and technology, thousand tenge;

Знов – the cost of production using new equipment or technology, thousand tenge;

Нов – the annual volume of production using new equipment and technology, units;

Сбаз – cost of production of the basic version, thousand tenge;

Снов – cost of production based on new equipment and technology, thousand tenge;

Кбаз – capital investment per unit of production of the basic version, thousand tenge;

Кнов – capital investment per unit of production based on new equipment and technology, thousand tenge;

Ен – normative coefficient of effectiveness.

Resulteing as:

$$Эг = (159{,}80 - 149{,}24) + 0{,}06 * 15212{,}00) * 64 = 5756{,}33 \text{ thousand tenge}$$

Finaly, the Project Payback Perriod is calculated by

$$T = \frac{k_g}{Э_Г}$$

where

T - project payback period, years,

Kg - capital investments, thousand tenge

Эг - annual economic effect from the introduction of equipment, thousand tenge.

As a result of the calculations, it can be concluded that the introduction of new equipment allowed to reduce the cost by 675.45 thousand tenge. Additional capital investments in the amount of 15212 thousand tenge to increase the level of automation of technological processes in the basic economy will pay off in more than 2 years.

Despite the high financial costs for the introduction of resource-saving systems of technical means in meat cattle breeding, this is the only way to develop effective meat cattle breeding in the regions of the Republic. The source of missing financial resources for rural producers can be the implementation of technical support with a differentiated selection of machines and equipment for model farms in the regions, with the calculated determination of the need for appropriate equipment of different cost and class [6].

In addition, in modern Kazakhstan, the main volumes of cattle meat are supplied by households, individual entrepreneurs, as well as small peasant or farm farms, which, for the most part, use simplified (extensive) technologies of cattle breeding [7].

It should be noted that over the past decade, the state has adopted a number of programs aimed at developing the country's agro-industrial complex. Among the activities carried out under these programs were measures aimed at the development of livestock industries, in particular, cattle breeding, through the creation of commodity farms based on the use of modern technologies [8].

## 5. Conclusions

Thus, the introduction of new technologies that make maximum use of the biological characteristics of meat breeds for the production of competitive meat, reducing labor-intensive work on feeding and keeping animals, and improving the genetic potential of used livestock require the purchase of modern equipment. This requires an increase in capital investment and current material and monetary costs. Without them, it is impossible to ensure the implementation of the elements of technology for maximum use of the genetic potential of livestock, the most important of which are the following. Normalized animal feeding - for this purpose, automatic stations must be installed in the barns, which will ensure a differentiated distribution of the most expensive concentrated feed. The normalized distribution of animal feed will increase productivity by 12-15% and reduce the consumption of feed resources by 10-12 percent. It is important to ensure the development and implementation of energy-saving and environmentally friendly technologies adapted to specific local conditions and automated complexes of machines for cleaning manure from livestock premises, transporting it to storage and processing sites.

An increase in capital investment and current material and monetary costs should be paid for by increasing productivity, ensuring sustainable sales of products, reducing unit costs and increasing its profitability.

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