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## EFFICIENCY OF USING AGRICULTURAL LAND IN KAZAKHSTAN

Aigul Yerseitova<sup>1</sup>, Sara Issakova<sup>2\*</sup>, Leila Jakisheva<sup>3</sup>, Almara Nauryzbekova<sup>4</sup>, Altynay Moldasheva<sup>5</sup>

<sup>1,2,3,4,5</sup> M. Kh. Dulati Taraz State University, Taraz, Republic of Kazakhstan

E-mail: \* [saraiissakova@yandex.ru](mailto:saraiissakova@yandex.ru)

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**Abstract.** The paper evaluates the use efficiency of agricultural land in the Republic of Kazakhstan using physical and relative measures, as well as a consolidated criterion defined as the volume of gross output of crops per 100 ha of agricultural land. The assessment of agricultural land use was conducted in the period between 2012 and 2016, after which the acquired results were benchmarked against the results of 1990. That year was set as a reference point since it gives an indication of the Republic's achievements in agriculture while it was still part of the USSR. The undertaken analysis has shown that between 2012 and 2016, most agricultural land use metrics tended to have a positive dynamic. Despite that, the country has never regained the agricultural performance level it had back in 1990. The agricultural land use score according to the consolidated criterion has also demonstrated an insufficient land use performance compared to Russia, Belarus and Ukraine. The approved ABI Growth Government Program for 2017-2021 outlines efforts aimed at the efficient utilization of the country's land resources, helping boost the output of domestic products.

**Keywords:** land, agricultural land, efficiency metrics for land resources use, cropland, crop yield, gross yield of plant and livestock products, efficiency, performance.

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### 1. Introduction

All the land within the borders of a given country contributes towards the common state reserve. For example, the total land reserve of Kazakhstan is 272,490.2 million hectares (ha), ranking ninth in the world by the size of its territory. If divided by the size of population, it makes 17 ha per capita, of which 1.5 ha is arable land. Compare this with the resources of other countries, such as Russia with 11.6 and 0.89 ha respectively, USA with 3.8 and 0.75 ha, China 0.8 and 0.08 ha.

The country's land reserve is extremely heterogeneous by its composition and so is subject to classification specified in the Land Code of Kazakhstan.

In accordance with Article 1 of the Land Code of Kazakhstan, the entire land reserve can be broken down to the following categories:

- 1) Agricultural land;
- 2) Urban land (cities, towns and villages);
- 3) Land for industrial, transportation, communication, space industry, defense, national security and other non-agricultural purposes;
- 4) Areas of special protection; lands of health-related, recreational, historical and cultural importance;
- 5) Forest reserves;
- 6) Water reserve lands;
- 7) Unzoned land (Mindrin et al., 2008).

In Kazakhstan, 95.8% of land is utilized and 4.2% of land is utilized by foreign countries. Of the entire land reserve, the largest percentage of land (39.7%) is classified as unzoned land, with agricultural land taking up 34.4%.

The percentage of urban land, land for industrial, transportation, communication, space industry, defense, national security and other non-agricultural purposes, areas of special protection; lands of health-related, recreational, historical and cultural importance is 19.8%.

The rest of the area consists of forest reserves (8.5%) with only 1.5% left for water reserves.

In line with the subject of this study, let us define land for agricultural needs. Land for agricultural needs is any land allocated for the needs of the agricultural industry. The category of land for agricultural needs includes farmland and any land occupied with nonfarm roads, communications, landlocked bodies of water, melioration networks, buildings and structures supporting agricultural activities and any other land (solonetz areas, sands, takirs and other miscellaneous types of land dispersed in between farmland) (Mindrin et al. 2008).

On the other hand, agricultural land is land that is systemically used to make agricultural products. Agricultural land includes farmland, set-aside land, and land under perennial plantings, hayfields and pastures.

Farmland is a plot of land which is systemically cultivated and used for growing agricultural crops, including perennial grasses, or is a fallow land.

Over 70% of dryland farms are concentrated in three regions: Akmola Region, Kostanay Region and North Kazakhstan; 60.7% of irrigated land is located in Almaty Region and South Kazakhstan. A set-aside land is a plot which used to be part of a farmland and then for over a year, starting from autumn, has not been cultivated or fallowed. The total area of set-aside land in Kazakhstan is 4,979,700 ha or 2.3% of all agricultural land.

Perennial plantings are plots of land used by farmers to plant perennial trees and shrubs that yield fruit, berries, and plants for technical and medicinal products and for landscape design. Areas with perennial plants in the Republic currently take up 152,300 ha, including 97,600 ha occupied by orchards and 14,600 ha by vineyards.

Natural hayfields and pastures are plots of land which are systemically used for producing hay and for animal grazing. The area of hayfields in 2016 was 4.9 mn ha, of which 62,400 ha were meliorated and 731,800 ha were irrigated using the inundation method. Pastures take up 180,000 ha or 83.8% of agricultural land. Pastures can in turn be with or without water supply. Within their boundaries, pastures with water supply have various irrigation canals, wells, lakes, rivers, ponds and other water reservoirs that supply water to the grazing cattle (Mindrin et al. 2008).

Agricultural land can be irrigated and non-irrigated.

The irrigated agricultural land is land which can be used for agricultural needs, including those that require water supply, and which has a permanent or temporary irrigation network connected to the irrigation source, with its water reserves sufficient for sprinkler-watering the land and meeting at least 75% of water demand within the best possible time and in compliance with the specification requirements or other applicable irrigation norms, with a certain known system efficiency.

According to the latest approved ABI Growth Government Program for 2017–2021, the area of irrigated land in the Republic is expected to expand to 640,000 ha (Kozenko & Zvereva 2008).

The lands irrigated by inundation are those land plots which are equipped with water-retaining mounds or dams and other hydrotechnical appliances helping retain and redistribute meltwater and spring water, alongside with water transmitted from irrigation and water supply canals, all over those plots to feed water into the soil (Mindrin et al. 2008).

The dynamics of agricultural land area is downward. Specifically, in the period from 2012 to 2016, the area of agricultural land shrank by 7,423,000 ha, that is 3.3%. The downsizing of agricultural land was due to the allocation of plots of land for various construction projects, industrial sites, and natural reserves. The inefficient land utilization also took its toll on some parts of hayfields and pastures which were eventually overgrown with shrubs.

Over the considered period, the area of farmlands has shrunk by 219,200 ha or 0.9%, hayfields by 263,100 ha or 5.1%, pastures by 7,626,800 ha or 4.1%. At the same time, we can see the increase in the area of set-aside land, from 4,316,700 ha to 4,979,700 ha, up by 15.4%. The land allocated for perennial plantings has grown in area from 127,100 to 152,300 ha or by 19.8%.

Of the entire land resources, the most valuable are agricultural land, farmland as part of agricultural land and cultivated land under crops as part of farmland.

Kazakhstan has a very high share of agricultural land in the total land area. Specifically, the percentage of agricultural land is over 80.0% of the entire land resource, with the decrease in this number over the studied period being 0.3% or 655,400 ha. However, the percentage of farmland in the total area of agricultural land is only 11.5%, down by 0.2% in 2016. Overall, the area of farmland has reduced by 221,300 ha over the studied period. That said, the share of cropped land in the total farmland area increased from 84.7% to 86.6%, i.e. the area of cropped land has grown by 282,900 ha. Judging by these figures, the country's land reserve has been used reasonably within the given time frame.

All land used for agricultural needs can be granted:

- 1) As a private property to citizens of the Republic of Kazakhstan for farming, gardening and building suburban houses;
- 2) As a private property or for rent to individuals and legal entities of the Republic of Kazakhstan for farming or husbandry, productions of agricultural produce, forestry, research and development, experimental and learning projects, growing fruit and vegetables on allotments, gardening and animal breeding;
- 3) To foreign citizens, stateless persons, foreign legal entities and legal entities whose authorized capital is comprised by more than 50% of assets owned by foreign citizens, stateless persons or foreign legal entities, for tenancy with a rental period of up to ten years (Mindrin et al. 2008).

In the wake of market economy and emerging agricultural reforms in the Republic back in 1991, all countryside residents were granted title deeds for provisional land plots. Overall, 2.3 mn such title deeds were granted. The grantees disposed of these land plots in the following manner: of the 652,000 land owners, 29% established farms, 28% leased their land, 22% invested their land in the authorized capital of companies, and 3.0% sold their plots and another 18% of unclaimed land plots were returned back to public ownership.

Of the total area of land used for agricultural needs, 37 mn ha (40.8%) are owned by over 3,300 different associations and joint-stock companies, 34.4% of land in this category are used by over 130,000 of farms, 16% are owned by 1,669 cooperatives and the share of land owned by other forms of agricultural organizations (institutions, public authorities) is 8.7%.

Overall throughout the country, more than 400,000 ha of land are already a private property, of which 55.8% or 224,000 ha are occupied by private farms, 22% or 87,600 ha are used for suburban and recreational housing and gardening.

Ten per cent or 40,500 ha are occupied with private residential houses, 9.5% or 38,000 ha of land belong to industrial, transportation and other companies and around 3.0% are owned by various service companies and organizations.

The diversity of soil in Kazakhstan is due to the latitude where the land zones are located, the climate that can vary from west to east and certain geological characteristics of different parts of land. The Republic's natural Chernozem soil is concentrated in fairly narrow strips of land in the northern and north-western parts of the country. Here, the temperature and precipitation allow gathering consistent yields of crops. The eastern and central parts are considered high-risk zones in terms of land cultivation due to frequent dry years. In the southern part of the Republic, land cultivation is only possible in irrigated areas since it is mostly covered with deserts and semideserts.

It bears mentioning that Kazakhstan's land resources, like those of every country in the world, are shrinking, as productive lands are increasingly allotted for the construction of residential houses and industrial mining, get overrun by cities and towns, get inundated in the process of building water storage reservoirs, etc.

Another curse for farmers is soil degradation. Throughout almost all regions of Kazakhstan, soil degradation takes place largely due to the following reasons:

- Inefficient use of land resources;

- Excessive development of the mining industry;
- A wide network of military ranges that used to function back in the time of the USSR.

Because of the Republic's vast deserts (81.6 mn ha) and unstructured animal grazing, wind erosion takes its toll. The Republic also suffers from soil erosion by water (salination, bogging, desertification), which affects 4.3 mln ha of land.

Wind and water erosion are responsible for the degradation of soils and their living cover, turning land into a desert. Desertification is the process of expansion of deserts, their overtaking of agricultural land. Neglect of crop rotation and the lack of organic and mineral fertilizers negatively affect the crop-producing power of the soil, reducing the amount of humus in the surface layers. Kazakhstan currently has a high percentage of soils with low humus content.

The excessive activity of the mining industry leads to soil pollution with heavy metals, dumping of all sorts of industrial and domestic waste, formation of potholes, pits and gulleys. Former military ranges also made soil unsuitable for farming.

Sustainable agricultural intensification plays an important role in land use improvement, helping preserve and increases its productive power around the globe, including in Kazakhstan. The need for sustainable intensification is determined by the growing demand for agricultural products of the right varieties and proper quality. The following major three groups of efforts can be taken to improve land use:

- 1) Involving less productive or unused agricultural land into the cultivation process;
- 2) Improving the productive power of the already used agricultural land;
- 3) More efficient utilization of the existing crop yield.

Each group of the efforts listed above has a whole system of interrelated steps:

- Implementation of scientifically grounded farming systems, design and application of crop rotation systems;
- Anti-erosion efforts, melioration and re-cultivation of damaged land;
- Lime treatment of soil, irrigation/drainage of soil;
- Introduction of promising region-specific varieties and hybrids of crops;
- Cultivation of major hayfields and pastures, tackling weeds, pests and plant diseases, and other organizational, economic and social initiatives.

## **2. Literature review**

The primary purpose of land is to satisfy the demand of our planet's population for food products of plant and animal origin. Despite the achieved success in the development of the world's agriculture, about 805 mln people around the world still suffer from regular malnutrition, and over 2.0 bn people experience the so-called "hidden hunger" (Wheater & Evans 2009; Volchik et al. 2018).

All of this happens as the population of our planet keeps growing, with about three billion more people expected to live in the world by 2050. That is why producing enough food to provide sufficient nutrition for every human should be our top priority. Delivery on this goal can happen only through the efficient use of the land resources we already have.

The economic use efficiency of land in agriculture is defined as a certain mode of land cultivation that yields a certain amount of produce per unit of land. In today's reality, the efficiency and sustainability of land use depends not only on the growing output of produce per unit of land, but also on its increasing quality, cost-effectiveness and the ability to maintain or improve soil fertility and at the same time care for the environment (Ivanov 2009; Melas et al. 2017; Lizińska et al. 2017; Tireuov et al. 2018; Akhmetova, Suleimenova 2018; Bychkova et al. 2018; Ivanova, Latyshov, 2018; Suleimenova et al. 2018).

The question of effectiveness of the agricultural aspects was reviewed in many written papers – both legal acts and research works. Thus, Mindrin et.al. (2008) discussed the rational usage of the land offering numerous methods on increasing the profitability of the land plots and gaining more economic benefits.

Gurova O.N. (2012), in turn, considered the aspects of growing a specific culture (namely, sunflower) and getting profits from planting them.

The questions of soil, its recovery from degradation and preserving water were considered in the works by Tefera and Sterk (2010) and Zvereva and Glushko (2013).

Legal aspects were covered in the works by Kozenko and Zvereva (2008), who discussed the questions of property rights in terms of the land plots, as well as Kazistaev Ye. (2016) discussed the consequences of effective subsidizing of the land plots.

Formal reports on using land can be found in the public reports published by Ministry of Agriculture.

### **3. Methods of assessment**

The following empirical scientific cognition methods became the methodological basis of the study.

The method of statistical observation - "method of the main array" used in the research to study and identify the regularities of agricultural land use in the Republic of Kazakhstan for 2012-2016.

The statistical study array was formed by physical and relative measures and one consolidated criterion. The physical measures are farmland area, crop yield, gross output of plant and livestock products, gross product output per 100 ha of cropped land or 100 ha of agricultural land, livestock and poultry population, per-capita agricultural production, livestock and poultry fertility. The relative measures are percentage of agricultural land in the total land area, percentage of farmland in the total area of agricultural land, percentage of cropped land in the total farmland area.

To determine the empirical characteristics of the studied phenomenon by the method of the main array, the indicators of the basic growth rate coefficient ( $T_b$ ) and the basic growth coefficient ( $K_b$ ) were used (1), (2):

$$T_b = \frac{Y_i}{Y_0} \times 100\% \quad (1)$$

$$K_b = \frac{Y_i}{Y_0} \quad (2)$$

where  $Y_i$  - data on agricultural land use for the reporting period;

$Y_0$  - data on agricultural land use for the base period, which is predetermined as a comparison base.

Comparison method is used in the study to compare the efficiency of agricultural land use in Kazakhstan with respect to countries such as Russia, Belarus and the Ukraine with the help of the consolidated criterion (CC) (3):

$$CC = \frac{V_{grouit}}{A_{ai}}, \quad (3)$$

where  $V_{grouit}$  - the gross output of agricultural products, USD bn;  
 $A_{ai}$  - agricultural area, mln ha.

As for the consolidated criterion, the authors plan to use the gross output of agricultural products per 100 ha of agricultural land (Gurova, 2012). This criterion will allow comparing the country's agricultural land use with that of other former Soviet republics. Using cost-related metrics is not possible in this case as the value of national currency has changed dramatically between 1990 and 2016 and costs cannot be compared.

To sort the data on livestock and gardening development in Kazakhstan, state subsidies volume, absolute and relative indicators of agricultural land use efficiency, the traditional method of tabular analysis is also used in the study. This method contributed to the fixation and comparison of the final dynamics and efficiency indicators.

#### 4. Results

Let us review the distribution of different crop cultures across available farmland. The dynamics of farmland cultivation between 2012 and 2016 has undergone significant changes.

In the studied period, the Republic's total farmland area increased by 282,900 ha or by 1.3%. The expansion of farmland was due to the land inventory which continues starting since 2012. The inventory covered 96.0 mln ha of land used for agricultural needs. It helped reveal 19,200 unused land plots suitable for agricultural needs with a cumulative area of 7.4 mln ha, of which around 943,000 ha are used as farmland. This also revealed more than 91% of unused land plots within farms with a total area of 3.7 mln ha, of which 407,600 are used as farmland, including 30,600 ha of irrigated cropland.

In the reporting year, the area of farmland under certain crops has decreased, specifically under grain and pulses, wheat, potato and grapes, whereas the area used for growing other kinds of crops has grown. In fact, over the studied period, the area of cropland under all kinds of grain and pulses has shrunk 5.2%, wheat – 7.6%, potato – 1.8% and vineyards – 1.4%. The drastic decrease in the area of cropland used to grow grain over the past years is explained by the ongoing optimization of cropland allocation. The decline in the cropland used for growing potato had to happen because of its excessive supply in the country.

At the same time, the areas of other cropland are expanding: in 2016, barley was sown on 62,600 ha, sugar beet – on 800 ha, sunflower – on 12,900 ha, vegetables – on 17,200 ha, melons – on 12,100 ha, berries and fruit – on 1.20 ha. The largest share of cropland between 2012 and 2016 was still used for grain. While the percentage of area occupied with all kinds of grain in 2012 was 76.7%, in 2016 it was 71.7%. To optimize cropland allocation, annual efforts are taken to diversify crops. This leads to increased areas of land used for sowing oil-bearing crops, vegetables and forage. New advanced methods are used, such as moisture retention and water retention technology.

Crop yield is an indicator showing the average output of agricultural produces per area unit. It is calculated as the ratio of the gross output to the area harvested, and is measured in quintals per hectare (q/ha). Great importance is placed on this indicator. Yields are greatly affected by farming practices, agricultural equipment and crop

cultivation technology, soil fertilization, the ability to perform all field works well and in short periods of time and other economic factors.

Let us have a look at the dynamics of crop yield in 2012-2016. In 2016, the yield of all crops was higher compared to that of 2012.

To give you the numbers, the yield of sugar beet in the studied period grew from 168.2 to 285.5 q/ha, potato – from 165.9 to 190.4 q/ha, vegetables – from 234 to 250 q/ha, melons – from 206.8 to 221.4 q/ha, grapes – from 58 to 60.8 q/ha and so on. All sorts of crops showed a 100%+ increase in yield in 2016 as compared with 2012. Overall throughout the Republic, this indicator says of a satisfactory efficiency of agricultural land use in the studied time frame.

During the considered period, crop yield went up and down alternately. It dropped especially sharply in 2012 compared to the previous years. The dry climate that year made a big impact on crop yield. It should be pointed out that crop yield performance was lower in agricultural companies than in private and cooperative farms.

The next physical measure of agricultural land use efficiency is the amount of plant products made, i.e. the gross output of crops (Table 1):

**Table 1.** Gross output of certain crops (in all kinds of farming businesses)

(‘000 t)

Crop variety	Year					Growth, %
	2012	2013	2014	2015	2016	
1. Grain (including rice) and pulses, including	12,514	17,886.8	16,785.1	18,250.6	20,186.5	161.3
-wheat	9,841.1	13,940.8	12,996.8	13,747	14,985	152.3
-barley	1,490.6	2,539	2,411.8	2,675.4	3,231.3	216.8
2. Sugar beet	151.6	64.6	23.9	174.1	345.0	227.6
3. Sunflower	400.3	572.7	512.7	534	754.9	188.6
4. Potato	3,126.4	3,346.6	3,410.5	3521	3,545.7	113.4
5. Vegetables	3,061.5	3,241.5	3,469.9	3,564.9	3,795.1	124.0
6. Melons	1,649.9	1,713	1,928	2,087.6	2,070.9	125.5
7. Grapes	77.1	68	70.3	63.4	75.0	97.3
8. Berries and fruits	206.7	214.7	233	216.8	260.7	126.1

The gross output of crops significantly varied year on year in the studied period, which to a certain extent is due to the natural and climatic conditions of production, the decrease or increase in the area of cropland and possible setbacks in logistics and technical equipment of farms. In the considered period of time, crop output was greatly affected by the reallocation of cropland and crop yield.

In fact, the additional expanses of cropland and the improved yield increased the gross output of barley by 1740,700 t, sugar beet – by 193,400 t, sunflower – by 354,600 t, vegetables – by 733,600 t, melons – by 421,000 t, berries and fruit – by 8,800 t. Thanks to the increased yields, the gross output of grain and pulses grew by 7672,500 t, wheat – by 5143,900 t and potato – by 419,300 t. The gross output of grapes was the only one to reduce by 2,100 t or 2.7%.

To further develop this topic, let us review the dynamics of such measure of agricultural land use efficiency as the gross output of individual varieties of crops per 100 ha of cropland. This dynamics is certainly positive, since the production output of all kinds of plants per 100 ha of cropland consistently grows.

The overall gross output of grain per 100 ha of cropland in 2016 grew 70.3% compared to 2012, including wheat output –64.8% and barley – 109.8%.

The gross output of sugar beets per 100 ha of cropland increased 113.1%, sunflower – 85.5%, potato – 15.5%, vegetables – 9.3%, melons – 9.3% and berries and fruit – 22.7%. The only crop to demonstrate a decrease in gross output per 100 ha of cropland was grapes, down 1.4%.

The next measure of the efficiency of agricultural land use is the per-capita production output of basic crops. In the reviewed period of time, the per-capita production output of crops was going up for all crops except grapes. Specifically, per-capita grain output was up by 394 kg, sugar beet – by 10.3 kg, sunflower – 18.4 kg, potato – by 13.0 kg, vegetables – by 31.0 kg, melons – by 18 kg and berries and fruits – by 2.3 kg. Per-capita grapes output is down by 0.4 kg.

The positive dynamics of crop output is partially driven by government subsidies. Subsidies for horticulture are aimed at cutting down on the costs of growing priority crops, orchards and vineyards, purchasing mineral fertilizers, herbicides and other agricultural chemicals, more cost-efficient watering, quality assessment of cotton, development of seed breeding, reducing the cost of fuel and lubricants and other materials, cutting down on the costs of growing crops in greenhouses, and at compensating leasing fees for agricultural equipment and supporting horticulture insurance, etc.

Let us take a closer look at horticulture subsidies over 2011-2015 (Table 2):

**Table 2.** Gross output per KZT 1 of subsidies, invested in the horticulture development

Indicator	Years					Rate of change
	2011	2012	2013	2014	2015	
1. Gross output of plant products, KZT bln	1,337.2	1,241.5	1,683.9	1,739.4	1,825.2	by 1.4 times
2. Amount of subsidies paid out, KZT mln	29,580.9	31,465.9	35,512.6	66,594.2	64,591.3	by 2.2 times
3. Gross output of plant products per KZT 1 subsidized, KZT	45.2	39.5	47.4	26.1	28.3	by 0.6 times

As can be seen from the table data, in 2011 the amount of subsidies was equal to KZT 29,580.9 million, but already in 2015 it increased to KZT 64,591.3 million or by 2.2 times. At the same time, the gross output of agricultural products increased from KZT 1,337.2 to 1,825.2 billion or by 1.4 times. In turn, the gross output per KZT 1 of subsidies in 2011 amounted to KZT 45.2, whereas in 2015 it decreased by almost half, i.e. by KZT 16.9.

"Hectare" subsidization of plant cultivating began to have a big impact on the return of agricultural products, which sharply went down, while the amount of subsidies from the state budget was growing regularly. The Ministry of Agriculture reported that since 2017 the hectare subsidy for plant production is abolished, subsidies are provided in accordance with the WTO requirements (Kazistaev, 2016).

Thus, in the period under consideration (2012-2016) there were positive trends in the development of plant production – gross harvesting of agricultural crops and their production per capita.

The output of livestock products depends on the households of the population by 71%, 15% is produced by peasant and private farms and 13% fall to agricultural enterprises. Livestock breeding is diversified in the region. Owing to the implementation of the "Sybaga" (subsidizing the purchase of breeding stock of cattle), "Kulan"

(subsidizing the purchase of breeding stock of horses), "Altyn Asyk" (subsidizing the purchase of breeding stock of sheep) programs there is an increase in the number of livestock of all types, except for poultry and pigs. Livestock breeding is an important branch of the Republic's agriculture, which provides about 40% of its gross output. Protein is required for adequate nutrition of the population; it is found in food products such as meat, milk and eggs. In addition, this sector of agriculture provides the industry with wool, leather, lambskin, etc. In the livestock sectors, waste from crop production is actively consumed; it served as a basis for creating valuable organic fertilizers such as manure and slurry. While the plant production is of seasonal nature of, livestock farming allows using labor and material resources all the year round. The development of livestock breeding is promoted in the country by the richest pasture lands and favorable climatic conditions. In recent years, there have been steady growth rates of livestock number increase in the Republic.

In the period under consideration, the cattle headcount increased by 723.2 thousand heads or by 12.7%, including cows by 629.8 thousand heads or by 24.4%.

The increase in the headcount of cows has positively affected the results of agriculture, as these animals have the highest dairy productivity, requires cheaper feed and supplies the country's population with beef and veal.

Sheep farming is also the main branch of livestock breeding, owing to which the country's economy has not only meat, milk and lard, but also skin, fur sheepskin, lambskins and wool. In the period under study, the number of sheep and goats increased from 17,633.3 to 18,124.2 thousand heads or by 2.8%. There is a negative trend in the country – a decrease in the number of pigs. The situation is determined by the departure of a large number of people, who used to grow pigs and consumed meat and lard, outside the national territory. It should be noted that pig farming is a productive and fast growing branch of livestock breeding. In general, the pig headcount declined from 1,031.6 thousand heads to 834.2 thousand heads or by 19.1%.

In 2012-2016 horse breeding is developed quite steadily. The horse headcount increased by 573.0 thousand heads or 34%. The main products of horse breeding are meat, milk and skins. Saumal and kumis are produced from mare's milk. These dairy products are very healthy.

Camel breeding also is developed dynamically. Thus, camel headcount increased by 15.3 thousand heads or by 9.3%. The maintenance of camels is very profitable, since they do not require large labor costs, a large number of feeds and construction of capital facilities. The main products of these animals are meat, milk and wool; farmers produce a healing drink called shubat from camel's milk, which is popular among the population.

Poultry farming is an economically viable livestock breeding industry. Poultry farming provides the country's population with eggs, dietary meat, and industry with down and feathers. In the period under study, the poultry headcount increased from 33.5 to 36.9 million heads or by 10.1%.

It should be noted that a large proportion of livestock and poultry are managed in peasant (private) farms and private households.

Over the past five years, the average productivity of farm animals in domestic producers has also increased. Thus, in the period under consideration, the average weight of one head of cattle increased from 310 to 329 kg, that of sheep and goats from 38 to 39 kg, and that of pigs from 98 to 105 kg, milk yield per one forage-fed cow increased up to 105 kg, the average egg yield per one laying hen increased up to 20 eggs, and the amount of wool shorn from one sheep remained without changing – 2.4 kg. At the same time, in Kazakhstan there is a decrease in calf crop per 100 calving cows by 5 heads; being less by 3 heads lamb and kid crop, by 6 heads for foal crop and by 2 heads for camel colt crop.

In this case, the low proportion of pedigree stock (for example, for meat cattle it is no more than 2.5%) is the main reason for the low productivity of livestock breeding in Kazakhstan. This situation is caused by the fact that in the country most animals are concentrated in the households of the population, hence this agricultural sector is characterized by low genetic potential, low animal productivity, inadequate nutrition and feeding conditions for modern technologies, lack of quality forage, insufficient care for animal health. In connection with the inaccessibility of water sources for the livestock watering, the potential of natural pastures is also poorly used.

It should be noted that the government increased annually the amount of subsidies for the development of livestock breeding in the country. Thus, over the recent 5 years the volume of state support for agriculture has increased by 3.0 times, but the increase in gross output of this sector of the economy was growing much more slowly (Table 3):

**Table 3.** Gross output per KZT 1 of subsidies invested in the livestock breeding development

Indicator	Years					Rate of change
	2011	2012	2013	2014	2015	
1. Gross output of livestock products, KZT bln	942.4	1,141.5	1,256.9	1,393.8	1,469.9	1.6 times
2. Amount of subsidies paid out, KZT mln	23,138.9	31,454.2	38,438.7	49,302.3	69,060.9	3.0 times
3. Gross output of livestock products per KZT 1 subsidized, KZT	40.7	36.4	32.7	28.3	21.3	0.5 times

As the table data show, the amount of subsidies in 2011 was equal to KZT 23,138.9 mln, but already in 2015 it increased to the level of KZT 69,060.9 mln or threefold. At the same time, the gross output of livestock products increased from KZT 942.4 bn to KZT 1469.9 bn or by 1.6 times. In turn, the gross output per KZT 1 of subsidies was equal to 40.7 KZT in 2011, but already in 2015 it decreased by almost half, i.e. by 19.4 KZT.

To increase the productivity and quality of livestock products, there are 33 areas of subsidies, which are divided into two large groups:

- To develop pedigree livestock breeding: the acquisition of pedigree cattle and sheep, the pedigree breeding of calving cows and ewes and other trends in the development of pedigree livestock farming;
- To improve the productivity and quality of livestock products, reduce the cost of production of milk, poultry, pork, horse meat, camel meat, fodder, fattening of bull calves, etc.

In 2015 KZT 69 bn were allocated for all areas of subsidies. Owing to this support, the share of the pedigree stock of all types of farm animals and poultry increased significantly and, by the end of 2015, amounted to 10.6% for cattle, 15.1% for sheep, 19.9% for pigs, 7.9% for horses; 13.1 % for camels and 17.1% for poultry. Undoubtedly, the activity of private farms in participating in the programs of the National managing holding "KazAgro" JSC, such as "Sybaga", "Kulan", "Altyn Asyk", played its role. Thus, for example, during the current year 75 thousand heads of pedigree cattle, 25.2 thousand heads of pedigree horses, 72 thousand heads of pedigree sheep were purchased. The number of the pedigree cattle herd reached 722 thousand heads, which is 22% of the total number of cattle. Subsidies are allocated for livestock breeding development from the republican budget, and from the regional, as well.

Due to the growth in the number of cattle, cows, sheep and goats, poultry and their productivity, production and sales of livestock products such as meat, milk and eggs are increasing, though wool production is declining (Table 4).

**Table 4.** Livestock breeding production

Indicator	Years					Rate of change, %
	2012	2013	2014	2015	2016	
1. Meat production in carcass weight equivalent, thous. t	844.7	871	900.2	931	960.7	113.7
2. Milk production, thous. t	4851.6	4930.3	5067.9	5182.4	5341.6	110.1
3. Wool production, t	38.4	37.6	37.8	38	38.0	99.0
4. Egg production, mln pcs.	3673.4	3896	4291.2	4737	4757.2	129.5

In the period under study, meat production in slaughter weight equivalent increased by 116.0 thousand t or 13.7%; milk production also increased by 490.0 thousand t or 10.1% and increase in egg production made 1,083.8 mln pcs or by 29.5%. At the same time, wool production decreased by 0.4 tons or 1.0%. In general, the dynamics of livestock production was positive in this period.

Next, let us analyze the production of the main types of livestock products per 100 ha of agricultural lands in the Republic of Kazakhstan.

In 2016, in comparison with the base period, the production of meat, milk and eggs per 100 hectares of agricultural crops increased, and the production of wool reduced. Meat production in live weight per 100 ha of agricultural lands increased by 14.1%, milk – by 10.4%, eggs – by 29.9%, and wool production decreased by 0.6%.

Further, in our studies calculations we made as to the per capita livestock production in Kazakhstan. The increase in the number of livestock and poultry and in their productivity affected the livestock production per capita. Thus, in the period under consideration, meat production in slaughter weight equivalent per capita increased by 3.6 kg, or by 7.2%, milk by 11.2 kg or 3.9%, eggs by 48.3 or 22.2%. Since the volume of wool in the period under review decreased, this index per capita naturally decreased by 0.2 kg or by 8.7%.

Thus, in the considered period the livestock breeding sector develops quite dynamically and steadily. The output is growing in this sector of agriculture.

## 5. Discussion

The analysis of the majority of natural and relative indicators that assess the effectiveness of the use of land resources in Kazakhstan was made. The use of land resources was analyzed for the period 2012-2016. Over this period, there has been a positive growth dynamics of all the indicators under study, but a goal was set to determine the level of land use in 2016 compared with 1990 (Table 5).

**Table 5.** Indicators assessing the effectiveness of the agricultural land use in Kazakhstan in 1990-2016

Indicator	UM	1990	2016	Rate of change,%
<b>Land resources</b>				
1. Agricultural land including	thous. ha	222,452.3	214,747.7	96.5
- farmland, including	-//-	35,576.8	24,794.6	69.7
- planted acreage	-//-	35,182.0	21,473.6	61.0
- hay lands	-//-	5,185.3	4,895.9	94.9
- pastures	-//-	181,340.7	179,925.6	99.2
- other lands	-//-	349.5		
<b>Relative indicators assessing the effectiveness of the agricultural land use</b>				
- a share of agricultural lands in total land area	%	85.2	82.2	-3.0
- a relative share of farmland in the structure of agricultural land	-//-	16.0	11.5	-4.5
- a relative share of agricultural crops sown in the farmlands	-//-	98.9	86.6	-12.3
- all grain and pulses	thous. ha	23,356	15,403.5	66.0
- wheat	-//-	14,070	12,437	88.4
- barley	-//-	6,660	1,901.9	28.6
- sugar beet	-//-	44.0	12.6	28.6
- sunflower	-//-	137.0	807.5	by 5.9 times
- potato	-//-	206.0	186.7	90.6
- vegetables	-//-	71.0	145.9	205.5
- melons and gourds	-//-	45.0	93.9	208.7
- vineyards	-//-	24.9	14.6	58.6
- berries and fruits	-//-	96.5	44.4	46.0
<b>Crop yield for certain agricultural plants</b>				
- all grain and pulses	htw/ha	13.4	13.5	100.7
- wheat	-//-	13.8	12.1	87.7
- barley	-//-	17.0	17.1	100.6
- sugar beet	-//-	260.0	285.5	109.8
- sunflower	-//-	10.3	9.3	90.3
- potato	-//-	113.0	190.4	168.5
- vegetables	-//-	154.0	250.0	162.3
- melons and gourds	-//-	84.0	221.4	263.5
- grapes	-//-	80.5	60.8	75.5
- berries and fruits	-//-	41.9	81.5	194.5
<b>Croppage for certain agricultural plants</b>				
- all grain and pulses, including	thous. t	31,249.0	20,186.5	64.6
- wheat	-//-	16,351	14,985	91.6
- barley	-//-	8,500	3,231.3	38.0
- sugar beet	-//-	1,134	345	30.4
- sunflower	-//-	140.9	754.9	by 5.4 times
- potato	-//-	2,324.3	3,545.7	152.5
- vegetables	-//-	1,136.4	3,795.1	by 3.3 times
- melons and gourds	-//-	301.5	2,070.9	by 6.9 times
- grapes	-//-	138.6	75.0	54.1
- berries and fruits	-//-	301.2	260.7	86.6
<b>Croppage for certain agricultural crops per 100 ha of planted acreage</b>				
- grain and pulses, including	t	133.8	131.1	98.0
- wheat	-//-	116.2	120.5	103.7
- barley	-//-	127.6	133.2	209.8
- sugar beet	-//-	2,577.3	2,738.1	106.2
- sunflower	-//-	102.8	93.5	91.0

- potato	-/-	1,128.3	1,899.1	168.5
- vegetables	-/-	1,600.6	2,601.2	162.5
- melons and gourds	-/-	670.0	2,205.4	by 3.3 times
- grapes	-/-	393.9	349.2	88.7
- berries and fruits	-/-	856.1	1,214.0	141.8
Plant production per capita				
- grain and pulses	kg	1,871.2	1160	62.0
-sugar beet	-/-	67.9	19.3	47.9
-sunflower	-/-	8.4	42.1	by 5.0 times
-potato	-/-	139.6	199	142.6
-vegetables	-/-	68.0	213	by 3.1times
-melons and gourds	-/-	18.1	116	by 6.4 times
-grapes	-/-	8.3	4.2	50.6
-berries and fruits	-/-	18.0	14.5	80.6
Livestock and poultry headcount				
- cattle, including	thous. heads	9,755.7	6,413.2	65.7
- cows	-/-	3,367.1	3,209.9	95.3
- sheep and goats	-/-	35,657	18,124.2	50.8
- pigs	-/-	3,223.8	834.2	25.9
- horses	-/-	1,626.2	2,259.2	138.4
- camels	-/-	142.5	180.1	126.4
- poultry	mln pcs	59.9	36.9	61.6
Livestock production				
- meat in slaughter equivalent	thous. t	1,547.6	960.7	62.1
- milk	-/-	5,641.6	5,341.6	94.7
- wool	-/-	107.9	38.0	35.2
- eggs	mln pcs	4,185.0	4,757.2	113.6
Basic livestock production per 100 ha of agricultural lands				
- meat in slaughter equivalent	t	695.7	447.2	64.3
- milk	-/-	2,536.1	2,486.6	98.0
- wool	-/-	48.5	17.7	36.5
- eggs	mln pcs	1,881.3	2,214.5	117.7
Livestock production per capita				
- meat in slaughter equivalent	kg	92.7	53.6	57.8
- milk	-/-	337.8	298.1	88.2
- wool	-/-	6.5	2.1	32.3
-eggs	pcs	250.6	265.5	105.9

Comparing the indicators of 1990 with those of 2016, it can be seen that the country's agricultural lands are not used at the proper level. First, the agricultural lands reduced by 7,704.6 thousand hectares, and, secondly, there is a decrease in farmland for 10,782.2 thousand hectares, including planted acreage for 13,708.4 thousand hectares, hay lands for 289.4 thousand hectares and pastures for 1,415.1 thousand hectares. Accordingly, other lands increase by 4,782.1 thousand hectares. Also, the share of agricultural land in the total land area is reduced by 3.0%, the share of farmland in the structure of agricultural land decreased by 4.5%, and a relative share of the planted acreage of agricultural crops in the farmland decreased by 12.9%.

In the period under consideration, the structure of planted acreage also underwent significant changes: mainly the areas sown with grain and pulses reduced by 7,952.2 thousand hectares.

On the one hand, this is caused by optimization of the cultivated lands conducted in the recent years. And the saddest thing is the decrease in planted acreage for sugar beet by 71.4%. Sugar beet is the only domestic product for sugar production. Currently, the existing situation with sugar production causes anxiety in the country. Domestic sugar is not enough to meet the needs of the population in this product, which are provided by imports

from Russia, Belarus and Ukraine. In addition, the sugar factories of the country process imported raw cane sugar that is delivered to the country duty-free until 2019. At the end of this time, the duty per 1 ton of imported raw sugar will be USD 250, which in turn will cause a rise in price of domestic sugar and its non-competitiveness in comparison with sugar production from sugar beets in the countries of the near abroad. And this in turn will affect the stoppage of the work of local sugar factories. In this case, the country will be completely dependent on imports.

Planted acreage for grapes also decreased by 10.3 thousand hectares or 41.4%, areas for cultivation of berries and fruits decreased by 52.1 thousand hectares or 54%. The needs of the population in these plant products are also provided by imports.

Planted acreage for other crops is growing: areas sown with sunflower increased by 5.9 times, and those planted with vegetables, melons and gourds doubled. The decline in acreage for potato cultivation can be explained by its overproduction in the country.

Crop yield of most crops has increased. Increase in crop yield and planted acreage increased the croppage of vegetables by 3.3 times, melons and gourds by 6.9 times. Only the growth of planted acreage increased the sunflower croppage by 5.4 times. And the increase in potato yield provided for its croppage by 52.5% compared to the base period. The decrease in planted acreage and yield of individual grain crops reduced croppage of wheat to a level of 14,985 thousand tons, barley – to 3,231.3 thousand tons, grapes – to 75.0 thousand tons. And, despite the increase in the yield of grain and pulses, their croppage decreased by 11,062.5 thousand tons, sugar beet croppage fell by 789.0 thousand tons, with croppage of berries and fruits decreasing by 40.5 thousand tons.

Croppage of certain agricultural crops per 100 hectares of planted acreage is increasing for almost all crops.

Plant production per capita for grain and pulses, sugar beet, grapes, berries and fruits is reduced compared to the base period, but sharply increases for sunflower (by 5.0 times), vegetables (by 3.1 times), melons and gourds (by 6.4 times) and potato (by 42.6%).

Thus, land resources in terms of cultivating plant products are mainly used effectively for growing sunflowers, vegetables, potatoes, melons and gourds; for other crops, the croppage has not reached the 1990 level, or has changed slightly.

However, the situation is the worst with the development of livestock breeding in the Republic. In 2016 the livestock and poultry population did not reach the level of 1990: the cattle headcount decreased by 3,342.5 thousand heads or by 34.3%, including cows by 157.2 thousand heads or by 4.7%, the number of sheep and goats decreased by 17,532.8 thousand heads, pigs' population reduced by 2,389.6 thousand heads, and that of poultry – by 23.0 million pieces.

Over the 26-year period there was a slight increase in the number of camels by 37.6 thousand heads and horses by 633.0 thousand heads.

The decrease in the number of livestock and poultry affected the livestock production. Thus, meat production in slaughter weight equivalent decreased from 1,547.6 to 960.7 thousand tons or by 37.9%, milk production from 5,641.6 to the level of 5,341.6 thousand tons or by 5.3%, wool production reduced from 107.9 to 38 thousand tons or by 64.8%. Only the number of eggs increased by 572.2 million pieces, or by 13.6% in the period under study. The growth of egg production is caused by a sharp increase in the egg-laying rate of chickens. Accordingly, with the decrease in the output of livestock products, their production per 100 hectares of agricultural land is reduced.

Thus, meat production in slaughter weight equivalent decreased by 248.5 tons, with the decrease in milk production by 49.5 tons and in wool production by 30.8 tons. In turn, the number of eggs increased by 333.2 million pieces.

The livestock production per capita is one of the main indicators of the land use effectiveness. The magnitude of these indicators is also low in comparison with 1990. Per capita meat production in slaughter weight equivalent decreased by 39.1 kg, with the decrease in this indicator for milk by 39.7 kg and for wool by 4.4 kg. Only the number of eggs per capita increased by 14.9 pieces.

Thus, Kazakhstani livestock breeding not only failed to reach the level of 1990 indicators, but it cannot provide the corresponding level of consumption for many products.

Next, let us compare the agricultural land use in our country with that in Russia, Belarus and Ukraine in terms of the gross output of agricultural products per 100 hectares of agricultural land. These indicators of the four countries are compared in US dollars (table 6).

**Table 6.** Gross output of agricultural products per 100 hectares of agricultural land in the Custom Union members in 2016

Indicator	UM	Russia	Belarus	Ukraine	Kazakhstan
1. Gross output of agricultural products	USD bn	84.1	7.8	24.7	10.8
2. Agricultural area	mln ha	222.1	8.5	41.7	214.7
3. Gross output per of agricultural land	USD thous.	37.87	91.76	59.23	5.03

The table data indicate that the most effective use of agricultural land is observed in Belarus, then in Ukraine, the third place is occupied by Russia and Kazakhstan is ranked the fourth. The high gross output of agricultural products per 100 hectares of agricultural land in Belarus can be explained by the large plowness of the territory, high crop yield and livestock productivity, the availability of sufficient water resources, which are evenly distributed throughout the country. Thus, the proposed criterion for assessing agricultural land is a convenient tool for international comparisons of the level of agricultural development.

The analysis of 2016 indicators showed that the agricultural lands are not used at the proper level in the Republic as compared with 1990: most of the indicators assessing the effectiveness of their use were reduced. Moreover, the inventory of agricultural lands that was conducted in 2012-2014 revealed 11.4 million hectares of unused land. And if we compare the results achieved with the results of economically developed countries, the main indicators of livestock productivity and crop yields lag behind the world figures. Thus, in the Republic of Kazakhstan the average live weight of one head of cattle is 300 kg, whereas in such countries as the USA, Canada and Germany this figure exceeds 500 kg. The average milk yield per cow in Kazakhstan is 2.2 thousand kg per year (this indicator making 8.6 thousand kg in the USA, 7.8 thousand kg in Canada, 6.7 thousand kg in Germany, and 3.5 thousand kg in Russia). Wheat yield in the RK is 10.8 cwt/ha (being 31.7 cwt/ha in the USA, 35.9 cwt/ha in Canada, and 22.3 cwt/ha in Russia). Corn yield in Kazakhstan is 52.8 cwt/ha (being 99.7 cwt/ha in USA, 95.9 cwt/ha in Canada, and 60.1 cwt/ha in Russia), etc. (Zvereva & Glushko 2013)

It should also be noted that in the Republic, the average annual growth rates of food production as a whole do not keep up with the growth rates of consumption and income of the population, as a result of which the free niche in the market is replenished by imports and its share in domestic consumption remains very significant (Kozenko & Zvereva 2008).

That is why it is necessary to radically change the attitude to the land (as the main means of agricultural production).

## Conclusions

At present, the land has been brought to a completely unsatisfactory state: a large number of lands are abandoned, there is a deficit of irrigation water, soil degradation and erosion, soil fertility is reduced, and the production capacities of processing enterprises are not fully utilized due to the lack of necessary raw materials.

To address this situation, the concept of a new state program to support the agribusiness industry for 2017-2021 was formulated at the end of 2016, one of the tasks of which is to create conditions for the efficient use of land resources.

The implementation of these measures will increase the planted acreage in 2021 by means of diversifying, developing fallow lands and using vacant waste lands for agricultural crops. Thus, wheat will cover 10,132 thousand hectares of land, barley – 2,787 thousand hectares, oil-yielding crops – 3,000 thousand hectares, fodder crops – 4,393 thousand hectares, sugar beet – 32 thousand hectares, fruits, berries and grapes – 65.0 thousand hectares, vegetables – 161 thousand hectares, etc. (Report, 2014). In 2021, the yield of grain crops will be 13.9 cwt/ha, oil-yielding crops – 10.2 cwt/ha, sugar beet – 350 cwt/ha, vegetables – 257 cwt/ha, melons and gourds – 234 cwt/ha, potatoes – 195 cwt/ha and fruits and berries – 70 cwt/ha. The increase in planted acreage and growth of crop yield will contribute to the increase in the crop production output: barley up to 4,004 thousand tons, rice – up to 387 thousand tons, oil-yielding crops – up to 3,046 thousand tons, sugar beet – up to 1,120 thousand tons, vegetables – up to 4,132 thousand tons, fruits, berries and grapes – up to 421 thousand tons.

The livestock and poultry population will increase in livestock breeding, namely: cattle – 6,951 thousand heads, horses – 2,957 thousand heads, sheep and goats – 21,100 thousand heads, pigs – 825 thousand heads, and poultry – 48,516 million heads. Not only livestock and poultry headcount will increase, but also the share of breeding stock: cattle – by 16.9%, horses – by 8.0%, sheep and goats – by 17.7%, pigs – by 17.0%, camels – by 18% and poultry – by 31.2%. Also, significant changes will occur in the productivity of livestock and poultry. Thus, the average milk yield per 1 cow is planned to reach 2,406 kg/year, the average weight of one head of cattle will be 377.9 kg, sheep – 42 kg, pigs – 109 kg and poultry – 2.4 kg.

In turn, the increase in the number of livestock and poultry and their productivity will increase the livestock production output in 2021: poultry meat to 298.0 thousand tons, beef – to 491 thousand tons, mutton – to 161 thousand tons, pork – to 133 thousand tons and milk – to 5,665 thousand tons.

Thus, the successful implementation of this State Program will reduce imports of certain priority types of products by means of increasing volumes of own production, and increase the percentage of national consumption of domestic products.

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**Aigul YERSEITOVA** is the Candidate of Sciences (Economics), acting Associate Professor at the Economic Faculty of the M. Kh. Dulati Taraz State University, Taraz, Republic of Kazakhstan.

**Sara ISSAKOVA** is the Doctor of Sciences (Economics), the Head of the Economics and Audit Department of the M. Kh. Dulati Taraz State University, Taraz, Republic of Kazakhstan.

**Leila JAKISHEVA** is the Associate Professor at the Economic Faculty of the M. Kh. Dulati Taraz State University, Taraz, Republic of Kazakhstan.

**Almara NAURYZBEKOVA** is the Vice-Rector for educational work and public relations, Candidate of Sciences (Economics) at the M. Kh. Dulati Taraz State University, Taraz, Republic of Kazakhstan.

**Altynay MOLDASHEVA** is the Student of the Economic Faculty of the M. Kh. Dulati Taraz State University, Taraz, Republic of Kazakhstan.

**ORCID ID:** [orcid.org/0000-0002-9667-3730](http://orcid.org/0000-0002-9667-3730)

Register for an ORCID ID:

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