IRSTI 68.75.13
UDC 338.43
DOI: 10.46666/2023-4.2708-9991.14 https://www.jpra-kazniiapk.kz

DAIRY INDUSTRY OF KAZAKHSTAN: REGIONAL ASPECT

ҚАЗАҚСТАННЫҢ СҮТ ӨНЕРКӘСІБІ: АЙМАҚТЫҚ АСПЕКТ

МОЛОЧНАЯ ПРОМЫШЛЕННОСТЬ КАЗАХСТАНА: РЕГИОНАЛЬНЫЙ АСПЕКТ

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Annotation. *The goal* is to assess the state of milk production and processing for all categories of farms in the republic, to show the role of the development of the dairy industry in providing the population with food from its own resources in order to achieve food security of the country. Within the framework of this study, general scientific *methods* were used - systematization, comparison, statistics, factorial, generalization. *Results* - it is noted that to obtain the required volumes of milk in Kazakhstan there is a favorable geographical and climatic resource potential; review of bibliographic materials on the management of dairy industry of the best foreign countries is presented; assessment of Kazakhstani regions with high indicators of processed raw materials was carried out; high proportion of individual business entities engaged in raising cattle and producing dairy products has been demonstrated; the reasons for the low quality of raw milk are revealed, which do not allow its use for the production of high-quality dairy products; emphasis is placed on the insufficient level of technical equipment of processing dairy plants; the need for automation and implementation of digital technologies on dairy farms is substantiated; problems of expanding the range of dairy products due to the small-scale production of personal subsidiary plots (farms) were identified; serious threats are identified from the lack of innovative equipment, storage and transportation of dairy raw materials. *Conclusions* - recommendations have been developed to increase the modernization and digitalization of dairy farms. The authors state that the use of innovations should give milk processing enterprises a qualitatively new character, increase the technical and technological potential of processors and the economic efficiency of their activities, improve the consumer properties and product positions of food products made from cow's milk.

Аңдатпа. ***Мақсаты*** **– республикадағы шаруашылықтардың барлық санаттары бойынша сүтті өндіру мен өңдеудің жай-күйіне баға беру, елдің азық-түлік қауіпсіздігіне қол жеткізу мақсатында халықты өз ресурстары есебінен азық-түлікпен қамтамасыз ету үшін сүт өнеркәсібін дамытудың рөлін көрсету. Осы зерттеу аясында жалпы ғылыми** ***әдістер*** **қолданылды – жүйелеу, салыстыру, статистика, факторлық, жалпылау.** ***Нәтижелері*** **- Қазақстанда сүттің қажетті көлемін алу үшін қолайлы географиялық және климаттық ресурстық әлеует бар екендігі атап өтілді; үздік шет мемлекеттердің сүт саласын басқару бойынша библиографиялық материалдарға шолу ұсынылды; өңделген шикізаттың жоғары индикаторлары бар қазақстандық өңірлерді бағалау жүзеге асырылды; ірі қара мал өсірумен және сүт өнімдерін шығарумен айналысатын жеке шаруашылық жүргізуші субъектілердің жоғары үлесі көрсетілді; шикі сүттің сапасы төмен, оны жоғары сапалы сүт өнімдерін дайындау үшін пайдалануға мүмкіндік бермейтін себептер ашылды; қайта өңдеуші сүт зауыттарының техникалық жарақтандырылуының жеткіліксіз деңгейіне баса назар аударылды; сүт-тауар фермаларында цифрлық технологияларды автоматтандыру және енгізу қажеттілігі негізделді; жеке қосалқы (фермерлік) шаруашылықтардың ұсақ тауарлылығына байланысты сүт өнімдерінің ассортиментін кеңейту проблемалары анықталды; инновациялық жабдықтардың, сүт шикізатын сақтау мен тасымалдаудың жетіспеушілігінің елеулі қатерлері белгіленді.** ***Қорытындылар*** **- сүт-тауар фермаларын жаңғырту мен цифрландыруды арттыру бойынша ұсынымдар әзірленді. Авторлар инновацияларды пайдалану сүт өңдеу кәсіпорындарына сапалы жаңа сипат беруі, өңдеушілердің техникалық-технологиялық әлеуетін және олардың қызметінің экономикалық тиімділігін арттыруы, сиыр сүтінен жасалған тағам өнімдерінің тұтыну қасиеттері мен тауарлық позицияларын жақсартуы тиіс деп атап көрсетеді.**

Аннотация. ***Цель*** **– дать оценку состояния производства и переработки молока по всем категориям хозяйств в республике, показать роль развития молочной промышленности для обеспечения населения продовольствием за счет собственных ресурсов с целью достижения продовольственной безопасности страны. В рамках настоящего исследования использованы общенаучные** ***методы*** **– систематизации, сравнения, статистики, факторный, обобщения.** ***Результаты*** **– отмечается, что для получения необходимых объемов молока в Казахстане имеется благоприятный географический и климатический ресурсный потенциал; представлен обзор библиографических материалов по управлению молочной отраслью лучших зарубежных государств; осуществлена оценка казахстанских регионов с высокими индикаторами обработанного сырья; продемонстрирована высокая доля индивидуальных субъектов хозяйствования, которые занимаются выращиванием крупного рогатого скота и выпуском молочной продукции; раскрыты причины низкого качества сырого молока, не позволяющие его использовать для изготовления высококачественных молокопродуктов; сделан акцент на недостаточный уровень технической оснащенности перерабатывающих молочных заводов; обоснована необходимость автоматизации и внедрения цифровых технологий на молочно-товарных фермах; выявлены проблемы расширения ассортимента молочных изделий из-за мелкотоварности личных подсобных (фермерских) хозяйств; обозначены серьезные угрозы нехватки инновационного оборудования, хранения и транспортировки молочного сырья.** ***Выводы*** **– разработаны рекомендации по повышению модернизации и цифровизации молочно-товарных ферм. Авторы констатируют, что использование инноваций должно придать молокоперерабатывающим предприятиям качественно новый характер, повысить технико-технологический потенциал переработчиков и экономическую эффективность их деятельности, улучшить потребительские свойства и товарные позиции продуктов питания из коровьего молока.**

Key words: dairy industry, milk production and processing, dairy farms, private farms, digitalization of the industry, government support.

Түйінді сөздер: сүт өнеркәсібі, сүт өндіру және өңдеу, сүт-тауар фермалары, жеке қосалқы шаруашылықтар, саланы цифрландыру, мемлекеттік қолдау.

Ключевые слова: молочная промышленность, производство и переработка молока, молочно-товарные фермы, личные подсобные хозяйства, цифровизация отрасли, государственная поддержка.

Introduction. A variety of factors, including rapid population growth, urbanization, the global health crisis (Covid-19), the political situation [1] between Ukraine and Russia, rising food and oil prices, current climate, and natural conditions, all of these overlapping threats directly impact food production and trade systems. The States of Ukraine and RF are the main producers and exporters of agriproducts at the global level, and the con-

tinuation of the current situation threatens negative market, price, logistics and risks in countries importing agricultural goods. According to FAO, the price index for 5 basic food products reached a fairly record value in 2022 - 143.7 points. And despite some definite decline over the last 9 months of 2023, in September 2023 it amounted to 121.5 points, which is 26% higher than the recorded figure before the pandemic in 2018.

Milk is also one of FAO's five main food price groups index. Thus, in September 2023 it amounted to 108.6 points, which is 34.1 points lower than the corresponding period last year and 2.6 points lower than in the previous month [2]. However, the amount of milk produced is increasing every year, and in 2022, the world produced a total of 544 mln t of milk, which is almost 50 mln t more than 7 years ago. The leaders in terms of the amount of cow's milk produced are India, the USA, China, while in this list Kazakhstan ranks 27th with about 6.3 million tons of milk.

Milk production represents one of the largest industries of agricultural production in the global economy as well as in the AIC of RK. The amount of milk produced, and milk processed is increasing annually, 6.3 million tons and 573.3 thousand tons respectively in 2022. RK produces almost all types of dairy products, milk, cheese, all types of cheeses, dairy products with and without added sugar, yoghurts, and kefir. In general, the generation of processed milk and dairy items is characterized by positive dynamics. However, there are a number of problems in the further expansion of the dairy industry. These include: an inconsistent influx of capital, insufficiency of the own funds of agricultural companies and farmers and digitalization, wear and tear of agricultural machinery and non-systemic measures. to support private farms.

Material and methods of research. Because of the fact that countries are unable to adequately provide nutritious food to their populations and facilitate to the create of food safety globally, a systematic approach, cooperation with international organizations and large producing countries is required to solve these problems in a sustainable manner. To study the dairy industry of Kazakhstan, the entire chain from the sown area of forage crops, the number of cows, their productivity to the processed milk produced was investigated.

An economic and statistical analysis was carried out among the country's leaders by region and a synthesis of materials related to the progress of dairy output over the past 9 years. Using the method of comparative and sequential analysis, the calculation of changes in indicators of the amount of cow's milk produced, as well as the average amount of milk yield per cow for one year among the countries with best results by regions of Kazakhstan was carried out. A cause-and-effect analysis was conducted on the amount of milk generated and processed.

Using the factor assessment methodology, we identified some factors at the level of wear and tear of agricultural equipment, lack of equity capital of agricultural farmers, lack of government funding and digital complex equipment. These factors made it possible to reveal and explain certain relationships that describe the degree of production of dairy goods in our state. From the point of view of assessing data collection, the generalization method was used in the work. The above presented gave the right to reveal threats, shortcomings and formulate several recommendations.

Results and their discussion. Over the past ten years, the country has been producing more milk every year, despite the small amount of sown area for feed crops and their prices, a high proportion of outdated and worn-out equipment, and high costs arising from the procurement and transportation of products. Any products that are made of milk are hard to store and transport because they are unsteady and have limited storage options. Milk is a product that easily spoils and must be kept at decently low temperatures, processed within a day, and transferred fast [3].

Despite this, new technologies in industry are increasingly being introduced and introduced in the world, which we could adopt into our production. Recent work by Masera et al. talks about the use of solar thermal energy in the dairy industry for processes such as cooling, heating and cleaning. All these processes are necessary for pasteurization, fermentation, storage or transportation of milk [4].

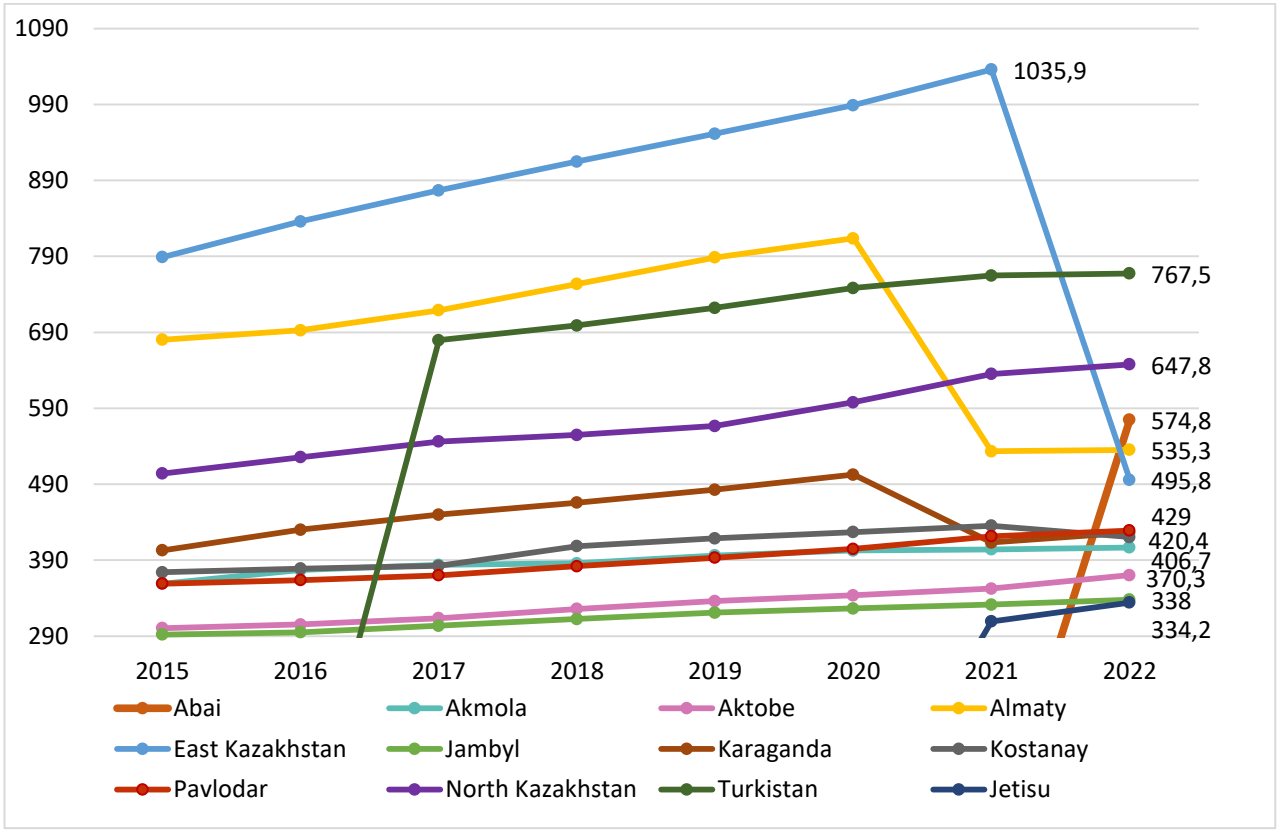
New research into the possibility of improving milk production is also being explored in the field of management and management for farmers and entrepreneurs. Leddin et al., 2023 note in their works digital technologies that help automate big data on dairy farms, including spatial data. Dairy management is a complex process as feed gain and milk production fluctuate seasonally, so providing the right information at the right time through digital technology leads to improved overall operations [5]. Similar studies were done by Maretto et al. (2023), Neethirjan & Kemp (2021), where digital technologies and digitalization are being introduced into agriculture, agro-industry and other areas of industry

[6-7]. Klerkx et al. (2019) contributed by examining seventeen investigates and discovering an association between computerized agriculture and variety of farms, studying managing systems on farms and new methods to operate robotic agriculture [8].

Strong consideration is paid to the relevance of providing citizens with essential food products, including bread products, dairy products, etc. [9].

Today there are 23 digital farms and 171 advanced farms in Kazakhstan, 24 million hectares of arable land have been digitized, that is, electronic field maps have been created, almost 100% of the total arable land. The digitalization of pastures has also begun, the leaders in the digitalization of pastures are Akmola, Kostanay and Karaganda regions [10].

The country produces more than 6.3 million tons of raw cow's milk. Figure 1 shows the amount of cow's milk produced by regions with the best indicators in the RK for 8 years.



Note: compiled by the authors based on source [11]

Figure 1 - Dynamics of cow's milk generated by regions with the best indicators in the Republic of Kazakhstan, 2015 - 2022

Graphics in the Figure 1 depict the regions that surpass production above 300 thousand tons of milk in one year. Overall, we can see a moderate growth of milk production increasing on average by 200 thousand tons per year in every region except Karaganda region in 2021 and Kostanay region in 2022. The fall of East Kazakhstan region and Almaty region is characterized by the division of these regions into two in June of 2021. However, goods that are sent to enterprises for processing from agricultural enterprises or individual entrepreneurs and farm enterprises in the main since the property of milk from households is doubtful. Thus, in 2022, agricultural enterprises produced 522 thousand tons and farms produced about 1.3 million tons of milk. The rest of the production of 4.4 million tons of milk came from households.

The permanent leaders by region are Turkistan, North Kazakhstan, Abai, Almaty and East Kazakhstan regions. Together they produce more than half of the total milk production in Kazakhstan. There are several reasons contributing to this, government support, the introduction of innovative technologies, and climatic conditions in the regions. North Kazakhstan formed the basis of a program for lending to dairy industry projects through a

social and entrepreneurial corporation, which is the reason for leadership.

According to the Ministry of Agriculture, it is mapped to build 65 new dairy farms with a production capacity of about 370 thousand tons, and 100 billion tenge of credit resources will be allocated from the country's budget. Furthermore, East Kazakhstan, Almaty, Turkistan, Akmola as well as Karaganda and Kostanay regions are actively engaged in the digitization of the agro-industrial sector. The milking device was established in the East Kazakhstan region for the first time of the country in 2012. Additionally, before June 2021 East Kazakhstan region was the leader among the regions by generating 1/6 of the milk of the entire country until the separation into Abai and East Kazakhstan regions.

Foreign authors found that people consume a lot of dairy products, which are the second most popular food and drink choice [12]. In the republic, according to our observations, consumption of milk and some dairy goods for 2022 is 18.9 kg per month or 226.8 kg per year per capita. This is 6.9% less than a year earlier. Overall, during the pandemic, milk consumption fluctuated around 21 kg per month per capita. With people staying at home during the global lockdown, this was the highest milk consumption in 23 years. Although this trend has been declining since then, milk consumption before the pandemic in 2018 was 12% higher than now in the second quarter of 2023 (19.2 kg per month per capita) [13].

On the basis of own results of a study of raw milk production, the best regions in terms of indicators in the country were identified and analyzed. Table 1 presents the average milk yield per milking cow for all categories of farms and agricultural enterprises for 3 years in regions with the highest rates of raw milk production.

Table 1 **-** Average milk yield per dairy cow for all categories of agricultural companies

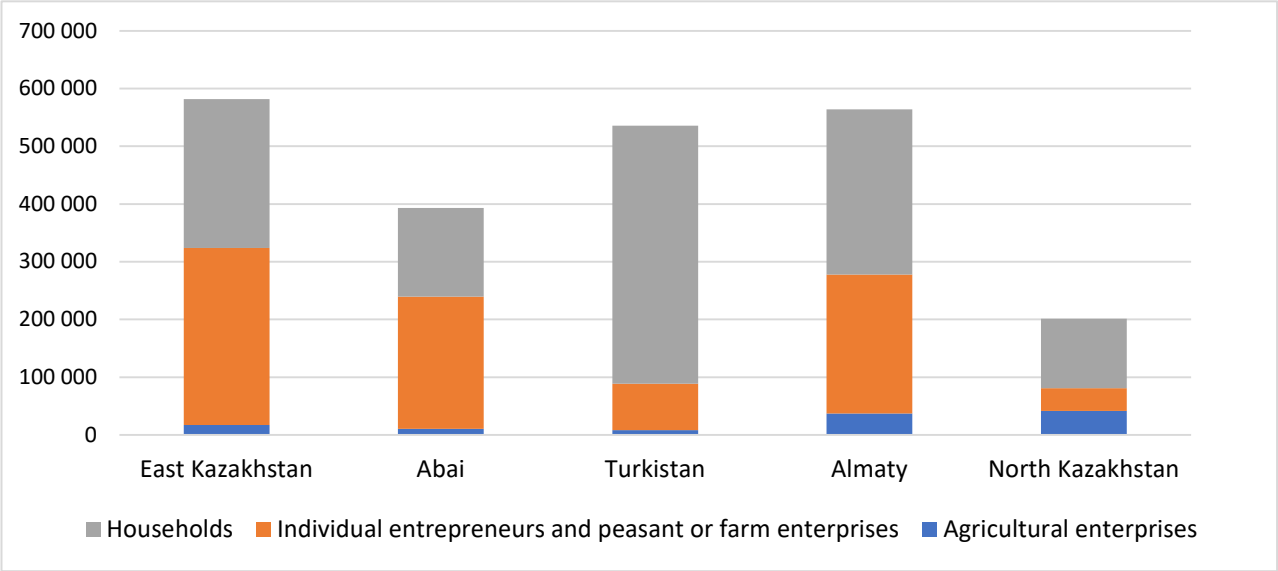
Regions of RK	Average milk yield per dairy cow for all categories of farms, kg			Average milk yield per dairy cow in agricultural enterprises, kg		
	2020	2021	2022	2020	2021	2022
East Kazakhstan	2085	2062	2345	4003	4048	5663
Abai	2085	1839	1817	4003	2770	2631
Turkistan	2388	2372	2358	5434	5288	5173
Almaty	2721	2861	3165	4835	5877	6132
North Kazakhstan	3132	3204	3174	4724	5404	5619
Note: compiled by the authors based on source [lk.11]						

Table 1 indicates that the average milk yield of a cow in agricultural enterprises is on average twice higher than the average milk yield for all categories of farms, which means low productivity of cows on private farms, individual entrepreneurs and farm enterprises. Although production in private households account for more than 70% of the total production of raw milk in Kazakhstan, due to insufficient technology and the correct structure and investment, this milk does not comply with technical regulations and cannot be accepted for processing by dairies.

This allows the state to grow and improve its productivity on a higher scale. The highest milk productivity is observed in agricultural enterprises of the Almaty region, on average 6 132 kg per cow per year. In comparison, the productivity of one dairy cow in the United States, one of the top five countries that generates about 10 thousand kg of raw milk per year [14].

In Figure 2 you can see the number of cattle among the regions with the best indicators for the amount of milk produced for all categories of farms for 2022.

Despite small quantity of cows in the North Kazakhstan region, this region is among the top three in terms of the amount of milk generated in the country, 647,0 tons in 2022. This indicates the high productivity of cows in this area and the high quality of raw milk sent for processing. In 2022, 360 thousand tons or 56% of raw milk produced will be sent for processing. The workload of enterprises was 86% [15]. While in many regions the amount of cattle in households is much higher than the level of individual entrepreneurs and peasant farms, while in East Kazakhstan and Abai regions the ratio is the opposite. This is because these regions actively support entrepreneurs and create favorable conditions for their development.



Note: compiled by the authors based on source [lk. 11]

Figure 2 - Number of cattle by five regions of the Republic of Kazakhstan for all categories of farms, 01/01/2023

Kazakhstan currently produces more than 6 million tons of raw milk, which is enough to provide processing plants with raw materials. However, about 50% of the produced milk provided for processing in dairies does not meet the technical and biological requirements of the Customs Union [16]. Table 2 provides data on the amount of processed milk in Kazakhstan from 2017 to 2022.

Table 2 - Amount of processed milk by region of Kazakhstan, 2017 – 2022

Year						Regions of RK
2017	2018	2019	2020	2021	2022	
483 085	538 077	571 556	616 953	611 685	573 323	RK
					2 390	Abai
54 410	65 280	89 140	102 220	104 330	81 990	Akmola
13 300	13 710	16 960	18 730	20 160	20 945	Aktobe
101 870	109 080	93 486	102 360	105 000	99 240	Almaty
146	120	150	316	364	344	Atyrau
1 010	1 370	1 360	1 110	2 400	3 670	West Kazakhstan
13 550	15 450	12 470	11 340	15 100	14 830	Jambyl
					16 600	Jetisu
13 125	11 480	9 515	9 270	8 754	9 690	Karaganda
78 794	78 220	70 980	77 050	68 050	69 516	Kostanay
6 000	6 130	6 426	6 940	7 230	7 760	Kyzylorda
350	420	565	300	170	90	Mangystau
16 210	15 270	17 304	18 914	21 320	22 040	Pavlodar
117 450	142 690	169 260	189 430	196 930	185 810	North Kazakhstan
2 690	2 550	3 375	2 894	2 550	1 784	Turkistan
19 430	20 680	21 520	23 100	22 160	20 280	East Kazakhstan
Note: compiled by the authors based on source [lk.11]						

Industrial output volume markers are displayed for all economic entities, considering the activities of individual entrepreneurs and peasant or farm enterprises. We can see in the table above, the North Kazakhstan region has the highest figures for the amount of milk processed, almost 186 thousand tons, which is almost double the next region in the ranking, Almaty region 99 thousand tons.

It should be added that despite the high productivity of raw milk in the Turkistan and East Kazakhstan regions, 767 and 647 thou-

sand tons, in this region there is a low share of processed milk, only 1.8 and 20.3 thousand tons, respectively. This may be related to several factors, namely the consumption of milk by households, the sale of raw milk to dairies close to the region and the production of other types of dairy goods, such as butter, all types of cheeses, cottage cheese, etc. In this regard, four dairy farms will be built this year in the Turkistan region. More than 20 billion tenge will be invested in their construction [17].

For more efficient work and development of the agricultural sector, new technologies and innovative equipment are being introduced in countries such as the USA, China, Australia and EU. In Kazakhstan, the use of digital technology in farming is just getting started. In 2021, country adopted the National Project called “Technological breakthrough through digitalization, science and innovation”.

The goal of the project is to make our republic a modern country with optimal government by using technology, making decisions based on reliable data, and using infrastructure safely in the digital age. The project also aims to increase the role of science in the country's socio-economic development. Thus, 45 914 122 tenge were allocated from the central budget for the digitalization of agriculture. However, we can see elements of digitalization within the rural segment, to be specific within the dairy branch in Kazakhstan.

For example, in East Kazakhstan region, five dairy farms have introduced elements of smart farms, which include a milking parlor equipped with software. Also, feeding and care is carried out by an automated system [18]. For example, the smart farm “Borte-Milka”, located in Turkistan, and the dairy farm “Kazyna Zher” in the village of Akdala in the city of Arys are completely robotic.

By analyzing the above factors, we can present a number of several issues in the dairy industry in Kazakhstan:

- the raw milk is insufficient to be processed in dairies;
- a little number of agricultural enterprises compared to farms/peasant enterpries or private farms. There are also only a few cows or other livestock;
- cows in farm enterprises and households are not productive;
- weak degree of use of new technologies and the introduction of digitalization in all categories of farms;
- also, there is a lack of technological equipment in private farms.

In our government, a generous amount of the milk is produced by people in their own house farms. From our opinion, the solution to the problem will rely on creating and using a good economic system for how farmers and processing companies work together.

We believe that in order to function effectively, processing organizations, with the encourage of the state and local authorities, must actively pursue an investment policy, which will consist of modernizing dairy equipment, training in new technologies, introducing digitalization into agricultural enterprises and improving the logistics infrastructure.

On this premise, it is necessary to carry out basic changes within the dairy industry with the help of government support.

Conclusions

1. The results of the presented work showed that during the studied period of time in Kazakhstan there is a slight increase in the production of dairy products and milk.

2. Economic analysis over the noted 8 years demonstrated that there was an increase in the amount of cow's milk produced by region. Here the leaders are such regions as: North Kazakhstan, Turkestan, Pavlodar and East Kazakhstan.

3. An assessment of processed milk by region was carried out from 2017 to 2022. It was revealed here that, despite the fairly high productivity in the East Kazakhstan and Turkistan regions, in these territories there is a weak degree of milk processing. This characterizes the shortcomings in the development of existing milk processing and commodity complexes based on outdated agricultural equipment.

4. The need for agro-digitalization in the context of modernization and design of new smart farms and the introduction of innovative information technologies in the dairy industry is substantiated.

5. Proposals are given for the structural modernization of processing dairy farms in Kazakhstan. Here, important attention is paid to state support based on the allocated financial resources of the new National Project for the Development of the AIC (2021-2025).

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