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Developing dairy farming and improving product quality

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Abstract. The need to find ways to improve the quality characteristics of milk as a basis for increasing the competitiveness of dairy products in the global market determines the relevance of the study. Ukraine's dairy industry is one of the critical ones in the agricultural sector of the economy, as it provides the country's population with vital foodstuffs. The purpose of this study was to substantiate the areas of solving organisational and economic problems of development of the dairy industry to meet the needs of the domestic market with quality dairy products and increase export

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potential. The study was conducted to identify the main reasons for the transformational changes that have taken place in dairy farming and to outline the promising areas for the development of this industry in the context of improving product quality. This study focused on European and national requirements for the quality of raw milk. The following methods of economic research were used in the analytical material: economic and statistical, comparative analysis, graphical, logical generalisation, systematic approach, systemic and structural analysis, calculation, and design. The study analysed the data of agricultural enterprises and households engaged in milk production in Ukraine for 2010-2022 and recalculated the purchase prices for raw milk in relation to the European quality indicators. The findings of this study showed that ensuring the competitiveness of dairy products depends on the quality of milk. It was found that it is higher in European countries, and therefore high standards for the quality of raw milk become a barrier to entry into European markets for most domestic dairy processing enterprises. Accordingly, the state's strategy should focus on increasing the production of high-quality raw milk and growing export potential by forming specialised milk production cooperatives for dairy processing enterprises. The practical significance of the obtained results is that the author's recommendations can be used by agricultural enterprises or private households in their everyday activities

Keywords: milk; quality of dairy products; international standards; producers; release price

INTRODUCTION

The problem of producing high-quality milk is multifaceted. In scientific discussions, various methods are discussed to determine the quality characteristics of products and their impact on the efficiency of the industry. In production and meeting the growing needs of society, the requirements for the quality characteristics of dairy products are constantly increasing. Therefore, for Ukrainian dairy products to be competitive in international markets, they must meet the safety and quality standards that have already become the norm for the world's leading producers.

Ensuring the quality, safety, and competitiveness of products is a key factor in the development of the dairy industry. Thus, M. Nikolaienko and L. Bal-Prylypko (2020) note that the guarantee of product quality is compliance with international ISO standards, which are actively implemented by Ukrainian dairy processing enterprises. M. Rahman and D. Hryzo (2021) note that the dairy and dairy processing industries in Ukraine have many issues that hinder their effective development and specify that domestic milk producers are trying to use modern European technologies, because in many developed countries, dairy producers adhere to stricter milk standards than in Ukraine. P. Borawski *et al*. (2020a) emphasise the significance of the dairy sector for the economy of the EU, which is the largest producer of milk in the world. Furthermore, European producers are focused on producing safe dairy products in compliance with certain limits on the number of somatic cells and bacteria in raw milk.

I. Fedulova (2018) considers the entry of dairy processing enterprises into foreign markets as a major factor in the current stage of dairy farming development and notes that the small-scale sector of the industry cannot fully meet all the needs of the processing industry with high-quality raw milk, which is mostly of the second grade. The author notes that the only strategic vector for the development of dairy farming can be cooperation of private farms and strict adherence to production technologies to obtain milk of proper quality. A. Popescu and E. Angel (2019) also believe that improving the quality of milk, primarily in terms of the number of bacteria and somatic cells, is an opportunity to increase profits in dairy farming. Scientists say that improving milk quality will increase customer confidence and demand for dairy products. O. Shpychak *et al*. (2022) emphasise the need for fundamental changes in the organisation and management of the dairy farming system and the creation of a suitable market infrastructure. Scientists believe that the development of the milk market environment by a considerable number of small farms leads to a decline in the quality and, consequently, price indicators of products. K. McGarr-O'Brien *et al*. (2023) have an extraordinary perspective on this issue and characterise the sustainability certification standards used in dairy production. They emphasise the diversity of existing standards, allowing farmers to choose the one that suits their beliefs or stage of development.

O. Kozak (2020) examines the factors that have a major stimulating impact on the development and further structural changes in the dairy industry. The author also notes that even in the context of the war waged by the Russian aggressor, Ukraine stays part of the global market for milk and dairy products. Despite the shock at the beginning of the war, the domestic industry managed to restart in the new reality and, just as before the full-scale invasion, is experiencing global trends in the development of the milk and dairy products market. In this context, P. Borawski *et al*. (2020b) also consider the impact of the global crisis on the dairy market.

However, the relevance of the issues under study does not diminish due to a considerable number of issues that impede the development of the industry, including martial law, the COVID-19 pandemic, declining consumer demand in the country, rising unemployment,

increased production costs caused by the crisis in the energy system, and the depreciation of the hryvnia, which necessitates further comprehensive research and development of recommendations for their solution. Thus, the purpose of this study was to analyse the current state of the Ukrainian milk market, determine the optimal price level depending on the quality of raw milk in agricultural enterprises and substantiate the ways to improve the efficiency of the dairy industry in the context of increasing its export potential.

MATERIALS AND METHODS

The study was conducted for 2010-2022 based on data and indicators from the State Statistics Service of Ukraine (n.d.), the Association of Milk Producers – a non-profit non-governmental professional association of farms specialising in dairy farming (n.d.), the methodology of the National Research Centre "Institute of Agrarian Economics" – "Expected indicators of production costs, performance, and profitability in agricultural enterprises of Ukraine in 2022: methodology and calculations (December 2022)" (Lupenko *et al.*, 2023), the findings of previous own studies and research of other Ukrainian scientists, namely, I. Fedulova (2018), O. Petrychenko and V. Rossokha (2018). The study also used available statistical data from the following official websites: CLAL, an Italian consulting company on dairy economics that analyses the dairy market and its development trends, generalising through information and training activities (CLAL.it., n.d.), and the Ministry of Agrarian Policy and Food of Ukraine (Ministry of Agrarian Policy and Food of Ukraine, n.d.) on the financial and economic activities of agricultural enterprises in Ukraine.

The economic research was based on the following principles: the choice of its area – research on the development of dairy farming and improvement of product quality; formulation of goals – identification of causes and consequences of changes in the state of the dairy industry, outlining the prospects for its development in the context of improving product quality; accumulation of facts and bringing them into a certain order – collection and processing of statistical information, systematisation of such information in the form of tables and graphs; sustainable theoretical generalisations – analysis of research and publications over the past 3-5 years; development of measures to determine the level of milk price depending on the quality of raw milk.

The dialectical method of cognition formed the theoretical and methodological framework of the study. A systematic and comprehensive approach was also used to investigate Ukrainian and foreign scientific provisions on the fundamental principles of analysing the state of dairy farming and factors influencing the quality of raw milk to improve its competitiveness. The information on the state of the domestic dairy industry was processed, described and summarised by selecting information from the Internet and printed media. To fulfil the purpose of this study, the following methods were used: monographic method – to investigate and systematise Ukrainian and foreign scientific achievements and practices in determining the main provisions of functioning and development of the dairy industry of Ukraine; method of system-structural analysis – to analyse the economic activity of agricultural enterprises engaged in milk production; method of cause-and-effect analysis – to identify urgent problems in the activities of enterprises in this industry; calculation and constructive method – to calculate the main indicators of development and economic efficiency of milk production in agricultural enterprises of Ukraine; method of logical generalisation – to formulate conclusions and proposals. The dynamics of milk production in Ukraine by major commodity producers and indicators of its economic efficiency were investigated using economic-statistical and economic-mathematical methods. Microsoft Excel software was used for statistical processing of the study results.

The requirements for raw materials necessary to produce dairy products were compared following the national standard DSTU 3662:2018 (2019). To adjust the selling price of milk, Methodological regulations on the organization of state statistical monitoring of the supply of milk to processing enterprises (n.d.) were considered.

RESULTS AND DISCUSSION

Since 1991, the situation in Ukraine's dairy industry has been radically different from what is happening globally. While in 1991, the world produced 440 million tonnes of milk, in 2021 it was 726 million tonnes. In 1991, Ukraine's gross milk yield was 24.5 million tonnes, and in 2022 it was 7.7 million tonnes. Thus, global milk production increased by 1.5 times, while in Ukraine it decreased by three times (Zhupinas, 2023). One of the factors of negative impact on milk supply is a constant decrease in livestock, which leads to a decrease in dairy production, conflicting interests of milk producers and processors, and a decrease in per capita consumption of milk and dairy products (Cherednichenko & Pashchenko, 2018). The dairy industry suffered significant losses in the first months of the war in 2022.

The occupation of the territories and hostilities meant that a considerable number of livestock was simply destroyed by the Russian invaders, and another part of the farm was forced to be sold for nothing or transported to safer regions. Thus, the industry lost 1 million tonnes of milk due to the war (Association of milk producers in Ukraine, n.d.). An analysis of the dynamics of milk production in Ukraine over 2010-2022 suggests that in all categories of farms, the average annual decline rate is 2.3%, including 2.0% and 3.7% in agricultural enterprises and households, respectively (Table 1).

Table 1. *Dynamics of milk production in Ukraine, thous. t*

Years	Farms of all categories	incl.			
		enterprises		households	
		thous. tonnes	% of total	thous. tonnes	% of total
2010	11,249	2,217	19.7	9,032	80.3
2011	11,086	2,246	20.3	8,840	79.7
2012	11,378	2,535	22.3	8,842	77.7
2013	11,488	2,583	22.5	8,906	77.5
2014	11,133	2,648	23.8	8,485	76.2
2015	10,615	2,669	25.1	7,946	74.9
2016	10,387	2,711	26.1	7,676	73.9
2017	10,281	2,766	26.9	7,515	73.1
2018	10,064	2,756	27.4	7,309	72.6
2019	9,663	2,729	28.2	6,935	71.8
2020	9,264	2,761	29.8	6,502	70.2
2021	8,714	2,768	31.8	5,946	68.2
average annual growth (decline) rate, %	-2.3	2.0	–	-3.7	–
2022	7,768	2,644	34.0	5,124	66.0
2022 to 2021, %	89.1	95.5	–	86.2	–

Source*: calculated by the authors of this study based on data from the State Statistics Service of Ukraine (n.d.)*

In 2022, all categories of farms produced 7,768 thous. t of milk, agricultural enterprises – 2,644 thous. t, households – 5,124 thous. t, which is 10.9%, 4.5%, and 13.8% less than in 2021, respectively. Thus, households have reduced milk production the most substantially. This is explained by the fact that they were forced to sell or abandon their livestock when fleeing the war from the occupied territories and the active combat zone.

An analysis of livestock productivity over 2010-2022, both in agricultural enterprises and households, suggests its growth. Thus, in 2022, the milk yield per cow in agricultural enterprises was 5,119 kg, while in households – 6,611 kg, which is 66.3% and 11.2% more than in 2010, respectively. Thus, according to the research, agricultural enterprises provided a much higher level of productivity than households and had an average growth rate of 5.1% compared to 1% for households (Fig. 1).

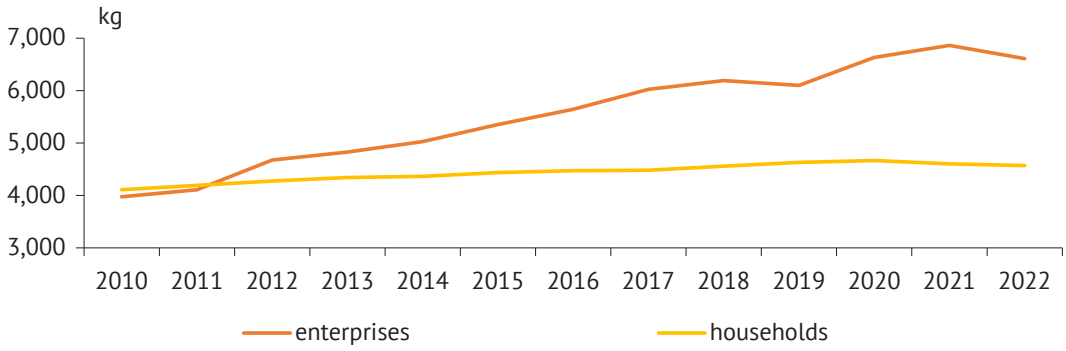


Figure 1. *Average annual milk yield per cow in Ukraine, kg*
Source*: compiled by the authors of this study based on data from State Statistics Service of Ukraine (n.d.)*

In 2022, interruptions in the supply of feed and veterinary medicines and power outages led to a decline in cow productivity, which ultimately led to a decrease in gross milk production. In 1990, there were 643 dairy plants in Ukraine, and as of 1 January 2022, only 140 of them had received permission to produce dairy products, of which 111 were operating. Since the outbreak of full-scale hostilities, the dairy processing industry has lost 38 enterprises in the occupied and temporarily occupied territories, and therefore as of 1 December 2022, only 73 were operating, which is almost 9 times less than in 1990. The total capacity of

the remaining enterprises is 4.9 mln t of raw materials. However, they are still under-utilised with raw materials, and therefore their unit costs are much higher than if they were fully utilising their capacity. The logistics aspect also plays a major role. Provided that the farm produces 15-20 t of milk, the processor is ready to take the raw materials even 300 km away. However, there are many small milk producers in Ukraine whose transportation is not very profitable for the processor (Agro-Times, n.d.).

An analysis of milk supply to Ukrainian processing enterprises in 2010-2022 shows that its quantity has decreased. Thus, in 2022, 2,740 thousand tonnes of milk were supplied, which is 42.8% less than in 2010. Notably, the structure of milk supply has changed considerably over the relevant period: while in 2010, 41.7% of milk came from agricultural enterprises and 56.1% from households, in 2022 the share of agricultural enterprises increased to 86.7%, and the share of households decreased to 13.3% (Table 2).

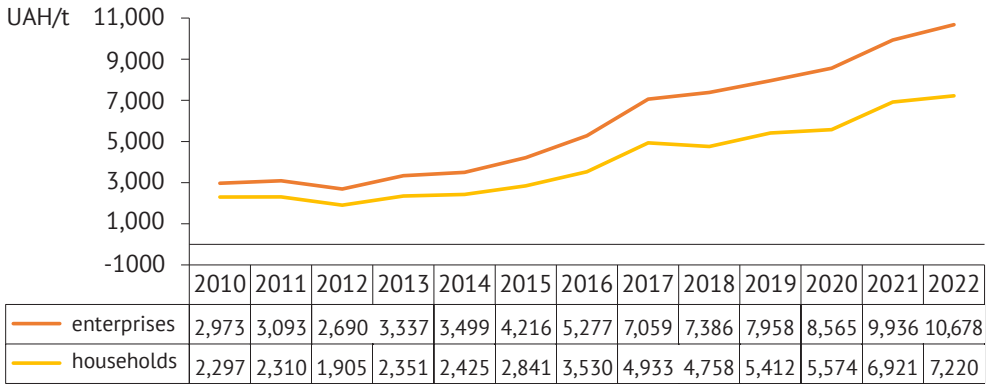
Table 2. *Milk supply to Ukrainian processing enterprises, thous. t*

Indicators	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Supply of milk and dairy products for processing, total	4,793	4,615	4,716	4,570	4,647	4,251	4,183	4,348	4,179	3,800	3,512	3,198	2,740
of which were purchased	4,537	4,547	4,692	4,545	4,617	4,090	3,710	3,928	3,809	3,462	3,289	3,032	2,657
incl. purchased from: enterprises	1,890	2,030	2,278	2,325	2,428	2,413	2,512	2,689	2,720	2,610	2,556	2,478	2,305
share of enterprises, %	41.7	44.6	48.6	51.2	52.6	59.0	67.7	68.5	71.4	75.4	77.7	81.7	86.7
households	2,544	2,155	2,007	1,824	1,737	1,346	1,198	1,239	1,089	851	733	554	353
share of households, %	56.1	47.4	42.8	40.1	37.6	32.9	32.3	31.5	28.6	24.6	22.3	18.3	13.3
other business entities	302.6	362	407	396	452	331							
Received on a tolling basis	42.1	59	15	6	7	138	441	396	347	318	203	148	74.8
Own-produced milk that was processed	13.9	9	10	19	23	24	32	25	25	20	20	18	7.8

Source*: calculated by the authors of this study based on data from the State Statistics Service of Ukraine (n.d.)*

One of the key factors in incentivising dairy producers is the price, the increase of which affects the efficiency of the enterprise (Bal-Prylypko *et al.*, 2022). Today, due to the involvement of intermediary structures, the purchase price for dairy products increases by 15-20%. Finished products are also sold from the processing plant to retailers through intermediary structures, which are usually recommended by the retailers where the products are sold. Depending on the range of products and the corresponding surcharges for the sale of dairy products in the retail network, the wholesale price of the company's dairy products increases by 25-60%. Often, the same product passes through two or three of these structures, which leads to an increase in price. Retailers sell at their own margin, and producers have no other alternative.

As a result of price distortions, raw milk is sold for virtually nothing, and prices for industrial products and services are so high that milk production for most farms becomes unprofitable or even detrimental. Thus, in 2022, agricultural enterprises sold milk at UAH 10,678 per tonne, while the retail price of milk in the retail network was UAH 35-42 per 1 litre (Fig. 2).



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
enterprises	2,973	3,093	2,690	3,337	3,499	4,216	5,277	7,059	7,386	7,958	8,565	9,936	10,678
households	2,297	2,310	1,905	2,351	2,425	2,841	3,530	4,933	4,758	5,412	5,574	6,921	7,220

Figure 2. *Average milk purchase price, UAH/t*

Source*: calculated by the authors of this study based on data from the State Statistics Service of Ukraine (n.d.)*

In March 2022, the situation in dairy farming was more critical than before due to the disruption of the supply chain for raw milk, finished products from dairy farms and dairy processing plants, which resulted in a

4.6 EUR/100 kg decrease in purchase prices. Due to the increase in exports in May-July 2022, the price of raw milk stabilised at 37.6-37.8 EUR/100 kg. However, as a result of the dollar's appreciation against the hryvnia in July, the price of milk dropped to 32 EUR/100 kg. Subsequently, the strengthening of the hryvnia and increased export activity led to an increase in the price of milk in hryvnia terms, and in November the price of milk reached 36 EUR/100 kg (Association of milk producers in Ukraine, n.d.).

At the end of 2022, purchase prices for raw milk were 40% lower than in the EU and 11% lower than in 2021. The Ukrainian dairy market is affected by the following factors that constrain milk price increases: reduced demand for dairy products, rising production costs due to the energy crisis, and lower real incomes, which leads to a decrease in dairy consumption in the short term. However, there is underutilised capacity in the dairy industry that could be used to further develop the market, depending on the strength of external and internal demand. It is believed that due to the diversification of foreign markets, support of the Ukrainian consumer as a result of the reduction of the VAT rate on milk and dairy products and the implementation of the School Milk programme, favourable conditions will be created for the recovery of the Ukrainian dairy industry (Association of milk producers in Ukraine, n.d.).

Over 2010-2022, milk production at agricultural enterprises has been consistently profitable. Milk retained its status as the most profitable livestock product. Thus, in 2022, the profitability of production of this product in agricultural enterprises was 17.4% (Fig. 3). However, the authors believe that achieving 20% profitability is insufficient for expanding business and attracting considerable investment resources.

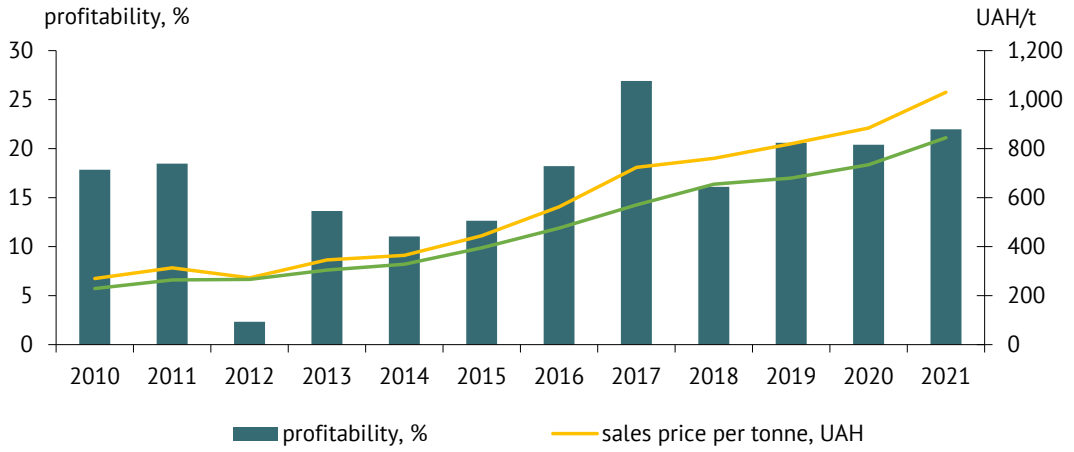


Figure 3. *Indicators of economic efficiency of milk production*
Source*: calculated by the authors of this study based on data from the State Statistics Service of Ukraine (n.d.)*

Dairy farming faces a significant risk of becoming unprofitable, as the industry has been stagnating for a long time and requires not only government support but also a systematic approach to effective strategic decisions at the level of each business entity, regions, and the entire country. Approximation to European standards requires compliance with new requirements for raw materials needed for dairy production. Ukrainian producers were given time, the so-called transition period, to bring the quality of cow's milk up to the required standards. In 2018, a new national standard DSTU 3662:2018 (2019) was introduced, which reinforced the requirements for the raw milk production process and its quality. In the grading system, milk is divided into grades (extra, premium, first) (Stepasyuk, 2020).

However, the implementation of these requirements for the safety and quality of milk and dairy products was postponed for two years until 1 January 2023 (Order of the Ministry of Agrarian Policy and Food, 2019). The extension of the transitional period for certain measures on state control of raw milk production and marketing was intended to provide time for milk producers and processors to harmonise their relations and create an effective organisational mechanism for the Ukrainian dairy industry. The state should be actively involved in the implementation of the Strategy for the Development of Dairy Farming and the Dairy Processing Industry, the development of relevant policies and the distribution of functions of competent authorities, including the State Service of Ukraine for Food Safety and Consumer Protection (Avercheva, 2021).

An analysis of milk supply to processing enterprises shows that milk produced by agricultural enterprises is of much higher quality. Thus, the share of milk that meets the requirements of the extra grade is 47.2%, while the highest and first grades are 32.6% and 19.3%, respectively. The quality of raw milk supplied for processing by households is quite different, with no extra milk at all, only 3.9% of milk of the highest quality, and the vast majority of milk being of the first and second quality, namely 77.1% and 19% (Fig. 4).

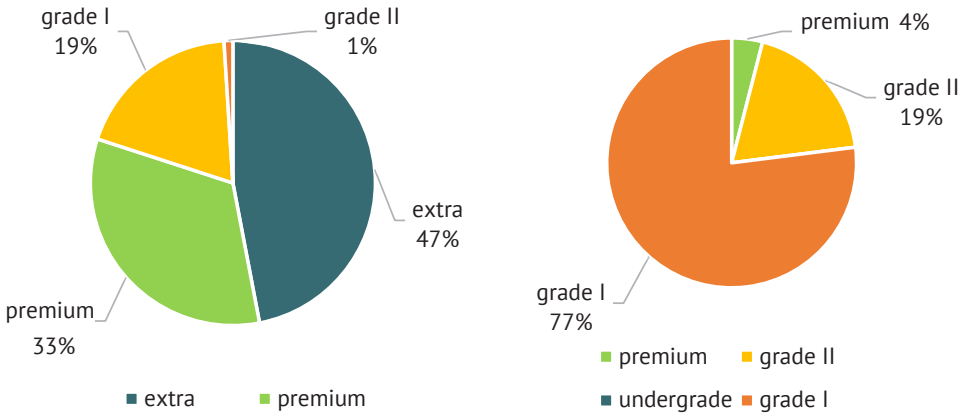


Figure 4. *Structure of milk sold by agricultural enterprises and households, 2022*
Source*: calculated by the authors of this study based on data from State Statistics Service of Ukraine (n.d.), Clal.it (n.d.).*

It was found that the quality of milk sold by agricultural enterprises tends to improve (Table 3). And this is natural, as producers seek to earn more income, and the price difference between grade I and grade II ranges within 10-20%, while between grade I and non-grade milk this deviation is over 30%. In addition, agricultural enterprises already have the proper conditions (minimal contact with air and prompt cooling) to produce such milk, and most of them breed highly productive cows with proper housing, feeding, and veterinary care.

Table 3. *Quality of milk supplied for industrial processing, by grade*

Indicators	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Agricultural enterprises												
Volume of milk supplied, thous. t	1,919	2,160	2,193	2,298	2,287	2,375	2,533	2,560	2,428	2,348	2,253	2,107
in terms of milk with basic fat content	2,030	2,278	2,325	2,428	2,413	2,512	2,688	2,720	2,610	2,556	2,478	2,305
including by grade:												
– extra	113	120	227	223	248	366	441	586	710	885	973	1089
specific weight, %	5.6	5.3	9.8	9.2	10.3	14.6	16.4	21.6	27.2	34.6	39.3	47.2
– prime grade	669	711	798.7	821	850	923	987	1036	938	874	875	750
specific weight, %	33.0	31.2	34.4	33.8	35.2	36.7	36.7	38.1	35.9	34.2	35.3	32.6
– grade I	1,157	1,311	1,182	1,251	1,197	1,056	1,018	895	844	776	614	444
specific weight, %	57.0	57.6	50.8	51.5	49.6	42.0	37.9	32.9	32.3	30.4	24.8	19.3
– grade II	83	128	113.7	129	113	160	235	194	97	16	16	21
specific weight, %	4.1	5.6	4.9	5.3	4.7	6.4	8.7	7.1	3.7	0.6	0.6	0.9
Undergrade	8	7	3.7	5	5	6	7	9	21	5	0.5	0.2
specific weight, %	0.4	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.8	0.2	0.0	0.0
Share in purchased milk, %												
– fat	3.6	3.59	3.6	3.59	3.59	3.6	3.6	3.6	3.66	3.7	3.74	3.72
– protein	x	x	x	3.07	3.05	3.06	3.06	3.1	3.13	3.16	3.19	3.20
Households												
Volume of milk supplied, thous. t	2,094	1,954	1,771	1,699	1,312	1,161	1,200	1,054	822	708	531	337
in terms of milk with basic fat content	2,155	2,007	1,824	1,737	1,346	1,198	1,239	1,089	851	733	554	353
including by grade:												
– prime grade	7.6	4.4	1.223	1.7	1.0	0.6	1.6	2.3	0.8	1.6	0.7	13.7
specific weight, %	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.1	3.9
– grade I	521	341	238.9	205	119	108	110	136	102	586	436	272
specific weight, %	24.2	17.0	13.1	11.8	8.9	9.0	8.9	12.4	12.0	79.9	78.7	77.1
– grade II	1,573	1,508	1,507	1,452	1,163	1,028	1,081	904	708	135	108	67
specific weight, %	73.0	75.1	82.6	83.6	86.4	85.8	87.2	83.0	83.2	18.4	19.6	19.0

Table 3. Continued

Indicators	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Undergrade	55	154	76.9	79	63	61	46	47	40	10.8	9.1	0.1
specific weight, %	2.5	7.7	4.2	4.5	4.7	5.1	3.7	4.3	4.8	1.5	1.6	0.0
Share in purchased milk, %												
– fat	3.5	3.49	3.5	3.48	3.49	3.51	3.51	3.51	3.52	3.52	3.54	3.56
– protein	x	x	x	2.93	2.92	2.93	2.95	2.96	2.94	2.96	2.94	2.96

***Source**: calculated by the authors of this study based on data from State Statistics Service of Ukraine (n.d.), Yu. Lupenko et al. (2023)*

It is much more difficult to bring milk from private households to a high quality, as the conditions of cows in such farms and the milking process do not always ensure that raw milk is of a high quality. In some cases, contamination of milk with microorganisms can occur even during milking due to non-compliance with sanitary standards. All this leads to contamination of milk with undesirable microflora, and due to imperfect procurement and logistics, milk from the private sector does not meet the requirements of regulatory documents. An analysis of milk supply to processing companies shows that in 10 months of 2022, extra grade milk was processed 10% more than in 2021 (Fig. 5). In other words, in 2022, 46% of milk supplied by agricultural enterprises was extra grade milk. Thus, in 2022, the share of extra grade milk produced by agricultural enterprises in Ukraine increased by a greater percentage than in the EU but did not reach their level.

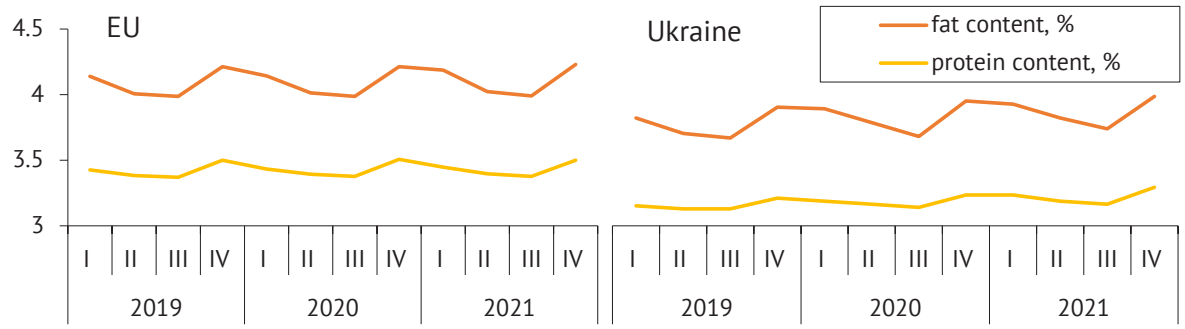


***Figure 5.** Milk quality (fat and protein content) in the EU and Ukraine in 2019-2021 (by quarters)*
***Source**: calculated by the authors of this study based on data from State Statistics Service of Ukraine (n.d.), Clal.it (n.d.)*

As noted earlier, Ukrainian standards are considerably inferior to European ones. When it comes to the quality of Ukrainian and European milk, these parameters differ significantly. Thus, fat content, protein, somatic cell count, and bacterial contamination in Ukraine are considerably lower than in Europe (Table 4).

***Table 4.** Main parameters of milk quality in Ukraine and Europe*

Country	Fat content, %	Protein content, %	SCC, cm³	Bacterial contamination, cm³
Ukraine	3.4	3.0	<400000	<100000
Europe	4.2	3.4	<249999	<24999

***Source**: DSTU 3662:2018 (2019)*

It was found that the higher level of raw milk prices in the world is conditioned by higher requirements for product quality – fat, protein, antibiotics, somatic cell count, and bacterial contamination. Considering the European fat content of 4.2% and protein content of 3.4%, the authors recalculated the purchase prices for raw milk in Ukraine relative to the European ones, using the methodology described below (CLAL.it). The pricing of milk and dairy products should factor in the quality of the product (fat and protein content as 40:60), which is incentivised by premiums and surcharges.

$$P = \left(\frac{P_{EU}}{P_{UA}} \cdot 0.6 + \frac{F_{EU}}{F_{UA}} \cdot 0.4\right) \cdot Pr_f, \quad (1)$$

where P_{EU} is the average protein content for EU countries, %; P_{UA} is the protein content in Ukraine, %; F_{EU} is the average fat content for EU countries, %; F_{UA} is the fat content in Ukraine, %; Pr_f – the factual price of milk in Ukraine, EUR/t.

Comparing the raw milk purchase prices recalculated to the basic indicators, it was found that their factual level in Ukraine (43.47 EUR/t in October 2023 in European countries, against 39 EUR/t in Ukraine for the corresponding period) is lower than in most European countries (Fig. 6).

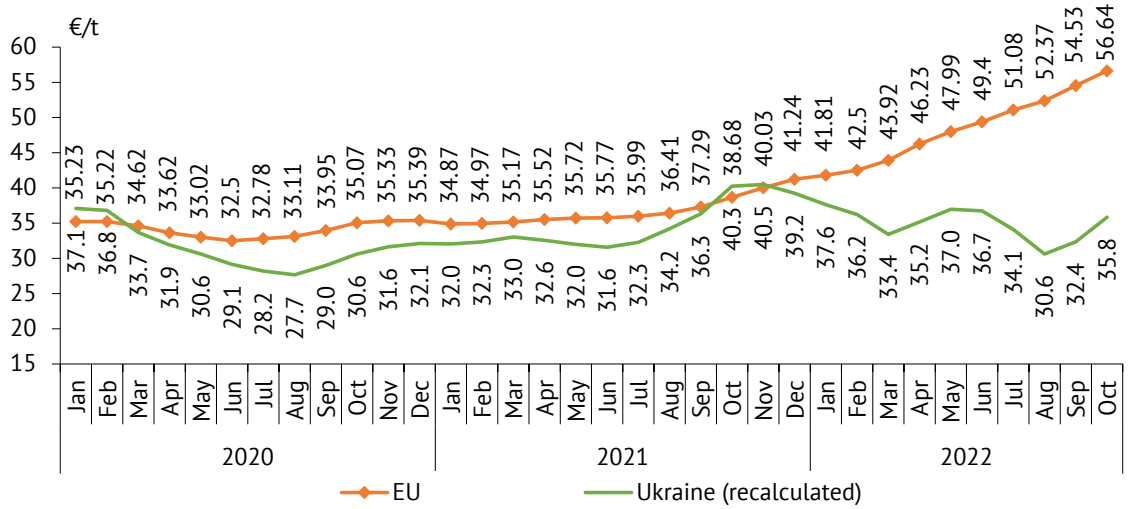


Figure 6. *Average milk price in the EU and Ukraine (converted to EU milk quality), EUR/t*
Source*: calculated by the authors of this study based on data from State Statistics Service of Ukraine (n.d.), Clal.it (n.d.)*

Thus, at the end of 2022, purchase prices for milk in Ukraine were 40% lower than in the EU and 11% lower than in 2021. Ukraine's dairy market is under pressure from a range of factors that are holding back milk price growth: declining domestic consumer demand; rising unemployment, which indicates a decline in dairy consumption in the near future; rising production costs due to the destruction of the energy system by Russia's shelling; depreciation of the hryvnia, etc. (Association of milk producers in Ukraine, n.d.).

There are numerous discussions among scientists about the readiness of Ukrainian milk producers to comply with European standards for fat (4%) and protein (3.4%) in milk. During the Soviet era, the only basic indicator of milk quality was fat content. The protein content indicator appeared a little later due to the lack of animal protein in the diet. Ukraine has the lowest basic indicators of fat and protein among post-Soviet countries. These requirements are not only consumer but also economic in nature. Thus, Israel does not accept Ukrainian milk for processing, even extra grade milk. The authors of the present study believe that achieving these standards will enable Ukrainian producers to join the so-called "elite" of milk producers.

Analysts have different opinions on compliance with standards. Y. Sivov *et al.* (2020) note the need to comply with such standards, but note that as a result of their application, the profitability of an average dairy farm may decrease by 12-14%. M. Bugai (2020) believes that Ukrainian dairy producers have all the capacities to produce products according to European standards without fantastic investments. An equally essential issue in the dairy industry is the dictates of retailers towards dairy producers. J. Britt *et al.* (2018) predict an increase in production and safety in the dairy industry through consolidation, modernisation, and specialisation. It is noted that large dairy farms will increase the level of automation to reduce costs, which will affect their profitability. The authors envisage a transition from the usual export of surplus to an increase in the production of value-added products that will be adapted to particular tastes and traditions. O. Shpychak *et al.* (2022) believe that to ensure the production and sale of high-quality milk, it is necessary to reorganise its production by concentrating the number of cows in farms. Government support mechanisms can play a vital role in this regard.

According to L. Tulush, Head of the Analytical Department of the Union of Dairy Enterprises of Ukraine (2021), state support measures, entrepreneurs' efforts and consideration of international practices will help ensure food security in Ukraine, reduce dairy imports, and introduce advanced resource-saving technologies to produce high-quality dairy products. If the quality of their products is maintained, domestic producers will be able to expand their sales geography by developing new international markets.

The state should facilitate the implementation of financial incentives for the development of the dairy industry to stabilise milk production. There is a shortage of raw milk in Ukraine, which prompts processing companies to consider various options for maximising their capacity utilisation. Otherwise, Ukraine will become more dependent on dairy imports, which will increase threats to food security. Thus, negative processes in the industry will become irreversible if the state does not intervene in this situation in the coming years (Tulush, 2021). N. Shyian and V. Kolosha (2020) also note that with the joint efforts of the state, milk producers, and processors, the Ukrainian dairy market has a real potential to run a profitable business and become a powerful exporter of dairy products to the European market and other countries. The findings of the present study and the conclusions of the above-mentioned

authors suggest that, given the strategic course towards European integration, the dairy industry of Ukraine should be guided by European product quality standards. A vital factor in fulfilling the purpose of the strategy is to improve the quality of the raw material base through concentration of livestock and joint efforts of the state, milk producers, and processors.

CONCLUSIONS

The conducted study suggests that, since Ukraine has been granted EU candidate status, the issue of the quality of domestic products is of particular importance. Given that European standards for raw milk procurement are several orders of magnitude higher than Ukrainian standards, it is necessary to harmonise state standards for these products with international requirements and introduce certain measures to improve the culture of milk production, delivery, and marketing to dairy processing enterprises.

An equally urgent issue is private households, which should be transformed into family dairy farms (cooperatives) to preserve the livestock, because second-grade raw milk, which is mostly produced by these farms, cannot be used to produce export-oriented products, which is 75% of all milk produced in Ukraine. Statistics show that more than half of the world's milk is processed by cooperatives, as this business model best serves the interests of raw milk producers and the processing industry.

It was found that the competitiveness of dairy products depends on the quality of the raw material base. Strict quality requirements for raw milk limit the ability of most Ukrainian dairy processing companies to enter European markets. Therefore, government mechanisms of influence should be aimed at supporting Ukrainian producers and promoting the formation of specialised milk cooperatives. The authors of this study propose to consider the quality parameters of products when forming the price of milk of Ukrainian producers using surcharges and extra charges to balance it against the basic indicators of raw milk quality in European countries. Comparing the raw milk purchase prices recalculated to the basic indicators, it was found that their factual level in Ukraine in October 2023 was 39.0 EUR/100 kg, and in European countries – 43.47 EUR/100 kg. Thus, the price of milk in Europe is 11.5% higher than the factual price offered by Ukrainian producers, which is an incentive for them to improve product quality and, consequently, generate higher profits.

The analysis of the current state of dairy farming suggests that to boost the dairy business, it is necessary to increase state support for the industry. The fact that the purchase price of milk from both agricultural enterprises and households, which is supplied to dairy processing plants, is almost three times lower than the final retail price is unacceptable. Therefore, the development of the dairy industry in the long term is possible only if the interests of all market players – producers, processors, and the state – are considered and they work closely together.

Further research will be aimed at a detailed analysis of the set of factors that directly affect the selling price of milk and substantiation of a fair distribution of the price between producers, processors, and trade. In the future, special attention should be paid to marketing strategies and innovative capabilities of the dairy business. Thus, the introduction of an effective mechanism for implementing the proposed measures with government support will be the driving force behind the accelerated development of the dairy industry.

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CONFLICT OF INTEREST

The authors of this study declare no conflict of interest.

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Анотація. Необхідність пошуку шляхів підвищення якісних характеристик молока як основи підвищення конкурентоспроможності молочної продукції на світовому ринку зумовлює актуальність дослідження. Молочна галузь України є однією з важливих у аграрному секторі економіки, так як забезпечує населення країни життєво необхідними продуктами харчування. Мета дослідження – обґрунтувати напрями вирішення організаційно-економічних проблем розвитку молочної галузі для задоволення потреб внутрішнього ринку якісною молочною продукцією та збільшення експортного потенціалу. Дослідження проводилися з метою виявлення основних причин трансформаційних змін, які відбулися в молочному скотарстві та окреслення перспективних напрямків розвитку даної галузі в контексті підвищення якості продукції. У фокусі даного дослідження – європейські та національні вимоги до якості молоко-сировини. При роботі з аналітичним матеріалом використовувалися такі методи економічних досліджень: економіко-статистичний, порівняльного аналізу, графічний, логічного узагальнення, системного підходу, системно-структурного аналізу, розрахунково-конструктивний. У статті проаналізовано дані сільськогосподарських підприємств і господарств населення України, які займаються виробництвом молока за 2010-2022 роки та здійснено перерахунок закупівельних цін на молоко-сировину відносно європейських показників якості продукції. Результати проведеного дослідження свідчать, що забезпечення конкурентоспроможності продукції молочної галузі залежить від якості молока. Встановлено, що вона є вищою в європейських країнах, тому високі стандарти щодо якості молочної сировини стають бар'єром входження на європейські ринки для більшості вітчизняних молокопереробних підприємств. Відповідно, стратегія держави повинна орієнтуватися на збільшення виробництва молочної сировини високої якості та зростання експортного потенціалу шляхом формування спеціалізованих кооперативів із виробництва молока для молокопереробних підприємств. Практична значимість отриманих результатів полягає в тому, що авторські рекомендації можуть бути використані сільськогосподарськими підприємствами чи особистими господарствами населення в їхній пересічній діяльності

Ключові слова: молоко; якість молочної продукції; міжнародні стандарти; виробники продукції; ціна релізації