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Factors of transformation of the dairy subcomplex of the agro-industrial complex of Ukraine

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Abstract. One of the main ways to overcome the existing problem of providing the country's population with proteins of animal origin is, among other things, to increase the production and consumption of milk and dairy products. Based on this, consideration of the existing problems of the functioning of the dairy subcomplex of the agro-industrial complex of the country is extremely relevant. The purpose of the study is to assess the current state of the subcomplex and to develop practical recommendations for improving the efficiency of its functioning. The research was based on the application of methods: analysis and synthesis, induction and deduction, factor and economic and statistical comparative analysis, analytical and logical generalisations, etc. In contrast to the existing positive trend of growth in milk production in the world, in dairy farming in Ukraine, there is a constant reduction in the number of cows and milk production. Over the past 10 years alone, the number of cattle in the country has decreased by 1.952 million heads, including cows by 0.958 million heads, and milk production in 2020 amounted to 9.263 million tons of milk (17.64% less than in 2010). There was a reduction in the number of milk processing enterprises. Thus, in 2020, there were only 192 of them left (of which 178 worked) or only 29.86% of their number in 1990. All this resulted in the fact that the actual consumption of milk per capita in 2020 was only 53.13% of the scientifically based standards of consumption of milk and dairy products. According to the results of the research, it was established that the decrease in the number of cows, without considering the growth of their productivity in farms of all categories, reduced the production of dairy raw materials. The results of the research allow identifying the main factors that affect the reduction in the production of milk and its derivatives. After analysing the state and trends in the development of dairy farming, it can be argued that the increase in the production of quality and safe milk and its supply for processing requires the cooperation of farms

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and households. Together, they can ensure the stability of production of the necessary volumes of milk, appropriate quality and safety and ensure the supply of significant volumes of raw materials to large processors. Possible areas and innovative technologies of animal husbandry and milk production and processing require further research

Keywords: dairy farming, dairy industry, raw milk, milk processing, dairy market

Introduction

Milk and dairy products are valuable food products, the world consumption of which is constantly growing, both in connection with the general growth of the world population and in connection with the increase in their consumption in certain countries (China, Vietnam, etc.), which is associated with the growth of living standards of the population of these countries. According to research by IFCN experts, the growth of world milk production in 2019 was mainly due to India, Oceania, Africa and the Middle East (Vasylieva, Vinichenko & Katan, 2019). However, this growth was 1.4% and was significantly lower than the long-term average (2.3%).

In 1990, Ukraine ranked 6th in the world ranking of milk-producing countries, with milk production of 24.5 million tons. In 2020, the country ranked 22nd in the world ranking (among 123 countries – major milk producers (producing 98% of world production) (Cherevko, 2012; Cortés *et al.*, 2019). The reasons for such a current state of affairs in the dairy subcomplex of the agro-industrial complex of Ukraine and trends in its functioning require more research.

The comprehensive study, evaluation and analysis of the state of enterprises of the dairy subcomplex of the agro-industrial complex of Ukraine and the prospects for their development are considered in the works of many scientists. Among the studies are the works of N. Belinska, P. Berezivskyi, V. Boyko, I. Yevseyeva, M. Ilchuk, T. Mostenska,

N. Oliadnychuk, M. Parkhomets, V. Radko, P. Sabluk, N. Shiyan, I. Fedulova and many others (Bhagal *et al.*, 2018; Atamurodov *et al.*, 2022). These scientists researched important issues on the development of the feed base, breeding work, conditions of keeping the dairy herd, optimisation of the organisational and economic mechanism of the subcomplex enterprises functioning and ensuring the growth of their competitiveness. However, dynamic changes in the global and domestic markets and the introduction of modern innovative products require constant identification and clarification of trends in the development of enterprises of the subcomplex to develop effective tools for managing their functioning and competitiveness.

The purpose of the study is to assess the current state of the dairy subcomplex of the agro-industrial complex of Ukraine, trends and factors of its transformation, and to develop practical recommendations for stabilising and improving the efficiency of its functioning and competitiveness.

Materials and Methods

The performed research was based on the application of methods: analysis and synthesis, induction and deduction, analytical and logical generalisations, etc.

Results

The results of the conducted research demonstrate that the root cause of the current state

of affairs in the dairy subcomplex of the agro-industrial complex of Ukraine is the existing trends in dairy cattle breeding, namely the reduction in the number of cows and milk production. Thus, at the beginning of 2021, the total number of cattle in Ukraine amounted to 2.874 million heads, which is 7.1% less than at the beginning of 2020 (Table 1). Therewith, the number of cattle in agricultural enterprises

decreased to 1.008 million heads, and the number of dairy cows decreased, respectively, to 423.9 thousand heads, which is 2.6% less than at the beginning of 2020. All this has ensured that the adverse trend of a decline in the number of dairy farms (DFs), averaging 4.3% per year, and a decline in milk production, averaging 2.3%/year, continues, in contrast to the current positive trend in global milk production growth.

Table 1. Dynamics of cattle population and cow productivity in Ukraine (end of the year)
(Feniak, 2020; Vasilchenko, 2021)

	1990	2010	2015*	2016*	2017*	2018*	2019*	2020*	2020/2010 yr. %
Cattle, thousands of head:	24 623	4826	3884	3750	3683	3531	3092	2874	59.55
Including cows thousand heads	8 378	2631	2167	2109	2018	1919	1788	1673	63.6
Milk yield per cow, kg of farms of all categories	2863	4082	4644	4735	4820	4922	4976	5129	125.6
Average annual milk yield of kg of milk from one cow in agricultural enterprises	2941	3975	5352	5643	6025	6190	6101	6634	166.9

Source: excluding the temporarily occupied territory of Crimea, Sevastopol and part of the temporarily occupied territories in Donetsk and Luhansk regions

Therewith, households at the beginning of 2021 reduced the number of cattle to 1.865 million heads, including the number of dairy cows to 1.249 million heads or by 6.4% compared to 2020 (Lysenko, 2014). Thus, the reduction of cattle and cows in households is faster than in cattle farms. Thus, it should be noted that the quantitative indicators of cattle and cows in private households raise some doubts since, for various reasons, the identification of livestock in them has not yet been completed, although the state should have ensured its implementation before 2015.

Analysis of the data in Table 1 allows concluding that only in the last 10 years the number of cattle in the country has decreased by

1.952 million heads, including cows by 0.958 million heads, which indicates the stability of the adverse trend in the development of meat and dairy cattle and in the volume of milk supply to processing enterprises (Table 2).

The reduction in the number of cows, despite their growing productivity in farms of all categories (on average by 2% per year), decreased the production of quality raw milk (Tables 1 and 2). Thus, according to the results of the research, in 2020 Ukraine produced 9.263 million tons of milk (7.1% less than in 2019). Among them, 2.761 million tonnes (1.2% more) were produced by agricultural enterprises and 6.502 million tonnes (6.3% less) by households

(Chernyakov, Usacheva & Chernyakova, 2021; Zadorozhna, 2014). All this reduced the actual per capita milk consumption by 2.2%, which is

2020 amounted to only 53.13% of the scientifically based standards of milk and dairy products consumption.

Table 2. Dynamics of milk production and processing in Ukraine, (Feniak, 2020; Vasilchenko, 2021)

Indicators	2010	2015	2016	2017	2018	2019	2020	2020 by 2010 years, %
Milk production, thousand tonnes	11249	10615	10382	10281	10064	9963	9 263	82.34
The total amount of milk supplied to processing enterprises, including thousand tonnes:	4793	4251	4183	4348	4179	3868	3299	68.8
from enterprises, ths. tonnes	2193	2744	2512	2689	2720	2750	2566	117.12
from the population, ths. tonnes	2544	1346	1198	1239	1089	870	733	28.8
The level of marketability, %	42.6	40.0	40.2	42.3	41.2	38.8	35.61	83.6
Milk consumption per capita, kg/year	206.4	209.9	209.5	200.0	197.7	200.5	201.9	97.8

The largest amount of milk in 2020 was produced in the Poltava region – 734.2 thousand tons (3.2% less than in 2019), Vinnytsia region (728.4 thousand tonnes, 4.6% less) and Khmelnytskyi region (651.5 thousand tonnes, 2.5% more). The lowest volumes of milk production in 2020 were demonstrated in Luhansk, Donetsk and Zaporizhzhia regions. The results of the analysis of the dynamics of milk production volumes allow concluding that there

was a transformation of the raw material base of the dairy industry both in terms of volumes and quality of milk supplied to processing enterprises (Tables 2 and 3). If 10 years ago the ratio of milk volumes supplied by different categories of producers for processing to dairy processing enterprises was about 50:50, in 2020 the share of households in the total volume of milk transferred to processing enterprises was only 22.8%.

Table 3. Dynamics of the quality structure of milk received for processing from agricultural enterprises in 2020, %% of the total volume (Feniak, 2020; Vasilchenko, 2021)

Year	Extra	Top quality	First quality	Second quality	Non-quality
2010	4.4	31.3	59.3	4.1	0.9
2015	10.3	35.2	49.6	4.7	0.2
2017	16.4	36.7	37.9	8.7	0.3
2018	21.6	38.1	32.9	7.1	0.3
2019	27.2	35.9	32.3	3.7	0.2
2020	34.6	34.2	30.4	0.6	0.2
2020 to 2010, %	7.46 times	109.26	51.26	14.6	22.2

Source: (Feniak, 2020; Vasilchenko, 2021)

Thus, there was a rapid reduction in the volume of supplies for processing low-quality, but cheap milk from farms that are unable to compensate agricultural enterprises by increasing the supply of quality raw materials.

Therewith, the quality and safety of milk supplied for processing by agricultural enterprises are steadily increasing. According to the results of the analysis, there was an increase in the share of “extra” and “first quality” milk (Table 3). Thus, the share of raw milk of “extra” quality in the total volume of milk received for processing increased from 27.2% in 2019 to 34.6% in 2020. However, the share of “top” quality milk decreased, respectively, from 35.9% to 34.2% and “first” quality – from 32.3% to 30.4%. The share of “second” quality decreased sharply from 3.7% to 0.6%.

Therewith, notably, there was a leap in milk quality in households, but only “on paper”. The share of second-quality milk supplied for processing by households decreased from

83.2% to 18.4%, while the share of first-quality milk, on the contrary, increased from 12% to 79.9% without any significant changes in the technology of milk production, storage and delivery (Petrichenko, 2018a; Petrichenko, 2018b). Thus, dairy processing enterprises, in conditions of shortage of raw materials, could not refuse to accept milk from households for processing and, thus, are trying to “perform” the requirements of the new legislation on the quality and safety of milk, through a “mix” of milk received from households and agricultural enterprises.

It is confirmed by the fact that in Ukraine sanitary control of milk quality is conducted only in 14.8% of households engaged in milk production (Kovalchuk, 2021). Therewith, milk quality control is performed only in 8.4% of households that cultivate 0.5 hectares of land or less, 17.1% of households – with an area of 0.51-1 hectares and 28.3% of households – with an area of land of more than 1 hectare.

Table 4. Dynamics of the number and capacity of milk processing enterprises in Ukraine

	1990	2000	2007	2010	2014	2019	2025 (forecast)	2019 to 1990,%
Number of enterprises, units	643	447	354	287	252	192	157	29.86
Total production capacity, million tonnes	18.6	13.9	13.46	12.7	12.0	9.8	8.1	52.69
Average capacity, thousand tonnes	28.9	31.1	38.02	44.2	47.6	51.04	51.6	176.6

The results of the research demonstrate that if the current adverse trends in the dynamics of milk production and supply for processing continue, 1-2 large milk processing enterprises will disappear in Ukraine every year. And it is confirmed by the results of the analysis of changes in the number of milk processing enterprises and their total processing capacity (Table 4). Thus, if at the end of 1990, there were 643 processing enterprises in

the country, in 2020 there were only 192 (of which 178 were operating) or only 29.86% of their number in 1990 (Udomkun *et al.*, 2020; Breus & Yevtushenko, 2022). However, notably, mainly old low-capacity enterprises were closed. The result of this feature was an almost twofold increase in the average production capacity of milk processing enterprises. However, these capacities, due to the lack of raw materials, are used on average by 30-40%.

The results of the analysis of the functioning enterprises demonstrate that the 80 most powerful milk processing enterprises, currently, produce 75-85% of domestic dairy products from whole milk. The owners of these enterprises invest heavily in the modernisation of production, improving the quality of dairy products, monitoring and promptly responding to changes in market conditions, and constantly improving and expanding the range of products to optimise the production process and increase production volumes and profits. The problem of adapting milk and dairy products production in Ukraine to European requirements, which became particularly urgent after the annexation of Crimea and the loss of the Russian market, pushes them to do it. The desire to enter the markets of the EU, CIS, Asia and Africa stimulates the enterprises of the dairy subcomplex of the agro-industrial complex to increase the volume of production that is competitive in these markets.

Although, if considering the development of competitiveness of domestic dairy processing enterprises and their products in the world and domestic markets, then, admittedly, for a processor who wishes to export its products profitably, it would be economically feasible to have one modern enterprise with a capacity of at least 500 thousand tonnes of milk processing per year. However, the establishment of such an enterprise in Ukraine requires the availability of an appropriate raw material zone for it based on the establishment of 5-6 modern dairy farms with a population of 10 thousand cows each and their productivity at the level of 10 tonnes of milk per cow per year.

The results of the research allow identifying abnormal heat and the loss of a specific amount of fodder among the factors that influenced directly or indirectly the reduction in milk

production during 2020. As a consequence, there was a significant increase in fodder prices (December 2020 to December 2019) for feed wheat by 57%, feed maize by 82%, sunflower meal by 126% and soybean meal by 74%. A significant problem in dairy farming is the insufficient amount of fodder to ensure balanced diets for cows. In the author's opinion, the growth of fodder prices will continue in the coming years as the global trend of rising prices for energy, fertilisers and agricultural products continues. From this, it can be concluded that further rise in grain prices will increase the price of mixed fodder, and therefore the production of meat and milk will remain low-profit or may even become unprofitable.

Therewith, the rise in fodder prices reflects on the cost of production of livestock products and increases prices. Thus, milk prices in 2020 were: extra – 12.15 UAH/kg, top – 11.7 UAH/kg, first – 11.08 UAH/kg. The weighted average price – 11.64 UAH/kg. The range of fluctuations in prices for medium and large batches of extra milk by region was: north and centre – 11.7-12.45 UAH/kg; south – 11.7-12.45 UAH/kg; east – 11.6-12.4 UAH/kg; west – 11.6-12.35 UAH/kg. The results of the analysis demonstrate that in Ukraine the prices for extra and premium milk are higher than in some EU countries. It results in the fact that domestic dairy products have a low level of competitiveness in foreign markets.

Ukraine has a huge potential in dairy production, and sustainable development of this industry is possible, but subject to the availability of cheap and long-term loans, appropriate professional education, and stable national policy on the conditions of functioning of the dairy subcomplex of the agro-industrial complex. Notably, in 2018, the state programme for fattening young cattle in private farms was launched

by the Resolution of the Cabinet of Ministers of Ukraine of February 7, 2018, No. 107 "On approval of the Procedure for using funds provided in the state budget to support the livestock industry". This resolution provided budgetary assistance to households on a non-refundable base for raising young animals to 13 months of age for 2500 UAH/head. However, in 2019, the population began to be massively denied subsidies, and in 2020 they were completely cancelled.

The development and stable functioning of the dairy farming and dairy processing industry require significant investments. Thus, to increase the number of cows to 2.1 million heads by 2030, and milk production – up to 11 million tonnes and, therewith, to process 9 million tonnes, it is necessary to invest UAH 9-11 billion annually in the industry. The state should actively participate in this, using the EU model as an example, where up to 50% of producers' costs are compensated by the state. For this purpose, with the restoration of the Ministry of Agrarian Policy, it is necessary to design a strategy for the development of dairy farming and dairy processing industry, which would include state support for breeding and genetic renewal of the herd, state participation in investing in the construction of new and reconstruction and modernisation of existing dairy complexes, development of cooperation of various forms, farming, development of infrastructure for cold logistics, etc. In reality, by abolishing the special VAT regime for agricultural producers in 2017, the government undertook to allocate at least 1% of the "agrarian" GDP for state support programs for the agro-industrial complex by 2021 – i.e. about UAH 7 billion. However, not a single year since this decision was made, the total amount of state support has not corresponded to the declared amounts, and only UAH 4.5 billion is planned for 2021.

As for the issues of increasing the production of quality and safe milk and its supply for processing, the future belongs to the cooperation of farms and households. By uniting, they can ensure the stability of production volumes, quality and safety of milk, and work with large processors. It is confirmed by the analysis of the experience of Poland, where there are about 200 thousand family farms with an average number of 10 cows. Thus, with a total number of cows of about 2 million and an average productivity of 6.5 tons per year, the country produces 13.5-14.6 million tons of milk per year and ranks 6th in Europe and 13th in the world. The price of Polish raw milk is 9-11% lower than the European average and 5% lower than the world average. The price of Polish raw milk is 9-11% lower than the European average and 5% lower than the world average.

Conclusions

The main factors of transformation of the dairy subcomplex of Ukraine include: a reduction in the number of cows, insufficient amount of quality raw milk and its non-compliance with EU regulations and standards, low technological level of milk production, insufficient control over the quality of raw materials, lack of modern equipment, high capital and labour intensity of production processes, rising prices for energy and other resources, reduced consumption of dairy products due to low purchasing power, increased competition in the world market.

Adverse factors that hinder the development and stable functioning of the subcomplex are:

- low level of investment attractiveness of the subcomplex due to the long payback period of investments and insufficient level of state support for its functioning and development;
- the necessity to allocate significant areas of agricultural land for fodder crops,

hayfields and pastures, which is quite problematic for livestock enterprises in the conditions of land market opening.

The problems of the functioning of the dairy processing subcomplex of the agro-industrial complex can be solved through the

implementation of the “Concept of state support for livestock breeding for 2021-2023” and the “National Strategy for the development of the dairy industry 2021-2030”, developed by the Ministry of Economy in dialogue with industry associations.

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