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FACTORS OF EFFICIENCY OF THE LIVESTOCK INDUSTRY IN CRISIS CONDITIONS OF WAR

Oleksiy KRASNORUTSKY, DEconSc., Professor,

<https://orcid.org/0000-0003-1744-3257>

Oleksandr KOLISNYK, DAgSc., Senior Researcher

<https://orcid.org/0000-0002-3575>

Stepan MYKHALCHENKO, DAgSc., Senior Researcher

<https://orcid.org/0009-0007-6176-3537>

Vasil PRUDNIKOV, DAgSc., Professor, <https://orcid.org/0000-0001-9318-2015>

Ruslan BATYR, CanAgSc., <https://orcid.org/0000-0003-3183-8458>

Livestock farming institute of NAAS of Ukraine, Kharkiv, Ukraine

The article examines the current state and dynamics of the development of the livestock industry in Ukraine and considers the impact of systemic and force majeure factors on its development in the pre-war period and in the first two years of the Russian military invasion of Ukraine. It was determined that in Ukraine the rate of reduction of cattle (from 2.6 to 2.1 million heads) and cows (from 1.5 to 1.2 million heads) in the first two years of the war exceeded that in the pre-war years, and the production volumes of milk (from 8.7 to 7.4 million tons) and beef (from 310 to 258 thousand tons) significantly decreased. A steady increase in cow productivity was noted, both in the pre-war years from 4.6 to 5.1 t/head per year and in the two years of the war from 5.1 to 5.4 t/head.

The state of the livestock industry in terms of economic entities was considered and it was determined that the share of agricultural enterprises in the structure of milk and meat production is naturally increasing and reached 75.0% and 37.8%, respectively, in 2023.

Research has established that there is a significant differentiation in livestock enterprises by the available livestock. Thus, agricultural enterprises with up to 100 heads of livestock occupy 42.5% of the total number of enterprises, medium-sized (from 100 to 1000 heads) - 42.2%, large (more than 1000 heads) - 17.8%. It was determined that a smaller number of enterprises with more than 1000 cows have a larger livestock (63.9%) and produce a larger share of milk compared to small ones (up to 100 cattle).

An analysis of the economic activities of the Agro-Novoselivka 2009 private enterprise in Novovodolazha district, Kharkiv region was conducted, which revealed that the enterprise has a meat and grain specialization. Analysis of the income structure by industry revealed the advantages of the livestock industry over crop production, especially in critical war conditions. It was determined that livestock production is less dependent on exports of products, and crop production is more export-dependent.

Keywords: *cattle breeding, cows, milk, meat, efficiency, profit, level of profitability, agricultural enterprises.*



ФАКТОРИ ЕФЕКТИВНОСТІ ГАЛУЗІ СКОТАРСТВА В КРИЗОВИХ УМОВАХ ВІЙНИ

Олексій КРАСНОРУЦЬКИЙ, д. е. н., професор
<https://orcid.org/0000-0003-1744-3257>

Олександр КОЛІСНИК, д. с.-г. н., старший дослідник
<https://orcid.org/0000-0002-3575>

Степан МИХАЛЬЧЕНКО, д. с.-г. н., с. н. д., <https://orcid.org/0009-0007-6176-3537>

Василь ПРУДНІКОВ, д. с.-г. н., професор, <https://orcid.org/0000-0001-9318-2015>

Руслан БАТИР, к. с.-г. н., <https://orcid.org/0000-0003-3183-8458>

Інститут тваринництва НААН України

В статті досліджено сучасний стан і динаміку розвитку галузі скотарства в Україні та розглянуто питання щодо впливу факторів системного та форс-мажорного характеру на її розвиток в довоєнний період і за перші два роки російського воєнного вторгнення в Україну. Визначено, що в Україні темпи скорочення поголів'я великої рогатої худоби (з 2,6 до 2,1 млн. голів) та корів (з 1,5 до 1,2 млн. голів) за перші два роки війни випереджали такі у довоєнні роки, а обсяги виробництва молока (з 8,7 до 7,4 млн. тон) та яловичини (з 310 до 258 тис. тон) суттєво скоротилися. Відзначено не впливний ріст продуктивності корів, як у довоєнні роки з 4,6 до 5,1 т/гол за рік так і за два роки війни з 5,1 до 5,4 т/гол.

Розглянуто стан галузі скотарства в розрізі суб'єктів господарської діяльності і визначено, що частка сільськогосподарських підприємств в структурі виробництва молока і м'яса закономірно збільшується і досягла у 2023 році відповідно до 75,0% та 37,8%.

Дослідженнями встановлено, що в тваринницьких підприємствах існує суттєва диференціація за наявним поголів'ям худоби. Так, сільгосп підприємства, що мають до 100 голів худоби, займають в загальній кількості підприємств 42,5%, середні (від 100 до 1000 голів) – 42,2%, крупні (більше 1000 голів) – 17,8%. Визначено, що менша кількість підприємств з наявністю корів понад 1000 голів налічує більше поголів'я (63,9%) та виробляє більшу частку молока порівняно з дрібними (до 100 голів худоби).

Проведено аналіз господарської діяльності ПП «Агро-Новоселівка 2009» Нововодолазького району, Харківської області, який виявив, що підприємство має м'ясо-зернову спеціалізацію. Аналіз структури доходів по галузях, виявив переваги тваринницької галузі відносно рослинництва, особливо у критичних умовах війни. Визначено, що продукція тваринництва є менш залежною від експорту продукції, а продукція рослинництва є більш експортозалежною.

Ключові слова. скотарство, корови, молоко, м'ясо, ефективність, прибуток, рівень рентабельності, сільгосп підприємства.

Introduction. The dairy subcomplex is an important component of Ukraine's agro-industrial production, and the livestock sector is its basic raw material foundation and ensures the state's food security in the main types of food - dairy products and meat, and also generates significant amounts of added value due to the significant labor intensity of milk production and processing activities. Even before 2021, structural changes began in the dairy livestock sector, and the conditions of martial law became a catalyst for the corresponding processes. As a result, the livestock sector in Ukraine has undergone



significant structural deformations in recent years, which will only intensify in the near future. In Ukraine, many researchers are studying the effectiveness of the development of the livestock sector. Developments on these issues are presented in the works of such economists as Latynin M. (2000), Lavruk O. (2020), Petrychenko O. (2018), Krasnorutskyi O. (2020), Kernasyuk Yu. (2020), Ryzhkov V. (2007), Shiyan N. (2019), Shust O. (2021), etc.

A number of Ukrainian scientists believe that the functioning of the dairy subcomplex affects the national economy (Lavruk O.V., 2020; Shust O.A., 2021). Kozak O.A. (2020) supports this view and argues that the dairy sector accounts for 36.1% of the value of gross livestock production and 9.5% of all agricultural production in Ukraine. The special importance of dairy farming lies in the fact that its products (milk) are sold daily - this makes it possible to constantly renew the working capital of commodity producers and dairy industry enterprises, to use labor resources, equipment and production facilities more fully and evenly.

Most modern scientists believe that determining ways to improve the economic mechanism in livestock farming lies in the plane of ensuring a level of profitability for commodity producers of the industry's products, which would stimulate them to increase the volume of its production and expanded reproduction (Pidpala T. V., 2018; Shiyan N.I., 2019; Eyfeel A., 2022; Kernasyuk Y. V., 2020).

In her research, Antoshchenkova V. V. (2020) notes that specialized production, as a rule, is highly intensive and efficient. That is, the higher the level of concentration of dairy cattle breeding, the higher the level of specialization of the enterprise on the products of this industry, and narrower specialization allows enterprises to concentrate economic resources on the production of one or several types of products. However, according to L. Melnyk and P. Makarenko (2002), a simple increase in the scale of production by increasing the level of concentration and specialization of production is unlikely to provide an increase in the level of economic effect.

Gladiy M. R., Prosovykh O. P. (2022), studying the current state and trends in the development of the dairy industry of Ukraine, argue that it is systemic rather than situational factors that were the cause of the current crisis in the industry and it is in the conditions of martial law that new opportunities for the development of the dairy business appear. Shiyan N. I. (2021) supports their opinion and proves that profitable production of beef by business entities in the industry is ensured at a level of specialization of more than 60.0%, and milk - above 63.8%.

A number of scientists believe that in households, land, labor and material resources are used more efficiently compared to their use in agricultural enterprises (Tkach G. V., 2004). Therefore, the amount of profit per unit of land area could be higher in them (Makarenko Yu. P., 2013).

However, despite the significant number of studies on the efficiency of the livestock industry, there is a need to identify the factors that most significantly affect the current conditions of its functioning. Important, in our opinion, is the issue of identifying problems that hinder its development and ways to overcome them. No less important is the study of factors and factors that have largely led to the current state of the industry - systemic or force majeure, caused by recent crisis events?

The purpose of this article is to assess the current state of development of livestock farming in Ukraine, to develop theoretical provisions and practical recommendations for increasing the efficiency of production and sale of milk and meat by agricultural enterprises in the current crisis conditions of martial law.

Materials and methods of research. The object of the study is the process of functioning of the livestock industry, both in Ukraine as a whole and in a separate



enterprise, in critical conditions of war, factors, processes and force majeure factors that determine its development.

The theoretical and methodological basis of the research is a set of methods, approaches, principles of scientific knowledge, fundamental provisions of economic theory, scientific developments on the formation of a mechanism for the effective development of livestock farming and substantiation of directions for improving the efficiency of livestock farming, especially in crisis conditions of war.

The article uses the method of analysis and synthesis, abstract-logical (formation of theoretical generalizations and conclusions), economic-mathematical, statistical, comparison and generalization. The theoretical and information base of the research is the works of domestic scientists, analytical reviews of Ukrainian and foreign experts, as well as national statistical information on the dynamics of the main indicators of the livestock industry.

Research findings. Russia's full-scale invasion of Ukraine on February 24, 2022, seriously disrupted the country's food production and food security, putting at risk not only its food security but also that of the world. Targeted attacks by the Russian army on Ukrainian agriculture, such as shelling of agricultural facilities and infrastructure across Ukraine, mining and burning of farmland near active combat zones, a five-month blockade of Black Sea ports (and the resumption of the blockade as of July 2023), the Polish border blockade of agricultural exports from Ukraine, and the blowing up of the Kakhovka hydroelectric dam, have made the functioning of the Ukrainian agricultural sector extremely difficult. While export-oriented agribusiness suffered the greatest losses, especially at the beginning of the war, agricultural enterprises and individual peasant farms were able to adapt to extreme conditions and provide food for the Ukrainian army and population.

Dairy and meat cattle breeding is one of the most important food security industries, the purpose of which is to ensure the production of milk and meat in volumes sufficient to load the production capacities of dairy and meat processing enterprises with the subsequent production of dairy and meat products. The state of development of the dairy subcomplex, including its important component - the dairy and meat cattle breeding industry, affects the social and economic stability of the economic system.

The total cattle population in Ukraine from 2015 to 2021 decreased by almost a third and amounted to 2.87 million heads, the number of cows during this period decreased by 493 thousand heads and amounted to 2.64 million heads. In 2022, during martial law, the cattle population decreased by 230 thousand heads or 8%, in 2023 it decreased further by 151 thousand (Table 1).

Before the war, 42% of all milk was produced in the regions that were most heavily shelled and occupied by the Russians. Therefore, as of the end of 2022, the number of cows was 1.35 million heads. This is 191 thousand heads or 12.4% less than in 2021. In 2023, the country continued to trend towards a reduction in the number of cows - it decreased by more than 90 thousand from the beginning of the year. Thus, as of the beginning of 2024, the total number of cattle was 2.15 million heads, cows 1.26 million heads, which is 7.0% and 7.1% less than in the previous year, respectively. At the same time, the number of cows in agricultural enterprises for the period from 2015 to 2021. decreased by only 19.6%. Since 2020, the corresponding process has actually stopped, and in 2021 it amounted to 1.54 million heads. If it were not for the Russian military aggression, the trend towards an increase in the number of cows would have continued in 2022. Instead, the result of the actions of the aggressor country was an 8.3% decrease in the number of cows in 2022 and a 14.2% reduction in 2023 in agricultural enterprises. Thus, the number of cows in agricultural enterprises as of the beginning of



2024 is about 73.3% of the figure at the beginning of 2015 and is 1.26 million heads. The total share of cattle in them as of 2023 is 42.7%, and cows 30.3% (Dezhkomstat of Ukraine, 2023).

Table 1

**Main production indicators of livestock farming in Ukraine for 2021-2023
(farms of all categories)**

Indicators	2021 y.	2022 y.	2023 y.	2023 % to 2021
Cattle, thousand heads	2644,0	2307,1	2156,2	81,6
including agricultural enterprises	1003,4	942,1	919,8	91,7
of households	1640,6	1365,0	1236,4	75,4
Cows, thousand heads	1544,0	1352,8	1262,9	81,8
including agricultural enterprises	424,6	394,2	382,2	90,0
of households	1119,4	958,6	880,7	78,7
Meat production, thousand tons	2438,3	2206,7	2239,5	91,8
including agricultural enterprises	1720,4	1608,1	1679,5	97,6
of households	717,9	598,6	560,0	78,0
Beef production, thousand tons	310,5	268,4	256,9	82,7
Milk production, thousand tons	8713,9	7767,7	7430,4	85,3
including agricultural enterprises	2767,7	2644,2	2809,9	101,5
of households	5946,2	5123,5	4620,5	77,7
Average annual milk yield per cow, kg	5155	5119	5476	106,2
including agricultural enterprises	6863	6611	7568	110,3
of households	4604	4569	4664	101,3
Rate of profitability of operating activities of agricultural enterprises, % 2015 - 43.0%	19,2	41,9	21,0	+1,8

As for households, a similar trend is observed here. The total number of cattle in them in 2021 decreased compared to 2015 by almost 2 times or by 1.11 million heads, cows by 703 thousand heads (73.3%). In 2022, their number decreased by 275 and 161 thousand heads, respectively, or 20.1 and 16.8%, in 2023 by 129 and 79 thousand heads, respectively. heads (10.4% and 8.8%) compared to the previous year. The total share of cattle in the total livestock of the country decreased from 62.0% in 2021 to 57.3% in 2023, and cows to 69.7%.

In general, the share of cows kept by agricultural enterprises in the total livestock has been growing dynamically in recent years - from 23.4% as of the beginning of 2015 to 29.2% at the beginning of 2023., and as of the beginning of 2024, the corresponding figure reached 30.2%. Households, respectively, accounted for almost 70% of the total cattle population in the country.

The reduction in the livestock population is primarily caused by military operations in Ukraine. Direct factors during the war include the physical destruction of livestock and livestock facilities by shelling, bombing, seizure of territories with livestock there, the bombing of the Kakhovka hydroelectric power station, the impossibility of



keeping cows and harvesting feed in front-line zones, mining of territories, etc. Indirect factors influencing the development of the industry include inflation, closed Black Sea ports, the blockade of land exports of Ukrainian agricultural products by the Poles, as a result of which there was a significant decrease in prices for crop products on the domestic market, etc. The difficult macroeconomic situation in the agricultural sector also affected the work of enterprises and households, where animals are increasingly being sent for sale due to the financial inability to maintain them.

In Ukraine, processes of concentration of dairy farms have been taking place for a long time, because keeping a larger number of cows is more economically profitable. Given this, the number of specialized dairy farms and the number of cows they keep is increasing in Ukraine. First of all, it should be noted a significant decrease in the number of enterprises that keep cows: during 2010–2021, their number decreased from 3,741 to 1,686 units (more than 2.2 times). In 2022, their number decreased to 1,440 units (2.6 times less than in 2010). It is especially worth noting that the number of enterprises that suffered losses increased from 11.0% in 2021 to 20.9% in 2022. It is obvious that the trend towards a decrease in the number of agricultural enterprises that keep cows will continue.

Total milk production in Ukraine has been falling rapidly over the last pre-war years (Dezhkomstat of Ukraine, 2023). Yes, they decreased by almost a quarter (by 1.9 million tons) in 2021 compared to 2015, but in the last pre-war year, milk production volumes almost began to level out and in 2021 decreased by only 39 thousand tons compared to 2020. During the years of the war in Ukraine, milk production volumes continued their negative downward trend. With the beginning of Russia's military aggression against Ukraine in 2022, they decreased by 947 thousand tons (12.2%), and in 2023 by another 337 thousand tons (4.5%). However, agricultural enterprises, after reducing milk production volumes in 2022 by 123 thousand tons, increased its production by 165 thousand tons. to the maximum in recent years of 2.8 million tons.

Despite a significant decrease in the number of cows in agricultural enterprises, the volume of milk production by them in 2015–2021 was practically unchanged and fluctuated within the range of 2.67–2.77 million tons (Dezhkomstat of Ukraine, 2023). This became possible due to a significant increase in the productivity of cows kept by agricultural enterprises, which increased by 74% over the period 2010–2021 - from less than 4 thousand kilograms in 2010 to 6.9 thousand kg/head in 2021. In 2022, official statistics recorded a decrease in cow productivity to the level of 6.6 thousand kg/head, which is quite logical for the period of martial law, but in 2023, despite all the hardships (continued war, shelling, power outages, drought, etc.), it increased by as much as 14.4% to 7.5 thousand kg/head, and in 2024, the average milk yield per cow in farms is expected to increase by more than 5-7% and cross the mark of 8 thousand kg/head. The reduction in total milk production is largely due to its decline in households (almost a quarter over 2015–2021). Over the past three years (Statistical Collection, 2022), households have also continued to significantly reduce milk production: in 2022 by 823 thousand tons or 16.1%, in 2023 by another 503 thousand tons (10.9%). This is due to the fact that as a result of hostilities, some agricultural workers and farmers were forced not only to cease economic activity in the agricultural sector, but also to leave their homes.

According to FAO (2022), more than 150,000 farmers / food system workers were directly affected by the war and/or were forced to migrate. Small-scale producers who were engaged in growing seasonal products and played an important role in ensuring employment and income of the rural population found themselves in a difficult situation. Forced population displacement, conscription of men into the Armed Forces of Ukraine lead to a shortage of labor and an increase in the workload of women.



According to FAO (2022), due to the war, rural households in Ukraine suffered about 2.25 billion USD in losses. Of these, about 1.26 billion USD in losses were caused in the field of crop production and 0.98 billion USD in livestock production. In Ukraine, 25% of agricultural households stopped or reduced production volumes due to the war, in front-line regions - 38%. As a result, the share of agricultural enterprises in the total volume of milk production in Ukraine is growing significantly in dynamics from 31.8 in 2021 to 37.8% in 2023, and according to preliminary estimates, in 2024 it will reach almost 40%. Also, in 2024, record milk production volumes by agricultural enterprises are expected to be achieved (about 2.85 million tons, which is 3% more than in 2021). In contrast, milk production volumes by households are forecast to decrease significantly and are expected to be about 4.5 million tons in 2024 (two times lower than in 2015), and their share in the total is 62.2%. Therefore, we can summarize that the dairy cattle breeding sector in the agricultural enterprises segment, despite the unfavorable conditions of martial law, began its growth in 2023. Along with other factors, it is due to the unfavorable situation in the field of crop production, where the cultivation of traditionally high-margin export-oriented crops has ceased to bring surplus profits to agricultural enterprises.

Ukraine has been experiencing a process of concentration of dairy farms for a long time, because keeping a larger number of cows is more economically profitable. Given this, the number of specialized dairy farms and the number of cows they keep is increasing in Ukraine. First of all, it should be noted a significant decrease in the number of enterprises that keep cattle: during 2010–2021, their number decreased from 3741 to 1792 units (more than 2.2 times), including enterprises that kept cows - to 1686. In 2022, their number decreased to 1533 and 1440 units, respectively (2.6 times less than in 2010). Their share in the total number of agricultural enterprises is also decreasing and already reaches less than 10%. It is obvious that the trend towards a decrease in the number of agricultural enterprises that keep cows will continue (Table 2). At the same time, the number of cows in agricultural enterprises decreased by only 19.6% from 2015 to 2021. Since 2020, the corresponding process has actually stopped, and in 2021 it amounted to 1.54 million heads. If it were not for the Russian military aggression, the trend towards an increase in the number of cows would have continued in 2022. Instead, the aggressor country's actions resulted in an 8.3% decrease in the number of cows in 2022 and a 14.2% reduction in 2023 in agricultural enterprises. Thus, the number of cows in agricultural enterprises as of the beginning of 2024 is about 73.3% of the figure at the beginning of 2015 and is 1.26 million heads. The total share of cattle in them as of 2023 is 42.7%, and cows are 30.3% (Dezhkomstat of Ukraine, 2023).

It should be noted that agricultural enterprises engaged in dairy farming are very differentiated in size, given the number of cows in them. Thus, in 2010, the share of enterprises that kept up to 100 cows in the total number of enterprises engaged in dairy farming reached 55.4%. However, in 2021, the share of such enterprises decreased to 43.8%, in 2022 to 42.5%, i.e. decreased by more than a quarter. According to preliminary data for 2023, it decreased to less than 40%.

It should be noted that small enterprises with a cattle population of up to 50 heads at the beginning of 2023 occupy a fifth (20.2%) of their total number, and up to 100 heads - 9.8%, i.e. the total number of small ones is 30%. However, the number of farm animals they have is 17.1%. Enterprises with a livestock of 100 to 500 heads occupy 33.0% in the structure of farms with a specific weight of livestock in its total number at the level of 14.4%. The share of large specialized enterprises from 1000 to 1500 heads is 8.4%, over 1500 heads - 9.4% (Dezhkomstat of Ukraine, 2023). It should be emphasized that the average segment of commodity producers from 100 to 500 cows as of 2022 accounts



for the highest share in the structure of 42.7%. In contrast, the share of enterprises that kept livestock of more than 500 cows in 2010 was only 7.2% in the total number of enterprises engaged in dairy farming. In 2021, it increased to 13.7% and in 2022 to 14.8%, or 1.9 times. The share of enterprises that kept a livestock of more than 1,000 cows increased from 1.2% in 2010 to 4.8% in 2021 and 5.1% in 2022.

Table 2

Grouping of enterprises by the number of farm animals (as of January 1, 2023)

Grouping of enterprises by number of animals (head)	Number of enterprises		Number of farm animals	
	units	% of total number	units	% of total number
Cattle				
up to 50	310	20,2	5,9	0,6
50–99	151	9,8	11,2	1,2
100–499	505	33,0	135,8	14,4
500–999	294	19,2	206,2	21,9
1000–1499	129	8,4	156,7	16,6
more than 1500	144	9,4	426,3	45,3
Total enterprises	1533	100,0	942,1	100,0
Cows				
up to 50	403	28,0	8,3	2,1
50–99	209	14,5	15,7	4,0
100–499	614	42,7	157,5	40,0
500–999	140	9,7	93,1	23,6
more than 1000	74	5,1	119,6	30,3
Total enterprises	1440	100,0	394,2	100,0

Farms with an existing livestock of 100 to 500 heads occupy a total of 42.7% with a further increase in the livestock per farm. Accordingly, if in 2010, on average, there were 157 cows per enterprise that kept them, then in 2021 there were already 252, and in 2022 there were 274 cows. It is preliminarily determined that in 2023 the corresponding indicator approached the level of 300 heads.

In contrast, the share of enterprises that kept a livestock of more than 500 cows in 2010 was only 7.2% of their total number. In 2021, it increased to 13.7%, or 1.9 times. The share of farms that kept a livestock of more than 1,000 cows increased from 1.2% in 2010 to 4.8% in 2021, that is, 4 times.

The share of the livestock of cows available in agricultural enterprises that kept up to 100 cows in 2010 was 10% of its total number. In 2021, the share of such livestock decreased to 5.6%, or almost 1.8 times. By the beginning of 2023, this figure had decreased to 1.8% (three times the figure for 2021). However, if in 2010 the share of the cow population in enterprises that kept more than 500 cows was 36.3% of their total population, then in 2021 the corresponding figure increased to 52.5% (1.45 times). For the population in farms that kept more than 1,000 cows, the corresponding figures were 11.3% in 2010 and 29.0% in 2021, that is, it increased almost threefold. It is expected that in 2023 the corresponding trend will continue and the share of cows in farms that keep more than 500 cows will exceed 53% of the total number, and in those that keep more than 1,000 cows, it will reach almost a third of the total number of cows (30.3).

If we analyze the grouping of enterprises by the available number of cattle and cows, the same pattern is determined here, that is, smaller enterprises have a smaller



number of livestock on their balance sheet. That is, small and medium-sized enterprises (up to 500 heads of livestock) make up more than half of all enterprises in Ukraine (63.0%), but keep only 16.2% of the total livestock and at the same time produce approximately 10 percent of livestock products. The share of agricultural enterprises with a livestock of 500 to 1,000 is 19.2%, while holding 21.2% of the livestock. The share of large agricultural holdings and enterprises with a livestock of over 1,000 heads is 17.8%, but they hold more than half (61.9%) of the total livestock.

Despite this, if in 2010 the share of the cattle population available at enterprises that kept more than 500 cows was 36.3% of their total livestock, then in 2022 the corresponding figure increased to 53.9% (1.5 times). For the livestock available at enterprises that kept more than 1,000 cows, the corresponding figures were 11.3% in 2010 and 30.3% in 2022. It is expected that in 2023 the corresponding trend will continue and the share of cows in enterprises that keep more than 500 cows will exceed 55% of the total number, and in enterprises that keep more than 1000 cows, it will reach almost a third of the total number of cows.

All these factors undoubtedly influenced the efficiency of both the livestock and livestock industries and the agricultural sector as a whole. Thus, the level of profitability of the operating activities of agricultural enterprises in 2015 was 43.0%, in 2021 – it decreased by half to 19.2%, in 2022, despite the military actions, it increased again to 41.9%, in 2023 it decreased by half to 21.0%.

General efficiency indicators show the trend of profitability of production, but cannot answer the question - what factors influence the formation of the efficiency of dairy and meat production of each individual enterprise. The representative of the largest middle class of agricultural producers engaged in meat production is the private enterprise "Agro-Novoselivka 2009" of Novovodolazha district, Kharkiv region. It is located only 30 km southeast of the regional center, which provides advantages in terms of proximity to sales markets (the population of the city of Kharkiv is currently about 1.3 million people), especially livestock products. The total land area of the enterprise is about 3 thousand hectares, agricultural land in 2023 was 2.88 thousand hectares (Table 3).

Despite the approaching military operations close to the city of Kharkiv and the almost neighboring Izyum district in 2022, the enterprise is increasing its technical equipment (both in livestock and crop production). At the beginning of 2022, two new tractors, a new feed mixer, and attachments for them were purchased. Therefore, the cost of fixed assets in 2022 increased by 12.6 million UAH. (40.6%), in 2023 by 2.1 million UAH. (4.7%) compared to the previous year. The enterprise has a meat and grain specialization. Meat production is provided by meat cattle breeding and pig breeding. In 2023, the livestock population increased by 26.4% compared to 2021 and amounted to 713 heads, over the same period, the pig population, despite the continuation of the war, increased almost threefold and amounted to 6634 heads at the end of 2023. The main part of meat production on the farm is provided by pig breeding, where gross production is steadily increasing in proportion to the livestock: in 2022, 718.3 tons of pork were produced, which is 28.8% more than the previous year. In 2023, 1.38 thousand tons of pork were produced, which is 2.5 times more than in 2021, and 1.9 times more than in 2022. This was even during the critical years of the war.

The enterprise breeds Aberdeen-Angus cattle, which are kept according to the free-range system, without year-round use of premises. In winter, cows with suckling calves are kept on reconstructed and new free-range feeding grounds, and in summer - on pastures. That is, the conditions for keeping cattle are close to natural conditions (Prudnikov V.G., 2024; Mikhalchenko S.A., 2020). The farm territory is fenced with a reinforced concrete fence made of slabs. Such a fence was also built around the free-range



feeding grounds. It serves as a protective barrier for beef cattle from gusts of wind and drafts. Along the fence on the eastern side (in this natural and climatic zone, the prevailing winds are from the northeast) of the site, canopies are equipped for rest and shelter from the weather. On the walking and feeding sites for cows, heifers of calving age and heifers, the area standards were 15 m²/head, for cattle on fattening from 7 to 14 months – 10 m²/head. The feed mixture is distributed to the cattle using a feed dispenser 2 times a day.

Table 3

Resource potential of PE "Agro-Novoselivka 2009"

Indicators	2021 y.	2022 y.	2023 y.	2023 % to 2021
Total land area, ha.	3013,8	3143,3	3240,4	107,5
including: agricultural land	2661,8	2791,3	2888,4	108,5
including arable land	2553,0	2680,0	2753,0	107,8
hayfields	23,8	26,3	29,9	125,6
pastures	85,0-	85,0	105,5	124,1
Average annual number of employees employed in agricultural production, people	43	42	39	90,7
including: in crop production	32	33	29	90,6
in livestock farming	11	9	10	90,9
Average annual cost of fixed assets, thousand UAH	31072	43672	45730	147,2
Availability, pcs.: tractors	10	12	12	120,0
combines	5	5	5	100,0
forage harvesters	1	1	1	100,0
Average annual livestock, head: cattle	564	634	713	126,4
cows	274	294	304	110,9
pigs	2875	4294	6634	230,7
Gross production, kg:				
live weight gain, cattle	510,8	447,3	580,4	113,6
live weight gain, pigs	5577,5	7183,0	13871,2	248,7

As reported by Kolisnyk O.I. (2018), the formation of the primary layer of long-lasting straw bedding on the walking and feeding sites began in September, with straw being brought in at a layer thickness of 40 cm. At all walking and feeding sites, earthen mounds were arranged with a height of 1–1.5 m, a width of 15–25 m. The mounds were covered with straw for comfortable rest of the livestock. Their area per head was 3–5 m². Due to the thermal processes that occur in the layer of straw, heat is released, as a result of which the livestock rests and warms up in adverse weather. To maintain a dry den, straw was added daily at the rate of 3 kg per head in dry weather and 5-7 kg - in adverse weather conditions (rain, snow, lowering air temperature).

The war left its mark on both production volumes and the efficiency of operational activities. Thus, the volume of sales of agricultural products in 2022 significantly decreased by 21.1 million UAH. or 27.7%, and in 2023 they have already increased by 54.7 million UAH (74.0%) compared to the previous year (Table 4).



Table 4

Industry structure of commodity products of LLC "Agro-Novoselivka 2009"

Industries and types of products	2021 y.		2022 y.		2023 y.	
	thousand UAH	%	thousand UAH	%	thousand UAH	%
Crop production, total	60933,2	64,5	33628,3	45,5	50601,8	39,3
Including: grains and legumes	47435,5	50,2	23095,2	31,3	30209,0	23,5
Sunflower	13249,7	14,0	10533,1	14,2	20083,2	15,6
Livestock production, total	24169,5	25,6	39623	53,6	77038	59,9
Including: meat: beef	3132,8	3,3	2900,8	3,9	2342,3	1,8
pigs	21036,7	22,3	36722,1	49,7	74696,4	58,1
Sale of other products, works and services	9338,0	9,9	676,7	0,9	1007,6	0,8
Total by household	94440,7	100	73927,9	100	128648,1	100

The structure of commodity products varied significantly over the same period. Thus, in 2021, the share of the crop sector in the total sales of the enterprise was 64.5%, and livestock farming was 25.6%. In 2022, these indicators were 45.5 and 49.7%, respectively, that is, they were approximately equal. And in 2023, livestock farming already formed a larger share of commodity products - 59.9%, and crop farming - 39.3%. The lion's share of commodity crop products has traditionally been grain and leguminous crops and sunflower. Livestock production, respectively, consisted of the sale of pork and beef, where the latter occupied an unfortunately low level - 1.8-3.9%. Of particular note is the following ratio between the crop and livestock sectors in the total volume of commodity production, which was 3 to 1 in 2021, 1:1 in 2022, and 1:1.5 in 2023. This was, of course, significantly influenced by the price situation in the domestic consumer market.

The main obstacle to the efficiency of the crop growing industry was, of course, the full-scale military invasion of our territory launched by Russia, which a priori entailed force majeure circumstances (especially at the beginning of the war, which was March, April, May 2022) a shortage of fuel (and sometimes its complete absence) for the 2022 sowing campaign, power outages, local blackouts, the threat of direct military invasion and shelling, closed ports and blocking of customs on the western border, prices on the domestic market for agricultural products, etc.).

The average purchase prices for wheat in 2021 were 9,650 UAH/t, sunflower seeds 19,650 UAH/t (AgroElita, 2021). In 2022, due to the above-mentioned force majeure factors, wheat prices halved to 4700-4800, and sunflower prices, respectively, 1.5 times to 12560 UAH/t (AgroElita, 2022). In 2023, due to the resumption of grain exports through the Black Sea ports and increased transit through land borders with Poland, Slovakia and Romania, they stabilized to some extent and amounted to 7400 UAH/t for wheat and 15120 UAH/t for sunflower, but still did not reach the level of 2021 (AgroElita, 2023).

Despite all these adversities, the agricultural producer, in particular the Agro-Novoselivka 2009 PE, maintained its production and production capacity and even ended both the first and second years of the war with a positive financial result (Table 5).

A detailed analysis of the financial results of the Agro-Novoselivka 2009 PE (Table 5) showed that the gross income of the enterprise in 2022, for the reasons already



indicated, decreased very significantly - by 22.2 million UAH. or 30.0%. In the same year, the management of the enterprise took drastic measures to stabilize production in both crop production and livestock farming. The result of this work was a sharp increase in gross output in 2023 to 133.3 million UAH., which is 37.1% and 77.3% higher than the results of the previous two years, respectively.

Table 5

Economic efficiency of Agro-Novoselivka LLC 2009

Indicators	2021 y.	2022 y.	2023 y.	2023, % to 2021
Gross income – total, thousand UAH	97206,0	74980,5	133317,7	137,1
Profit (loss), total, thousand UAH	11407,8	8973,4	12783,0	112,1
including: in crop production	9183,1	4016,8	5192,1	56,5
in livestock farming	2224,7	4956,6	7590,9	341,2
Profitability level – total, %	13,1	13,6	9,6	73,3
including: in crop production	18,4	5,5	3,8	20,7
in livestock farming	5,3	16,5	12,8	241,5
Gross output per 100 hectares of agricultural land, thousand UAH	3651,9	2686,2	4615,6	126,4
Profit production per 100 hectares of agricultural land, thousand UAH	428,6	321,5	442,6	103,3
including crop production	345,0	143,9	179,8	52,1
livestock farming	83,6	177,6	262,8	314,4

However, gross income characterizes the overall effect of the enterprise's work, and the economic component of the production process reveals the profit received from operating activities, which is the most important structural criterion of production. Thus, the profit of the enterprise as a whole in 2022 decreased by 2.43 million UAH. (27.1%) compared to 2021. However, in 2023 it has already grown almost one and a half times or by 3.81 million UAH. and even exceeded the level of 2021 by 1.37 million UAH or 27.1%.

In the context of individual sectors of the economy, a different picture has emerged. Let's analyze them separately. The crop sector in the first year of the war reduced its profits by more than half or by 5.16 million UAH. In contrast, in 2023, by applying a number of operational measures and adapting the process to critical conditions, profits were increased by 1.17 million UAH. or 29.3%. But due to the negative impact of the price of grain and industrial crops on the domestic market and despite the increase in gross production of crop products in physical terms, this indicator did not reach the level of 2021 and was almost twice as low (5.19 million UAH). Profits in the livestock sector in 2022 exceeded the similar indicator of 2021 by 2.73 million UAH. or 2.2 times. During the second year of the war, the profitability of this sector also tended to grow and exceeded the previous year by 2.63 million UAH. or 53.1%, and compared to 2021 it increased more than threefold - 5.57 million UAH. and amounted to 7.59 million UAH, respectively. Analysis of the structure of income by industry revealed the advantages of the livestock sector over crop production, especially in critical war conditions. Livestock production is less dependent on exports, while crop production is more export-dependent.

This trend is quite logical given the price situation on the domestic meat market. According to AgroPortal (2023), beef prices (in live weight) increased - for bulls with a live weight of more than 400 kg by 8%, and for cows - by 10% and are, depending on the



region, 58.00-62.00 UAH/kg. The first price increase was observed in early autumn 2022, as pre-war export volumes had already been established, which provoked a gradual increase in demand and market activation. In addition, the cost of products is also affected by macro-financial indicators: the level of inflation, subsidies, lending, etc.

A number of economists believe that the most objective and thorough indicator characterizing the economic efficiency of livestock farming is the production of products and profit per 100 hectares of agricultural (agricultural) land. The production of gross products per 100 hectares of agricultural land in 2022 decreased by almost 1 million UAH. or 36.0% compared to the previous year, in 2023 this indicator increased significantly: by almost 1 million UAH. (26.4%) compared to 2021 and by 1.92 million UAH. (71.8%) compared to 2022. As for the profit received per 100 hectares of agricultural land, it should be noted that it also decreased in 2022 by 107.1 thousand UAH. (33.3%), and in 2023 it increased by 14.0 thousand UAH compared to 2021. UAH. against 2022 by 121.1 thousand UAH. or 3.3% and 37.7%, respectively.

In terms of individual industries, it should be noted that the same trend is observed in crop production and livestock production as in gross output. That is, in the crop production sector, profit per 100 hectares of agricultural land in 2022 decreased by half or by 201 thousand UAH., and in 2023 it increased by 36 thousand UAH. (23.6%). In the livestock sector, this indicator in 2022 more than doubled or by 94 thousand UAH., and in 2023 it increased by 85 thousand UAH. (1.5 times) compared to 2022, and four times or 179 thousand UAH compared to 2021. It should be noted separately that in peacetime, crop production brought the farm three times more profit per 100 hectares of agricultural land than livestock production. However, under the influence of negative factors of the war, it was already inferior to the livestock industry in 2022 by 22.7%, and in 2023 - by 43.6%.

Therefore, we must summarize the following. The private enterprise "Agro-Novoselivka 2009" is an existing example of a medium-sized, modern agricultural enterprise of the grain and meat direction. Despite the difficult, and in the spring of 2022, critical situation in our country, the decrease in production and financial indicators in 2022, it withstood all the adversities, applied cardinal, quick decisions regarding production management, continued to produce and produced crop production products so necessary for the population agriculture and livestock farming and at the same time received positive financial results.

Discussion of research results. Before the war, economic instability and the economic crisis in the agro-industrial complex of Ukraine negatively affected the development of the livestock industry. From 2015 to 2021, the cattle population in Ukraine decreased by almost a third and amounted to 2.87 million heads, the cow population during this period decreased by 493 thousand heads and amounted to 2.64 million heads. Milk production volumes decreased by 1.9 million tons to 8.7 million tons. However, cow productivity during this period increased from 4.69 to 5.15 t/head.

Force majeure factors caused by the war accelerated the reduction in the cattle and cow populations by 488 thousand heads (22.6%) and 281 thousand heads (22.3%). Milk production during the two years of the war decreased by 1.28 million tons or 17.3%, despite an increase in cow productivity by 321 kg per year. Over the same period, beef production decreased by 53 thousand tons (20.9%).

Due to the war, rural households in Ukraine, according to FAO estimates, suffered about 2.25 billion USD in losses, 25% of agricultural households stopped or reduced production volumes due to the war, in front-line regions - 38%. The total share of cattle in households in the total number of livestock in the country decreased from 62.0% in 2021 to 57.3% in 2023, and cows to 69.7%. Despite the catastrophic impact of direct



factors of the war, households remain an important source of food supply. They produce 75.0% of meat and 37.8% of milk in Ukraine.

In general, the share of cows kept by agricultural enterprises in the total livestock has been growing dynamically in recent years - from 23.4% as of the beginning of 2015 to 29.2% at the beginning of 2023, and their meat and milk production in 2023 amounted to 25.0% and 62.2%, respectively.

In Ukraine, the processes of concentration of dairy farms have been taking place for a long time, because keeping a larger number of cows is considered to be more economically profitable. Small farms with a livestock of up to 100 cows occupy 42.5% of all enterprises (of which 28.0% - up to 50 heads), medium - 42.7%, large - over 500 - 9.7% and 1000 cows - 5.1%. However, the largest share of the cow population is concentrated in large enterprises (over 500 heads) 53.9%, in medium-sized enterprises – 40.0%, and in small ones – 6.1%. Accordingly, the amount of produced products (milk and meat) is distributed in the same proportion.

The reduction in the animal population is primarily caused by military operations in the territory of Ukraine. Also, the difficult macroeconomic situation in the agricultural sector has affected the work of enterprises and households, where animals are increasingly being sent for sale due to the financial inability to maintain them.

Today, 90% of agricultural enterprises in Ukraine are engaged in narrow specialization and concentrate only on the production of crop products, which is considered profitable and win-win. However, the critical force majeure conditions of the war emphasized that in similar conditions, the livestock industry has advantages compared to crop production. This is influenced by both systemic and force majeure factors.

It can be concluded that the livestock sector in the agricultural enterprises segment, despite the adverse conditions of martial law, began its growth in 2023. Along with other factors, it is due to the unfavorable situation in the field of crop production, where the cultivation of traditionally high-margin export-oriented crops has ceased to bring excess profits to agricultural enterprises. In contrast to the arguments of Antoshchenkova V. V. (2020) about the need for narrower specialization, it should be emphasized the need to diversify production and concentrate agricultural enterprises not on one, but on two or three types of products. It is desirable that these be the branches of crop production and livestock farming (most often - livestock farming, where two types of products are formed: milk and meat). And here we completely agree with a number of authors (Pidpala T. V., 2018, Shiyani N.I., 2019, Kernasyuk Y. V., 2020, Eifeel A., 2022), who believe that improving the economic mechanism in livestock farming lies in the plane of ensuring the level of profitability for commodity producers.

An analysis of the production activities of the medium-sized agricultural enterprise PP "Agro-Novoselivka 2009" of Novovodolazha district, Kharkiv region, which has a grain-meat specialization and is engaged in the production of grain, pork and beef, was conducted. Despite the force majeure factors of the war, the enterprise simply maintained production capacity, and ended both the first and second years of the war with a positive financial result. In 2022, 8.9 million profit was received with a profitability of 13.6%. In 2023, having applied a number of measures to overcome critical conditions, the farm increased its profit to UAH 12.7 million with a production profitability of 9.6%. It should be especially noted that the traditionally profitable crop growing sector of the enterprise could not withstand force majeure factors and significantly reduced its profits from UAH 9.1 million in 2021 to UAH 4.0 to 5.1 million in 2022 and 2023. The livestock sector, on the contrary and in two years of war increased its profitability from 2.2 to 7.6 million UAH. It should be noted that the ratio of crop and livestock sectors in the total



profit of the enterprise in 2021 was in favor of the first 3: 1, in 2022, livestock farming already exceeded the first by 25%, in 2023 - the ratio also changed in favor of livestock farming and amounted to 1.5: 1. This became possible due to the specialization of the enterprise not on one type of product, but on three: crop production (wheat and sunflower), pig meat and beef. In this regard, the statement of Antoshchenkova V. V. (2020) that specialized production, as a rule, is highly intensive and efficient, has a place to exist. As reported by Izhdolbina O. O. (2021), research experience shows that large-scale financial support from the state, as a rule, does not guarantee successful production of livestock products, which is more relevant for large-scale producers. Therefore, we believe that in crisis conditions, and especially in war and post-war periods, attention should be paid to the development of small-scale producers (up to 50 and up to 100 cows) with the use of specialization in two or three types of products and resource-saving technologies, including keeping livestock in open pastures, according to the technology adopted in the Agro-Novoselivka 2009 PE.

Conclusions. Based on the research conducted to assess the current state of development of Ukrainian livestock farming and the formulation of recommendations for increasing the efficiency of milk and meat production, the following conclusions can be drawn:

1. It has been proven that the state of the livestock industry was negatively affected by both the economic crisis in the agro-industrial complex of Ukraine and force majeure factors caused by the war. The number of cattle and cows in Ukraine decreased sharply from 2015 to 2021 by 1.1 million heads and 493 thousand heads, respectively, and during the two years of the war they decreased by another 488 and 281 thousand heads.

2. It has been determined that the total volume of milk production in Ukraine is declining. Milk production during the two years of the war decreased by 1.28 million tons or 17.3%, despite the increase in cow productivity by 321 kg per year. During the same period, beef production decreased by 53 thousand tons (20.9%). The reduction in total milk production is largely due to its decline in households. According to FAO estimates, in Ukraine, 25% of agricultural households have stopped or reduced production due to the war, in frontline regions - 38%.

3. It was determined that the share of cows kept by agricultural enterprises in the total livestock was growing dynamically and as of the beginning of 2023 reached 30.2%. Households, respectively, accounted for almost 70% of the total number of cows in the country. Meat and milk production by agricultural enterprises in 2023 amounted to 75.0% and 37.8%, respectively. In households, these figures were 25.0 and 62.2%, respectively.

4. It was established that the number of specialized dairy farms is increasing in Ukraine. Over the past ten years, the number of enterprises that keep cattle has halved and amounted to 1,533 units in 2022. Small farms with a livestock of up to 100 cows occupy 42.5% of all enterprises (of which 28.0% - up to 50 heads), medium - 42.7%, large - over 500 heads - 9.7% and 1,000 cows - 5.1%. The largest share of the cow population is concentrated in large enterprises (over 500 heads) 53.9%, in medium - 40.0%, and in small - 6.1%.

5. As of the beginning of 2022, more than 80% of agricultural enterprises in Ukraine were narrowly specialized and focused only on the production of crop products. The level of profitability of the operating activities of agricultural enterprises in 2015 was 43.0%, in 2021 it halved to 19.2%, in 2022, despite the beginning of aggression from the Russian Federation, it increased again to 41.9%, in 2023 it halved to 21.0%.

6. The analysis of the production activities of the medium-sized agricultural enterprise PE "Agro-Novoselivka 2009" of the Novovodolaz district, Kharkiv region showed that despite the force majeure factors of the war, the enterprise maintained



production capacity and received profits of 8.9 million UAH. in 2022 and 12.7 million UAH. 2023 with profitability of 13.6% and 9.6%, respectively. The crop sector could not withstand force majeure and reduced its profits in 2022 by half (by UAH 5.1 million), in 2023 it increased them by UAH 1.1 million, but still almost half as much as in 2021. The livestock industry, on the contrary, increased its profits in 2022 by two times (by 2.7 million UAH), in 2023 by another 1.5 times (by 2.6 million UAH).

7. Agricultural enterprises of Ukraine specializing in grain production are recommended to switch from narrow crop specialization to grain-meat or grain-meat-milk specialization with the ability to use available resources more efficiently and be able to withstand the impact of negative force majeure factors. In livestock farming, it is necessary to apply resource-saving technology with keeping livestock in open grazing areas.

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