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Search for Reserves to Increase the Livestock Production Efficiency Based on the Sustainable Development Strategy

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The article aims to analyse livestock production factors and search for reserves to increase efficiency in achieving Sustainable Development Goals (SDGs). The main tasks of Ukraine in the framework of achieving the SDGs and the role of livestock in this process are identified. The world experience of sustainable livestock development has proved its contribution to overcoming world hunger. The main trends in livestock production development in agricultural enterprises of Ukraine are identified. The influence of livestock intensification on the economic and social efficiency of livestock production is determined. Ways to increase the efficiency of livestock production through innovation are substantiated. The system of factors of production efficiency is expanded, taking into account its social aspects; in particular, it is shown that the development of livestock has a significant impact on the internal social efficiency of enterprises, affecting labour demand and wages. The strengthening of specialization and concentration in livestock in Ukraine is following the same global trends. The influence of livestock intensification on the formation of the ratio "costs - production results" is proved, which made it possible to identify the possibility of increasing profitability while rising production costs per head of livestock. Increasing the production intensity can lead to increased technological, economic, and social efficiency.

Keywords: livestock production, efficiency, sustainable development, intensification, innovative technologies, social efficiency, SDGs, Ukraine.

Introduction

In September 2015, the 2030 Agenda for Sustainable Development, including the 17 Sustainable Development Goals (SDGs), was adopted by world leaders during the historical United Nations (UN) summit and officially came into force on 1 January 2016. Each country faces particular difficulties in achieving sustainable development goals. This reaffirms the vital role of the World Food Security Committee and welcomes the Rome Declaration on Nutrition and the Framework for Action. These documents emphasize the need to allocate resources for rural development and the introduction of sustainable methods of agriculture (UN, 2015).

According to research, as evidenced by some signs, global economic growth has peaked, but in 2019–2020 its pace will remain stable, with a further decline expected. Therefore, the most significant task at this stage of society is to ensure sustainable development. Climate change and environmental threats in sustainable development goals put people and nature first, not income; that is, social efficiency begins to prevail over economic. The Secretary-General of the United Nations Antonio Guterres emphasized that “[w]hile global economic indicators remain largely favourable, they do not tell the whole story. The World Economic Situation and Prospects 2019 underscore that behind these numbers, one can discern a build-up in short-term risks that are threatening global growth prospects. More fundamentally, the report raises concerns over the sustainability of global economic growth in the face of rising financial, social and environmental challenges” (UN, 2019). The world is not on track to achieve Goal 2 Zero Hunger by 2030. If recent trends continue, the number of people affected by hunger will surpass 840 million by 2030.

To achieve SDG 2 Zero Hunger in Ukraine, the following targets and indicators have been identified:

- 1 Ensured accessibility to balanced nutrition to the level of scientifically based standards for all population groups. The indicators are as follows: consumption of meat per capita, kg/year; consumption of milk per capita, kg/year; consumption of fruit per capita, kg/year.
- 2 Double agricultural productivity, primarily through innovative technologies. The indicators are as follows: labour productivity in agriculture, USD 1000 per employee; the index of agricultural production, %.
- 3 Ensured development of sustainable food production systems that help maintain ecosystems and gradually improve the quality of land and soil, primarily through innovative technologies. The indicators are as follows: the index of food production, %; share of food industry and agricultural raw materials processing production in exports of Ukrainian Classifier of Goods for Foreign Economic Activity groups 1–24, %; share of agricultural land under organic production in the total area of agricultural land, %.
- 4 Reduced volatility of food prices. The indicator is the consumer price index for food (annual average), % (Sustainable Development Goals: Ukraine, 2017).

Based on sustainable development goals in Ukraine, the Strategy of Sustainable Development “Ukraine – 2020” (Decree, 2015) has been adopted. The government has approved the concept of the State target program for the development of the agricultural sector of the economy until 2022 (Order, 2015). In addition, the Decree of the President of Ukraine on the Sustainable Development Goals of Ukraine for the period up to 2030 was also adopted (Decree, 2019). These documents result from analytical work carried out by Ukrainian experts with the support of the United Nations Development Program in Ukraine and the Global “Integrating Rio Conventions into Ukraine’s National Policy Framework” (UNDP, 2013).

An important direction in overcoming hunger and increasing the efficiency of agricultural production is the development of the livestock sector. The world’s demand for livestock products has grown significantly over the last 30 years, driven by rising affluence, urbanization, and population growth, especially in developing countries. Created in 2011, the Global Agenda for Sustainable Livestock (GASL) aims to increase the contribution of the livestock sector to sustainable development. GASL consists of over 100 institutional partners from government, farmers, private sector,

civil society, donors, and research community who respond to the sector's many challenges in achieving sustainable development goals. They direct the global dialogue to improve local practices, focusing on innovation, capacity building, incentive systems, and creating an enabling environment (GASL, 2019a). In 2019, GASL, in its report, noted that innovation plays a vital role in the growing demand for livestock products and the need for sustainable livestock development (GASL Report, 2019b). The Global Agenda created a new direction, "Innovation for sustainable livestock systems," and, accordingly, developed several innovative measures to achieve sustainability of livestock on a global scale.

Livestock production plays a key role and, according to world experts, is a powerful tool in overcoming hunger and poverty in rural areas (FAO, 2018). At the household level, its contribution is to increase the consumption of milk, meat, and dairy products, generate income and create jobs. At the level of rural communities, it is an opportunity for employment in the relevant food chains. At the national level, the sector's development allows reducing prices for livestock products, generating budget revenues, and earning foreign exchange (FAO, 2018). In addition, growing urbanization affects the improvement of nutrition for urban residents by increasing animal fat intake. The transformation of the diets of urban dwellers occurs in several stages. First, vegetable fats are replaced by cheap animal fat (the cheap segment of dairy products and poultry). At the second stage, subject to further income growth, a premium dairy segment (expensive hard cheeses) and more helpful meat (beef) are introduced into the diet. As a result, global consumption and production of livestock products are constantly growing.

In Ukraine, the consumption of livestock products per capita has increased over the past four years (2017–2020) by 8% for beef (from 7.5 kg/capita to 8.1 kg/capita), and by 1% for milk (from 200 kg/capita up to 202 kg/capita). Meanwhile, livestock is one of the problematic sectors caused by the insufficient level of production efficiency. In this regard, the problem of finding reserves for its increase becomes especially relevant. It is advisable to identify the components,

justify methods and methodological approaches to quantitative assessment of production efficiency. On this basis, Riabokon emphasizes that, due to many reasons, insufficient attention is paid to the social aspects of rural development and the fundamental improvement of rural residents' lives (Riabokon, 2015). Therefore, when searching for reserves for livestock development, it is necessary to consider the social consequences of efficiency in the context of the SDGs implementation.

In Ukraine, livestock producers are both households and agricultural enterprises. The main share of raw material needs of the processing industry (71.4% of milk and 78.4% of cattle meat) is provided by agricultural enterprises (formal sector). However, they produce only about 30% of total milk and cattle meat. In addition, households (informal sector) have competitive disadvantages in meeting the raw material needs for the processors: low level of output quality; complicated logistics; high transport costs; and high costs of production per unit of output. The peculiarities of the rural structure and dense housing, which does not allow keeping more than 2–3 cows in a farmyard without violating building regulations, also have effect. Therefore, it is impossible to meet the raw material needs at the expense of households; thus, it is necessary to increase the capacity of agricultural enterprises.

Methods

The methodological basis of the scientific article is dialectical and abstract-logical methods of cognition of economic phenomena and objective laws of market economy development. We use the following methods: the dialectical method to learn the patterns of livestock production development; the abstract-logical method to form theoretical positions and conclusions; the method of the system approach to determine the place and role of livestock in the economy in general and in agriculture in particular; the graphical method to visualize the results of the study; the sociometric method and the method of cognitive modelling to assess the factors influencing the achievement of

economic and social efficiency of livestock production in agricultural enterprises; and the calculation-constructive method to substantiate the optimal level of intensification, concentration, and specialization of livestock production. We used modern computer software to process statistical information and economic-mathematical modelling.

For analysis in the article, the authors selected agricultural enterprises of the Kharkiv region producing milk and cattle meat. According to the State Statistics Committee of Ukraine, the defined area occupies one of the leading positions in dairy farms concentration. The peculiarity of Ukraine is that beef production as an independent sector is underdeveloped. The number of farms specializing in beef production (excluding dairy) in 2018 was only 2.2% of all farms with cattle. The rest are dairy farms, where cattle meat is a by-product of milk production (Kozak and Hryshenko, 2019). We therefore analyse the dairy farms more in the article.

As mentioned above, agricultural enterprises are the leading suppliers of milk and cattle meat to processors. For the last ten years, livestock producers have witnessed an upward vector of development, positive economic results (mainly due to dairy production), and increased competitiveness accordingly. They have an annual increase in livestock production, productivity growth, new technologies, improvement in business processes, and investment attraction. Given the need to implement the provisions of the Association Agreement between Ukraine and the EU (Association Agreement between Ukraine and the EU, 2017), including strengthening the requirements for the quality of livestock products, agricultural enterprises are the primary entity for the rapid increase of high-quality products and the competitiveness of the Ukrainian milk and cattle meat.

The choice of the region is due to the high competitiveness of milk production in agricultural enterprises (Kozak and Hryshenko, 2020), which makes it possible to classify the Kharkiv region as one of the most vital dairy regions of Ukraine. In addition, the National Scientific Centre "Institute of Agrarian Economics", which is in cooperation with agricultural enterprises of the Kharkiv region, has the opportunity to obtain more detailed data as well as to conduct surveys.

Results

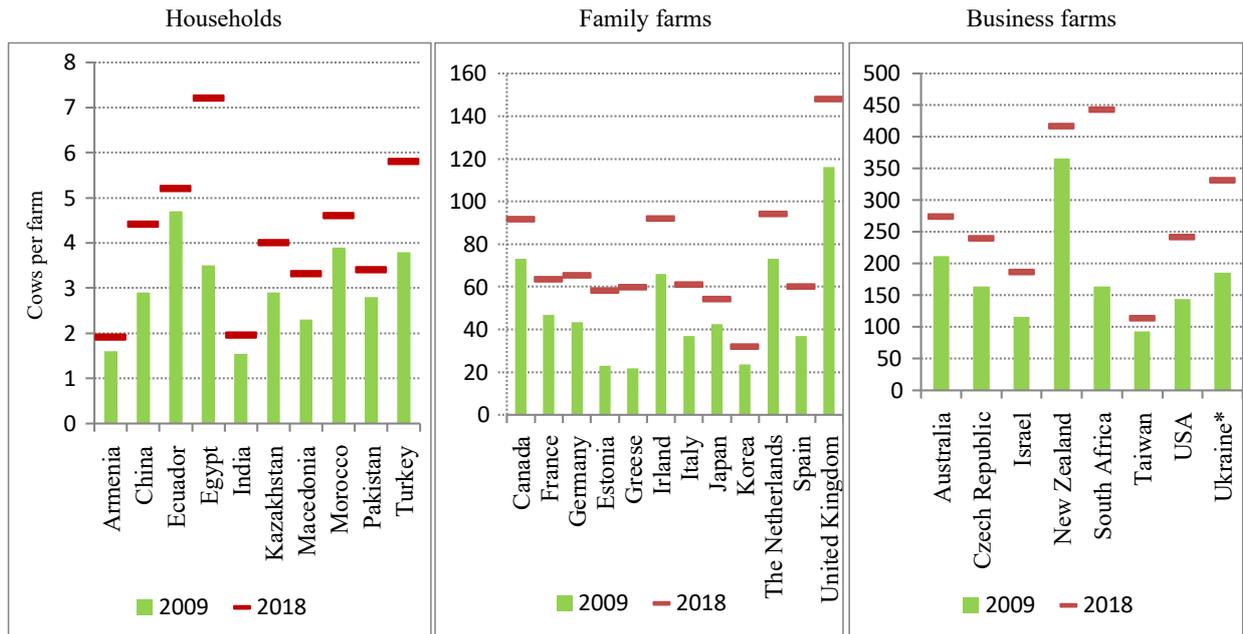
Goal 2 targets include the following: "By 2030, double the agricultural productivity and incomes of small-scale food producers, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment" (UN, 2016).

Factors such as concentration and specialization have a significant impact on improving the efficiency of livestock production. World experience proves the strengthening of these processes over the past ten years. Thus, a decrease in the number of dairy farms and an increase in their size is typical for most countries, regardless of the type of farm (Hemme et al., 2019): household (1–30 cows), family farm (30–100 cows) or business farm (more than 100 cows) (*Fig. 1*).

Like most countries globally, Ukraine is deepening the specialization and concentration of livestock production, focusing on the business farm model. Thus, the number of beef farms decreased from 4.7 thousand heads in 2009 to 2.3 thousand in 2018, but the average size of the farm increased from 350 heads of cattle to 496 heads. The number of dairy farms decreased from 3.2 thousand to 1.4 thousand, and the average farm size increased from 186 to 330 cows. Ukrainian dairy farms increased productivity by 30% during 2009–2018, business farms by 1.6 times (from 3893 kg/year/cow to 6101 kg/year/cow), reaching the milk yield of Australia, New Zealand, Ireland, and Poland.

Livestock specialization is determined by the ratio of milk and cattle meat production in the structure of marketable products. There is reason to agree that among the livestock production concentration indicators, one should pay attention to the cattle number, which applies to both cows and cattle. Two factors have the most significant impact on the profitability of milk production: the number of cows and milk yield. Using the double grouping of agricultural enterprises of Ukraine, you can see this dependence (*Fig. 2*). For example, a group with an average herd of 192 cows with a productivity of 4 tons/cow/year gets a return of 10%, that of 6 tons gets 25%, and that of 8 tons gets 40%.

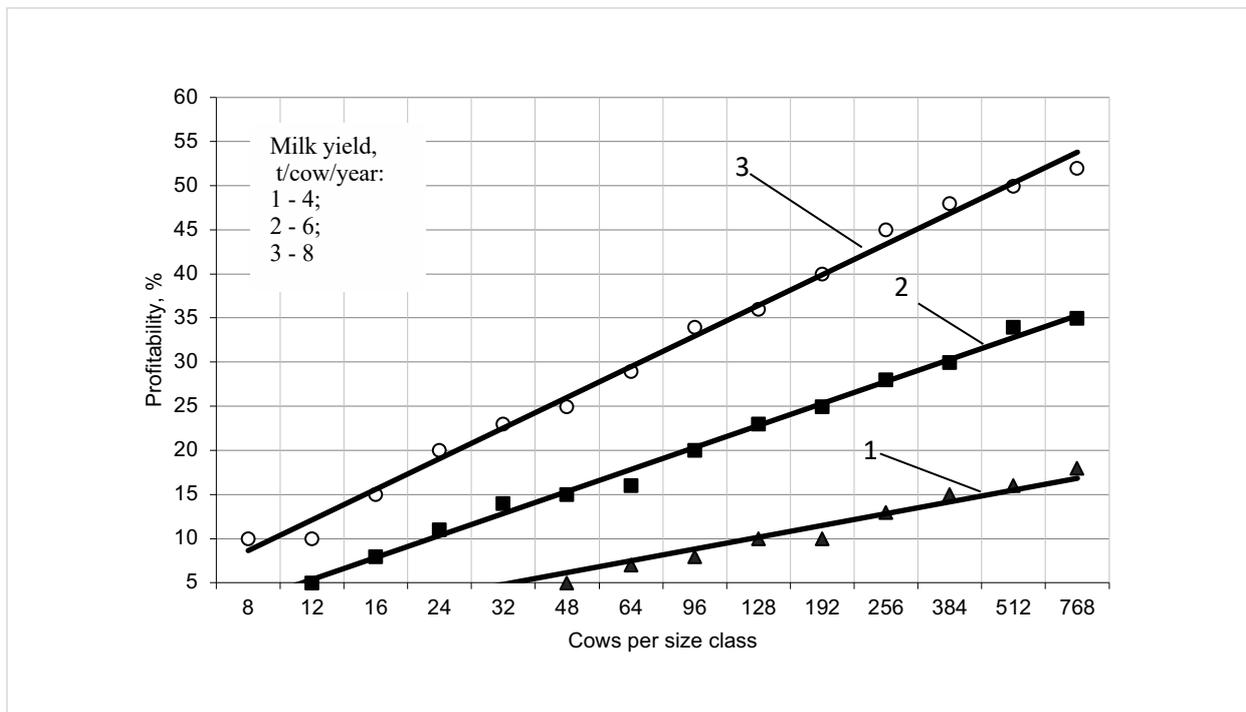
Fig. 1. The shift in the average size of a dairy farm in selected countries



*) Agricultural enterprises of Ukraine

Data source: (Hemme et al., 2010; Hemme et al., 2019).

Fig. 2. Estimated profitability of milk production depending on the farm size and milk yield in Ukraine, 2018



Data source: State Statistics Service of Ukraine

As for the milk production concentration scale, we propose using a system of indicators for their characterization: the cow number, the volume of production, and milk sales per enterprise. Along with these indicators, we recommend using additional ones, two of which stand out, i.e., the amount of revenue from the sale of milk per enterprise and the cow density per 100 hectares of agricultural land.

At the same time, the industry intensification is significant in the system of factors for the formation of livestock efficiency. The characterization of the indicator of the value of costs per cow and head of cattle for rearing and fattening is most often used. Of course, the intensification of production is impossible without

the introduction of new technologies. Given the many essential factors of production efficiency, an important aspect is their interaction in one system.

To determine the indicators of economic efficiency of livestock production, we use the data of agricultural enterprises of the Dvorichansky district of the Kharkiv region.

The analysis of the technological equipment of the surveyed enterprises showed the use of free-stall reconstructed barns with milking parlours and stanchion barns with the milk pipeline and milking machines: Parallel 2x16 "DeLaval," herringbone 2x12 "Euro 1200" with a milk cooler, and "UDM-200" with a milk cooler (*Table 1*).

Table 1. Characteristics of milk production technologies in agricultural enterprises of Dvorichansky district of Kharkiv region, 2018

Production technology	Agricultural enterprise		
	Rodyna	Vilshanske	Vyselok
Breed	Ukrainian red and white		
Feed type	Year-round feed ratio with complete feed mixtures		
Production system	Free-stall barn		Stanchion barn
Cow barn	Reconstructed with two milking parlours	Reconstructed with one milking parlour	Mechanized with a milk line
Milking system	In the milking parlour (milking machine Parallel 2x16 "DeLaval") with a milk cooler	In the milking parlour (milking machine Herringbone 2x12 "Euro 1200" with a milk cooler	In stalls (milking machine with a milk pipeline "UDM-200") with a milk cooler
Manure removal	Delta scraper machine		Scraper conveyor

Data source: information of three agricultural enterprises of Dvorichansky district Kharkiv region

Although the average annual costs per cow were much higher than the corresponding indicator for the region, the production cost was lower than similar indicators in all the enterprises. This circumstance shows a positive practice of innovation introduction, which allows achieving a significant increase in technological efficiency, reflected in the milk production profitability over these enterprises, being 1.5–3 times higher than the average size. To determine the impact of the principal factors on the livestock production efficiency, we represent the indicators of the leading

enterprises of the Dvorichansky district compared with the average in the region (*Table 2*).

Cattle meat production was unprofitable in all enterprises without exception. Still, despite the small share of sales, the livestock production generally shows profitability at the level exceeded by 2.5–5.6 times of the same indicator in the region. The indicators of social efficiency of livestock production significantly exceeded the regional average ones, namely the average number of employees and the wages per 100 hectares of agricultural land.

Table 2. *Economic efficiency indicators of livestock production in agricultural enterprises of Dvorichansky district, Kharkiv region, 2018*

Indicator	Agricultural enterprise			Average in the region
	Rodyna	Vilshanske	Vyselok	
Number of cows per enterprise, head	850	500	300	273
Number of cattle per enterprise (excluded cows), head	822	852	629	458
Milk yield per 1 cow, t/year	10.5	8.8	9.1	7.2
Daily weight gain per 1 head of cattle, g	682.6	664.1	382.8	515.1
Number of employees per 100 hectares of agricultural land, persons	3.73	3.21	3.08	2.44
Wage per 100 hectares of agricultural land, USD/year	2920.5	3025.4	3067.1	2304.8
Cost per 1 cow, USD/year	2511.1	2803.9	2181.3	1483.1
Cost per 1 head of cattle, USD/year	178.0	347.6	188.6	224.0
Cost of milk production, USD/100 kg	23.9	19.1	24.0	24.3
Cost of cattle meat production, USD/100 kg	73.9	84.2	83.3	135.2
The share of the revenue from the sale of milk in the overall structure of marketable products, %	77.9	54.0	50.0	28.4
The share of the revenue from the sale of cattle meat (live weight) in the overall structure of marketable products, %	0.7	5.9	5.0	18.8
The share of the revenue from the sale of milk in the structure of marketable livestock products, %	99.1	90.1	90.9	88.2
The share of the revenue from the sale of cattle meat (live weight) in the structure of marketable livestock products, %	0.9	9.9	9.1	11.8
Milk price, USD/100 kg	33.4	31.2	30.6	27.8
Cattle meat price (live weight), USD/100 kg	58.2	68.1	76.8	109.8
Profit per 1 cow, USD/year	996.7	1061.6	604.2	218.0
Profit per 1 head of cattle, USD/year	-64.5	-66.4	-14.7	-42.1
Milk profitability, %	39.7	63.1	27.7	14.7
Cattle meat profitability, %	-21.3	-19.1	-7.8	-18.8
Profitability of livestock production, %	35.7	49.0	24.9	9.1

Data source: authors' calculations based on agricultural enterprises data of Dvorichansky district Kharkiv region.

Increasing the farm size has a positive effect in terms of the sustainable development paradigm. The lower cost of livestock production in big farms compared with the average in the region indicates economic sustainability. The selected farms generate higher profits to cover the livelihoods of the farm owner and worker's families, providing social sustainability. Getting a better milk yield is consistent with environmental

sustainability because rising milk yield decreases the carbon footprint.

The enterprises have two ways of improving the social efficiency indicators. The first is to increase the wages with fewer employees involved in the maintenance per 100 hectares of agricultural land; the second is to increase the number of employees with the same wages.

Agricultural enterprise “Rodyna” had the largest share of workers involved in animal husbandry. A similar distribution of workers was in “Vilshanske” where 56% of workers served the animal husbandry. Considering that most presented enterprises have milk and cattle meat production as the main business activity, livestock became the guarantee of employment for most of their workers.

Today there are many different methodological approaches to assessing livestock intensification. In our opinion, the most relevant indicators of production

intensity are the costs per head of cattle, the average annual cattle productivity, and the leading efficiency indicators – profit and profitability. At the same time, it is appropriate to consider the impact of intensification on social efficiency, namely on the average number of employees and the wages per 100 hectares of agricultural land. Therefore, to study the existing level of livestock intensification in the Kharkiv region and its impact on the economic and social efficiency of production, we carried out groupings of livestock producers for the average costs per cow (Table 3).

Table 3. Influence of the production costs per cow on the economic and social efficiency of milk production in agricultural enterprises of Kharkiv region, 2018

Indicator	Groups of enterprises by the value of average costs per cow, USD						Average in the region
	I	II	II	IV	V	VI	
	up to 800	800.1–1100	1100.1–1400	1400.1–1700	1700.1–2000	more than 2000	
Number of enterprises	4	21	27	29	28	16	125
Production costs per cow, USD	726.7	1082.6	1319.9	1631.4	1928.0	2372.9	1483.1
including: feed costs	395.2	622.2	739.9	924.9	1025.8	1328.5	840.8
salary expenses	11.5	13.4	17.2	21.0	24.8	28.7	19.1
social tax	26.0	27.7	41.9	46.1	46.5	50.0	41.9
depreciation of assets	19.6	16.1	21.9	44.4	115.3	126.8	57.7
Number of cows, head	91	109	237	324	333	308	273
Number of employees per 100 hectares of agricultural land, persons	2.02	2.19	2.18	2.47	2.61	3.47	2.44
Wage per 100 hectares of agricultural land, USD	1613.3	1843.8	2305.1	2373.9	2535.3	2765.7	2304.8
Monthly salary per 1 employee, USD	190.6	214.4	262.1	238.4	243.0	226.4	238.3
Milk yield per 1 cow, t/year	5.3	6.4	7.0	7.5	8.3	9.0	7.2
Milk production per enterprise, t	386.2	579.4	1467.7	2433.3	2742.3	3244.4	1931.2
Cost of milk production, USD	21.4	22.0	23.0	23.6	23.8	24.1	24.3
Milk price, USD/100kg	24.8	25.6	27.0	28.1	28.4	29.0	27.8
Profit per cow, USD	109.0	150.4	187.5	250.7	283.4	370.7	218.0
Profit per 100 kg of milk, USD	3.4	3.6	4.0	4.5	4.6	4.8	3.6
Profitability, %	16,0	16,5	17,4	18,9	19,5	19,9	17,7

Data source: authors' calculations based on agricultural enterprises data of Kharkiv region (State Statistics Service of Ukraine)

Table 3 shows that milk producers in each of the six groups, together with increased costs per cow, also enhanced the average annual milk yield. At the same time, there was a significant increase in the average yearly wage per 100 hectares of agricultural land and the number of employees per 100 hectares of agricultural land, proving the social efficiency growth. At the same time, livestock is increasing. The increase in costs per cow also affected the production cost of milk, which grew steadily in groups.

Increasing the concentration of milk production, primarily due to the increase in the number of cows, is one of the principal conditions for increasing the profitability of the production process. To represent the identified trends, we use a graphical method (Fig. 3).

Increasing the number of cows has a positive influence on the indicators of social efficiency. The mathematical processing of statistical data on enterprises for 2016–2018 shows the need to increase the concentration of milk production in the Kharkiv region based on an increase in the number of cows for the external social efficiency rising (Table 4).

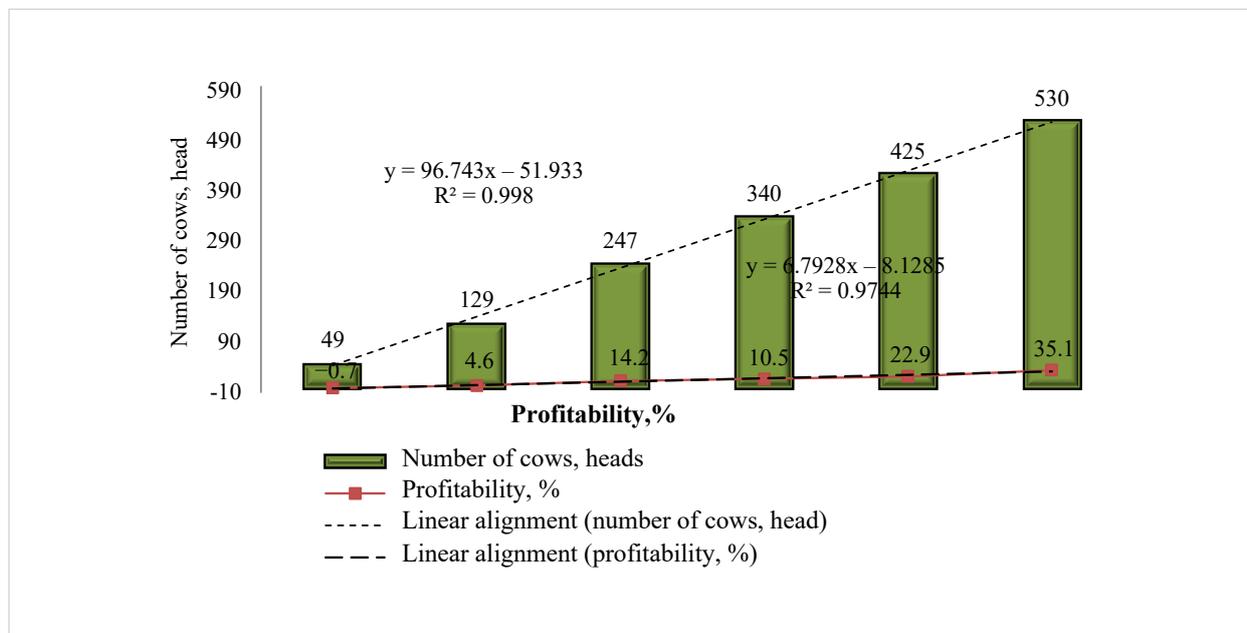
Thus, we found that during the studied years, the size of the average wage per 100 hectares of agricultural

land was 80.5% dependent on the number of cows. The adequacy and reliability of the obtained results confirm the actual values of the Student and Fisher criteria, which were higher than the tabular ones.

The tendencies revealed by using grouping proved that livestock farms of the Kharkiv region specialized mainly in milk production. Thus, 82.5% of enterprises involved in livestock specialized primarily in milk production, as evidenced by its volume in the structure of marketable livestock products by more than 80%. Specialization of milk production affects the economic efficiency as evidenced by the profitability of livestock products (Fig. 4).

As we can see, the profitable production of livestock products, in general, turned out to be only for enterprises with a share of marketable milk of more than 80%. Even though milk production was profitable for all the enterprises, the unprofitability of cattle meat production harmed the total economic results of livestock production. There was an opposite trend with the beef sale where all the groups of enterprises were unprofitable. Therefore, as a result, agricultural enterprises now specialize in milk production, allowing them to avoid losses and improve economic and social efficiency.

Fig 3. Correlation between the milk production profitability and the number of cows in agricultural enterprises of the Kharkiv region, 2018



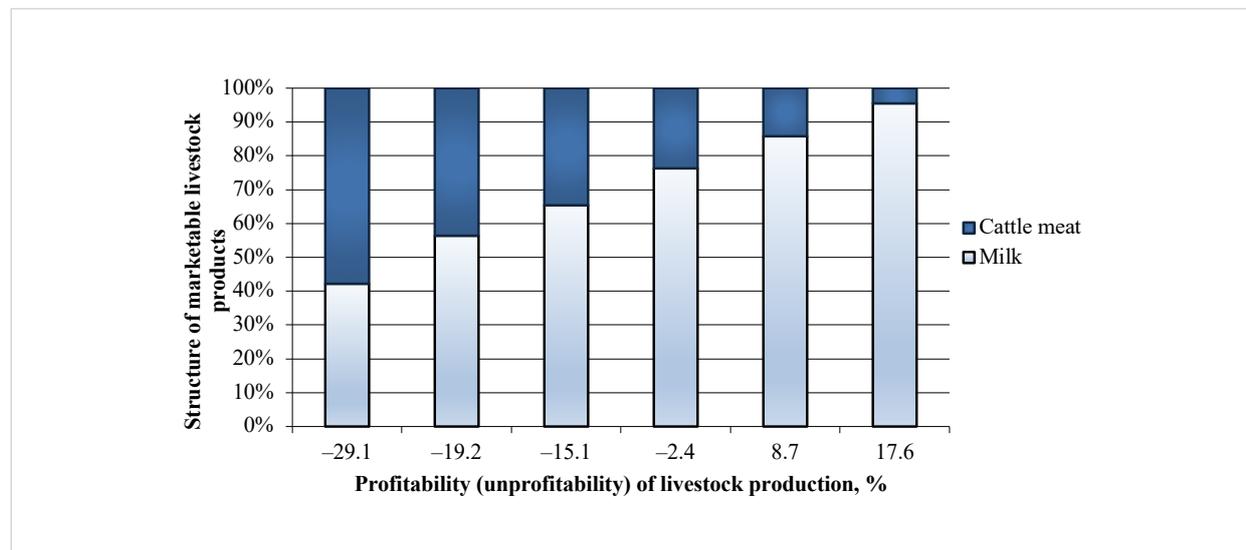
Data source: authors' calculations based on agricultural enterprises data of Kharkiv region (State Statistics Service of Ukraine)

Table 4. Parameters of econometric models of correlation between the average wage per 100 hectares of agricultural land (y) and the number of cows (x) in agricultural enterprises of Kharkiv region, 2016–2018

Year	Linear regression equation	Paired correlation coefficient (r)	Determination coefficient (R^2)	Student criterion (t)		Fisher criterion (F)		Number of enterprises (n)
				t-fact	t-tabl.	F-fact	F-tabl.	
2016	$y = 37600.99 + 41.89x$	0.867	0.752	16.0	2.57	58.1	4.53	132
2017	$y = 41148.74 + 61.61x$	0.899	0.808	13.0	2.57	1184.5	4.53	127
2018	$y = 44360.11 + 59.05x$	0.867	0.752	14.1	2.57	229.0	4.53	125
Average for 2016–2018	$y = 40981.94 + 54.28x$	0.897	0.805	14.3	2.57	797.21	4.53	384

Data source: authors' calculations based on agricultural enterprises data of Kharkiv region (State Statistics Service of Ukraine)

Fig 4. Correlation between the profitability of the livestock production and specialization of agricultural enterprises in the Kharkiv region, 2018



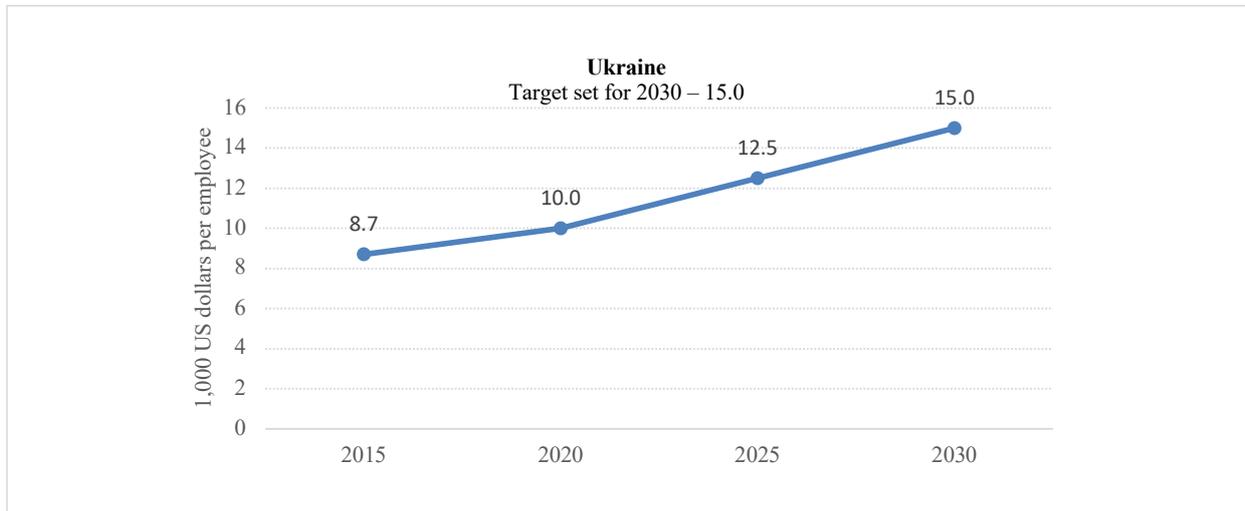
Data source: authors' calculations based on agricultural enterprises data of Kharkiv region (State Statistics Service of Ukraine)

Discussion

International documents stipulate that one of the aspects of achieving the goal of overcoming hunger is maintaining economic growth per capita by national conditions and, in particular, the development of the gross domestic product at the level of at least 7% per year. It is necessary to increase productivity in the

economy due to diversification, technical modernization, and innovative activity, including focusing on high value-added and labour-intensive sectors. In Ukraine, taking into account the analysis of previous years, the target of labour productivity in agriculture is set at the level of 15 thousand US dollars per employee (Fig. 5).

Fig 5. Labour productivity in agriculture, thousand US dollars per employee



Data source: (Sustainable Development Goals: Ukraine, 2017)

The development of food production is impossible without investments and innovations. The average annual growth rate of productivity in the food industry in 2011–2018 was 3.4%. At the same time, the innovative development of the food industry is relatively slow, as the business environment in the country is unstable and with infrastructural problems. The share of innovative products in the total volume of sold products of the food industry decreased from 3.3% in 2011 to 0.82% in 2017 (Balian et al., 2019).

The introduction of innovative technologies and business methods has an important influence on increasing labour productivity in agriculture. This requires resources. However, the situation with attracting investment is not very comforting. The analysis results show that the share of capital investment in agriculture in recent years is about 11.42%, which is relatively meagre for the agro-oriented economy. According to statistics, the primary sources of capital investment for 2011–2018 were the company's sources, namely depreciation deductions and profits. The most significant volume of capital investments from the own funds of enterprises and organizations amounted to USD 14,109.4 mill in 2017, the smallest in 2018 – USD 2,949.7 mill (Sergeyeva et al., 2020).

According to the research, financing the modernization of economic entities consists of increasing the

rate of economic growth, ensuring an effective social and environmental component. The defining function of financial security is the attraction and rational use of financial, credit, and investment resources. The availability of financial resources/capital provides the necessary conditions for functioning of the economic system and companies as its key components. The capital during circulating economic activity takes various forms and influences the reproductive processes of the economic entity. The most relevant today is considering economic changes, their consequences, and risks in the reproduction of the capital in terms of the balanced, harmonious development of financial, environmental, and economic directions (Kostyrko and Zaitseva, 2020).

At present, in addition to economic efficiency, social and ecological efficiencies have become necessary. Due to the sustainable development strategy, profit is no longer the primary goal of entrepreneurship compared with human and social needs. The profit, received despite environmental pollution or human labour in harmful conditions, will not sustain industry development and resource preservation.

The efficiency of agri-food production seems to be a holistic system that combines social and economic components, which are closely interconnected and are the basis for each other's development. Thus,

achieving social efficiency is essential for economic growth and vice versa; without obtaining an economic effect, social development is under threat. The underestimation of the social efficiency by the management of enterprises does not allow realizing possibilities. Accordingly, only the enterprise aimed at achieving economic and social efficiency can ensure sustainable development in the future (Ksyonova, 2018).

Therefore, the factors of production that affect social efficiency indicators play an essential role. The cost of milk production is one of the most critical qualitative indicators, influencing the financial result of the enterprise, the pace of expanded production, and the competitiveness. The assessment of the fair value of milk produced depends on the actual market prices. Studies on the valuation of milk produced at a fair value indicate dynamic price fluctuations over short periods, which are not objective. In addition, the revaluation of products with each change in the market price will lead to additional time and resources. Therefore, most economic entities in the agricultural sector use the second method of valuing milk production – production costs (Yalovega, 2019). According to the research, increasing the specialization of enterprises in the production of livestock products rises the number of wages per 100 hectares of agricultural land. This indicates a positive social effect to livestock development in agricultural enterprises (Shyian, 2019).

All processes of agribusiness management relating to the innovation introduction can be combined into nine main blocks: 1. Land management; 2. Technologies used for planning and determining crop rotation and formation of technological maps; 3. Finance and economics; 4. Agricultural production; 5. Marketing; 6. Logistics; 7. HR; 8. Security; and 9. Logistics. In connection with the development of marketing and logistics as the factors in the introduction of innovations, methodological principles of ensuring the implementation of the organizational and economic mechanism of benchmarking at the enterprises of the agricultural sector of Ukraine are gaining relevance, which is associated with the need to increase the food competitiveness and agri-food market requirements (Bobrovnyk, 2020).

Three stages could be defined due to the needs of enterprises in innovation (Mazurenko and Stoliarchuk,

2019). 1. Diagnosis and consulting, with areas for research of innovation priorities, optimization of business processes (BPMN, LEAN), and IT strategy development; 2. Project management, with areas of competencies for landbank management, precision land management, control of goods and materials (fuel, warehouse optimization, PPE mixing technologies), and connectivity (safety, security); 3. Open innovation means that by understanding the company's needs, it is necessary to find or create innovative solutions, e.g. corporate accelerators with RadarTech; Venture building (creation and development of solutions from scratch); measures (Idea garages, hackathons, etc.).

Based on the above, the technical and technological renewal of the livestock industry should be conducted by providing physiological conditions for the realization of the genetic potential of cattle in terms of minimizing investment and operating costs. 1. Livestock industry restoration is possible if the number of cattle in agricultural enterprises increases; 2. Ensuring the potential genetic improvement of livestock productivity is possible by increasing the level of technical and technological support of livestock farming: creation of a controlled biotechnical system of milk and beef production using precision livestock technologies; development and implementation of saved milking equipment with the adaptive mode of operation; introduction of automatic process control systems (APCS) to the farms.

Conclusions

According to the official documents declared by the UN and the strategies adopted on their basis, the main tasks for achieving SDG 2 in Ukraine have been identified to overcome hunger and develop agriculture. One of them is to increase the productivity of agriculture, primarily through the use of innovative technologies. It is determined that social efficiency increases along with the intensification of production.

Livestock plays a vital role in achieving many of the sustainable development goals. The growing demand for livestock products worldwide, driven by population growth, higher incomes, and urbanization, opens

new opportunities for farmers, processors, and other stakeholders. In Ukraine, milk and cattle meat consumption is growing.

The analysis showed that the global trends of the increasing farm size and the decreasing number of farms are inherent in the livestock sector in Ukraine. In particular, the number of farms producing livestock products decreases while the cattle number per farm is growing. The analysis proves that the higher consolidation level leads to better economic indicators of enterprises. This, in turn, has a positive effect on sustainable development and achieving the SDGs.

Concentration and specialization have a significant impact on improving the efficiency of production in the livestock sector. It involves the following indicators: the number of cows, the volume of milk production and sales per enterprise, profitability, production cost, average costs per cow, and the density of cows per 100 hectares of agricultural land. The modelling proves the link between the number of cows and profitability.

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The assessment of three big livestock farms in the Kharkiv region confirms their economic and social efficiency compared with the area's average. Increasing the number of big livestock farms will help accelerate SDG 2 in terms of rising livestock production, increasing income of rural workers, and the corresponding availability of better rations for enlarging beef and milk consumption.

The grouping of livestock enterprises by costs per cow reveals the level of intensification of milk and cattle meat production in the Kharkiv region. Higher costs per cow tend to correlate with better economic performance and the social effects of SDG 2. In turn, social efficiency depends on technological innovation and investment, the number of employees, and wages. The most appropriate indicators of production intensity are the cost per head, cattle average productivity, and the leading indicators of its efficiency – the profit and profitability of milk and cattle production.

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