Production Activity of Agricultural Business Structures and Its Efficiency in Ukraine

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Abstract. The paper discusses that in the conditions of domestic economy transformational changes, insufficient financing and economic risks growth; there is a need to increase efficiency level of agricultural business structures activity. Providing of these conditions depends on scientific and practical developments implementation into enterprises production activity with a purpose of its improvement. To achieve a high efficiency level, it's necessary to analyze the agribusiness structures functioning environment which is characterized by market conditions dynamic changes and greatly affects the size, specialization, production structure etc. Most enterprises are on the stage of assets accumulation and production diversification directions search which involves different activities and intensive development. At the same time, banks' lending volume decrease and production costs growth due to devaluation of the national currency as well as economic activity decline leads to agricultural enterprises research of new ways to increase return on investments.

Keywords: agricultural business structure, plant growing, stockbreeding, social efficiency, employment, integral indicator.

1 Introduction

The aim of the article is to develop offers how to optimize production activity of agricultural business structures and increase its efficiency. This task requires resources provision level determination of agricultural enterprises, their rational combination and effective usage. They should be solved by resource-saving production technologies, investments attractiveness increase and responsible attitude to the environment.

A significant contribution to the research of the production activities of the agricultural business structures and definition of production's optimization belong to such domestic and foreign scientists as M. Ilchuk [1, 2], S. Kvasha [3], N. Reznik [4, 5], U. Lupenko [6], M. Malik [7], B. Paskhaver [8], O. Shubravskaya [9], A. Sen [10], S. Mocherny [11], A. Borisov [12], A. Azryliyan [13] and others [14-16]. In particular O. Shubravskaya claims that production optimization is among the main methods to provide agricultural enterprises effective functioning in the unstable market environment. Because of that, its theoretical and methodological implementation features, the correlation between production resources, and their influence on output as well as parame-

ters and restrictions for the optimization model development under limited resources conditions are extremely important [9]. S. Mocherny considers optimization of production as a process of interaction between people and nature, as well as just between people during creating material and immaterial goods in an optimal (the most perfect) state by choosing optimal criteria with quantitative and qualitative parameters in order to develop productive forces and economic relations [11]. A. Borisov offers that it is – the definition of optimal values of economic indicators in the process of creating different types of economic product in order to achieve the best state [12]. A. Azryliyan interprets the optimization of production as bringing the human-made process of creating products (products, energy and services) into the best (optimal) state [13].

Highly appreciating the contribution of these scientists for the development of the theoretical and methodological foundations in analysis of the production activity of agricultural enterprises and its efficiency, it should be noted that the question about influence of the main factors of agrarian production on its effectiveness remains to be fully investigated and needs offers for improvement of the main economic, social and environmental indicators of agricultural production in conditions of economic risks increasing.

2 Research Findings

2.1 Analysis of agricultural business structures

In accordance with the economic theory of social welfare, namely its provisions about efficiency of resource distribution, each enterprise should maximize the effect of the use of productive resources taking into account social interest. It means that in addition to efficient use of resources according an economic point of view, it should be taken into account the possible negative influence on nature and potential social problems due to excessive automation of production and the failure of the enterprise to provide workable people of the countryside with work. An existed interrelation between the interests of business, society and the environment is situated below (fig. 1).

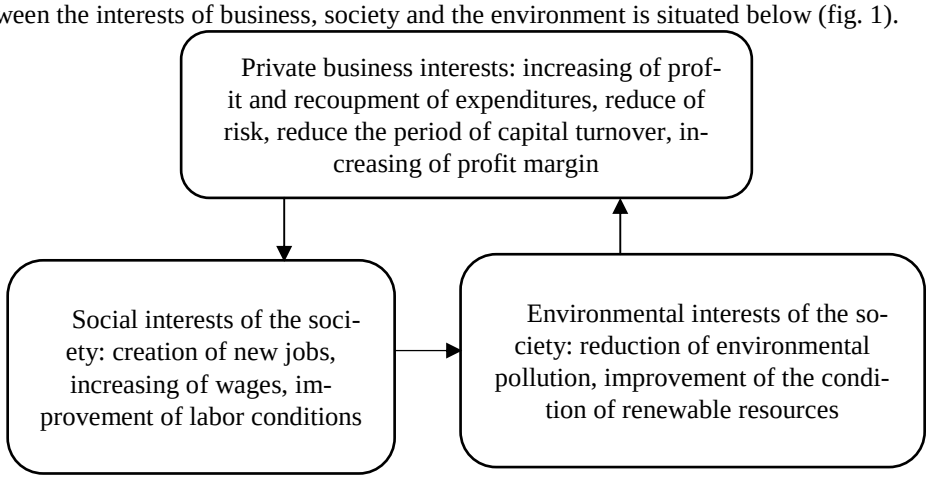

Fig. 1. Interrelation between the interests of business, society and the environment in organization process of production

Effective production activity of agricultural business structures requires a rational combination of plant growing and stockbreeding branches, needs to take into account market conditions, as well as providing of economic, social and environmental efficiency of agricultural production. A rational combination of branches involves using secondary production, transferring of seasonal employers to permanent employment during the year at the expense of diversification of production, as well as increasing of economic efficiency of production activities and reducing of financial risks.

Analysis of the cultivated areas and stockbreeding of agricultural enterprises of Ukraine is shown below with the aim to evaluate production activity (fig. 2).

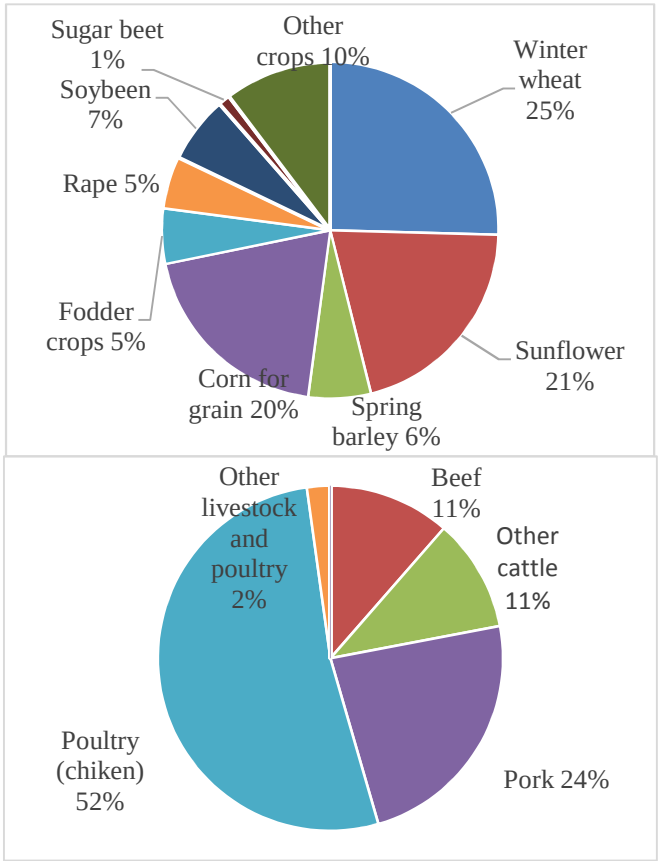

Fig. 2. Structure of the cultivated areas and stockbreeding of agricultural enterprises of Ukraine, 2016 (including farms)

Ukrainian agricultural enterprises, including farms, are concentrated on the production of the four most profitable crops: winter wheat, corn, sunflower and soybeans. More than 50% of the total land area of agricultural enterprises is used for the grain

crops. At the same time, the structure of grain cultivation is changing: if in 2011 winter wheat accounted for 43,9%, spring barley – 20,9%, corn – 12,7%, then in 2016 the crop area under wheat was 25% , under barley – 6%, and corn – 20%. One of the reasons for this change is possibility of getting bigger profit from 1 hectare of corn cultivation. An important trend is the reduction of cultivated areas under fodder crops, because of decreasing of livestock and poultry and a reduction of volume of production of certain livestock products. Changing the livestock structure is explained by higher profitability and a lower period of capital turnover when chicken and pork are grown. At the same time, the growth of cattle in most agricultural enterprises is generally unprofitable. However, the reduction in the number of cattle has both negative social (unemployment, income reduction) and negative environmental influence, in particular reduction of organic fertilizers introduction. In addition, the creation of large complexes for the production of pork and poultry meat involves significant risks in the conditions of epidemics, and also has a negative influence on the environment.

Changing structure of cultivated area and livestock have direct influence on the volume and production of agricultural products. Consider changes of gross products in terms of the main types of products of plant growing and stockbreeding sectors, as well as its structure with the aim to research influence of the above changes on the production results of agricultural enterprises (Table 1).

Table 1. Gross products of agricultural enterprises of Ukraine, calculated according constant prices of 2010

Types of products	**2012**		**2013**		**2014**		**2015**		**2016**	
	Mln. hrn.	**%**	**Mln. hrn.**	**%**	**Mln. hrn.**	**%**	**Mln. hrn.**	**%**	**Mln. hrn.**	**%**
Products of plant growing	71275	74	66813	71	92138	76,1	82130	72,6	103128	75,5
Wheat	17530	18,2	13681	14,5	18143	15	12932	11,4	17982	13,2
Barley	7972	8,3	5260	5,6	5197	4,3	3928	3,5	4279	3,1
Corn	8747	9,1	10152	10,8	20646	17,1	18751	16,6	28018	20,5
Sunflower	14715	15,3	15875	16,9	20716	17,1	20267	17,9	26846	19,7
Soybeans	2382	2,5	3808	4	5085	4,2	5362	4,7	6158	4,5
Rape	5050	5,2	3854	4,1	3839	3,2	3293	2,9	6375	4,7
Other products	14879	15,5	14183	15,1	18512	15,3	17597	15,6	13470	9,9
Products of stockbreeding	24998	26	27276	29	28915	23,9	30952	27,4	33463	24,5
Cattle (live weight)	2125	2,2	2033	2,2	1984	1,6	2076	1,8	2043	1,5
Pork (live weight)	4292	4,5	5244	5,6	5752	4,8	6202	5,5	7123	5,2
Poultry(live weight)	8500	8,8	9321	9,9	9724	8,0	10396	9,2	11772	8,6
Milk	5460	5,7	5512	5,9	5585	4,6	6304	5,6	6422	4,7

Eggs	4208	4,4	4766	5,1	5462	4,5	5574	4,9	5693	4,2
Other production	412,9	0,4	400,8	0,4	408,6	0,3	400,9	0,4	410	0,3

This table confirms that there is a steady tendency to increase the share of production of basic agricultural products in the structure of gross products. At the same time, there is an increase in production of corn for grain and sunflower and a decrease in the production of barley and wheat. In the stockbreeding sector, the decline of production is only for beef; production of other types of products is increasing. At the same time, the change in the structure and size of production in livestock production is much slower than in the field of plant growing. Also, the production of livestock products is much less dependent on the natural and climatic conditions, so there are no such sharp fluctuations in the volume of gross products, as in the field of plant growing.

The size of agricultural enterprises is depend on available agricultural land, the requirements of production specialization, the size of production expenditures, the availability of financial resources, etc. Consider the quantitative changes in agricultural enterprises of Ukraine by size of land (Table 2).

Table 2. Groups of agricultural enterprises of Ukraine by size of agrarian land, units

Groups of agricultural enterprises	**2012**	**2013**	**2014**	**2015**	**2016**	**2016 in % to 2012**
Up to 5,0 ha	5850	5784	5639	5332	5026	85,9
5,1-10,0 ha	4082	4038	3983	3809	3755	92,0
10,1-20,0 ha	5088	4925	4897	4795	4784	94,0
20,1-50,0 ha	13928	13707	13535	13334	13294	95,5
50,1-100,0 ha	4731	4831	4895	5016	5275	111,5
100,1-500,0 ha	7385	7181	7195	7261	7233	97,9
500,1-1000,0 ha	2764	2667	2595	2624	2666	96,5
1000,1-2000,0 ha	2781	2661	2549	2565	2531	91,0
2000,1-3000,0 ha	1363	1347	1304	1270	1251	91,8
3000,1-4000,0 ha	701	666	640	632	619	88,3
4000,1-5000,0 ha	378	376	355	334	323	85,5
5000,1-7000,0 ha	313	332	342	337	345	110,2
7000,1-10000,0 ha	159	178	175	179	165	84,9
Over 10000,0 ha	112	131	152	164	175	156,3
Enterprises, which have agrarian land, ha	**49635**	**48824**	**48256**	**47652**	**47442**	**95,6**
Enterprises, which don't have agrarian land, ha	**7517**	**7669**	**7877**	**8214**	**8416**	**112,0**

Total	**57152**	**56493**	**56133**	**55866**	**55858**	**97,7**

This grouping makes possibility to argue that transformational changes have led to the consolidation and reduction of agricultural enterprises.

Reasonable consolidation of enterprises contributes for more efficient use of resources. There is a steady tendency to reduce the number of agricultural enterprises with the aim of its consolidation, which has influence on the reduction of the number of employers in agricultural enterprises of Ukraine (Table 3).

Reducing the number of employers in the stockbreeding is faster than in the field of plant growing. One of the reasons for this is a reduction in stockbreeding and a focus on poultry breeding, which has a higher level of profitability, a shorter period of capital turnover, and is less labor-intensive.

Table 3. Level of employment in agricultural business structures of Ukraine, thsd. persons

Indicators	**2012**	**2013**	**2014**	**2015**	**2016**	**2016 in % to 2012**
Number of employers, thsd. persons	733,0	709,2	732,7	708,2	678,8	92,6
plant growing	513,7	500,1	538,4	528,0	510,0	99,3
stockbreeding	219,3	209,1	194,3	180,2	168,8	77,0
Structure of employment, %	100 %	100 %	100 %	100 %	100 %	-
plant growing	70,1	70,5	73,5	74,6	75,1	+5
stockbreeding	29,9	29,5	26,5	25,4	24,9	-5

At the same time, such a decrease in the number of employees may mean a transition to a more efficient system of production activity.

2.2 Analysis of production efficiency of agricultural business structures

Providing of effective production activity of agricultural business structures involves accordance to scientifically substantiated level of use of production resources. One of the ways to provide it is to reduce the cost of labor to execute production processes and control of target using of labor time. The implementation of this strategy requires automation of processes and the transition from labor to capital-intensive production. Compare the number of agricultural employers per 1000 hectares of agrarian land and the proportion of the employed population in different countries to determine the optimal number of workers in the agricultural sector of Ukraine (fig. 3).

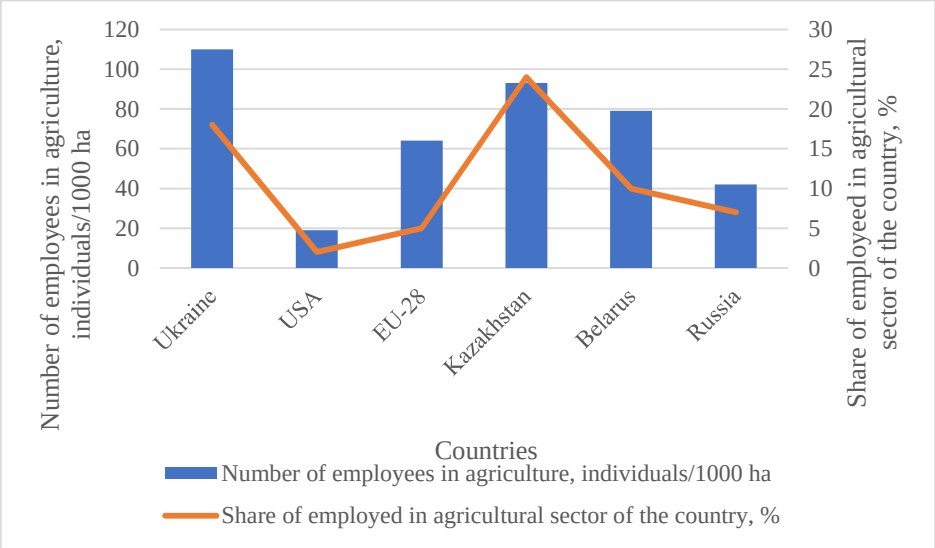

Fig. 3. Employment level in agricultural sector of different countries, 2016

These data provide an opportunity to argue that agriculture of Ukraine is labor-intensive in comparison with other considered countries of the world. For example, with the working out of 1,000 hectares of agricultural land in the EU, the number of workers is twice as low as in Ukraine, and in the USA this figure is five times smaller. At the same time, employs about 18% of the Ukrainian workable population are employed in agriculture, compared to 5% in the EU and 2% in the USA. This means possibility to significantly reduce the labor productivity of the agricultural sector, increase its competitiveness if modern technology and the necessary level of investment in Ukraine appear. A system of indicators was used to evaluate the efficiency of agricultural production, including: cost 1 ts, sales volume, price, profit on 1 ts and profitability level (table 4).

Table 4. Main production efficiency indexes of agricultural enterprises in Ukraine, 2016

Products	Cost, UAH/quintal	Sales volume, quintal	Price, UAH/quintal	Profit, UAH/quintal	Profitability level, %
Wheat	146,2	6998047	187,2	41,0	28,0
Sunflower	281,9	3920759	384,7	102,8	36,5
Corn	140,1	14950106	176,8	36,7	26,2
Soybean	346,8	1363196	466,5	119,7	34,5
Barley	144,6	1349163	171,1	26,5	18,3
Rape	324,2	1061920	418,8	94,6	29,2
Poultry	1281,5	3102711	1084,5	−197,0	−15,4
Eggs, 1000 pcs.	503,2	644403	799,1	295,9	58,8

Pork	1747,7	303617	1845,9	98,2	5,6
Beef	2128,4	179518	1365,1	−763,3	−35,9
Milk	328,3	2760868	364,5	36,2	11,0

Among many instruments which are used for enterprises production efficiency analysis one of the most common is production function. Production function is a technical ratio between amount of resources used by producers and production volume on its basis. It is calculated at the macroeconomic level, where it shows aggregate output dependence in monetary terms, and at microeconomic level. One of the most popular type of production function is Cobb-Douglas function which in general form can be written as [5]:

$$Y_t = f(K_t, L_t) = A\, K_t^{\alpha} L_t^{\beta} \quad (1)$$

where: A – coefficient which characterizes production efficiency, α і β – production elasticity coefficients of capital K and labor L, which according to neoclassical theory every production factor role in final output growth (or revenue share of relevant factor in total income unit). In practical calculation the model should be converted into linear-logarithmic:

$$LOG(Y) = C_1 LOG(X_1) + C_2 LOG(X_2) + C_3 \quad (2)$$

The equation of agricultural enterprises production function of the countries calculated for 2005-2014 years and evaluated by least squares method in econometric modelling environment Eviews (table 2 and table 3). Constructed regression models show output (V) dependence from fixed assets value (K) and salary fund (L). Production function calculation based on Ukrainian agricultural enterprises data creates the following model:

$$LOG(V) = 0.88 * LOG(K) + 0.39 * LOG(L) - 4.12 \quad (3)$$

where determination coefficient is (R^2=0,986).

It allows to consider that production volume change caused by fixed assets value and salary fund changes on 98,6%. Factors L=0,88 and K=0,39 together equal 1,27>1, which shows high reproduction level with Labor factor dominant role in it. Calculations indicate that Ukrainian agricultural enterprises production is labor-intensive which means lower competitiveness of their products on global market. It is necessary to optimize agricultural production of Ukrainian enterprises to improve competitiveness of domestic crop and livestock production.

The construction of a relative indicator requires the transformation of absolute data into relative indicators. There may be several ways of such a transformation, let's consider the most popular: relatively average, relatively to norm or standard, relatively to the scale of variation and relatively to the entire array. In addition, it is necessary to define the weighting coefficients that allow following methodical techniques: calculation of the matrix of coefficients for pair correlation, factor's load and expert estimates. Summarizing the experience of calculating integral indicators, we can offer an algorithm for its construction in the form of the following sequence of steps: the formation of feature' set, standardization of indicators, justification of weighting functions and aggregate of indicators.

Formation of a set of features involves defining the initial list of selected criteria of the synthetic category that is being analyzed, as well as selecting methodology from

the list of individual criteria and statistical indicators that play a key role in the formation of the integral indicator. The validity of the calculation process and the value of the obtained data depend on the correctness of the hypothesis, on the basis of which the criteria for the integral indicator is selected.

The evaluation criterion of production structure optimization was accepted integral index of aggregate enterprise production efficiency (*In*), which was considered in their works by such scientists as S. Shumskaya [14, 15] and U. Sayenko [16]. Methodical approach of aggregate production efficiency determination on the test enterprise A data was constructed on three indicators that characterize economic, social and environmental performance. According to investigation purpose, economic efficiency most adequately described by profit value, social efficiency by average annual employees number and ecological by used organic fertilizers amount. Integral index value of aggregate test enterprise A efficiency was determined by formula:

$$In = a_1 x_1 + a_2 x_2 + a_3 x_3 \quad (4)$$

where a_1, a_2, a_3 – weight performance indicators coefficients which characterize the influence of this partial indicators. The weight coefficients determined on the basis of experts evaluations based on agricultural economy transformational changes in 2000-2016 years.

x_1, x_2, x_3 – graduated economic (profit), social (average annual employees number) and environmental (organic fertilizers usage) performance indexes. The graduation of the indicators calculated in relation to their average value (table 5). These coefficients change annually, since technological efficiency is closely linked to natural conditions, productive potential of land, technological characteristics of land, which is an important part of the cost of production and has influence on the profitability of an enterprise, and economic efficiency depends, for example, on market prices and tax policy.

Table 5. Basic production performance indicators of test agricultural enterprise A

Indicators	**Years**									
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Statistical data										
Profit, thsd UAH	809	130	3346	5571	2624	6333	3820	6543	8253	3384
Average annual employees number, person	334	296	221	250	288	254	222	229	171	165
Organic fertilizers usage, tons	6186	5830	5580	4520	3890	5080	4632	4238	4523	4781
Graduation (relative to average value)										

Profit, thsd. UAH	0,198	0,032	0,820	1,365	0,643	1,552	0,936	1,603	2,022	0,829
Average annual employees number, person	1,375	1,218	0,910	1,029	1,185	1,045	0,914	0,942	0,704	0,679
Organic fertilizers usage, tons	1,256	1,184	1,133	0,918	0,790	1,031	0,940	0,860	0,918	0,971
Weight coefficients (experts evaluation)										
Profit, thsd. UAH	0,623	0,604	0,603	0,524	0,523	0,425	0,400	0,386	0,412	0,387
Average annual employees number, person	0,236	0,265	0,249	0,294	0,294	0,307	0,359	0,377	0,377	0,343
Organic fertilizers usage, tons	0,141	0,131	0,148	0,182	0,170	0,216	0,223	0,237	0,261	0,270

Methodical approach of total efficiency integral index in test enterprise A production was built on three main factors, which characterize economic, social and environmental efficiency. In the research it was found that economic efficiency most appropriate reflected by profit, social efficiency – by average annual number of employers and environmental efficiency characterized by organic fertilizers amount (fig. 4).

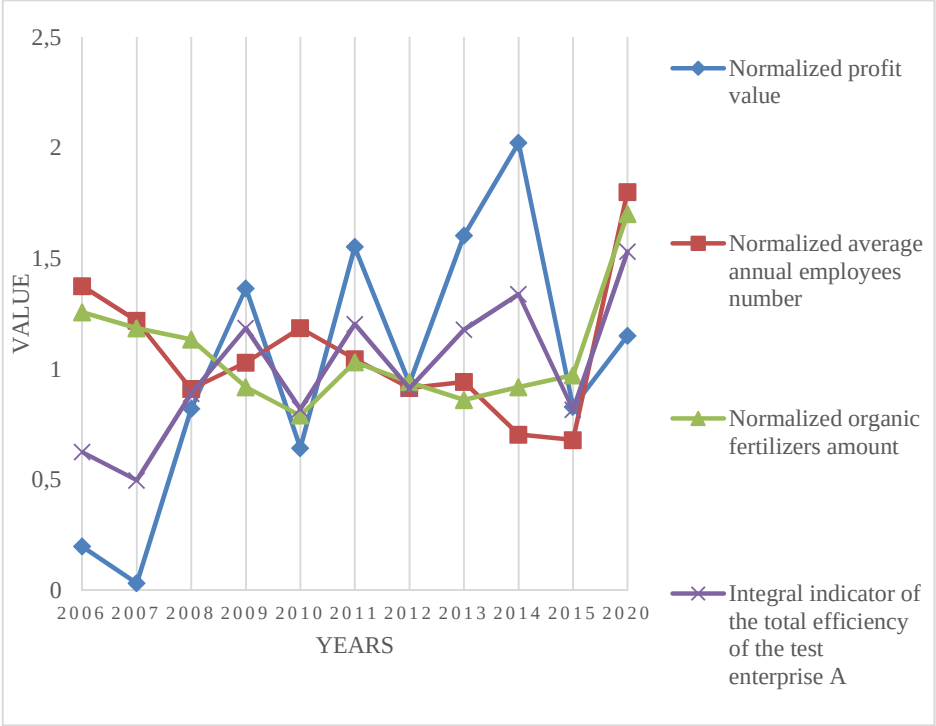

Fig 4. Aggregate efficiency integral index of test agricultural enterprise A production

Calculated integral index of aggregate enterprise production efficiency of test agricultural enterprise A is increasing from 0,82 in 2015 year to 1,53 units in 2020 year despite the fact that profit growth occurs at a lower rate from 0,83 to 1,15 units accordingly. Growth is caused by livestock increase and, as a result, new jobs creation as well as organic fertilizers higher usage.

Integral indexes usage for production optimization effectiveness determination of agricultural enterprises can become an important method of companies' conditions assessment in agricultural economy sphere because it allows to take under account at the same time indicators which are expressed in different measuring units. Further investigations should be performed towards database expanding for integral index calculation and improvement of factors weight coefficients justification.

3 Conclusions

Offered calculations of the production function of Cobb-Douglas and the overall integral indicator of total production efficiency make possibility to argue that the agricultural business structures in Ukraine have opportunity to provide expanded reproduction. At the same time, the factor of labor on the volume of production is 0.88 and is much higher than the influence of the factor of capital (0.39) that confirms about labor-intensive reproduction process. This trend is confirmed by the forecast of the integrated indicator by 2020 at the level of 1.53 units, which is explained by the creation of new jobs and an increase of organic fertilizers. A rational combination of economic, social and environmental efficiency will achieve a socially oriented economy based on sustainable development of the agrarian sector.

The efficiency of agricultural businesses depends on the effective use of fixed assets: land, labor and capital. A rational combination of these factors in the production process contributes to the food security of Ukraine, in particular: ensuring the physical and economic availability of food products, as well as the safety of its consumption. At the same time, the formation of the optimal size and production structure of agricultural enterprises is essential for ensuring food security of the country. The optimal size of agricultural enterprises depends on the specialization of the enterprise, available production resources, etc. The optimized production structure should be formed taking into account market conditions. Optimization of the structure and size of agricultural enterprises must be carried out taking into account the criteria of optimality.

The criteria for the optimal production structure and size should include economic, technological, social and environmental aspects of production efficiency. Economic efficiency is the main because it generates resources for social and environmental efficiency. The main indicators of economic efficiency are: the volume of gross output, cost, the amount of gross and net income and profit, the rate of profit, the level of profitability and others. Economic efficiency is closely linked to technological efficiency, the main indicators of which are: yield of crops, livestock productivity, productivity of employees, productivity of agricultural machinery, etc.

References

1. Ilchuk, M.: National Economic Development and Modernization: experience of Poland and prospects for Ukraine. Baltija Publishing, Poland (2017).
2. Ilchuk, M., Konoval, I.: Methodical approaches to enterprise activity evaluation in the agricultural sphere. Economy of APK 5, 51-58, Kyiv, Ukraine (2017).
3. Kvasha, S., Ilchuk, M., Konoval, I.: Economic justification of wheat production program in Ukraine. Economy of APK 3, 16-25, Kyiv, Ukraine (2013).
4. Reznik, N.: International practice of investments in agrarian sector. Formation of market relations in Ukraine 12, 65-67, Ukraine (2008).
5. Reznik, N.: Entrepreneurial firm: organizational aspect. Kyiv International University, Kyiv, Ukraine (2016).
6. Lupenko, U., Kropyvko, M.: Agroholdings in Ukraine and their social orientation activities intensification. Economy of APK 5, 5-21, Kyiv, Ukraine (2013).

7. Malik, M.: Competitiveness of agrarian enterprises: methodology and mechanisms. Institute of Agrarian Economics, Kyiv, Ukraine (2007).
8. Paskhaver, B.: Solvent food demand. Economy of APK 9, 51-61, Kyiv, Ukraine (2016).
9. Shubravska, O.: Agricultural production development in Ukraine: tasks and challenges. Economy of APK 4, 5-12, Kyiv, Ukraine (2016).
10. Sen, A.: Collective Choice and Social Welfare: An Expanded Edition. Harvard University Press, Cambridge (2017).
11. Mocherny, S.: Economic Encyclopedic Dictionary. World, Lviv, Ukraine (2006).
12. Borisov, A.: Big economic dictionary: economics, finance, accounting, taxes, insurance, marketing, management. The Book World, Moscow, Russia (2010).
13. Azriliyan, A.: Big economic dictionary: 26500 terms. Institute of New Economy, Russia (2008).
14. Shumskaya, S.: Peculiarities of construction and implementation of integral indicators in international and Ukrainian practice. Economist, Ukraine (2006).
15. Shumskaya, S.: Production functions in economic analysis: theory and practice of usage. Economics and forecasting 2(4), 104-123, (2007).
16. Sayenko, U.: Methodology and methods for the determination of integral social indicators. NAS of Ukraine, Institute of Sociology, Kyiv, Ukraine (2004).
17. Ukraine state statistical service. Mode of access: http://ukrstat.org, last accessed 2018/03/01.