

The agricultural production in the region is not just a complex of the industries, developing independently from each other, but the rational and systematic combination of all elements and factors of production under certain specific natural and economic conditions, the interrelated development of various branches of agriculture, first and foremost, the rational combination of scientifically grounded systems of farming and livestock, the optimal combination of which lies in their rational interconnection. What is important to notice is that between the volumes of agricultural production and food consumption in the agro-industrial countries, there is a direct relationship with the total amount of consumption, because the manufacturers of this production and most of its consumers are the same individuals.

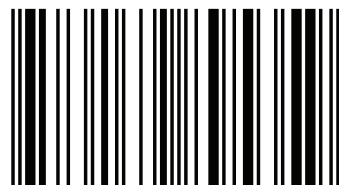


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Place of employment: Sumy National Agrarian University, Ukraine.
Direction of scientific work: Estimation of economic potential of food supply of the region. Advantages of the methodology: systematization of various types of agricultural products as conditional and forecasting of food supply to the population of the region.

Provision of grain production in conditions of sustainable development

Determination of potential possibilities of food supply by grain products in the conditions of sustainable development



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PROVISION OF GRAIN PRODUCTION IN CONDITIONS OF SUSTAINABLE DEVELOPMENT

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Abstract. The purpose of the paper is to determine the potential of the food provision of the Sumy region. The agricultural production in the region is not just a complex of the industries, developing independently from each other, but the rational and systematic combination of all elements and factors of production under certain specific natural and economic conditions, the interrelated development of various branches of agriculture, first and foremost, the rational combination of scientifically grounded systems of farming and livestock, the optimal combination of which lies in their rational interconnection. What is important to notice is that between the volumes of agricultural production and food consumption in the agro-industrial countries, there is a direct relationship with the total amount of consumption, because the manufacturers of this production and most of its consumers are the same individuals. Along with this, the main problems which may occur in the growth of production volume in the agri-food complex of the transition economy could be: the low purchasing power of population and insufficient level of the development of product promotion infrastructure. Having regard to the principles of agricultural location, and in view of a range of the above problems, in our opinion, it stands to reason that the issue of the region self-provision with the main types of production, which should be affordable to the

average consumer, i.e. be solvent in effective demand, is the most pressing. It is essential to put emphasis on the fact that the theoretical and practical aspects of the formation of the regional food policy and the market strategy of their development, the motivational potential of their existence in the market economy environment require further research.

Methodology of the study. When conducting this research, we used the statistical records of Sumy Region for the last 3 years and the statistical records of EU-28 for the last year (Derzhavnyi komitet statystyky Ukrainy. Holovne upravlinnia statystyky v Sumskii oblasti, 2016, Silske hospodarstvo Ukrainy u 2016 rotsi, 2017, Agricultural statistics of EU-28, 2017). The regression and index analyses for the development and calculation of the integrated factor of agricultural land adjustment have been used as well.

Results. After conducting the research, we have determined that the solution to the problem of food provision of Ukraine and Sumy Region and of EU-28 and Estonia, Latvia, Lithuania, in particular, is to increase the efficiency of agricultural land use. Taking the above mentioned into consideration, we consider it appropriate to transfer unused arable land to the full-fledged private and owner-operated farms, and private households. However, the large agricultural enterprises in the coming years should seek to play a more significant role in addressing the problems of food provision of the region, especially in grain crop. We have substantiated the functional structure of the cluster of sustainable development of grain production and determined the effectiveness of the cooperative links in it.

Practical use. The results of the conducted research will help reallocate land plots among agricultural enterprises of different forms of ownership for their more efficient use and improve food security in the region after the proper implementation of the land reforms. In view of the foregoing, there is a need for the state regulation of the grain market and support for grain sales prices. This necessitates the objective assessment of the potential opportunities on the region scale for Ukraine and Europe.

Key words: potential gross yield, opportunities, resource factors, agricultural

land adjustment, food provision, sustainable development of the region, cluster.

JEL Classification: Q10, Q 15, Q 18

1. Introduction

Solving the problem of creating a balanced agricultural production in any country suggests that the first and most important task in this regard is to ensure the so-called "safety of food", which, in turn, is the key to the survival of society. This goal is realized through the provision by the state of its own food of proper quality.

Undoubtedly, the economic and social role of food supply can not be overestimated, but food production is confronted with the problem of resource constraints. Given that the agricultural production and raw material supply base is agriculture, this problem should be considered through the prism of potential production capacities of the agrarian sector of one region or another.

In economic literature, such a concept as "production potential" has been studied in a rather deep and detailed way. The most widespread approach was the resource approach, according to which production potential represents a combination of resources or factors of production. Within the framework of this concept there are two directions:

1. Production potential of the enterprise is considered without connection to the process of production and its results and is characterized by certain resources or factors of production;

2. Under the industrial potential means a set of factors or resources capable of producing certain products and determining the capabilities of an object.

There is no doubt that resource factors, including natural ones, will be able to ensure the continuity of social reproduction in the event that they represent a system of interconnected in qualitative and quantitative terms of certain elements that change in time and space in accordance with the development of productive forces, while giving a certain impact on this process.

Therefore, in the economic literature, the concept of resource potential is considered, which individual authors define as a set of objective natural and economic conditions that influence the process of reproduction in agriculture and which is characterized by the potentially possible volume of production of agricultural products at a given quality of land, the availability of productive assets, as well as labor (Grygoryev 2015, Kozak, 2014).

It is legitimate to consider the approach in which the resources needed for food production are divided into real and potential, which in their totality constitute the generic for the given moment or period of production resources, which, after passing through the production process, are consumed in it and converted into finished products.

The actual resources are determined not only by the fact of existing being, but by the direct relation to social production, or by active participation in the production process or the ability to be at any moment included in it. Potential include resources that, although available, are not yet involved in production due to insufficient level of technology or economic inefficiency. This group should also include resources that currently do not exist, but which, based on the existing preconditions, should be created and included in economic activity for a long period of time. In some cases, the existence of such resources is predictable and even probabilistic. In order to include potential resources in the production process, that is to convert them into real ones, additional costs of living and settled labor are needed, which will add to them, as means of production, a certain qualitative completeness.

In view of the foregoing, we can conclude that the objective condition for the functioning of the production potential as a system of resource factors is the objectively determined relationship between its elements - real and potential resources. If the proportionality within the system is violated, there is an unfavorable situation for the whole social reproduction. Due to the lack of real resources and the untimely forecasting of the needs for potential resources, the threat of violation of the continuity of reproductive processes in the agrarian sector

is created, which will inevitably affect the food supply of the population.

In this regard, we should already talk about the food supply of one or another region, the level of which will affect both the degree of use of basic production factors, as well as qualitative parameters of the latter.

Considering the problems of production (agrarian) potential, in our opinion, it is necessary to separately highlight the potential of the food complex, which is proposed to be considered as the ability to meet the needs of the population in food products and evaluate them quantitatively and qualitatively. A quantitative assessment of the potential of the food complex should take into account the maximum production volume (under specific given conditions) of product kits or individual products that, by their quality and degree of provision, meet the needs of the population of the region, as well as food products and raw materials for their production to supply to other regions.

In general terms, the food potential is characterized by the ability to supply food and raw materials for their production in order to meet both regional needs and the needs of the country as a whole. In this regard, the product structure of regional production is determined by its specialization, which provides the most complete satisfaction of the needs of food products of the entire society, with the best use of available natural, material, labor and financial resources.

The agricultural production in the region is not just a complex of the industries, developing independently from each other, but the rational and systematic combination of all elements and factors of production under certain specific natural and economic conditions, the interrelated development of various branches of agriculture, first and foremost, the rational combination of scientifically grounded systems of farming and livestock, the optimal combination of which lies in their rational interconnection.

This combination of industries is based on the rational use of land as the main means of production in agriculture, which requires the monoculture exclusion, and the optimal system of crop rotation. However, the full employment of labor with the consideration of the seasonality of agricultural production

requires the combination of crop cultivation with the development of livestock industries and industrial sectors of the agricultural formations.

The economic basis of such labor division determines the efficiency of the location of agricultural production on the territory of the country or region in accordance with the principles of food security. In the Decree of the Cabinet of Ministers of Ukraine “On Principle of the Location of Competitive Agricultural Production by Natural-Economic Zones, Depending on Market Conditions”, these principles are divided into priority and specific.

Priority ones include the following principles:

- definition of strategically important types of products for growth of the agrarian sector, guaranteeing food security of the state, achieving social stability of the society, increasing the export potential of the country;

- definition of natural and economic zones for the production of strategically important types of products with maximum use of their bioclimatic potential, the least cost of material and technical resources, efficient use of labor resources and ensuring the ecological safety of agricultural production;

- Minimization of fluctuations and stabilization of gross crops of main crops taking into account current and forecast aggregate demand for products by developing state target programs and introduction of a mechanism for stimulating the participation of commodity producers in their implementation;

- regulation of supply and demand in the food market through intervention, application of economic instruments (subsidies, preferential loans, etc.);

- formation of the infrastructure of the agrarian market, in particular on a cooperative basis;

- promoting the development of the agricultural market monitoring system.

Specific principles are as follows:

a) at the national level:

- definition of strategically important types of products and volumes of its production, which guarantees the food security of the state and creates conditions for increasing its export;

- economic stimulation of agricultural production in the most favored areas through the implementation of state target programs, taking into account regulatory costs;

- establishment of mortgage prices (support prices), regulation of supply and demand in the food market through appropriate mechanisms;

- ongoing monitoring of the food market and pricing at the global, national and regional levels, with the provision of relevant information to commodity producers;

b) at the regional level:

- balancing levels of agricultural development in the region and sectors of the food and processing industry;

- creation of an appropriate agricultural market infrastructure;

- increasing the use of high and resource-saving technologies in accordance with the relevant state target programs;

c) at the basic level (level of commodity producers):

- free choice of spheres of production activity, direction of specialization and integration with other subjects of the agrarian market;

- participation in the implementation of state target programs under the conditions determined by the relevant regulatory acts, including the use of state budget funds;

- participation through inter-branch associations (associations) in the final distribution of profits received from sales of products.

What is important to notice is that between the volumes of agricultural products and food consumption in the agro-industrial countries, there is a direct relationship with the total amount of consumption, because the manufacturers of these products and most of their consumers are the same individuals. Along with this, the main problems which may occur in the growth of production volume in the agri-food complex of the transition economy could be: the low purchasing power of population and insufficient level of the development of product promotion infrastructure.

Having regard to the principles of agricultural location, and in view of a range of the above problems, in our opinion, it stands to reason that the issue of the region self-provision with the main types of products, which should be affordable to an average consumer, i.e. be solvent in effective demand, is the most pressing one.

It is essential to put emphasis on the fact that the theoretical and practical aspects of the formation of the regional food policy and the market strategy of their development, the motivational potential of their existence in the market economy environment require further research. The above aspects are to some extent reflected in the scientific works of V. Balabanov, V. Boiko, Yu. Kovalenko, P. Loiko, V. Mykytiuk, G. Palamarchuk, Yu. Parkhomova, G. Pidlisetskyi, P. Sabluk and others.

The majority of authors, such as V. Bytov, K. Kozak, L. Stashynska, V. Proskura, Ye. Grygoriev, O. Shevchenko, O. Shapovalova and others, agree that the government should develop the effective doctrine of food security as a component of the national security.

In view of the foregoing, we believe that food security of the region is one of the main tasks in improving the national development sustainability for the near future. The above reasonings are the convincing argument of expediency of strengthening the influence of state regulation of the process of manufacture of food products, especially in terms of the region self-provision. Against this background, the issue of the development of methodical bases of determining the potential opportunities of the region for manufacture of agricultural products, in particular, grain, is of relevance.

The main directions of improving the food security of the Ukrainian regions include:

- intensive development and increased competitiveness of agro-industrial complex against import on the basis of the integrated assessment of the natural and climatic, and production potential of the region;
- increase in real income of the population, especially its socially vulnerable

groups on the basis of proficiency, employment and labor productivity enhancement, as well as the targeted provision of social institutions, educational institutions, low-income families;

- promotion of export of food products with high added value rather than raw materials to be processed in Ukraine, the widespread use of the non-tariff methods of import regulation;

- state support of prices for agricultural products through the establishment of reserve funds, subsidies for the infrastructure development and crediting of agricultural enterprises, the compensation of the disparity of prices for agricultural products and resources for their manufacture;

- development of regional clusters in food production;

- creation of the national system of information on the condition of regional and external food markets (Kozak, 2014).

2. Analysis of agricultural market of Sumy Region

Sumy Region geographically covers two natural zones – Forest-Steppe and Polissia that determines the specialization and location of its agricultural production. The natural and climatic conditions are sufficiently favorable for the successful cultivation of raw material of the main agricultural food products.

Certain specified criteria of the optimal manufacture of the main types of agricultural products do not exist, with the exception of grain, the optimal amount of which in the region is 1,000 kg per capita (taking into account the needs of the livestock industry). According to the research results, the manufacture of the main agricultural products per capita per almost each product name annually tends to increase in Sumy Region (Table 1).

A more detailed analysis of the production output of the types of products listed in Table 1 has made it possible to reveal the general trend over the last six years. The positive growth rate, except for sugar beet and potato, the gross yields of which per capita have decreased annually by 111.0 centners or 39.0% and 5.0 centners or 0.5%, respectively. The production of sunflower and grain crops has

Table 1

Production of the main types of agricultural food products per capita in Sumy
Region, center

Product	2012	2013	2014	2015	2016	The average annual growth (+/-), center	Average annual growth rate, %
<i>Corn</i>	2323.3	3152.7	3492.8	3339.3	3448.0	281.2	110.4
<i>Sugar beets</i>	515.5	27.2	68.4	66.7	71.5	-111.0	61.0
<i>Sunflower</i>	253.2	368.1	375.7	421.4	441.3	47.0	114.9
<i>Potato</i>	982.8	959.4	1175.7	955.3	962.9	-5.0	99.5
<i>Vegetables</i>	161.4	166.4	172.2	169.1	181.1	4.9	102.2
<i>Meat (in slaughter weight)</i>	55.0	37.1	39.9	39.2	61.6	1.7	102.9
<i>Milk</i>	372.1	375.5	378.6	373.4	374.6	0.4	100.2
<i>Eggs, pcs.</i>	328.9	373.8	391.2	371.5	362.0	8.3	102.4

increased most significantly. The average annual increase of the above crops in relative measurement accounts for 14.9% and 10.4%. The production of vegetables, meat and eggs has annually increased approximately with the same intensity (from 2.2% to 2.9%). The slightest average annual growth characterizes the intensity of milk production, and accounts for only 0.2% annually.

The solution of the food problem in Ukraine depends primarily on the efficiency of grain production, the level of the development of which largely determines the socio-political and economic stability in the country, its food security. One can judge the level of the grain production development not only by the economic performance of the agro-industrial complex and its sectors, but also by the might of the state itself (Ambrosov, Sabluk, 2000).

3. Analysis of agricultural market of European Union

The structure of agriculture in the Member States of the European Union (EU) varies as a function of differences in geology, topography, climate and natural resources, as well as the diversity of regional activities, infrastructure and social customs.

Traditionally, agriculture in the EU is divided into crop and livestock production.

The range and variety of crops grown across the European Union (EU) reflects their heritable traits as well as the ability of plant breeders to harness those traits to best respond to the myriad of topographic and climatic conditions, pests and diseases.

The statistics on crop production in Estonia, Latvia and Lithuania are shown in the table 2 (Agricultural statistics of EU-28, 2017).

Table 2

Crop production, 2016

Product	EU-28, thousand tonnes	Estonia		Latvia		Lithuania	
		housand tonnes	percent	housand tonnes	percent	housand tonnes	percent
<i>Cereals</i>	301357.9	934.1	0.310	2703.2	0.897	5120.82	1.699
<i>Potatoes</i>	55969.8	62.91	0.112	203.6	0.364	344.78	0.616
<i>Tomatoes</i>	17956.31	0.36	0.002	5.8	0.032	11.4	0.063
<i>Carrots</i>	5593.57	11.14	0.199	14.8	0.265	43.02	0.769
<i>Onions</i>	6577.92	0.06	0.001	5.2	0.079	25.01	0.380
<i>Apples</i>	12568.46	2.77	0.022	9.8	0.078	57.52	0.458

In 2016, the harvest of crops in the EU decreased by about 4.4 % compared to the previous year, which was largely explained by unfavourable climatic conditions.

From Estonia, Latvia and Lithuania in 2016 came less than 1 percent of every type of production. Estonia, Latvia and Lithuania do not grow peaches, oranges and sugar beet.

The economic relevance of animal production in agricultural accounts is underlined by the fact that it accounts for 43.1 % (EUR 167 billion) of the total EU-28 agricultural output. Animal production covers two items: output for animals and animal products. Output for animals, which represents 57.5% of animal output, is the value of animals produced either directly for slaughter, or used alive for herd

renewal or for further growing and fattening. Animal products account for the remaining 42.5% and cover eggs, milk, wool, etc. (Table 3) (Agricultural statistics of EU-28, 2017).

Table 3

Livestock production, 2016

Product	EU-28, thousand tonnes	Estonia		Latvia		Lithuania	
		thousand tonnes	percent	thousand tonnes	percent	thousand tonnes	percent
<i>Bovine meat</i>	7799.01	9.43	0.121	17.7	0.227	42.29	0.542
<i>Pigmeat</i>	23440.41	42.82	0.183	31.16	0.133	60.35	0.257
<i>Poultry meat</i>	14400.0	0.0	0.0	30.02	0.208	104.1	0.723
<i>Drinking milk</i>	30700.0	99.22	0.323	61.98	0.202	93.48	0.304
<i>Cream for direct consumption</i>	2770.0	25.65	0.926	35.99	1.299	23.38	0.844
<i>Milk powder</i>	2800.0	2.04	0.073	0.0	0.0	36.22	1.294
<i>Butter</i>	2400.0	5.14	0.214	7.2	0.300	17.67	0.736
<i>Cheese</i>	9616.0	43.29	0.450	38.63	0.402	97.5	1.014

In 2016, the production of raw cows' milk in the EU-28 remained relatively stable, with only a slight increase (+0.2 %). Similarly, a slight decrease was observed in the number of dairy cows (-0.4 %). High decreases were reported in Latvia (-5.2 %), Estonia (-5.0 %), Lithuania (-4.9 %).

The apparent milk yield per dairy cow in EU-28 increased by 0.6 % (40.2 kg/head), reaching 6 941 kg per dairy cow in 2016. The apparent milk yield grew strongest in Estonia (452 kg/head) and in Latvia (380 kg/head).

In 2016 nearly seven million holdings (6.92 million) reared livestock, representing 56.5 % of EU-28 farms. As a proportion of all farms, 23.5 % reared pigs, 21.4 % bovine animals (cattle, buffaloes, etc.), 18.7 % broilers, 7.7 % sheep and 4.4 % reared goats.

4. Definition of the resource potential of the region

In order to define the potential opportunities of the region in relation to the

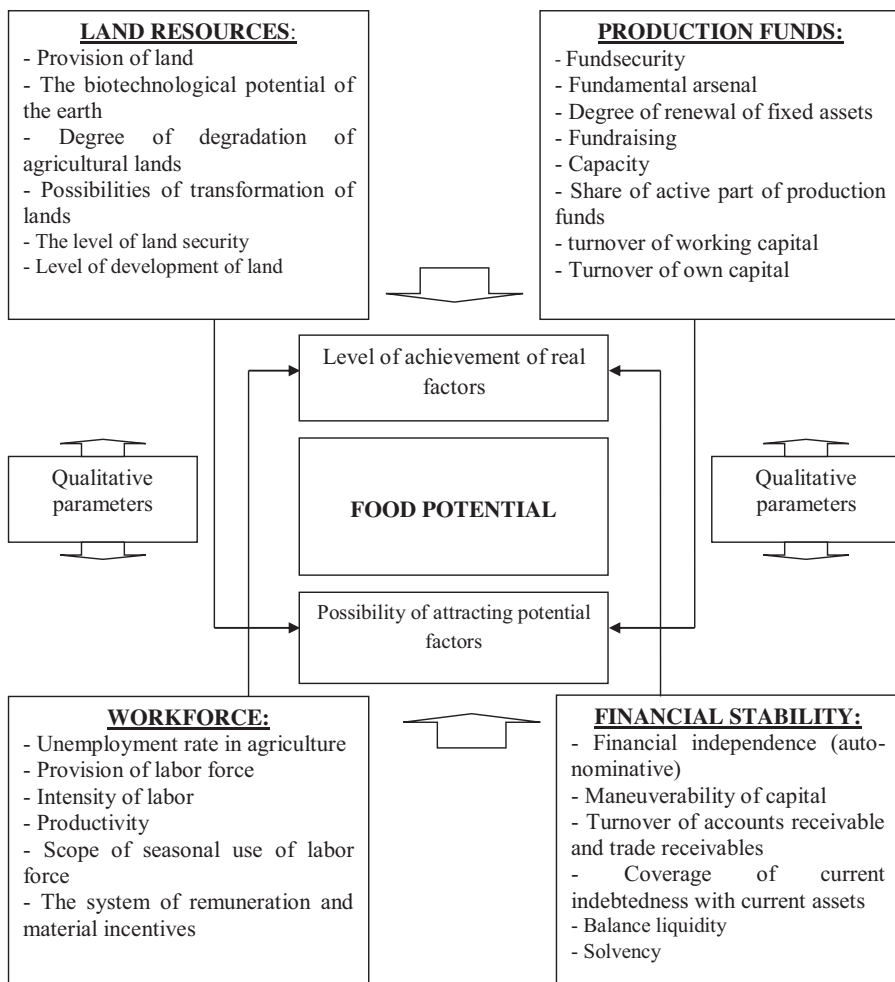
manufacture of grain products we may use, to a degree, one of the three methods for determining the resource potential. Its essence reduces itself to the determination of the total resource with the size of the so-called adjusted agricultural land, which by its structure differs significantly in the soil quality. In addition, there are some significant differences in the levels of investments per area unit, the employment rate in individual enterprises or areas, and they often reach two-three-time value. In order to account for these objective differences, we introduce the relative resource provision indicator per area unit, and then determine the area of the adjusted agricultural land (Myroshnychenko, 1997).

We have chosen the quality of agricultural land, the provision with fixed assets and current assets, the supply of labor force given labour productivity as the resource factors. These factors are weighted by the equity ratio.

As already noted, there is no doubt that there is a clear relationship between the volume of commodity output and the size of the resources of the agricultural enterprise. The resources indicated in the picture 1 to varying degrees influence the output of commodity products, therefore it is necessary to detail the identification characteristics of each of them:

1. Land resources. Land in agriculture is the main means of production and its quality directly affects its effectiveness. Depending on the destination in use, the land can act as either a spatial basis for the placement of production facilities or means of production. Moreover, in the form of means of production, the land can simultaneously be both an object of labor and a means of labor. It is the subject of labor when a person sends her efforts to her (he adds fertilizers, processes, implements irrigation, etc.). And a means of labor when the land itself directly participates in the creation of the crop. It performs its last function due to its unique property - fertility, which is nothing but the ability of the land to create products. In addition, taking into account the quality of land is required in order to have a complete, reliable picture of the effectiveness of agricultural production.

Under conditions of a market economy and granting to agricultural enterprises a certain economic independence, or inappropriate use of available means of



Picture 1. Resource factors of the food potential of the region and their qualitative parameters

management of the level of soil fertility leads to its decline. This negatively affects the efficiency of the plant growing industry and other interconnected industries, as well as financial results of agricultural enterprises.

When calculating the effectiveness of the result obtained must be compared with resources, costs, and in agriculture, it is the land that is the main component

of the resource potential.

So an objective assessment of the land helps to objectively compare the potential or work of individual regions, agricultural enterprises or their subdivisions. Any economic indicators by themselves do not adequately characterize the level of economy, if they are considered without taking into account the quality of the land, its assessment.

The complexity of determining the price of land is due to its natural origin and spatial constraints, distinguishing it from other real goods. The price of the latter forms the cost of production, its mass can be increased on the basis of additional investments in production and in accordance with consumer demand. Therefore, in a market economy, when land is drawn into market turnover, and the right to it becomes a commodity, its price is directly dependent on the size of the profit derived from it. In countries with market economies, the problem of pricing on agricultural land is reduced for this reason to obtain predictive estimates, derived first of all from market factors such as the dynamics of demand and supply in the land market, prices for agricultural products, conditions of accumulation and reproduction.

So to this day, the system of monetary valuation of land has not yet been completely formed. However, it is possible to reliably use the ballroom assessment of land. On the basis of land cultivation, a comparative assessment is made of the suitability of the soil for the main fertility factors for the cultivation of agricultural crops (availability of humus, nutrient content, etc.). Indicators of bonitet in balls are determined on the basis of expert assessments of agro-industrial groups of soils within the districts and individual farms, taking into account the technological conditions and the intensity of production.

2. Fixed assets per 100 hectares of agricultural land determine the capital of the enterprise and is the second most important after the land by the industrial factor characterizing the production potential of agrarian formations; is taken into account in determining the actual production capacity for a more reasonable assessment of the results of economic activity and production planning. Increasing

the fund's disadvantage along with qualitative improvement of funds and improving their use is an important condition for the growth of agricultural production and increase its efficiency.

3. Current assets per 100 hectares of agricultural land. The importance of this factor is determined by the cycle of capital, which covers three stages: procurement (procurement), production and sales. Elements of working capital are part of a continuous flow of business operations. Purchases lead to an increase in inventories and payables; production leads to the growth of finished products; implementation leads to an increase in receivables and cash. This cycle of operations is repeated many times and eventually reduces to cash revenues and cash payments. The period of time during which the turnover of funds takes place is the duration of the production and commercial cycle.

4. The labor force is determined by the average annual number of workers per 100 hectares of agricultural land. In our opinion, the absolute magnitude of the number of employees can not objectively reflect the quality of labor resources, because the variation of labor productivity indicators is significant, therefore we propose the number of workers to adjust to the level of productivity:

$$Kp = \bar{Y} * \frac{P_f}{P_b} \quad (1),$$

where K_p - adjusted labor force per 100 hectares of agricultural land, person ; \bar{Y} - average annual number of employees, people; P_f and P_b - actual production of gross output at comparable prices in 1996 per average annual employee, respectively, in the economy and in the region on average, UAH.

The proposed indicator can be used both in analytical and forecast calculations, providing the necessary depth and objectivity of the results obtained.

5. Financial independence (the percentage of equity in the total assets). The use of the model of this factor is argued that a low proportion of own funds negatively affects the financial sustainability of the enterprise, in addition, some of the property can be used as collateral in obtaining loans. In addition, as already

noted, financial independence is a guarantee of stability and continuity of production, its proper financing (Mushtai, 2007).

Given a large variation range of the characteristics, the value of each resource factor is weighed by the adjustment factor, which, in this case, is determined by the ratio of the magnitude of the corresponding resource of a certain area and the average region value. The adjusted area of agricultural land is determined as the product of the actual area and integrated adjustment factor, calculated according to the following formula (2) (Myroshnychenko, 1997):

$$\bar{K} = \sqrt[3]{k_B \cdot k_{CL} \cdot k_{CA} \cdot k_{LF} \cdot k_{ER}} \quad (2),$$

where \bar{K} - integrated agricultural land adjustment factor;

$k_B, k_{CL}, k_{CA}, k_{LF}$ – factors of adjustment of soil bonitet, capital-labor ratio, current assets value, labour force participation rate per 100 ha of agricultural land;

k_{ER} – equity ratio.

Thus, it has been determined that the area of the adjusted agricultural land is distinctly different from the actual indicators, and these deviations fluctuate significantly by districts (Table 4).

In relation to the factors and their coefficients - the coefficients of variation are within the acceptable limits (from 25.3 % to 40.5%), confirming the objectivity of the performed calculations. Depending on the values of the resource factors and the level of financial self-sufficiency, the area of individual districts can be more or less than the actual value. Accordingly, the amount of food potential will depend on the degree of influence of the resource factors and the financial self-sufficiency of the district.

Using the product of the adjusted agricultural land area and the coefficients of its ploughness, we will determine the adjusted arable land area that will be used in further calculations of the potential agricultural production output in Sumy Region.

Table 4

Determination of adjusted arable land area taking into account the influence of resource factors in the districts of Sumy Region

Districts	Area of corrected lands, ths ha	Deviation from the actual value, ths ha	Plow land, %	Area of adjusted arable land, ths ha
<i>Belopolsky</i>	81.0	-26.0	90.0	72.9
<i>Burinsky</i>	60.5	-24.0	86.8	52.5
<i>Velikopasyrivsky</i>	55.1	-3,5	87,0	47,9
<i>Glukhivsky</i>	76.7	-22.3	84.4	64.7
<i>Konotopsky</i>	95.3	11.7	83.9	80.0
<i>Krasnopolsky</i>	52.9	-14.8	83.3	44.1
<i>Krolevetsky</i>	40.6	-17.7	72.9	29.6
<i>Lebedinsky</i>	99.7	-1.8	73.0	72.8
<i>Lipovodolinsky</i>	69.6	-1.2	78.0	54.3
<i>Nedryhaylivskyy</i>	70.8	2.4	90.2	63.9
<i>Okhtyrsky</i>	93.9	19.0	88.4	83.0
<i>Putivlsky</i>	57.3	-9.3	70.4	40.3
<i>Romensky</i>	123.0	-11.3	83.4	102.6
<i>Seredino- Budsky</i>	28.3	-25.0	58.0	16.4
<i>Sumsky</i>	136.5	20.0	80.9	110.4
<i>Trostryanetsky</i>	55.8	-1.9	79.9	44.6
<i>Shostkinsky</i>	52.1	6.6	67.9	35.4
<i>Yampil'sky</i>	24.3	-18.0	75.2	18.3
<i>In the region</i>	1273.4	-117.1	79.6	1033.7

5. Assessment of the grain potential of Sumy Region

The definition of the importance and relevance of the above issues, and the necessity for their regulation and solutions at the regional level result in the need to develop the system of determination of the grain production potential, which is the basis of the food complex, since it is recognized as the most significant branch of agriculture, the development of which influences, to the fullest extent, the provision of food to the population and, particularly, living standard.

Based on the research findings, it is worth noting that as of today the grain production is the branch of agriculture that has the most positive dynamics. However, the growth in the production output, both in general and at the regional level, could significantly reduce market prices that would adversely affect the

agricultural producers.

Unfortunately, most of the options of support for grain prices are focused on the current period, i.e. they are of a short-term nature and cannot ensure the stability of their sales policy for producers. The way out is seen in stimulating the demand for the main agricultural product, primarily on the part of the industries which are traditionally the largest grain consumers, the manufacture of bread products, poultry, cattle fattening, etc.

However, it should be noted that today there is the monopolization of markets by foreign trading companies resulting in change to the structure of wholesale trade not in favor of domestic products. They invest heavily in the creation of the nationwide network of their own structures, use a variety of the protectionist measures to promote their products in the Ukrainian market. This is so much the case that these companies use the unfair methods of competition. Unfortunately, the Ukrainian trading companies and the state regional authorities are not opposed to this process, and operate separately that leads to the expansion of food products from abroad and the aggravation of the problem of the sales of domestic products. This passivity could result in losing both food market and food security (Grygoriev, 2015).

Although Ukraine has always been and remains the breadbasket of Europe, the consumption is partly satisfied by imports. Export capacities are expanded through the activities of large agro-industrial formations, which have the possibility of entering the international market. Nowadays, such agro-industrial formations in Ukraine are the agricultural holdings, which play a crucial role in the Ukrainian economy and under the reasoned government policy could be the basis of ensuring food security by the virtue of the socio-economic development and the formation of Ukraine's image as a highly developed industrial-agrarian country.

The volatility of prices for grain products limits the reproductive potential of the agricultural enterprises, that is, makes the destabilizing influence on the financial performance. This situation precludes commodity producers from generating the sales volumes sufficient for reproduction. Thus, the income is

unstable, the costs of production are on the rise, and prices are subject to fluctuation (Lyshenko, 2015).

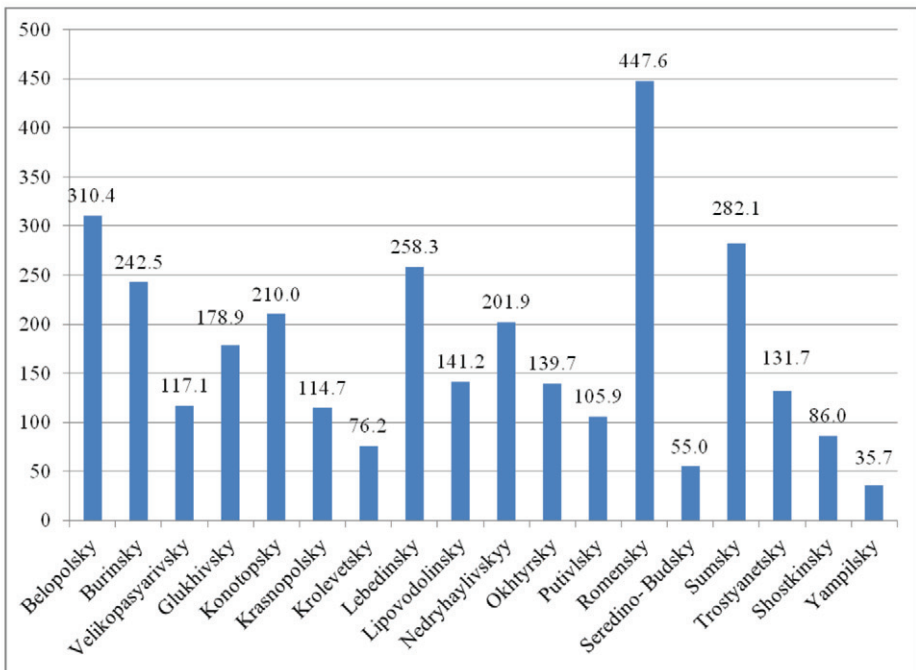
In view of the foregoing, there is a need for the state regulation of the grain market and support for grain sales prices. This necessitates the objective assessment of the potential opportunities on the region scale. Using the proposed methodology, we can calculate the grain potential of Sumy Region in terms of the districts (Table 5 and Picture 2).

Table 5

Grain potential of the districts of Sumy Region with the existing structure of crop acreage

Districts	Area of adjusted arable land, ths ha	The share of sowing area in the area of arable land	The coefficient of marketability	Potential yields, c/ha	Potential gross tax, ths. t.
<i>Belopolsky</i>	72.9	0.780	0.836	65.3	371.3
<i>Burinsky</i>	52.5	0.916	0.798	63.2	303.9
<i>Velikopasyrivsky</i>	47.9	0.624	0.779	50.3	150.3
<i>Glukhivsky</i>	64.7	0.707	0.764	51.2	234.2
<i>Konotopsky</i>	80.0	0.606	0.816	53.1	257.4
<i>Krasnopolsky</i>	44.1	0.757	0.731	47.0	156.9
<i>Krolevetsky</i>	29.6	0.716	0.635	56.6	120.0
<i>Lebedinsky</i>	72.8	0.600	0.844	70.2	306.6
<i>Lipovodolinsky</i>	54.3	0.596	0.736	59.3	191.9
<i>Nedryhaylivskyy</i>	63.9	0.521	0.855	70.9	236.0
<i>Okhtyrsky</i>	83.0	0.443	0.752	50.5	185.7
<i>Putivlsky</i>	40.3	0.723	0.707	51.4	149.8
<i>Romensky</i>	102.6	0.683	0.901	70.9	496.8
<i>Seredino- Budsky</i>	16.4	0.914	0.645	56.9	85.3
<i>Sumsky</i>	110.4	0.527	0.893	54.3	315.9
<i>Trostyanytsky</i>	44.6	0.614	0.795	60.5	165.7
<i>Shostkinsky</i>	35.4	0.754	0.762	42.3	112.9
<i>Yampilsky</i>	18.3	0.748	0.640	40.8	55.8
<i>In the region</i>	1033.7	0.679	0.771	56.4	3996.4

The potential gross yield of grain is determined as the product of the adjusted arable land, the relative share of crop acres in arable land area, and average yields. The magnitude of grain potential is determined by multiplying the potential gross



Picture 2. Grain potential of the districts of Sumy Region

yield by the average marketability coefficient.

According to the calculations shown in Table 3 and Picture 2, the main potential grain producers in the region are Romenskyi (14.27%), Bilopolskyi (9.9%), Sumsky (9.0%) and Lebedynsky (8.24%) and Burynsky (7.74%) districts, which account for 49.15% of the total regional grain potential.

By comparing the actual manufacture of grain products with the potential output in terms of the districts of Sumy Region, we have calculated the relevant coefficients and determined the coefficients of their self-provision (Table 6).

As evidenced by the data of Table 4, in all districts of Sumy Region, the actual volume of grain production is less than potential. The districts closer to the potential level of the manufacture of grain products are Shostkynsky (0.968), Seredyno-Budsky (0.950), Sumsky (0.948), Krolevetsky (0.938), Krasnopilsky (0.928), Glukhovsky (0,913), and Konotopsky (0.911) districts. However, these districts, except for Sumskyi, are not the main potential grain producers in the

Table 6

Comparison of the actual manufacture of grain products with the potential output in the context of the assessment of self-provision of Sumy Region

Districts	Actual gross tax, ths. t.	Potential gross tax, ths. t.	Absolute deviation (+/-), ths. t	Ratios of the actual production volume to the potential	Ration of self-sufficiency
<i>Belopolsky</i>	332.3	371.3	-39.0	0.894	7.326
<i>Burinsky</i>	270.0	303.9	-33.9	0.888	12.135
<i>Velikopysarivsky</i>	128.0	150.3	-22.3	0.851	7.846
<i>Glukhivsky</i>	214.0	234.2	-20.2	0.913	10.121
<i>Konotopsky</i>	234.6	257.4	-22.8	0.911	8.869
<i>Krasnopolsky</i>	145.7	156.9	-11.2	0.928	5.486
<i>Krolevetsky</i>	112.6	120.0	-7.4	0.938	3.123
<i>Lebedinsky</i>	275.2	306.6	-31.4	0.897	15.483
<i>Lipovodolinsky</i>	154.9	191.9	-37.0	0.807	10.193
<i>Nedryhaylivsky</i>	206.9	236.0	-29.1	0.876	9.616
<i>Okhtyrsky</i>	146.5	185.7	-39.2	0.788	7.002
<i>Putivlsky</i>	131.1	149.8	-18.7	0.875	5.383
<i>Romensky</i>	456.8	496.8	-40.0	0.919	14.975
<i>Seredino- Budsky</i>	81.1	85.3	-4.2	0.950	5.175
<i>Sumsky</i>	299.7	315.9	-16.2	0.948	5.057
<i>Trostryanetsky</i>	146.4	165.7	-19.3	0.883	4.719
<i>Shostkinsky</i>	109.4	112.9	-3.5	0.968	5.462
<i>Yampilsky</i>	49.6	55.8	-6.2	0.888	2.338
<i>In the region</i>	3494.7	3996.4	-501.7	0.895	7.794

region, since their relative share in total grain sales is significantly less than 8%. Such districts as Okhtyrky (0.788), Lypovodolynsky (0.807), Velykopysarivsky (0.851), Putyvlsky (0.875), Nedrygailivsky (0.876), Trostianetsky (0.883), and to the same extent Burynsky and Yampilsky (0.888) use their production potential least of all.

Among the main potential grain producers in the region, Sumsky (0.948) and Romensky (0.919) districts use their potential to the greatest extent.

The level of self-provision of the districts of Sumy Region with grain products has been calculated by comparing the potential of manufacture of the main types of products, and taking into account the net yield of products with the

rational nutritional standards. Based on the research findings, it has been established that the food potential of Sumy Region makes it possible to provide the population with grain products that 7.794 times exceeds the demand for them. Yampil'sky, Krolevetsky and Trostianetsky districts have the smallest indicator of self-provision – 2.338, 3.123 and 4.719, respectively. However, given the fact that the food capacity of Lebedynsky, Romensky, Burynsky, Lypovodolynsky and Glukhivsky districts more than ten times exceeds the demand, the issue of self-provision is solved at the adequate level.

6. Assessment of the grain potential of European Union

Before the evaluation of the grain potential of European Union we have to learn about the structure of the land in this region.

Agriculture, forestry, industry, transport, housing and other services use land as a natural and/or an economic resource. Land is also an integral part of ecosystems and indispensable for biodiversity and the carbon cycle. Land can be divided into two interlinked concepts:

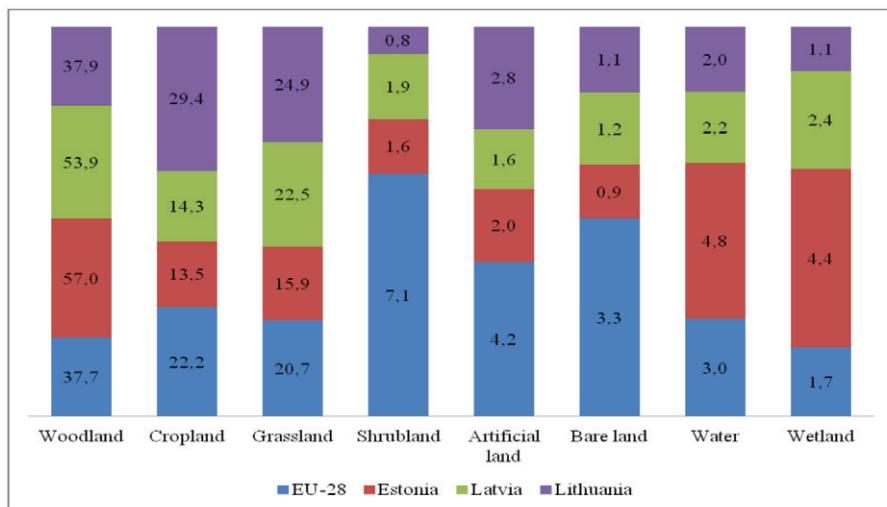
- land cover refers to the biophysical coverage of land (for example, crops, grass, broad-leaved woods, or built-up areas);
- land use indicates the socioeconomic use of land (for example, agriculture, forestry, recreation or residential use).

Land cover and land use data form the basis for spatial and territorial analyses which are increasingly important for:

- the planning and management of agricultural, forest, wetland, water and urban areas;
- nature, biodiversity and soil protection, and the prevention and mitigation of natural hazards and climate change.

Forests and other wooded areas occupied more than one third (37.7 %) of the total area of the EU-28 in 2016, while more than one fifth of the total area was covered by cropland (22.2 %) and by grassland (20.7 %). The remaining types of land cover in the EU-28 were much less prevalent, as shrub land occupied 7.1 % of

the total area, followed by artificial land — which includes built-up areas, roads and railways — which had a 4.2 % share. The lowest shares of EU-28 land use were recorded for bare land (3.3 %), water areas (3.0 %) and wetland areas (1.7 %) (picture 3) (Agricultural statistics of EU-28, 2017).



Picture 3. Main land cover by land cover type, 2016 (% of total area)

Using the proposed methodology, we can calculate the grain potential for EU-28, Estonia, Latvia and Lithuania like we have done for the Sumy Region of Ukraine (Table 7).

According to the calculations the main potential grain producers between these countries have Lithuania.

By comparing the grain potential of the Baltic countries and the Sumy region, it can be stated that this indicator is higher in Ukraine. This is due to the fact that agriculture in the regions of Ukraine has developed better than in the Baltic countries (Mushtay, . Shumkova, 2017).

Cereal production is a strategic sector of the Ukrainian economy, since grain is the basis of the stability of the food market, therefore the issue of grain crops production is extremely important, especially in the context of the global food crisis. It is not only a source of bakery products, but also a forage base for the

Table 7

Grain potential of the Eu-28, Estonia, Latvia and Lithuania

Country	Area of adjusted arable land, ths. ha	The share of sowing area in the area of arable land	The coefficient of marketability	Potential yields, c/ha	Potential gross tax, ths. t.	Grain potential, ths. t.
<i>EU-28</i>	96010,2	0,511	0,862	44,05	42290,75	36454,62
<i>Estonia</i>	58384,6	0,498	0,541	26,94	15729,85	94,10
<i>Latvia</i>	61844,4	0,477	0,581	27,71	17139,37	147,68
<i>Lithuania</i>	127148,6	0,482	0,590	28,44	36158,52	308,17
<i>Average value</i>	82459,2	0,486	0,571	27,70	23009,24	183,32

production of livestock products, as well as raw materials for the processing industry.

Natural-climatic conditions and fertility of the land of Ukraine make it possible to obtain high-quality food grain in amounts sufficient to meet domestic needs and to form export potential.

Grain production is a priority area of agricultural development in the country (Lyshenko, 2018). In the period from 2000 to 2014, the production of grain crops in Ukraine as a whole and in the Sumy region, in particular, increased by 2.2 and 2.3 times respectively. It should be noted that the growth rate of grain production in the period 1960-1990 was higher than in the period of 1990-2016. In the structure of gross production of crop production (at constant prices in 2010), at agricultural enterprises of Ukraine, the share of grain crops is 65, 7%. The main cereals crops grown by agricultural enterprises in the Sumy region are winter wheat, spring barley and corn for grain. It should be noted that the production of grain in modern conditions requires significant costs. The results of researches show that for 2010-2016 in general in agricultural enterprises for production of grain was directed to 33,2% of production costs. At the same time, the value of grain production for the state and agricultural enterprises is explained by the fact

that grain forms the basis of food security of the country and provides more than 55% of proceeds from the sale of crop production for 2010-2016. in agricultural enterprises. The study of cost recovery showed that in agricultural enterprises of Ukraine during the investigated period there was a decline in the level of payback of expenses on revenues for grain production from 1.64 in 2000 to 1.15 in 2016, 49%. Factors that shape the payback index grew: the cost of 1 ts grain - 5 times, the price of 1 ts - 3.5 times. The share of proceeds from grain sales exceeds the value of the structural cost index, and therefore, grain production is appropriate for most agricultural enterprises, which allows even profits to flow under difficult weather conditions. The Sumy region is one of the important regions of the country in the production of grain, where the gross production of cereals in the structure of gross national taxes varies from 2.6% in 2006 to 5.8% in 2011.

The production of grain in Ukraine for a long period of time is one of the main places in the development of agriculture as an industry that is of paramount importance in ensuring food security of the state, serves as a raw material base for the manufacture of many industrial products, is an important source of fodder resources for livestock development, plays a role determining role in the formation of export supplies of food products. In 2016, compared with 2012, the area of grain in Ukraine decreased by 1048 thousand hectares. This was due to the reduction of areas under bright crops by 1689 thousand hectares, although the area under winter increased by 641 thousand hectares (Table 8).

It is worth noting that the yield of main crops in Ukraine, despite the steady growth in recent years, still lags behind productivity in most developed countries. In particular, according to the Association "Ukrainian Agribusiness Club" (UCAB), the rate of productivity growth in Ukraine is repeating the world trends

of 10 years ago. In the past five years, the yield of corn in Ukraine has increased from 4.5 to 6.05 t / ha, sunflower - from 1.5 to 1.92 t / ha, and rape - from 1.5 to 2.4 t / ha . However, such indicators, according to UCAB, were observed in Europe in 2000-2005. The main reason for this development in the association is called the slow pace of use of modern technological approaches,

Table 8

Dynamics of sown areas in the context of grain crops, thousand hectares

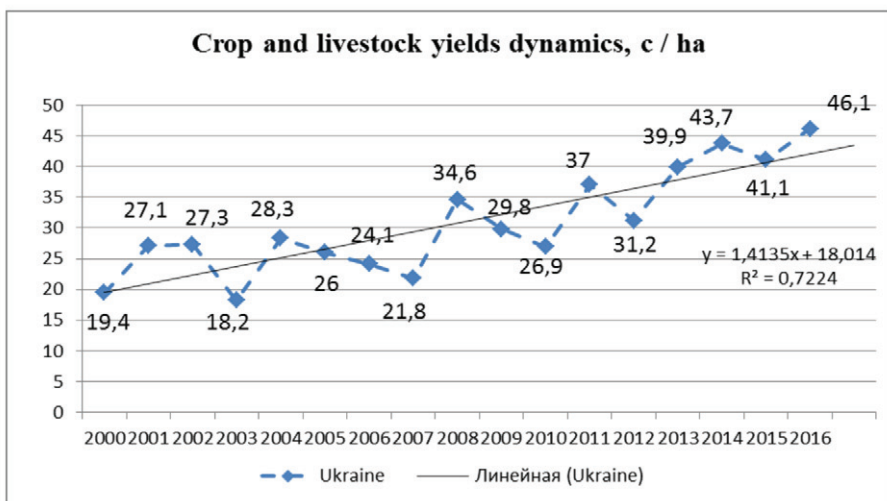
Cultures	2012	2013	2014	2015	2016	Deviation (+ ; -)
<i>Cereals and legumes</i>	15449	16210	14801	14739	14401	-1048
<i>winter</i>	6537	7891	7174	7904	7178	641
<i>wheat</i>	5534	6525	5898	6696	6028	494
<i>rye</i>	302	282	185	150	144	-158
<i>barley</i>	701	1084	1091	1058	1006	305
<i>yarrow</i>	8912	8319	7627	6835	7223	-1689
<i>including</i>						
<i>wheat</i>	238	159	163	171	190	-48
<i>barley</i>	2724	2275	1950	1768	1861	-863
<i>oat</i>	310	252	247	213	209	-101
<i>corn for grain</i>	4625	4893	4691	4123	4286	-339
<i>millet</i>	191	98	103	112	109	-82
<i>buckwheat</i>	300	189	140	133	154	-146
<i>Fig</i>	26	24	10	12	12	-14
<i>legumes</i>	318	280	227	250	324	6
<i>of them peas</i>	219	189	154	170	240	21
<i>vetch</i>	18	12	12	14	13	-5

high-yield varieties and seed hybrids (Poticha, 2015).

The yields of grain and legume crops in all categories of Ukrainian farms during 2000 - 2016 were unstable and fluctuating annually (Picture 4).

Experts estimate that the potential of wheat crop in Ukraine is used by 42%, barley is 36%, corn - 49%. Crop yielded in 2016, when yields increased for all types of grain. Fluctuations in yields of grain and leguminous crops both in the country as a whole, and in areas that cause corresponding fluctuations in the value of the gross harvest of cereals, are associated with changes in economic conditions, complex weather and climatic conditions, low quality of sowing material, the use of old low-yield varieties grain crops, insufficient use of mineral and organic fertilizers and plant protection products, insufficient material and technical support of farmers.

Researchers of the grain economy of Ukraine noted that the main factor in reducing yields, production volumes and grain quality over the years was a sharp



Picture 4. Dynamics of grain yield and leguminous crops in Ukraine, c / ha

Source: built on data (Crop, livestock and provision of services in crop and livestock production)

decrease in the volumes of mineral and organic fertilizers. Compared to the European Union countries, Ukrainian farmers are using fertilizers about three times less, and several times less the means of plant protection. Recently, there has been a tendency to reduce the amount of mineral fertilizers (Table 9).

Table 9

Introduction by agricultural enterprises of mineral and organic fertilizers
under grain crops on 1 hectare of sown area

Fertilizers	2012	2013	2014	2015	2016	Deviation (+ ; -)
<i>Mineral, kg</i>	90	111	88	93	79	- 11
<i>Organic, t</i>	0,5	0,4	0,5	0,5	0,5	-

Source: calculated on the basis of data (Official site of the State Statistics Service of Ukraine)

Thus, in 2016, agricultural enterprises made grain and leguminous crops less than 2000 in terms of 1g of sown area per 11kg of mineral fertilizers, but the price is 29% less than the same indicator for 1990 (Yaremchuk, 2014).

In addition, agricultural commodity producers not only reduced the introduction of mineral and organic fertilizers, but also violated their scientifically based ratio. While the introduction of mineral fertilizers is gradually restored to scientifically based indicators, the low level of organic fertilizer use remains practically unchanged. In the average in Ukraine, in 2010, only 0.5 t / ha of organic fertilizers was introduced against 8.6 t / ha in 1990 (Sabluk, 1997).

The main reason for reducing the introduction of organic fertilizers is a catastrophic reduction in the number of cattle in all categories of farms. All this caused an aggravation of the problem with the balance of nutrients (nitrogen, phosphorus, potassium). Each year, the cost of nutrients for the production of crops is five times higher than their income to the soil, which reduces yields and leads to degradation of agricultural land. Studies have shown that 13% of the crop area remains at all without any fertilizers, and the share of the area fertilized with organic fertilizers does not exceed 2.7% (in corn) (Table 10).

In January 2017, the sale price amounted to 3768.3 UAH. / t, whereas in 2016 for the same period amounted to UAH 3278.7. for 1 ton due to the economic and political crisis in the state (Picture 5).

Therefore, in the period when the price increase is most profitable to sell the grain, but the problem lies in its storage until this period.

The dynamics of prices for agricultural products depends on a number of factors and has a seasonal nature. In particular, the growth of prices for legumes and oilseeds is due to the cost of their storage and the harvest times of July-August.

Territorial peculiarities of the value of agricultural raw materials depend on the factors of pricing that are inherent in a particular area. The main ones are agroclimatic conditions, fuel cost, crop yields, availability of storage facilities, ultimately logistic solutions and supply-demand compliance.

The formation of the value of grain and legume crops is most influenced by the matching of supply and demand, as evidenced by the maximum indicators of the Crimea - 2007, 60 UAH / 1, Dnipropetrovsk - 2171.0 UAH / 1, and the minimum in Chernihiv 1525.7 UAH ./1t. and Sumy - 1597.4 UAH / 1 ton. areas.

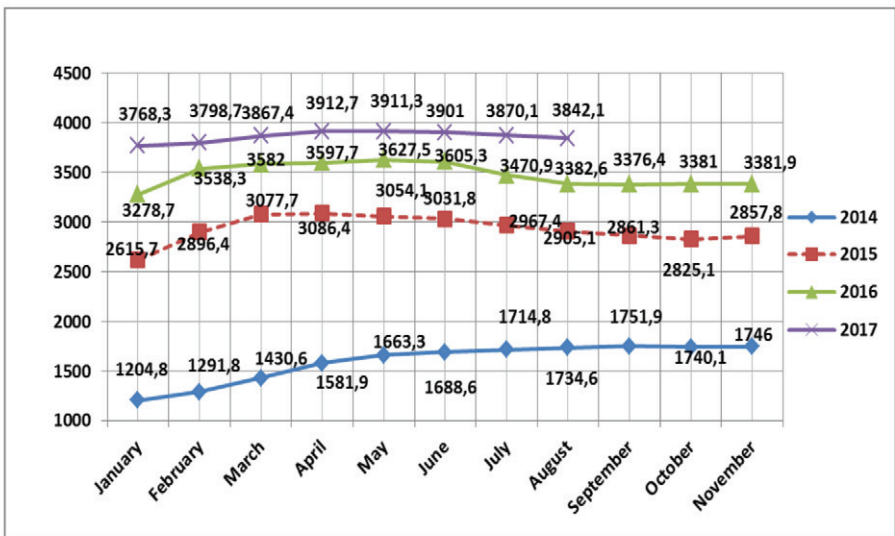
Table 10

The introduction of mineral and organic fertilizers and the area under cultivation in 2016

Area	Mineral fertilizers (in nutrients)				Organic fertilizers		
	of all	including			on 1 square	of all	on 1 square
		nitrogen	phosphate	potassium			
thousands of quintals	thousands of quintals	thousands of quintals	thousands of quintals	kg	thousands of tons	tons	
2016							
<i>Under crops of agricultural crops - all</i>	14119,9	9835,3	2224,3	2060,3	79	9636,3	0,5
<i>incl. grain and leguminous crops (without corn)</i>	5759,1	4383,7	755,9	619,5	80	2332,5	0,3
<i>of them for wheat</i>	4630,9	3564,9	587,9	478,1	89	1864,4	0,4
<i>Fig</i>	23,4	20,4	2,2	0,8	202	–	–
<i>corn for grain</i>	3423,1	2567,8	432,4	422,9	112	2287,3	0,8
2015							
<i>Under crops of agricultural crops - all</i>	17244,0	11949,8	2860,9	2433,3	96	9132,5	0,5
<i>incl. grain and leguminous crops (without corn)</i>	6977,4	5327,7	916,1	733,6	102	2025,4	0,3
<i>of them for wheat</i>	5320,0	4117,5	668,7	533,8	114	1556,7	0,3
<i>Fig</i>	23,7	20,4	2,6	0,7	198	–	–
<i>corn for grain</i>	4106,8	3070,8	561,5	474,5	130	2249,5	0,7

Source: calculated on the basis of data (Statistical Yearbook of Ukraine)

Proceeding from the considered indicators of dynamics and geography of prices for agricultural products in 2013, it should be noted that the main conditions for their formation are the attraction to the sources of production and processing capacity, the matching of supply and demand levels. The agricultural sector has significant unexploited production potential, which currently lacks effective management, support of state target programs, favorable long-term investments, but is hindered by excessive price regulation, the dominance of imported raw



Picture 5. Dynamics of average prices for sales of grain and legumes in Ukraine in 2014-2017, UAH / ton

Source: built on data (Statistical bulletin "Realization of agricultural products")

materials and numerous intermediaries in the movement of raw materials to the consumer.

According to the Food and Agriculture Organization of the United Nations (FAO), the grain price index declined by 1.4% in December last year, compared to November, and is the lowest since August 2010. In general, in 2013, the average value of the grain price index decreased by 7.2% in comparison with the previous year.

The decrease in prices was influenced by a significant increase in grain production. Gross grain production has increased in Ukraine and in most countries of the world, especially in the USA and South America. Reducing prices, in turn, negatively affected the profitability of Ukrainian companies. In addition, there was an increase in the normative monetary valuation of land, which led to an increase in rent. Other production costs increased, in particular for seeds, plant protection,

mineral fertilizers (Statistical bulletin "Realization of agricultural products").

Therefore, in the period when the price increase occurs, it is most profitable to sell the grain, but the problem lies in its storage until this period.

There are two problems on this issue: firstly, there is a lack of storage capacity for grain in Ukraine. According to the latest data, over 650 certified grain storage facilities with a capacity of about 31-32 million tons currently operate in Ukraine. The 2nd problem is the cost of storage on elevators. It is quite high for a commodity producer. Of course, it is more profitable to keep the grain to the best of times, but for this you need to have your own grain storage, where the cost of storage will be almost 2 times cheaper than on elevators. In 2014, the price situation in the grain market of Ukraine. is completely different from the trends and indicators of past years and has a tendency to steady increase from February to August, even if the sales volumes for July-August are the highest in 2014. Thus, in Ukraine there is an increase in sales, which directly affects the price of grain sales. On the one hand, the increase in market volume is positive, but on the other hand, the increase in grain production can cause serious problems for market participants.

After all, grain market participants are faced with a number of problems today: in Ukraine, there is not enough capacity to store grain. That is, even with a grain yield of 58 million tons and oilseeds at a level of 13 million tons (totaling more than 71 million tons) there is a significant shortage of storage tanks; Ukrainian ports can pass for export to 2.8-3.0 million tons of grain per month (except for the winter period). Therefore, with increasing production it is necessary to increase logistic capacities. The transport system remains a problematic issue, as today in Ukraine there are about 10,800 grain carriages, of which 1,5-1,7 thousand are leased in the CIS countries and about 1,5-1,6 thousand - on planned repairs. As a rule, the increase in grain yield leads to lower prices, and the current season has not been an exception. In the last 10 years, when the crop in Ukraine declined, there was an increase in profitability. The only exceptions were the periods when the global grain balance became more complicated, the world's transitional grain

stocks declined, and there was a high demand for Ukrainian grain. This year, almost all major grain exporters are expecting high yields, which is why domestic companies will have to face fierce competition for sales markets.

The rules of exchange trading on the Agrarian Stock Exchange, as amended by the Order of the Agrarian Fund dated December 18, 2012, No. 166, ensure: maximum simplification of the search for the market of sales and suppliers; - transparency of market pricing; freedom of brokerage (more than 50 brokerage offices became members of the Agrarian Exchange); free and qualitative consultations of specialists of the Bidding and Legal Department on market conditions, procedures for entering into contracts, resolving disputes and other issues related to stock trading; the organization of public procurement of agricultural products (Ganganov, 2008).

Calculations have shown that the share of grain income from the income of crop production has steadily increased during the period under investigation from 51.2% in 2009 to 61.6% in 2016. Analysis of the structure of agricultural enterprises' expenditures on crop production has shown that the largest share in the structure expenses include mineral fertilizers (18.4%), payments for services and works performed by outside organizations and other material expenses (15.3), petroleum products (12.7), seeds and planting material (12), land rent (10.4%). Labor costs accounted for only 8% of total expenditures (together with deductions for social measures - 10.9%), which may indicate an underestimation of the labor of agricultural workers and a lack of motivation for effective work. Comparison of the volume and cost structure of the main grain crops of the region (wheat, rye, corn, barley) in 2016 confirmed the revealed pattern and showed the prevalence of costs for mineral fertilizers and petroleum products in all grain crops (Table 11).

Gradually, the use of plant protection products by agricultural producers in the region is increasing: insecticides (by 1% during 2016), fungicides (21), herbicides (200), defoliants (by 23 times), which will contribute to the growth of grain yields (Statistical Yearbook of Ukraine).

At the same time, the analysis showed that the problem of grain farming is

Table 11

Costs for the production of the main types of grain products by elements in 2016, UAH million.

Articles of expenditure	Wheat	Rye	Oats	Barley	Corn for corn
<i>Costs - all</i>	40666,5	377,8	330,7	9918,7	39747,6
<i>including direct material expenses</i>	27622,1	276,1	220,5	6721,7	27229,4
<i>of them seeds</i>	3053,3	43,9	36,6	866,3	5771,2
<i>mineral fertilizers</i>	10373,5	89,3	54,9	2277,0	7159,4
<i>fuel and lubricants</i>	4045,8	50,8	51,7	1197,4	3339,9
<i>payment for services and work of outside organizations</i>	3921,9	43,9	28,9	814,5	5601,2
<i>other material expenses</i>	6227,5	48,2	48,4	1566,6	5357,7
<i>Direct labor costs</i>	1897,3	24,9	23,5	524,2	1653,1
<i>Other direct expenses and total production costs - total</i>	11147,1	76,8	86,8	2672,9	10865,1
<i>Of these, depreciation of non-current assets</i>	2157,1	19,3	18,1	576,5	1677,7
<i>deductions for social events</i>	445,3	5,8	5,5	118,5	378,6
<i>The rest of the direct and total production costs</i>	8544,7	51,7	63,2	1977,8	8808,8

Source: (Statistical Yearbook of Ukraine)

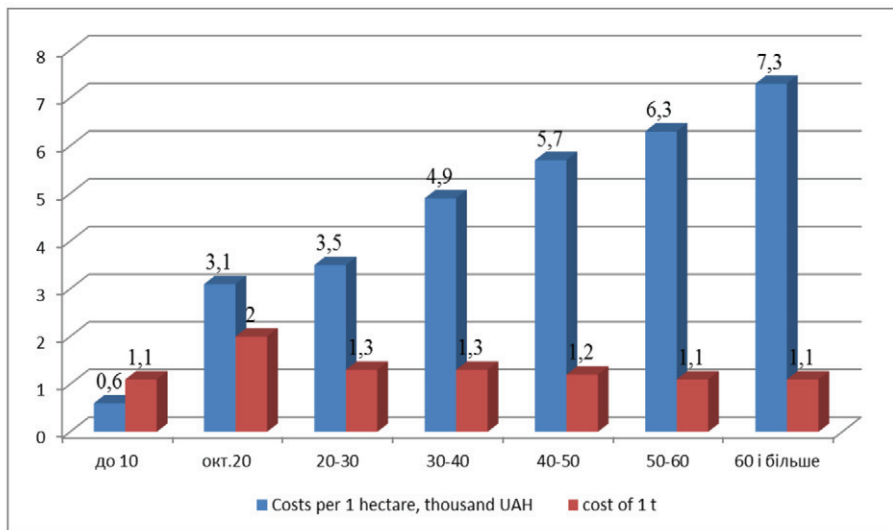
the use of old varieties, notes that over the past ten years, the average shortage of grain in Ukraine due to the use of old varieties amounted to more than 2.5 million tons, and their share in the structure of grain increased to 40% (Lisikova, 2009).

At the same time, the analysis showed that the problem of grain farming is the use of old varieties, notes that over the past ten years, the average shortage of grain in Ukraine due to the use of old varieties amounted to more than 2.5 million tons, and their share in the structure of grain increased to 40% (Lisikova, 2009).

Old non-productive, low-resistant varieties, unstable to extreme conditions and diseases, reduce the yield of grain crops. Therefore, the agrarian service of the region should intensify the work on timely sorting and sorting.

We also investigated the patterns of crop impact on the cost of 1g and the cost of agricultural enterprises directly in the climatic zones, in particular the forest-steppe zone, where the Sumy region is located. It has been found that there

is a certain relationship between these indicators. In the agricultural enterprises of the Forest-Steppe zone, in the chosen gradation, the proportionality of the growth of costs and productivity is observed, namely, 1% of the increase in yield provides 0,005% reduction in the cost price of wheat (Picture 6).

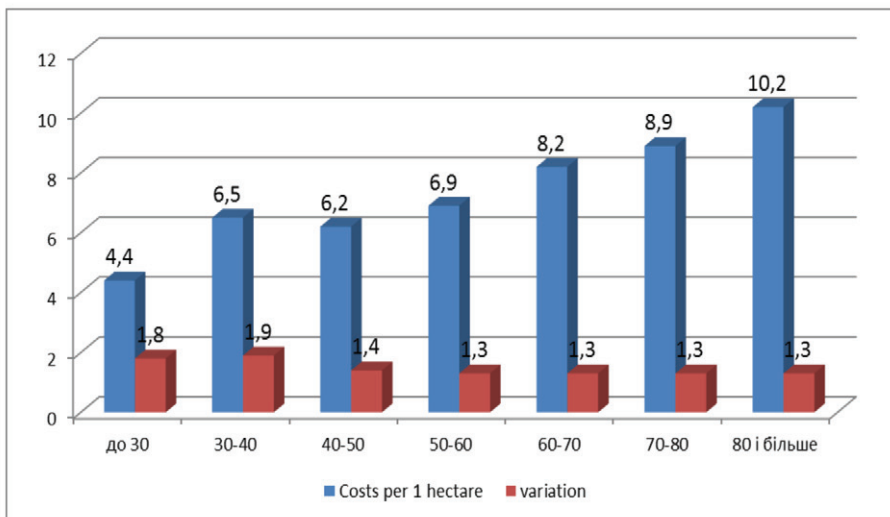


Picture 6. Variations in the cost and cost of wheat in agricultural enterprises, depending on the yield in 2016

Source: built according to (Official site of the State Statistics Service of Ukraine)

Similar studies have been conducted on corn. Variations in costs and costs in different natural and climatic zones of corn cultivation in agricultural enterprises are more evenly dependent on yield. Variations in costs and costs in the forest-steppe zone are shown in picture 7.

Grain economy not only determines the level of development of the agricultural sector of the country, but also has an impact on many other sectors of the economy. Grain production should provide rational standards for the consumption of bread products (bread and pasta products in terms of flour, cereals, flour, legumes), create conditions for extended reproduction in the field (seeds),



Picture 7. Variations in the cost and cost of corn in agricultural enterprises, depending on yield, 2016

Source: built according to (Official site of the State Statistics Service of Ukraine)

provide forage livestock industry, produce raw materials for processing for non-food purposes and bioethanol etc. The satisfaction of the nationwide domestic demand led to a significant increase in grain exports, which continues to grow, with a prospect of reaching 36 million tons by 2017.

According to the calculations of the main directions of the socio-economic development of the state, aimed at gradual improvement of the quality of food supply, Ukraine is expected to increase the cost of grain for feed purposes to maintain and increase the stock of livestock and poultry in all categories of farms. In particular, it is assumed that the production of meat (in slaughter weight) per capita in the region should increase to the level of the average in Ukraine to 44.9kg, and in 2020 - to 50kg. Taking into account the above, according to our calculations, the grain balance in Ukraine has the following indicators, which are given in table. 12. In the conditions of growth of production and stable demand for grain for consumption, it is expected to increase the cost of grain for feed,

Table 12.

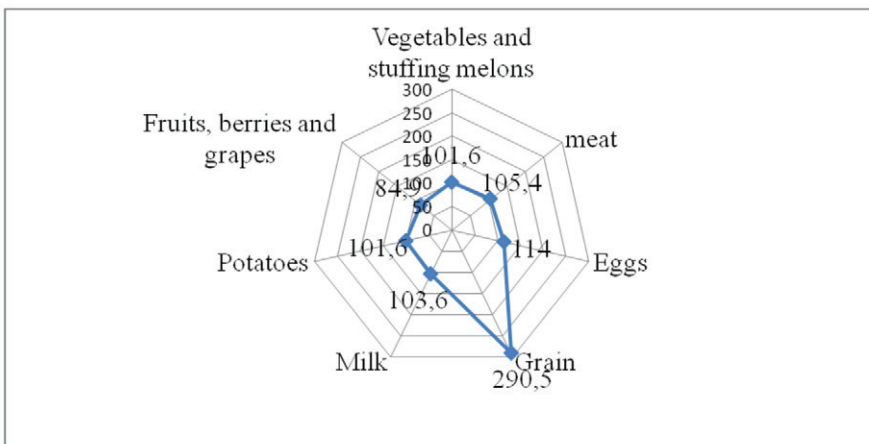
Balance of grain and leguminous crops, thousand tons (including cereal conversion products)

Indexes	2000	2005	2010	2012	2013	2014	2015	2016
Production	24459	38016	39271	46216	63051	63859	60126	66088
Change of stock at the end of the year	1329	-314	-2054	-10052	6933	2977	-3204	2130
Imports	1010	226	175	228	242	263	190	240
Total resources	24140	38556	41500	56496	56360	61145	63520	64198
Export	1330	12650	14239	27798	27836	33423	38338	41451
Spent on sowing	3597	3294	3222	2953	2890	2883	2597	2330
Spent on food	11056	13817	14787	16147	16183	15678	14189	12278
Losses	309	375	794	1491	1506	1593	1400	1350
Processing for non-food purposes	100	670	1650	1454	1367	1281	1089	1044
The consumption of grain is consumed	7748	7750	6808	6653	6578	6224	5897	5745
Consumption Fund bread products	6141	5817	5106	4990	4933	4668	4423	4309
in terms of 1 person, kg	124,9	123,5	111,3	109,4	108,4	108,5	103,2	101,0

Source: (Crop, livestock and provision of services in crop and livestock production)

processing for non-food purposes, especially for export needs (from 800 thousand tons in 2010 to 1200 thousand tons in 2020) (Crop, livestock and provision of services in crop and livestock production).

During the study, it was found that growing grain processing for non-food purposes and reducing the cost of crops. An analysis of the balance of grain and legume crops showed instability of their production and consumption. Such unstable dynamics are observed in the export and import of cereals. These are almost the only products in which per capita consumption over the last five years exceeds the norm, although per capita consumption of cereal products tends to decrease, as well as the cereal consumption fund (Picture 8). Negative is the increase in imports of cereals in 2013 by 38% compared to 2010 and by 6% compared to 2012. Exports of cereals for export in 2013 amounted to 49.4%, animal fodder - 28.7%, direct consumption of population - 11.7%, and losses and processing for non-food purposes - equal 2.7% and 2, 4% respectively.



Picture 8. Level of self-sufficiency of main types of agricultural products in 2016

Source: built according to(Official site of the State Statistics Service of Ukraine)

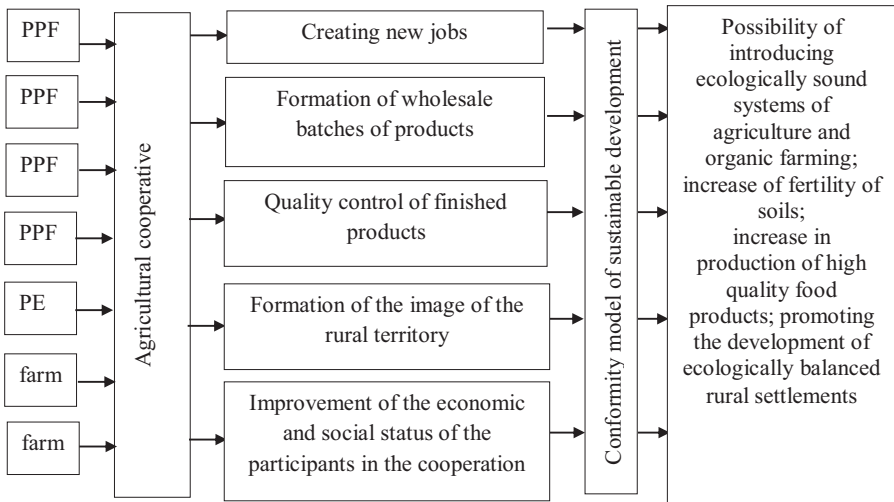
The conducted studies have shown that the formation of a competitive agrarian sector of the region, whose activities would meet the needs of producers and consumers, is possible only under the conditions of an integrated approach to the problems of agricultural producers. The use of an integrated approach provides an opportunity to find ways and means to increase the effectiveness of agroformation development, maximize their rapprochement with all spheres of agribusiness and develop strategies for sustainable development of grain production using the service cooperatives. The development of such strategies is a central unit of the system for regulating sustainable agricultural development, which takes into account existing opportunities for the development of the agrarian sector and threats that may hinder their implementation (Makarenko, 2018).

The policy of sustainable development in the agrarian sector requires a gradual transition from non-renewable to renewable resources, the introduction of such processes that have a minimal impact on the environment. The programs of sustainable agriculture and rural development of the regions are to increase the level of food production and food security. To address this challenge, it is

necessary to support educational initiatives, stimulate the use of economic innovations and promote the development of new technologies, thus ensuring a stable access to food products, in accordance with the human needs in nutrition elements; access to them for poor groups; development of commodity production; reducing unemployment and raising income levels to combat poverty; management of natural resources and environmental protection (Organizational and economic regulation of the grain market in conditions of sustainable development, 2018).

Consequently, on the path to sustainable development of the region, based on three components (economic, ecological and social), there is a need to balance social, environmental costs with economically viable economic activity. Social costs, in turn, are aimed at achieving certain material and intangible benefits.

If we analyze the models of modern agricultural production and their conformity to the model of sustainable development, one can confidently say that the cooperative form of agricultural production is the most optimal (Picture 9).



Picture 9. Compatibility of agricultural cooperatives model of sustainable development of the region

The cooperative model of agricultural commodity production provides the opportunity for cooperatives to increase grain production, to ensure the economic

efficiency of production, which will enable to stimulate expanded reproduction. The social component of cooperative development includes raising the level and quality of life of peasants, stabilizing demographic and migration processes. However, it should also be noted that today the cooperative formations are not able to fully act as catalysts for the sustainable development of agricultural production and rural areas due to the lack of sufficient financial resources and comprehensive support from the state in the development of agricultural co-operation (Makarenko, 2018).

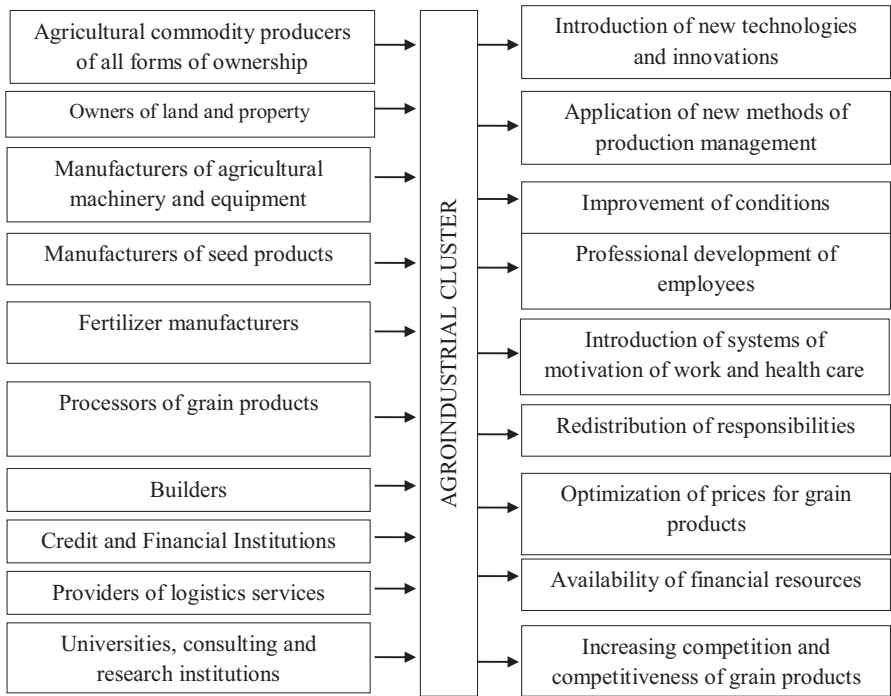
It should also be emphasized that there is a high resource intensity, low level of mechanization and automation of production processes, imperfect marketing and management systems, low productivity, decline of procurement sectors, problems of wholesale and retail pricing policies, slow wholesale development, inherent in the overwhelming number of cooperative formations.

Therefore, one of the areas of increasing the competitiveness of all types of Ukrainian cooperation is the creation of clusters that can combine the material, monetary and labor resources of all types of cooperatives and other agricultural commodity producers at regional levels (Picture 10).

Clusters increase innovation activity, productivity, profitability, competition based on innovation achievements among small and medium-sized enterprises, which form the basis of cooperative movement, and therefore, it can be assumed that the creation of clusters through the grouping of cooperative formations and agricultural enterprises is a rather progressive process. the steady development of the agro-industrial sector in the region.

We have developed the model of the links of the regional agro-industrial cluster. The number of such units can be quite large and depends on the specific regional features and capabilities of integrators. The cooperation of the cluster link participants takes place on mutually beneficial terms.

The formation of clusters is the integration of enterprises, industries, complexes, etc. Necessary conditions for integration processes are the presence of an integrator (a legal entity that can initiate and organize the implementation of the

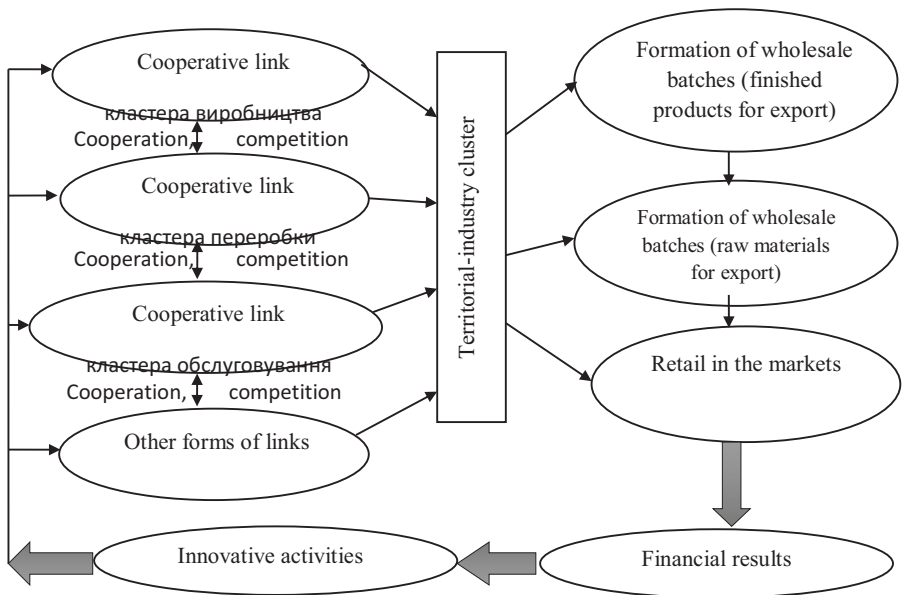


Picture 10. Possible participants in the agro-industrial cluster and the benefits of its creation

integration process). The system of consumer co-operation can act as an integrator of the cooperative sector of the Ukrainian economy, since it is the most organized and most widespread (Makarenko, 2016).

The cluster as the most effective form of achieving a high level of competitiveness is the union of various organizations (agricultural and industrial enterprises, research centers, public authorities, public organizations), which allows us to take advantage of two ways of coordinating the economic system - the intra-firm hierarchy and market mechanism, which gives the ability to more quickly and efficiently distribute new knowledge, scientific discoveries and inventions, which in turn improves the overall socio-economic In the region of the territory of which the cluster functions.

The cluster production structure synthesizes the effect of synergy arising from the general standardization of products. Thus, all members of the cluster receive additional competitive advantages under the influence of the combined effect of scale effects, coverage and synergy. The mechanism of their influence is as follows: non-profit cluster enterprises have the opportunity to move the lower profitability margin with the help of specialization, which ensures increased productivity and lower production costs. We have developed a structural scheme for the functioning and development of a regional agro-industrial cluster (Picture 11).

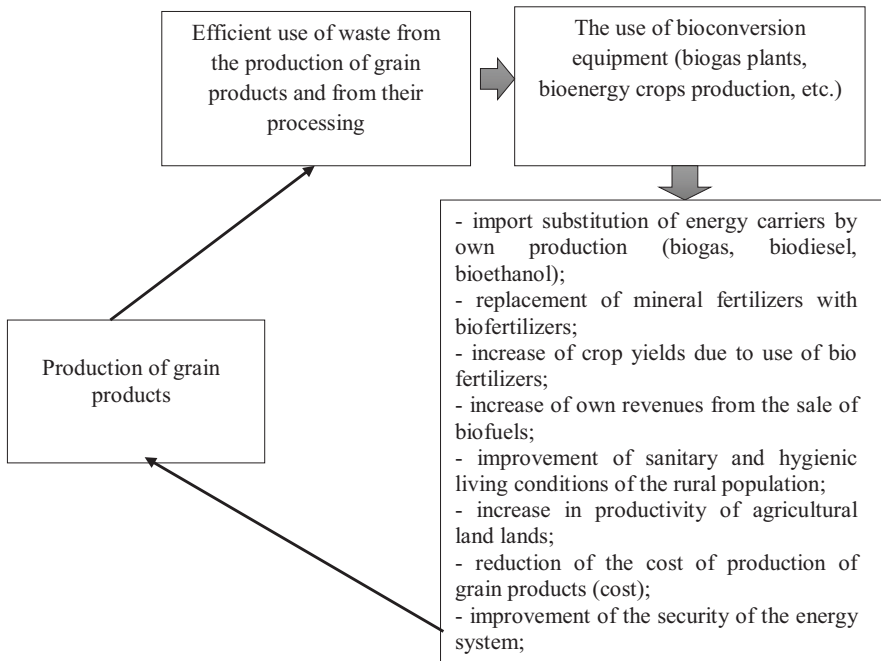


Picture 11. Functional scheme of the regional agro-industrial cluster

The innovative structure of the cluster contributes to reducing the total cost of research and development of innovations by increasing the effect of the production structure, which allows cluster participants to sustainably innovate for a long time.

Together with the production sector, the sustainable development of agro-industrial production involves paying much attention to environmental safety issues. Environmental costs are aimed at preventing environmental pollution and require the transition from non-renewable to renewable resources, the introduction of technological processes that would have a minimal negative impact on the environment.

Using a cluster model of the agro-industrial complex, we offer a scheme for a closed cycle of production of grain products (picture 12), which is based on a non-waste production cycle, minimizes the negative impact on the environment, and also increases the profit of the cluster participants.



Picture 12. The scheme of a closed cycle of production of grain products

Source: Built by authors

The calculation of the economic effect of the cluster created, the stage of cluster realization, is calculated as the difference between the sum of additional

results and the sum of additional costs for all cluster industries together (formula 3):

$$\Delta Ec = \left(\sum Rc_n - \sum Cc_n \right), \quad (3),$$

where ΔEc - an additional effect from the formation of the cluster, ths. hryvnias.

It should be noted that the formation of a cluster would be expedient if the additional effect of its activities has a positive result, that is, the effect of education should exceed the total effect of the activities of enterprises of the sectors of grain production using the same resources without the formation of the cluster. Consequently, an additional effect can be considered as motivation for the creation of a cluster for the grain industry, that is, the local effect.

The effectiveness of combining certain types of cooperation into clusters increases with the effect of synergy. It is calculated as the difference between the sum of the effects of the enterprises of the sectors of grain production after the formation of the cluster and the sum of the effects of the enterprises of the branches prior to its formation (formula 4):

$$Ec_c = \left(\sum \Delta Ec - \sum \Delta Ec_n \right), \quad (4),$$

where Ec_c - the synergetic effect between the cluster links, ths. hryvnias;
 $\sum \Delta Ec$ - the sum of additional effects from cluster formation by all cluster links, ths. hryvnias;

$\sum \Delta Ec_n$ - the sum of additional effects from the use of resources of all participating organizations without the formation of a cluster, ths. hryvnias.

Moreover, the profit from the activities of industries in the cluster must exceed the profit from the activities of enterprises of the sectors of grain production using the same resources without the formation of the cluster (Makarenko, 2018).

The expected results of implementing the strategy of sustainable agro-ecological development in the long-term perspective are food security of the state on the basis of ecologically clean food products, increase of the cost of land (ecologically clean), preservation of the environment, increase of employment of rural population, introduction of the system of biologization of grain production, increase of life expectancy and decrease health care costs, increase of competitiveness of agriculture in the international market x, growth of investment attractiveness of the agrarian sector for both domestic and foreign investors.

7. Conclusions

Summarizing the above, we believe that the priority direction of the region development should be an increase in the sales of agricultural products, given the specified potential of manufacture of agricultural food products. The solution to the problem of provision of the country and Sumy Region, in particular, with food is in the increase in the efficiency of agricultural land use. Taking the above mentioned into consideration, we consider it appropriate to transfer unused arable land to the full-fledged private and owner-operated farms, and private households. However, the large agricultural enterprises in the coming years should seek to play a more significant role in addressing the problems of food provision of the region, especially in grain crop.

Thus, the study of grain production indicators in Ukraine has shown that they are characterized by instability and fluctuate over the years of the investigated period, depending on the weather conditions and the availability of material and technical resources. This affects the supply and demand balance of grain and foreign trade indicators. The distribution of grain by agricultural enterprises occurs to a large extent through "other channels". The analysis of the grain market showed the prevalence of weaknesses and risks over strengths and opportunities. Accordingly, it is necessary to formulate a strategy for the development of the grain market, which envisages targeting the following priorities: optimization of land tenure and land use, saturation of the national market with affordable and

qualitative grain, improvement of the logistical support of agrarian formations on an innovative basis, creation of an efficient grain distribution system, development of export potential market development, agricultural risk insurance market development, effective price policy, transformation of income support policy agricultural commodity producers.

The developed structural scheme of the functioning and development of the regional agro-industrial cluster contributes to reducing the aggregate cost of research and development of innovations by increasing the effect of the production structure, which allows the cluster's participants to stably engage in innovative activity for a long time. The calculation of the economic effect of the cluster created, ie the cluster implementation phase, was proposed to be calculated as the difference between the sum of additional results and the sum of additional costs across all cluster sectors together. The formation of a cluster would be expedient if the additional effect of its activity had a positive result, that is, the effect of education should exceed the total effect of the activity of enterprises of the sectors of grain production using the same resources without the formation of a cluster.

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