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ФОРМУВАННЯ РИНКУ ЗЕРНА ТА ЙОГО ПЕРЕРОБКА ПІДПРИЄМСТВАМИ БОРОШНО-КРУП'ЯНОЇ ГАЛУЗІ АПК ВОЛИНСЬКОГО РЕГІОНУ

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GRAIN MARKET FORMATION AND ITS PROCESSING BY THE ENTERPRISES OF THE FLOUR-AND-CEREALS INDUSTRY IN VOLYN REGION

Objective. *The purpose of the article is to study the formation of the grain market and its processing by the enterprises of the flour-and-cereals industry of the agro-industrial complex in Volyn region*

Methods. *The main research results are obtained applying the complex general scientific and special methods of investigation: dialectical method of scientific knowledge, theoretical generalization, comparison, grouping and analysis.*

Results. *The article proposes an organizational mechanism for the formation of a logistics system of the flour-and-cereals industry based on the use of modern mathematical modeling methods to harmonize the relationships of participants. The main provisions on the system for improving inter-branch economic relations in the flour-and-cereals industry are considered on the basis of the proposed structure for the sale of grain. The practical significance of the results obtained is that sound proposals for the effective functioning of the flour-and-cereals industry in the region will help stabilize and further increase the production of competitive products to meet both the domestic needs of the region and participation in foreign trade.*

Key words: *grain market, flour-and-corn industry, agro-industrial complex, economic potential, grain supplies.*

Problem statement. Significant institutional transformations in the infrastructure of the food complex have led to the creation of new modern forms of processing enterprises of small size. Moreover, if in highly developed countries these processes are a scientifically based market marketing strategy, then in the conditions of the Ukrainian economy, these processes are mostly spontaneous. Important place in a number of different channels of implementation also belongs to wholesale markets, which play a leading role in price formation and are a kind of guideline when selling products through other channels of sales. Recently, the tendency of creation of small processing enterprises, which arise at places of production of raw materials and exert significant competitive pressure on large processing enterprises, clearly outlines.

The transformation of land and property relations in the countryside, the privatization of enterprises of the food industry, flour-groats and other branches of agroindustrial complex, have changed the nature of organizational and economic relations between the participants of the grain market in the process of its functioning. The system has become even less organized compared to the period of its public procurement, as a result of which numerous intermediary structures are used, the corresponding price levers do not work, and so on.

Analysis of recent research studies. The flour-groats sector plays a leading role in providing the population as well as other branches of the food industry with such socially significant products as flour and groats. The economic problems of processing enterprises of the flour-and-agroindustrial industry and food security were investigated in works of: R. H. Green [1], K. Eich-

er and J. Staats [2], V. B. Eide [3]. Flour and groats industry is the basis of the processing industry of agroindustrial complex, which is interdependent both from the provision of raw materials and consumer purchasing power. Considerable attention of scientists is given to the study of the factors influencing the economic stability of the processing enterprises of the flour-groats industry of agriculture, the allocation of its types in order to build a model for ensuring sustainable development in the long run. However, despite a significant range of practical, methodological, theoretical studies on this issue, the analysis of literature on this topic, revealed the lack of a unified approach to the assessment of the economic potential of processing enterprises, leaving the discussion points for further research. Therefore, there is a need for deep scientific research to find new approaches and methods for assessing the economic potential of processing enterprises of agroindustrial complex taking into account the established grain market in the region [4–8].

The objective of the article To study of the formation of the grain market and its processing by the enterprises of the flour-groats industry of the agroindustrial complex of the Volyn region.

Tick tock. The absence of any civilizational form of organizing the purchase of agricultural surplus in Personal peasant economy remains an obstacle to increasing their economic activity. Regional markets, which are more or less close to production directly, do not play their role, due to which significant volumes of commodity resources are used unproductively, and the commodity producer loses material interest.

In our opinion, the block of economic relations between economic entities and the state plays an important role in the flour-groats sector. It should be noted that the system of state stimulation and support of the agricultural producer, including in the field of plant growing, operating in recent years, is aimed mainly at solving secondary problems of the current nature. Different economic structures occupy their niche (channels of implementation) in accordance with the volume of offer and obligations arising in the process of repayment of loans, wages.

The current development of the economic potential of the enterprises of the flour-groats sector is characterized by ambiguous economic activity, which is dynamically changing, and in most cases not for the better. In order to meet the current level of market relations, reorientation of the stereotypes of the production and economic mechanism and the management system of the processing enterprise of the agroindustrial complex is necessary.

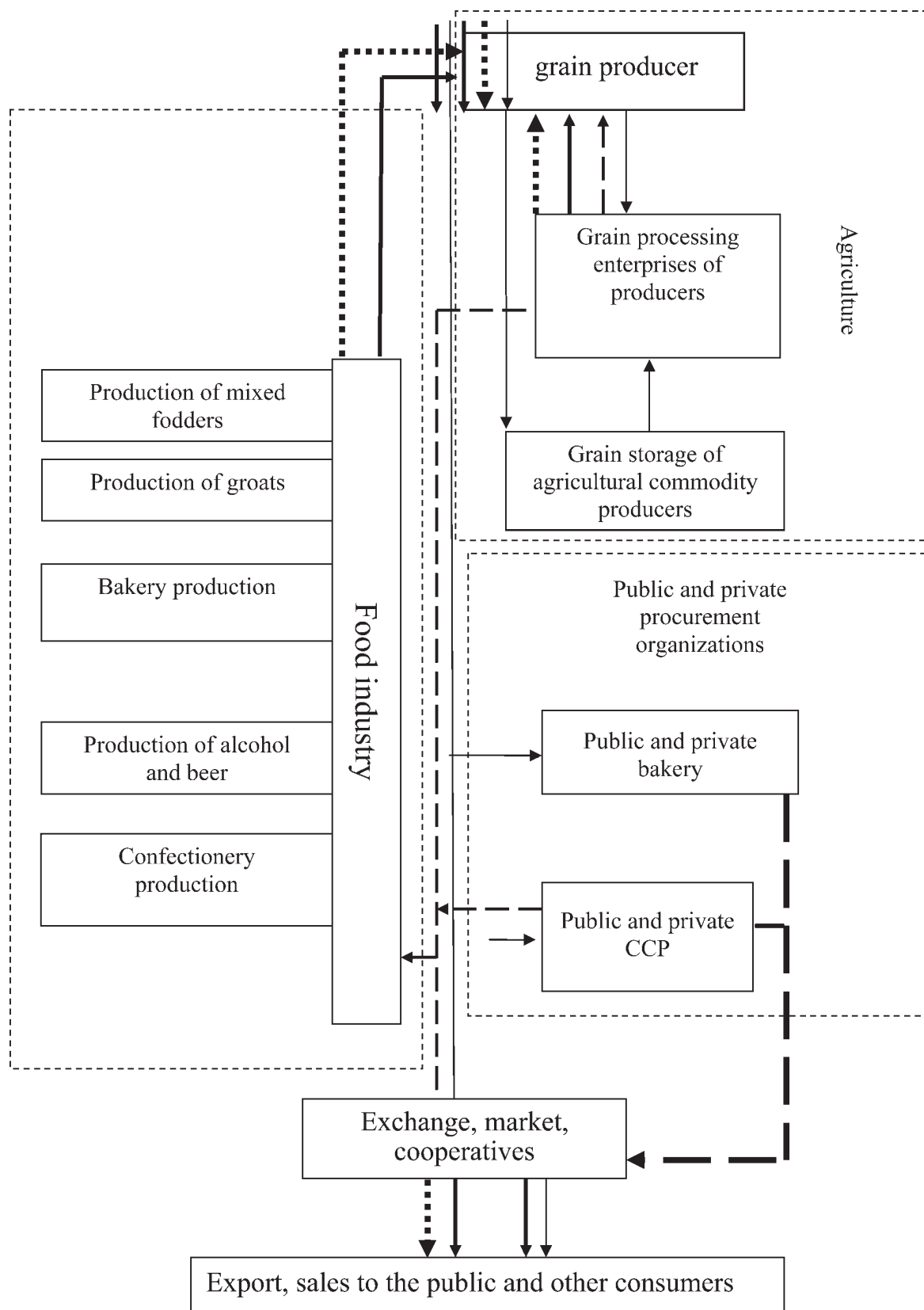
The implementation of the functions of public administration in the processing enterprises of the flour-groats sector has a number of significant shortcomings that affect the attractiveness of investment objects and in accordance with the economy of the industry. The author refers to:

- lack of a model of phased reformation of the agrarian sector of the economy;
- violation of intersectoral relations, parity of the equivalent exchange between agriculture and industry;
- formation of the market of goods and services without taking into account their socio-economic value;
- underestimation of the essence and importance of the agrarian sector in the Ukrainian economy.

The main problems of the functioning of the processing industry and the flour-groats industry, in particular in Ukraine, are: dependence on the complex market conditions, low solvency of the consumer of the shortage of funds for the purchase of finished products from the producer, there will appear on the market of a limited number of intermediaries, lack of support from the state, growth of receivables and creditor debts, shortage of working capital for technological and technical re-equipment, outdated and worn-out equipment with energy and resources, lack of working capital for back-up procurement of raw materials,, dependence on related branches of agroindustrial complex. Scheme of grain processing presents the general tendency of development of flour-mill production is investigated in drawing 1.

Coke-chemical production (CCP) was divided between state structures, which today operate under the name of PJSC «The state food and grain corporation of Ukraine», State Agency for Reserve and Ministry of Agrarian Policy.

Flour mills were designed in the times and for the needs of the planned economy. Imported grain was supplied and processed with the help of flour mills, and processed products were sup-



Drawing 1 — Grain processing scheme

plied to the Union republics. After the collapse of the USSR, the production chains were torn apart, and at least 70 large and medium-sized CCP began to look for other business models. In 2000, part of the CCP was transferred to the newly formed holding of the SJSC «Bread of Ukraine», the part was corporatized and was given to privatization.

But due to the production capacity of the CCP, which is aimed at processing not less than 100 thousand tons of grain per year, some of them have not found an effective business model of production. The capacity of only one CCP in one week can cover the monthly need of industrial consumers in the region. In the current market situation CCP loses in competition with small energy-efficient mills because they can not maneuver capacity. The cost of CCP for processing 1 ton of grain — 110 kW, while in the Turkish 100-ton mills — 60–80 kW.

Due to the continuous production of flour and the 7-storey construction of the CCP mills with relay automation, the continuous presence of workers on each floor in three changes is required. With such energy and human resources costs, the break-even point of production is practically impossible. The CCP, which are located closer to the ports, found a way out of the situation by exporting a large volume of grain products.

Parts of the CCP — for some time were the main reservoirs of grain for the state reserves, which due to sufficiently large elevators allowed to exist without large amounts of processing. But today, almost every CCP has debts for budget subsidies of the nineties of the last century for harvesting seeds. It does not allow to effectively draw working capital for production activities. The CCP, which did not find export channels, focused its economic activities mainly through the provision of grain storage and processing elevators. High yields and the lack of warehouses for grain storage allows to profitably work and partly subsidize unprofitable grain processing. But in the regions with a small volume of grain production and the lack of provision of producers with their own repositories, this type of activity is ineffective.

Customer service business model does not allow large CCP function effectively. Revenue from the provision of services alone does not fully cover the costs of enterprises. It also does not allow modernization of fixed assets that adversely affect the cost of services and with high competition in the market of elevator services, reduces their already low profitability. In order to generate profit, the CCP should be able to purchase rather large industrial volumes of grain during the harvesting season and, depending on the market conditions, implement it or recycle it, ensuring the profitability and financial sustainability of the enterprise to maintain the rhythm of production at the enterprises.

The government as the owner of the CCP for 25 years did not decide on the further development of processing enterprises. This problem is partly due to the preservation of strategic stocks of state-owned grain and the desire to maintain control over the production of flour in Ukraine. At the moment, all CCP are on the list of state-owned objects that are not subject to privatization, which impedes private investment in this branch of the economy. Although a good example of the effective use of assets of parts of the above-mentioned plants is their work in the structure of the SFGC. It enables them to combine the available financial resources of the corporation and to load all the industrial capacities of the CCP.

The indicators in table 1 reveal the structural ratios of grain sales by agricultural enterprises in 2017. The analysis shows that in 2017, agricultural enterprises sold almost 194.3 thousand tons of grain, of which the main share falls on winter wheat and yara — 12.8 million. t, or 65.6 %. Another 21.3 % falls on the main fodder crops — corn and barley. In regard to the channels of implementation, the indicator of grain sales to processing enterprises is important, it indicates the existence of other schemes, in particular tolling, for which they are supplied with raw materials. In general, processing enterprises (including elevators) received 23.8 % of all grain, while «other channels» that are various commercial structures received 50.1 %. Analysis of the data shows that on average, 36.7 % of the total crop is used in its own economy for the needs of feed for cattle and poultry. This confirms the structure of the use of cultivated grain by types. Thus, the share of wheat grown on the farm, which was used for own needs, is 28 %, rye — 65.8 %, other crops — 55.5 %. We are not saying that households are baking only their own bread. It depends on family traditions and skills acquired earlier. Of course, part of the grown wheat is used for feed.

First of all the main issue is the possibility of using commodity resources, that is, the real balance of available grain. It lies in the fact that the largest of them in the area of sowing grain (by volume of crop) leave on the farm 32,6 % of grain of wheat, and small Private Peasant Farming (PPF) — 74,6 %. The main indicator of economic relations in the grain market between its sub-

Table 1 — Implementation of grain crops for processing in the Volyn region for 2017 (Statistical Bulletin «Product sales by agricultural enterprises in 2017», the State Statistics Committee)

	Crops	Wheat	Rye	Barley	Millet, buck- wheat	Corn	Oat	Le- gumes	Other grain
Implemented — of all									
quantity, tons	194273	127686	15853	17888	936	23630	5440	1066	1774
price, UAH / t	3482,2	3518	3325,6	3863,2	5400,8	2796,8	4232,8	6072	3474,8
Through the implementation channels:									
to processing enterprises (including elevators)									
quantity, tons	46188	28586	8220	4800	118	3766	228	254	216
price, UAH / t	3753,2	3950,4	3290,8	3862,8	5383,2	3008,4	3670	4608,8	4014,8
to the population for the payment of labor									
quantity, tons	7821	6005	674	214	20	110	561	35	202
price, UAH / t	3100,8	2902,4	3544,4	3985,2	5720	2065,6	4201,6	4137,2	3649,6
To shareholder in the rent for land and property shares									
quantity, tons	22353	18856	1039	1225	15	75	728	13	402
price, UAH / t	2640	2520,4	3703,6	2838,8	3906,8	2896	3701,6	4892,4	2810,8
on the market, through their own stores, stalls, tents									
quantity, tons	18845	14001	703	1804	96	510	1366	74	291
price, UAH / t	3628,4	3625,6	3382	3979,2	5487,6	2926,4	3880,4	4410,8	3321,2
by other channels									
quantity, tons	99066	60238	5217	9845	687	19169	2557	690	663
price, UAH / t	3548,8	3662	3269,2	100,5	402	2755,6	4629,2	5056,8	3732,8
The presence of grain in the economy at the end of the reporting period, t	159629	76972	8132	19976	-	123931	-	-	-

jects — legal entities and individuals is the selling price (purchasing, wholesale, retail). It should be noted that in Ukraine the price of bread of mass consumption, flour, pasta remains stable for a long period of time and is accessible for the consumer. In regard to the purchase price for which the grain is sold by agricultural enterprises, it varies annually, usually not in favor of the village. Over the past ten years, there have been clear trends in reducing the volumes of final products of flour mills, increasing the cost and reducing the profitability of production. This process has a nationwide character, as Ukraine's flour production in 2009 to 2017 decreased by 30.7 %, cereals — by 44.6 %, bread and bakery products — by 40 % (Table 2).

The main cause of negative phenomena in the processing industry of the region is the decline in grain production. As a result, the consumption of bread products per capita produced in the sectors of the grain-processing industry decreased. So, if in 2006 per capita they produced 104.5 kg, then in 2017 — only 30.1 kg.

Now in the Volyn region there are 87 bakeries of all types of ownership, 35 flour-grubs and 10 feed-fodders. These enterprises are able to provide the population with bread products, but because of the inefficiency of work, they use only a small part of their capacity.

In recent years, the level of usage of production capacity by processing enterprises has fallen outrageously due to the following reasons: reduction of grain production, expansion of sales channels, lack of funds for grain purchases and weak material and technical base, as well as reduction of demand for bakery products by the end user. As a result, we can assume that the main causes are situational rather than systemic. In case of insufficient working capital, the main problem of processing enterprises is to provide their capacities with raw materials. The offer of grain outside of the state obligation is insignificant and can not provide demand for it by the processors. Processors are forced to turn to the enterprises of SJSC «Bread of Ukraine», where the prices for grain and flour are much higher due to high purchasing prices and spendings for grain delivery to the terms of the goods — pre-cleaning, drying and storage.

Table 2 — Indicators of activity of processing enterprises of the flour-and-groats industry of agroindustrial complex in the Volyn region (The statist bulletin «On the socio-economic situation of the region for 2017», the Main Department of Statistics in the Volyn region)

Indicators	Year								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
Grains produced, thousand tons *	329,6	311,2	340,5	270,6	423,0	350,1	234,8	270,8	362,1
Implemented by processing enterprises, ths. tons *	15,1	12,6	11,0	27,2	59,9	68,4	32,0	32,6	46,2
%	4,6	4,0	3,2	10,0	14,2	19,5	9,1	12,0	12,8
Production, thousand tons:									
Bread and bakery products	100,2	95,5	90,3	89,7	82,2	78,8	44,9	44,9	43,6
Flour	100,5	114,5	120,7	117,9	120,5	119,8	47,75	59,7	48,6
Pasta	1,1	1,2	1,3	2,0	2,1	2,0	9,3	10,1	7,3
Groats	2,4	2,3	2,0	1,9	1,7	1,3	0,3	0,4	0,4
Fodder	23,4	33,2	24,8	26,8	25,6	24,7	59,4	61,6	61,4

Most of the grain produced in the region is stored in elevators and grain receiving enterprises, which is an intermediate link between the producer of grain and consumer products of grain processing.

Primary processing, storage, transportation and processing of grain in the region are carried out by 13 grain reception companies located near railway stations in accordance with the requirements of the territorial organization of the industry.

Among them are 3 types of enterprises: bakery products (bakery products), bread making enterprises and sales bases.

The largest of them are CCP in Lutsk, Volodymyr-Volynsky and Golobsky according to capacity, number of employees and production volumes.

The bakery complexes include granaries, elevators, flour mills and feed mills. The CCP produces flour of different varieties, bran, feed. These enterprises act as the regulatory lever for intra — and interregional cargo flows of grain, which is mainly transported by rail. Enterprises of bread acceptance for primary processing of grain are located in Ivanychy, Olyci, Rozhivtsi and Turiysk, revalues for grain processing in Kovel, Kamen-Kashirsky, Lyubomli. In addition, in each

Table 3 — Estimation of efficiency of flour-and-groats processing enterprises of agroindustrial complex of Volyn region in 2017 (Statistics of the Main Department of Agro-Industrial Complex of Volyn Region)

Indicators	Grain processing enterprises			
	OJSC Golobsky CCP	Millenium Ltd.	State Enterprise Vladimir-Volyn CCP	State Enterprise Lutsk CCP № 2
Net proceeds from sales, ths. UAH	5776,4	4690,8	14390,2	19951,8
Labor costs, ths. UAH	601,1	192,2	539,3	980,3
Capital invested in reserves, ths. UAH	633,5	185,9	718,9	942,7
The main productive assets used for logistics operations, ths. UAH	3647,2	2682,8	1031,8	2660,2
Logistic Costs, ths. UAH	1430,0	563,2	2056,6	2587,8
Costs of production and sales of products, ths. UAH	5477,7	3768,3	11495,5	15869,3
Profit from sales of products, ths. UAH	298,7	922,5	2894,7	4082,5
Cost-effectiveness of production, %	5,4	24,4	25,1	25,7
Level of logistics costs	0,25	0,12	0,15	0,13
Profitability	0,21	1,64	1,41	1,58
Confidentiality	0,11	0,04	0,05	0,05
Stock turnover	8,7	20,33	16,0	16,8
Capital invested in logistics, ths. UAH	4280,7	2868,7	1750,7	3602,9
Turnover of capital invested in logistics	1,35	1,64	8,22	5,54
Profitability of capital invested in logistics, %	0,07	0,32	1,65	1,13

district of the region one inter-farm feed mill is operating. While serving farms, these factories buy their fodder grain, and sell them feed.

In our opinion, the efficient formation and utilization of the economic potential of processing enterprises is crucial in competitive advantage, since it is aimed at reducing commodity stocks, accelerating circulation of working capital, reducing the cost of production and general logistics costs, optimal use of warehouse and transport capacities, and providing consumers with quality services. The research of efficiency of economic potential of processing enterprises for 8 grain-processing enterprises of Volyn region of different assortment direction. For a more detailed analysis, 4 grain-processing enterprises with the results of their economic activity were taken into account, such as: SE Lutsk CCP № 2, OJSC Golobsky CCP, SE Volodymyr-Volynsky CCP, Millennium Ltd., city of Turiysk.

A generalizing financial indicator of the efficiency of the economic potential of processing enterprises is the operation proceeds from sales of products, the provision of services. This indicator takes into account and gives a quantitative assessment of the cumulative impact of internal production, foreign economic and social factors. As can be seen from table 3, the most effective control of these factors is carried out by the SE Lutsk CCP № 2, which occupies the main positions in the market of flour-grinding products and maintains a high level of sales.

At the Golobsky CCP, as well as in other factories (Rozhyshche, Novovolynsky, Ivanychivsky), in conditions of high competition, such a level of sales has not been achieved and has been concentrated only on local markets. Accordingly, these enterprises have lower costs for production and sales of products, while Turiysky, Volodymyr-Volynskyy factories take additional costs in support of the brand of goods, expansion of sales channels. Logistics operations also require the costs of personnel engaged in logistics operations. As regards to this indicator, the following trend is observed. This factory has its own logistics specialists, so it constantly costs to motivate their activities and maintain proper working conditions. It explains the significant spendings on the given enterprises in comparison with other.

The Turin factory does not have its own staff of logistics personnel and uses the services of external organizations. As the result of hiring additional employees the enterprise carries significant labor costs. In comparison, other companies are limited to the services of marketers who have completed advanced training and are well oriented in the logistic concept of product management and its inventories. As a result, these enterprises are saving in labor costs. Another indicator of the efficiency of the logistics system is the material resources for inventory creation in the logistics system. The cost of material resources in the logistics system of the Golobsky enterprise is relatively high under conditions of supporting a high level of production and service of consumers of flour products.

SE Lutsk CCP № 2 also puts significant funds in stocks, forming its reserves, which does not meet the conditions for efficient stock management for the logistic concept. For grain-processing enterprises it is not typical to create a stock of raw materials for several years. The most typical are the Turian, Rozhischensky, Kamin-Kashirsky, which hold the smallest amount of reserves in comparison with other enterprises. The part of the main productive assets used for logistics operations also determines their level of efficiency. The Golobsky factory is taking the first steps in the implementation of the logistics system of inventory management. The Lutsk factory maintains it at a high level and has a relatively high cost of equipping production funds. Factories such as Rozhyshchens'kyi, Volodymyr-Volynsky, on the other hand, have a fairly productive equipment that requires only ongoing repairs. As a result, the overall logistics costs of these enterprises are determined more by the size of stocks that grow and raise the level of logistics costs (up to 0.15). At the Golobsky factory, the logistics cost was 0.25, indicating that it has a large part of the proceeds from sales of products. At other enterprises, logistics costs have not yet reached such a return.

Given the size of proceeds from sales and costs of production and sale of these products, SE Lutsky CCP № 2 gets the most profit from the sales. Other companies work on less power and therefore do not get the same effect, it reflects in lower sale value of return, which equal to 5–20 % compared to Lutsk factory, where this indicator reached 25 %. Yield of Lutsk and other enterprises are greater than 1, ranging from 1.41 to 1.64, which allows to cover logistical costs and have a certain margin effect, which is absent in Holobskomu CCP, where logistics costs exceed the value of the profits.

Logistics costs include not only stocks but also fixed assets, but reserves for improving the efficiency of the logistics system are laid down as the base, and therefore the most important indicator is the stock-consistency. This indicator has roughly the same values in all enterprises except Golobsky, where for every hryvnia of proceeds from the sale of products accounts for only 0.04–0.05 UAH it's invested in the stock, which shows a high return on these enterprises. At the Golobsky Factory, it is necessary to invest more, at least 0,11 UAH in stock to get 1 UAH of revenues. First of all, it depends on the turnover of stocks, which at the enterprises was 8.7, that is twice as much compared with other enterprises (where this indicatir reaches 16–20.3). As the result it's not enough of raw materials supply and sales of finished products in such harsh competition.

Even if accounting the costs of major productive assets in logistics costs, it does not change the situation. The turnover of capital and its profitability have the highest importance in enterprises, other than Lutsk, which is characterizing the tendency to improve the use of all types of enterprises resources. When assessing the efficiency of logistics costs, it is necessary to consider the cost of savings in all logistics subsystems. The classification of costs in logistics and the assess-

ment of their level in the grain processing enterprises of the Volyn region is given in table 4. The largest costs for the organization of orders, the formation and storage of stocks in comparison with the other belongs to Lutsk factory, which prefers the purchase of high quality grain from permanent suppliers, with which seasonal grain delivery contracts. Under the terms of the contract, the enterprise pays to the supplier up to 1 % of the delivery price. Other enterprises, which have lower costs for organizing orders, supply grain from private farms. However, at the same time they bear additional transport costs. It shows in the analysis of data in table 4.

Table 4 — Costs of processing enterprises of the flour-and-groats industry of agroindustrial complex of Volyn region in 2017, ths. UAH (Statistics of the Main Department of Agro-Industrial Complex of Volyn region)

Indicators	Grain processing enterprises			
	OJSC Golobsky CCP	Millenium Ltd.	State Enterprise Vladimir-Volyn CCP	State Enterprise Lutsk CCP № 2
Transportation costs	328,7	188,4	804,7	1031,5
Storage costs, including:	849,0	236,1	992,1	1282,1
Cost of capital invested in stocks	633,5	185,9	718,9	942,7
The cost of organizing orders	152,1	33,5	186,9	235,7
Costs for the formation and storage of stocks	63,4	16,7	86,3	103,7
Administrative expenses	252,3	138,7	259,8	270,2

Considerable transportation costs at the Lutsk factory are explained by the fact that more flights are being made during the change to meet the needs of the bakery products.

Storage costs for each of the analyzed enterprises are insignificant, since the raw materials are not subject to long-term storage, and the supplies of auxiliary materials, packaging materials, and others are seasonal. These costs depend on factory capacity and the amount of purchased supplies to meet current needs. Accordingly, they tend to grow in both Lutsk, Golobsky and Volodymyr-Volynskiy factories. The rest of the companies, effectively using warehouses, have savings on inventory costs, and therefore these costs are relatively lower.

In the system of logistics costs of the analyzed enterprises administrative costs are approximately the same, since the introduction of logistics conception of inventory management and its maintenance require equally significant funds for the payment of logistics services, providing the necessary level of equipment with computing and control equipment.

The calculation of the cost of implementing the logistics system of the grain-processing enterprises of the region corresponds to the results of an assessment of the efficiency of this system, which emphasizes the direct dependence of profitability of the enterprise's activity on cost savings through the logistic approach to inventory management at the enterprises under analysis.

Since the harvesting of grain is carried out on a large territory, in all districts of the region and even in other areas, in order to build the most perfect mechanism for its storage, warehousing and movement, it is necessary to create a logistic informational system that allows effectively solve problems of inventory management, transportation of raw materials, warehousing and other logistic functional areas. Consequently, the condition of the task can be expressed as such: the grain, which is expected to be processed throughout the year (production cycle) will be stored in specially equipped storage points "m" in quantity V_i ($i = \overline{1, m}$) tone in the i-th point. It's aimed at ensuring that each batchman has been spending the least on transportation of grain and its cultivation to conditioned state, and therefore concentrates on the territory of the whole region. The storage cost is different for different points and is C_i ($i = \overline{1, m}$) UAH per 1 ton for the whole

month in the i -th point. It is necessary to make a plan for grain transportation throughout the year, which would provide minimal expenses for its storage for a brokerage firm. It is also necessary to take into account that all harvested raw materials throughout the production cycle must be transported to the processing enterprise. The capacity of the warehouse premises on the territory of Lutsk CCP-2 is known, it's 40 thousand tons, it is calculated for 57 days of its work (number of days — T). If we divide the total number of working days of the entire production cycle (320–330 days), which denotes R , on T , then the recipient of the periods N , during which the factory can be provided with raw materials from the stocks of its own warehouses, provided that at the beginning of each period they will replenished. Each of N periods has the same duration of T days, namely

$$N = \frac{R}{T}.$$

Denote by C_i^* the total cost of storing 1 t of grain in the i -th point during T days.

Grain storage facilities are located in such way that a part of the raw materials can be transported by road, and the other part is by rail. Analyzing the volumes of procurement and the cost of goods transportation by rail, we come to the conclusion that in order to minimize transport costs by rail, it is expedient to transport raw materials in maximum batches. In order to avoid production downtime due to lack of raw materials, delivery of grain should be organized at the beginning of each period. For each storage point, the cost of preserving 1 ton of grain at the beginning of each period is known. Thus, we obtain a matrix of storage values:

$$C = \begin{pmatrix} 0 & c_2 & c_3 & \dots & c_{1N} \\ 0 & c_2 & c_3 & \dots & c_{2N} \\ 0 & c_3 & c_3 & \dots & c_{3N} \\ \dots & \dots & \dots & \dots & \dots \\ 0 & c_{m2} & c_{m3} & \dots & c_{mN} \end{pmatrix} \quad (1)$$

where c — the cost of preservation of 1 t of grain in the i -th point at the beginning of the j -th period, UAH.

Since at the beginning of the first period the cost of storage is practically equal to 0, then $C_{i1} = 0$ ($i = \overline{1, m}$), a $C_k = C_i^* \times (k - 1)$ ($i = \overline{1, m}; k = \overline{2, N}$). In solving the problem we'll refer to the following matrix of values for storage enterprises of the Volyn region (table 5).

Thus, we consider the transport type task? the essence of which can be formulated as such: the entire volume of raw materials, concentrated in the i -th point, respectively, in quantities V_i ($i = \overline{1, m}$), must be distributed in N periods for the successive transportation to the warehouse premises of the factory. The demand for cargo for the j -th point is:

$$b_j = \frac{\sum_{i=1}^m V_i}{N}, \quad (2)$$

where b — cargo requirement for each raw material delivery period; V — volumes of raw materials at procurement enterprises; N — periods of consistent delivery of raw materials to the processing factory.

It is necessary to find the optimal transportation plan, that is, the elements of the matrix:

$$X = \begin{pmatrix} x_1 & x_2 & x_3 & \dots & x_{1N} \\ x_2 & x_2 & x_3 & \dots & x_{2N} \\ x_3 & x_3 & x_3 & \dots & x_{3N} \\ \dots & \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & x_{m3} & \dots & x_{mN} \end{pmatrix}, \quad (3)$$

where — x_j the number of goods that will be transported from the i -th ($i = \overline{1, m}$) point at the beginning of the j -th ($j = \overline{1, N}$) period.

By the optimality criterion, choose the minimum total cost of grain storage at all points. Thus, the target function has the form:

$$Z = \sum_{i=1}^m \sum_{j=1}^N c_{ij} \cdot x_{ij} \text{ ® min,} \quad (4)$$

where Z — total cost; c — the cost of storage; x — the amount of raw material at the point of preservation.

Table 5 — The Matrix of the cost of grain storage at processing enterprises of the flour-and-groats industry of agroindustrial complex of the Volyn region (Statistics of the Main Department of Agrarian and Industrial Complex in Volyn region)

Company names	Period of storage, months					
	1	2	4	6	8	10
OJSC «Lutsk Elevator»	7,47	14,94	29,88	44,82	59,76	74,70
CJSC «Gorokhizernoprode»	7,42	14,84	29,68	44,52	59,36	74,20
PE «Impalzo»	7,17	14,34	28,68	43,02	57,36	71,70
LLC «Pyatinde»	7,96	15,92	31,84	47,76	63,68	79,60
SE Lutsk CCP № 2	6,79	13,58	27,16	40,74	54,32	67,90
Open Society Golobsky CCP	6,79	13,58	27,16	40,74	54,32	67,90
Millennium Ltd.	6,21	12,42	24,84	37,26	49,68	62,10
Volodymyr-Volynsky CCP	8,2	16,4	32,8	49,2	65,60	82,00
Agro Plus Ltd	7,89	15,78	31,56	47,34	63,12	78,90
Kolki bread-baking complex	6,96	13,92	27,84	41,76	55,68	69,60
Lutsk CCP № 1	8,29	16,58	33,16	49,74	66,32	82,90
OJSC «Novovolynsky Bakery»	7,98	15,96	31,92	47,88	63,84	79,80
OJSC «Kovel bakery»	8,35	16,7	33,4	50,1	66,80	83,50
Lyubomlsky bakery	7,15	14,3	28,6	42,9	57,20	71,50
»Volynagroproduct» Kivertsi	7,32	14,64	29,28	43,92	58,56	73,20
Ivanichivsky DCC	6,91	13,82	27,64	41,46	55,28	69,10
OJSC «Bread»	8,49	16,98	33,96	50,94	67,92	84,90
OJSC «Liubeshivsky CCP»	7,75	15,5	31	46,5	62,00	77,50
OJSC «Novovolynsky CCP»	7,95	15,9	31,8	47,7	63,60	79,50
Volynsvnishtorghlib Ltd.	8,28	16,56	33,12	49,68	66,24	82,80
Lyubeshivsky CCP	7,09	14,18	28,36	42,54	56,72	70,90
Ltd «Smokota» tts. Old Vyzhivka	6,61	13,22	26,44	39,66	52,88	66,10
OJSC «Gorokhhlib»	8,31	16,62	33,24	49,86	66,48	83,10
CJSC «Energo»	6,78	13,56	27,12	40,68	54,24	67,80
LLC «Kovelhlib»	8,35	16,7	33,4	50,1	66,80	83,50
CJSC «University»	7,69	15,38	30,76	46,14	61,52	76,90
Volodymyr-Volynskiyi m	7,53	15,06	30,12	45,18	60,24	75,30
PE «Polisservice» city Rozhyshche	8,2	16,4	32,8	49,2	65,60	82,00
Tsumanske SE «Zhuravka»	7,12	14,24	28,48	42,72	56,96	71,20
«Sopharm» Lutsk	7,84	15,68	31,36	47,04	62,72	78,40
Ratniv bakery	7,18	14,36	28,72	43,08	57,44	71,80
Shatsky bakery	7,3	14,6	29,2	43,8	58,40	73,00

By setting the target function, and by entering restrictions, we obtain a solution to a given task, which is given in table 6. On one hand, the limitations are the amount of purchased raw material stored on specific elevators or grain receiving points, and on the other, the quantity of products needed by the processing enterprise to ensure uninterrupted operation.

When changing the limits or cost of services for storage companies, we have the opportunity to get new solutions that will reduce logistical and marketing costs, optimize the logistics chain for the transportation of grain volumes and the cost of moving the raw material from producer to processor. In addition, taking into account the effect of external organizational and economic factors, an analysis of relations between grain producers and their processors, it should be noted that the contradictions between them arise also in the questions of pricing for raw materials and execution of contractual circumstances.

The consequences of these conflicts are respectively price disparity between agricultural and industrial products, which affects agricultural producers, and their profits do not provide conditions for advanced manufacturing, as well as payments crisis, worsening the situation of farmers. When we change the restrictions or cost-saving services companies, we are able to obtain new solutions that will reduce the logistics and marketing costs, optimize logistics chain for carriage of grain volumes and costs on the way from raw material producer to the processor.

Table 6 — The scheme of optimal deliveries of grain from storage points for processing in the Volyn region

Storage locations	Saving periods, months						Estimated value	Type of restriction	Restriction
	1–2	3–4	5–6	7–8	9–10	11–12			
OJSC «Lutsk Elevator»	0	1351	0	0	0	0	1351	=	1351
CJSC «Gorokhizernoprode»	0	185	2955	0	0	0	3140	=	3140
PE «Impalzo»	0	0	0	3887	0	0	3887	=	3887
LLC «Pyatinde»	0	5221	0	0	0	0	5221	=	5221
SE Lutsk CCP № 2	0	0	0	0	0	1531	1531	=	1531
Open Society Golobsky CCP	0	0	0	0	0	7784	7784	=	7784
Millennium Ltd.	0	0	0	0	0	2586	2586	=	2586
Volodymyr-Volynsky CCP	5433	0	0	0	0	0	5433	=	5433
Agro Plus Ltd	0	3336	0	0	0	0	3336	=	3336
Kolki bread-baking complex	0	0	0	0	0	4226	4226	=	4226
Lutsk CCP № 1	2090	0	0	0	0	0	2090	=	2090
OJSC «Novovolynsky Bakery»	2218	4644	0	0	0	0	6862	=	6862
OJSC «Kovel bakery»	9851	0	0	0	0	0	9851	=	9851
Lyubomlsky bakery	0	0	0	7607	0	0	7607	=	7607
»Volynagroproduct» Kivertsi	0	0	4473	0	0	0	4473	=	4473
Ivanichivsky DCC	0	0	0	0	4185	0	4185	=	4185
OJSC «Bread»	3035	0	0	0	0	0	3035	=	3035
OJSC «Liubeshivsky CCP»	0	6600	0	0	0	0	6600	=	6600

Continuation table 6

Storage locations	Saving periods, months						Estimated value	Type of restriction	Restriction
	1–2	3–4	5–6	7–8	9–10	11–12			
OJSC «Novovolynsky CCP»	0	729	0	0	0	0	729	=	729
Volynsvnishtorghlib Ltd.	5851	0	0	0	0	0	5851	=	5851
Lyubeshivsky CCP	0	0	0	0	639	0	639	=	639
Ltd «Smokota» tts. Old Vyzhivka	0	0	0	0	0	1304	1304	=	1304
OJSC «Gorokhhlib»	2730	0	0	0	0	0	2730	=	2730
CJSC «Energo»	0	0	0	0	0	3325	3325	=	3325
LLC «Kovelhlib»	2996	0	0	0	0	0	2996	=	2996
CJSC «University»	0	5182	0	0	0	0	5182	=	5182
Volodymyr-Volynskiy m	0	1	0	0	0	0	1060	=	1060
PE «Polisservice» city Rozhyshe	5796	0	0	0	0	0	5796	=	5796
Tsumanske SE «Zhuravka»	0	0	0	8241	3720	0	11961	=	11961
»Sopharm» Lutsk	0	11692	0	0	0	0	11692	=	11692
Ratniv bakery	0	0	0	830	0	0	830	=	830
Total for the Volyn region	0	0	32572	19735	0	0	52016	=	52016
Estimated value	40000	40000	40000	40000	40000	40000	240000	=	240000
Limit amount	40000	40000	40000	40000	40000	40000	240000	=	240000

Thus, the costs of the proposed variant of optimization of supplies of raw materials amounted to UAH 8406156, which is UAH 1022617, it's less than in modern conditions. In addition, the intermediary that's buying significant batches of raw materials, can form more powerful commodity flows. The intermediary structure also performs a number of very important functions today:

- sales promotion — creates and distributes transport communications, more favorable terms of delivery of products;
- establishing contacts — establishes and maintains communication with regular clients;
- ensures the requirements of the processing enterprise for the quality of raw materials;
- negotiate — tries to coordinate prices and other terms of sale;
- organizes the transportation and storage of raw materials;
- takes risks — assumes the responsibility for the performance of contractual relations with suppliers of raw materials and with the processing enterprise.

As can be seen from the scheme, the movement of grain in the market is carried out directly from farms to bakery and bakeries or immediately to the trading network. At each of these stages, the movement of the material flow (grain) is accompanied by the concomitant movement of information flow, which is usually ahead of the material, which allows you to plan the size of the procurement and production program. Of course, the information flow has a reverse or opposite direction of the material flow when the information goes back from buyer to consumer in order to be able to control the execution of orders. Regarding the financial flow, we can assert that

its movement in the accompanying material flow, however, may be as outstripping — in the case of down payments, and also proceed directly after the executed order in case of postponements of payments or other arrangements. Based of this scheme, we can conclude that only clearly planned movement of all flows — material, informational, financial — will allow all grain market operators to get the desired high economic effect, which will cover all costs and will allow further development and branching of the logistics system of the grain market.

Our analysis of the state of stock management in the flour-and-groats industry of Volyn region showed common problems that most of the economic entities of the industry have. In particular, the main obstacles include the seasonality of production and, accordingly, uneven supply of raw materials throughout the year, inadequate quality of raw materials entering the enterprise, the lack of a well-established system of relations with suppliers of raw materials and consumers of finished products, obsolete equipment, the use of which leads to an increase in the number of defective products.

The lack of a well-balanced state policy and the monopoly pressure from the state structures about raising prices in an unstable economy has worsened the equivalence of the exchange between agricultural products and the processing industry. Given the significant rise in material and technical resources (from 7 % of the cost price in 2009 to 16.2 % in 2017), the proceeds from the sale of agricultural raw materials do not provide the production needs of agricultural production. In particular, in 2009–2017, the ability to buy diesel fuel by grain producers has decreased fourfold.

The crisis of non-payment as an expected reaction of the economic system of a monopolized type to the mechanism of self-regulation of the economy turned out to be no less acute for the processing enterprises of the flour-and-groats industry of agroindustrial complex. Grain processing enterprises of the Volyn region, which are subordinated to SJSC «Khlib Ukrainy», use their monopoly position mainly in their own interests (unreasonable refusal to accept raw materials for processing, decrease of quality (overestimation of grain), delay of payment for it, etc.), referring to the program of public procurement, accept subjective decisions regarding terms and order of payment, as well as conditions for acceptance of grain for storage.

The root cause of the contradictions in the relationship between agricultural and processing enterprises is the decline in the level of key economic indicators that accompanies the activities of enterprises in conditions of uncertainty, instability and risk. Subjects of entrepreneurship are under the burden of negative influence of both external and internal factors, which does not allow the use of internal production reserves to increase the efficiency of production. The lack of clear strategic goals and tactical targeting of temporary benefits destroys established links within the traditional raw material zones. Thus, it is practically impossible to improve the administrative relationship between producers and processors of agricultural products, and the means of solving the problem in this context will be only economic growth of both agricultural and processing enterprises against the background of strengthening of market relations. At the same time, the state should play a decisive role at ensuring favorable conditions for competition at the expense of the practical realization of well-considered measures of regulation of the market.

Summary. The analysis of the flour-and-groats industry in the Volyn region made it possible to formulate the main conclusions and proposals. Volyn region is one of the specific regions of western Polissya, both in terms of its agro climatic and natural resources, as well as on the socio-economic components of its productive potential. In the context of transformations, agriculture of the region is slowly adapting to market conditions, adapting the traditional production structure of the public and private sectors to the deformed market infrastructure and relations between its subjects. In the process of reforming land and property relations in the region a certain direction of production and territorial specialization was formed. At the same time, in the public segment, the production of grain and large-scale goods is still traditional, and in PPE — cattle-breeding, potato-growing and grain-farming.

The incompleteness of transformational changes at different hierarchical levels of their implementation in the socio-economic area of rural development is determined by ambiguous performance indicators of various subjects (legal entities and individuals) of entrepreneurial activity.

This applies to the grain industry of the region, which operates in a heterogeneous environment. Efficiency of grain production, as an effective indicator of the use of the whole set of relevant factors, in particular logistics and labor resources in the grain industry, is formed depending on the price policy of the state. However, studies have confirmed the influence of concentration and specialization of production, structure and volume of expenses per hectare of sowing, etc. In general, there is a significant discrepancy between farms of the public sector in terms of grain yields, the cost of 1 ts of grain and the profitability of sales.

The production of grain in recent years is characterized by low productivity of crops with a simultaneous increase in its cost. This is due to a decrease in the agricultural culture in agricultural enterprises. There is a significant deterioration in the quality of grain, but it remains the most profitable agricultural products.

The main way of improving the efficiency of the flour-and-groats sector is the further development of this industry in various forms of management and property, in close relationship with enterprises of the processing industry, re-equipment of the technical base of flour mills and bakery enterprises. The construction of the logistics system provides an opportunity for positive changes in establishing economic relations in this field. In this connection, the logistic scheme of grain movement in the flour-and-groats industry of the region is proposed. The optimal supply of raw materials on the basis of the logistics inventory management system makes it possible to reduce the cost of maintaining grain volumes for processing and to reduce the costs of moving the raw material from producer to processor. Calculations have shown that the amount of expenses for the proposed optimal variant of transportation to UAH 1.02 million. or 10.8 % less than actual, which can be considered as additional investments to producers. In order to ensure the effective development of the economic potential of the flour-and-groats industry in the Volyn region, it is necessary to improve the quality of both grain and end products of grain processing by introducing modern advanced technologies, as well as reducing the cost of production at the expense of fixing prices for material and technical resources consumed by agricultural commodity producers.

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Цель. Целью статьи является исследование формирования рынка зерна и его переработки предприятиями мукомольно-крупяной отрасли АПК Волынского региона.

Методы. В процессе исследования формирования рынка зерна и его переработки предприятиями мукомольно-крупяной отрасли АПК Волынского региона использованы диалектический метод научного познания, а также общенаучные методы гносеологии: теоретического обобщения, сравнения, группировки и анализа.

Результаты. В статье предложен организационный механизм формирования логистической системы мукомольно-крупяной отрасли на основе использования современных математических методов моделирования для гармонизации взаимоотношений участников. Рассмотрены основные положения по системе совершенствования межотраслевых экономических отношений в мукомольно-крупяной отрасли на основе предложенной структуры по сбыту зерна. Практическое значение полученных результатов заключается в том, что обоснованные предложения по эффективному функционированию мукомольно-крупяной отрасли в регионе будут способствовать стабилизации и дальнейшему наращиванию объемов производства конкурентоспособной продукции для обеспечения как внутренних потребностей региона, так и участия во внешней торговле.

Ключевые слова: рынок зерна, предприятия мукомольно-крупяной отрасли, предприятия АПК, экономический потенциал, запасы зерна.

Мета. Метою статті є дослідження формування ринку зерна та його переробки підприємствами борошно-круп'яної галузі АПК Волинського регіону.

Методи. В процесі дослідження формування ринку зерна та його переробки підприємствами борошно-круп'яної галузі АПК Волинського регіону використано діалектичний метод наукового пізнання, а також загальнонаукові методи гносеології: теоретичного узагальнення, порівняння, групування та аналізу.

Результати. Визначення ефективності переробки зерна підприємствами борошно-круп'яної галузі АПК Волинського регіону проведено на основі систематизації показників, які характеризують борошно-круп'яну галузь в цілому, що дозволяє порівнювати як окремі підприємства, так і виробництво, заготівлю та переробку зерна. Поряд з цим, при комплексній оцінці економічної ефективності переробних підприємств борошно-круп'яної галузі використані показники наявних ресурсів регіону. Результати проведеного дослідження дають підстави для висновку, що основними передумовами розвитку борошно-круп'яної галузі регіону є залучення внутрішньовиробничих резервів підвищення ефективності виробництва та

переробки зерна, зумовлених впливом техніко-технологічних факторів; кількісне та якісне оновлення основних фондів; покращення якості як зерна, так і кінцевої продукції переробних підприємств шляхом впровадження сучасних прогресивних технологій, а також зниження собівартості продукції за рахунок фіксації цін на матеріально-технічні ресурси. Оцінка стану функціонування борошно-круп'яної галузі показує, що за останні роки в регіоні намітилися чіткі тенденції до скорочення обсягів виробництва кінцевої продукції зернопереробних підприємств, збільшення собівартості та зниження рентабельності виробництва. Це дає підстави для висновку, що вирішення питання еквівалентного міжгалузевого обміну на ринку зерна між його учасниками лежить у площині виробництва, заготівлі й переробки зерна в єдиній економічній системі, упорядковуючи цим виробничі та фінансові взаємозв'язки, які відображаються в логістичній схемі руху зерна між її учасниками. Розвиток процесів інтеграції у агропромислому комплексі регіону на основі запропонованих заходів дозволить відтворити ланцюг виробництво-заготівля-переробка-споживання. При цьому значний стабілізуючий вплив на вдосконалення міжгалузевих відносин між сферами виробництва й переробки зерна у Волинській області може забезпечити дієва інтеграція партнерів агропромислового комплексу, зокрема шляхом створення кооперативних об'єднань сільськогосподарських товаровиробників. Розміщення і спеціалізація переробних підприємств у регіоні мають бути системно поєднані з розвитком інших галузей. Процес трансформаційних перетворень охоплює широке поле господарської діяльності, особливо в період, коли поставлене певне економічне завдання вимагає поліпшення відповідної координації, зокрема у використанні всього ресурсного потенціалу АПК регіону. У статті запропоновано організаційний механізм формування логістичної системи борошно-круп'яної галузі на основі використання сучасних математичних методів моделювання для гармонізації взаємовідносин учасників товарного ринку. Розглянуті основні положення щодо системи вдосконалення міжгалузевих економічних відносин в борошно-круп'яної галузі на основі запропонованої структури по збуту зерна. Практичне значення одержаних результатів полягає у тому, що обґрунтовані пропозиції щодо ефективного функціонування борошно-круп'яної галузі в регіоні сприятимуть стабілізації і подальшому нарощуванню обсягів виробництва конкурентоспроможної продукції для забезпечення як внутрішніх потреб регіону, так і участі у зовнішній торгівлі.

Ключові слова: ринок зерна, підприємства борошно-круп'яної галузі, підприємства АПК, економічний потенціал, запаси зерна.

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