

*colloquium-journal*

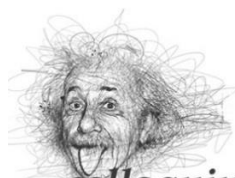
*ISSN 2520-6990*

*Międzynarodowe czasopismo naukowe*

**Economic sciences**

**№17(104) 2021**

**Część 5**



**colloquium-journal**

ISSN 2520-6990

ISSN 2520-2480

Colloquium-journal №17 (104), 2021

Część 5

(Warszawa, Polska)

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UDC: 330.322

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## THE CURRENT STATE OF LOGISTICS OF THE AGRICULTURAL SECTOR OF UKRAINE

### Abstract.

*The article covers the issues of assessment and challenges of the current state of logistics of the agricultural sector of Ukraine's economy. The main components of logistics are considered, as such the transport, production, costs, logistics and energy resources are determined. The main trends observed in the logistics of the agricultural sector are analyzed based on statistical data, and ways to improve certain areas of logistics are identified.*

**Keywords:** *logistics, resource flows, system characteristics of logistics, agricultural sector, consumers, distribution, transport.*

**Challenge problem.** Ukraine has all the necessary components to further development and use of the potential of agribusiness. This applies to increasing the export of raw materials, finished products, the use of advanced agricultural machinery, technologies for growing and harvesting, improving the logistics component. The logistics component aims to minimize losses at every stage and every process.

The organization and management of logistics supply chains of agricultural products is characterized by a high level of complexity. Logistics in agricultural supply chains has a number of features, primarily due to the specificity of agricultural products as an object of material flows, namely: seasonality of its production (mainly for crop products), limited shelf life and significant loss of consumer properties.

The processes of planning and operational management in agrolistics are often complicated by the

need to take into account the sensitivity of agricultural products to climatic conditions, various diseases and pests. Also, a wide range of agricultural products provides for the application of a diversified approach in the choice of mode of transport, location and technical equipment of warehouses, the number and composition of participants in supply chains and other conditions of logistics processes.

Analysis of the current state of agricultural logistics in Ukraine allows us to conclude that the main obstacles to its development are:

- 1) lack of a government program for the development of agrolistics at the appropriate level;
- 2) lack of qualified logistics personnel in agricultural enterprises;
- 3) lack of funds for the implementation of logistics approaches, as software logistics products are too expensive for domestic enterprises;

4) lack of funds for the construction of a sufficient number of modern warehouses;

5) lack of funds for the purchase of modern vehicles;

6) low quality of road surface, imperfect digital GPS software for Ukrainian roads and lack of a network of communication systems for large vehicles;

7) low investment attractiveness of agricultural sectors in Ukraine, which is mainly due to the imperfect regulatory framework and the unstable political situation in the country;

8) corruption component.

If we talk specifically about the types of transport and restraining factors of development, we can distinguish the following:

1) *Road transport:*

- Relatively high cost of transportation;

- Loss of time due to the accumulation of cars in ports during “peak periods”;

- Significant wear and tear of the equipment and high depreciation costs due to low quality roads;

- Inefficiency of long-distance transportation.

2) *Rail transportation:*

- State monopoly on services and ownership for most cars;

- Critical service life of grain wagons;

- Low capacity of railway stations in “peak” periods in ports;

- Lack of state investment programs to update the fleet of grain wagons.

3) *Water transportation:*

- High capital intensity of the development of own terminals and fleet;

- Low mobility and efficiency of transportation, limited transportation areas;

- Limited access to deep-water areas when placing terminals.

Due to inefficient logistics today, Ukrainian farmers lose about \$ 20 per ton of manufactured products. And this in annual terms at the current turnover of Ukrainian exports reaches \$ 600 million. At present, the cost of logistics in the agro-industrial complex of Ukraine is 30% higher than in the US and 40% in the EU [1]. The functioning of an economic entity is associated with the adoption of management decisions, which are almost always based on the optimization of certain processes, resources, etc. Accordingly, the elements of logistics are at every company. However, when it comes to using a logistics approach, it is necessary to apply it systematically, which will increase the efficiency of the entity. In order to ensure the efficient operation of the logistics system, it is necessary for the company to implement the appropriate sequence of actions (Fig. 1).

Thus, logistics today remains a “problematic” factor in the agricultural sector. This is a shortage of modern elevators, and low-quality road infrastructure, insufficient investment in the modernization of rail and road transport, so in almost all parts of the process we have reserves to improve performance, and hence – for further growth.

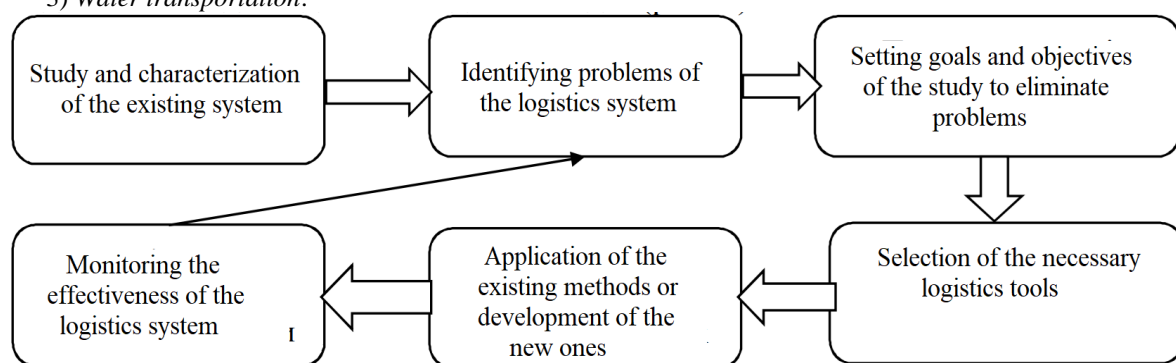


Fig. 1. Package of actions for the formation of an efficient logistics system of agricultural enterprises  
Source: developed by the author on the basis of the studied literature.

Ukraine is a country with great potential in the agricultural sector, it plans to increase exports of grain and other agricultural products in the near future. Therefore, the development of agrolistics and increasing its efficiency is currently a priority for economic development. Therefore, the research topic is relevant.

#### Analysis of recent research and publications.

World and domestic experience of efficient operation of agricultural enterprises confirms the need to improve the logistics component. Logistics is a powerful tool for optimizing all economic processes of agricultural enterprises. Many domestic scientists, namely: LV Balabanov, OA Bugutsky, OM Varchenko, OI Gutorov, SM Dimarchuk, IG Klimova, VA Kolodiychuk, EV Krykavsky, TV Kosarev, MA Oklander, VV Pisarenko, Yu. V. Ponomarev, OM Sumets, OM Tridid, LV

Frolov, NI Chukhrai and others. Scientists, studying the application of logistics, argue that the novelty of the logistics approach to material resource management is a change in the priorities of economic activity, when the main role is played not by the product but by the process in the form of flow (material, information, etc.).

The purpose of logistics is to optimize the reproduction cycle through a comprehensive, needs-oriented, the formation of the flow of materials and information in the production and distribution of products [1].

#### Presentation of the main results of the study.

The logistics system is considered an indispensable component of the development of modern society. It combines the components of the formation and promotion of resource flows with the supply of raw materials

to the finished product. The accompanying (supporting) function of this process belongs to transport logistics. Transport operation and logistics determine the efficiency of trade flows and the development of individual industries as a whole. Advances in technology and management principles improve load traffic, delivery speed, quality of service, operating costs, facility use and energy savings. Transport ensures the flow of materials in the supply chain from the place of departure to the destination where the goods are consumed. Most agricultural enterprises use inbound logistics and outbound logistics. This distribution is determined by the characteristics of the resource flow, the generation of which occurs from the supply of raw materials and ends with the entry of finished products into a competitive market. Inbound logistics includes the purchase of materials and goods from suppliers. Outbound logistics includes the supply of materials and goods to customers. The components of the logistics of the agricultural sector of the economy are the logistics of supply, storage

and production.

In order to analyze the logistics, it is necessary to analyze the existing freight turnover of domestic enterprises (Fig. 1). The general trend is a tendency to reduce transportation. Thus, in 2020 the transportation flow decreased compared to 2018 by 41,776.9 million tkm, which is an 11.1% decrease. Analysis of statistical data allows us to conclude that in January-August 2018, the freight turnover of transport enterprises amounted to 219.7 billion tons km, or 97.6% of the volume in January-August 2017.

Transport companies in 2020 transported 1,641.0 million tons of cargo, which is 99.9% of the volume in 2018 [5]. The largest volumes of traffic are concentrated on rail transport, which had the smallest decrease in 2020 compared to 2018 (in 2020 to 2018 -0.5%). The volumes of road and pipeline transportation decreased significantly.

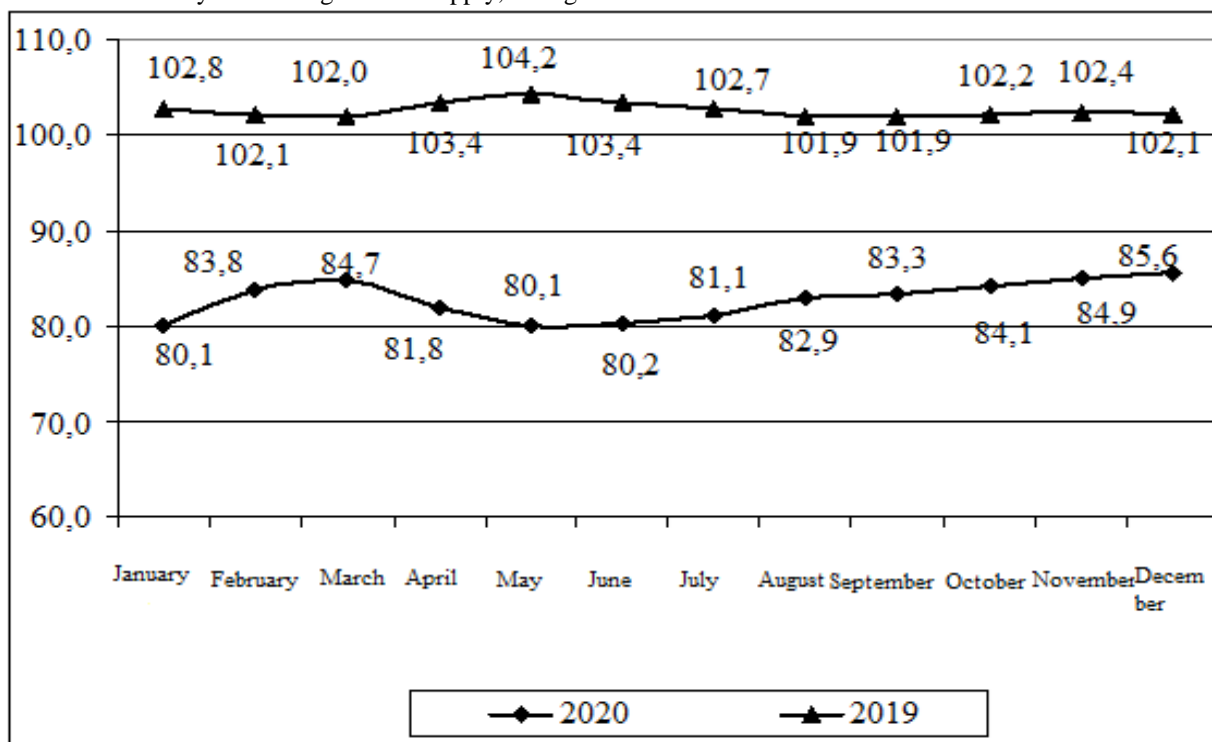


Fig. 1. Freight turnover of transport enterprises (in % against the corresponding period of the previous year, cumulative total)

Source: calculated according to [5].

The leading role in the internal transportation of goods belongs to the railway. According to Ukrzaliznytsia [15], 305.5 million tons of cargo were transported in 2020, which amounted to 97.6% of 2019. The most active was domestic transportation, which in 2020 amounted to 143.4 million tons of cargo (102.8% against 2019). Transit traffic is still insufficiently used, the level of which in 2020 amounted to 87.2% against 2019. According to the State Statistics Service of Ukraine in January-August 2018, 176.5 million tons of

cargo were transported by rail in domestic traffic and for export, which is 4.0% less than in January-August of 2017. Transportation of grain and ground products decreased by 15.0%, oil and petroleum products – by 12.7%, timber – by 8.7%, construction materials – by 8.4%, coal – by 7.0%, cement – by 3.5%, coke – by 2.6%. At the same time, transportation of ferrous metals increased by 0.8%, ferrous scrap – by 3.3%, iron and manganese ore – by 3.5%, chemical and mineral fertilizers – by 3.5%.

Table 1

## Freight turnover in Ukraine, 2018 – 2019

Types of Transportation		January – December 2018	January – December 2019	January – December 2020	Deviation of 2020 from 2018
Transportation	mln. tkm	331856.2	338962.5	290079.3	-41776.9
	In % to the corresponding period of the previous year	96.7	102.1	85.6	-11.1
railway	mln. tkm	186344.1	181844.7	175587.1	-10757
	In % to the corresponding period of the previous year	97.1	97.6	96.6	-0.5
road	mln. tkm	42569.5	48906.3	42016.9	-552.6
	In % to the corresponding period of the previous year	102.7	114.9	85.9	-16.8
water	mln. tkm	3363.0	3387.8	2877.3	-485.7
	In % to the corresponding period of the previous year	78.7	100.7	84.9	6.2
pipeline	mln. tkm	99239.9	104528.1	69281.8	-29958.1
	In % to the corresponding period of the previous year	94.1	105.3	66.3	-27.8
airlift	mln. tkm	339.7	295.6	316.2	-23.5
	In % to the corresponding period of the previous year	123.4	87.0	107.0	-16.4

Source: compiled and calculated according to [5]

In the total volume of cargo transportation by water, foreign transportation accounted for 48.4%. Compared to January-August 2017, the volume of foreign cargo transportation increased by 1.0%. In 2020, there was the largest amount of transportation of iron and manganese ore, which amounted to 79.7 million tons (26.1% in the structure of traffic in 2020). The volume of transportation of grain and ground products in 2020 amounted to 35.2 million tons, which in the structure of transportation in 2020 was 11.5%. In this group there was a decrease in transportation, which amounted to 86.8% in 2020 against the level of 2019. Compared to 2019, in 2020 there was an increase in the following types of cargo: iron ore and manganese (106.9% against 2019) and construction materials (116.8% against 2019). [5]

The railway of Ukraine has a developed network with a length of about 22,000 km. Almost 70% of the country's railway lines are equipped with modern control systems and automatic locking system. The Ukrainian railway system is connected to the railways in Russia, Belarus, Moldova, Poland, Romania, Slovakia and Hungary. It uses six railways connecting all regions of the country and serves 18 seaports in the Black Sea-Azov basin [15]. At the same time, after 2014, in connection with the occupation of part of the territory of Ukraine, the logistics connection was also disrupted, which significantly affected the flow of goods in the

country.

The state company Ukrzaliznytsia, established in December 1991, is the monopoly operator of railway transport in Ukraine. Currently, Ukrzaliznytsia is restructuring its own assets in order to modernize them. The restructuring of Ukrzaliznytsia should encourage investment in the railway sector and stimulate large-scale modernization of the domestic car fleet.

High wear of rolling stock and inefficient use of Ukrzaliznytsia causes logistical obstacles for Ukrainian grain market operators. This is exacerbated by the bureaucratic system of obtaining appropriate sanitary permits, which causes delays in the supply of grain.

Modern production systems require the adaptation of logistics systems to the existing requirements of internal and external users. After all, today logistics is defined as part of the supply chain where the management, planning and control of the efficiency of the flow of goods, their storage. This also applies to services and relevant information from the place of departure to the place of consumption to meet the needs of consumers.

In order to study the effectiveness of logistics support of the agricultural sector of the economy, it is necessary to analyze the volume of agricultural production in Ukraine (Table 2). In modern management conditions, it is important not only to grow the crop, but also to have the capacity to store it and transport it to end users.



**Harvesting of agricultural crops, 2018 – 2019**

Agricultural crops	The area harvested, thousand hectares		Production volume, thousand centners		Yield, centners per 1 ha of harvested area	
	2019	2019 in % against 2018	2019	2019 in % against 2018	2019	2019 in % against 2018
Cereals and legumes	15291.9	103.3649	80.1	79.8	47.4	49.1
Commercial sugar beet	221.3	80.56061	95.3	94.6	508.5	461.1
Sunflower	5958.9	96.63342	86.1	85.8	23	25.6
Potato	1308.8	99.15903	1.9	1.8	170.5	154.8
Vegetables	452.4	102.7481	14.4	14.7	214.3	214
Horticultural and berry crops	195.5	97.75	21.6	16.6	128.4	108.1

Source: calculated according to [12].

Examining the infrastructure for storage of agricultural products, it should be noted that the vast majority of warehouses in Ukraine was built in Soviet times. Despite some modernization since the first wave of privatization in the 1990s, many tanks, especially granaries, remain obsolete. Infrastructure facilities for storage of agricultural products in Ukraine are still underdeveloped. As of 2018, about 80% of farmers do not have access to equipment for cleaning and drying grain, which results in the significant (5-7%) crop losses and reduces the quality of final products and also reduces the price [15].

Grain warehouse account for 54% of total storage, while elevators account for the remaining 46%. A significant number of domestic grain warehouses are not

mechanized and, as a rule, are not equipped with machines for drying and cleaning. They are able to store grain for only 3-4 months, while modern elevators are able to store grain for up to 2 years [15]. High humidity, which is the result of different moisture contents and temperature changes at different times, can significantly degrade grain quality during storage. Given the above, it is now necessary to attract investment to upgrade existing logistics capacity. As a result of the implementation of this, you can increase the added value in the production of agricultural products.

The growth rate of agricultural production and the changes of gross surplus exchange value according to the types of economic activity indicate a rapid increase in production and the need for appropriate adaptation of logistics systems (Table 3).

Table 3

**Gross exchange value according to the types of economic activity, at actual prices, UAH million**

Types of economic activity	2015	2016	2017	2018	2019	2019 against 2015, %	2019 against 2018, %
Gross surplus exchange value (principal prices)	1689387	2023228	2519561	3018190	3418141	202.3	113.3
Agriculture, forestry and fisheries	239806	279701	303949	361173	358072	149.3	99.1
Industry	393142	505432	632887	748977	790057	201.0	105.5
Real estate development	38928	47457	64431	81259	106751	274.2	131.4
Wholesale and retail trade; repair of motor vehicles and motorcycles	273989	318075	409994	471844	524083	191.3	111.1
Transport, warehousing, postal and courier activities	134978	156745	191209	227256	268968	199.3	118.4
Temporary accommodation and catering	11946	15551	18727	25112	34630	289.9	137.9
Other types of economic activity	596598	700267	898364	1102569	1335580	223.9	121.1

Source: calculated according to the data of [12]

Taking into account the building up in production, it is necessary to increase the storage capacity. The capacity of domestic grain warehouses ranges from 25,000 tons to more than 200,000 tons, and the capacity of each individual elevator is from 8000-25000 tons. Poltava, Odessa, Dnipropetrovsk, Vinnytsia and Kirovohrad regions have the largest volumes for grain storage in Ukraine, accounting for 38% of the total national

capacity. Given further investment in storage infrastructure, the total capacity of elevators will increase to 12-15 million tons in the next 10 years.

Existing domestic logistics systems are adapted mainly for the export of raw materials. At the same time, when analyzing the production of certain types of food industry products, we can conclude that it is necessary to establish closed production cycles for certain types of food products (Table 4).

Table 4

**Production of certain types of food industry products, thousand tons**

Types of products	2015	2016	2017	2018	2019	2019 against 2015, %
Beef and veal, fresh or chilled – carcasses, half-carcasses, quarters unboned	50.0	59.1	58.5	56.3	55.8	111.6
Fresh or chilled pork – carcasses, half-carcasses (including those treated with salt or preservatives for temporary storage)	235.4	237.5	228.2	222.7	226.2	96.1
Beef and veal frozen – carcasses, half-carcasses, quarters, cutoffs	20.7	15.2	18.4	20.2	16.6	80.2
Frozen pork – carcasses, half-carcasses	12.4	7.4	6.6	6.7	11.8	95.2
Hen, chicken, fresh or chilled – carcasses	325.9	294.8	319.8	266.9	249.0	76.4
Hen, chicken, frozen – carcasses	145.0	216.7	76.8	103.8	128.4	88.6
Sausage and similar products of meat, by-products or blood of animals, and similar products and food products based thereon (excluding liver sausages and prepared meals)	228.8	233.0	247.1	247.8	237.2	103.7
Tomato juice, million liters	44.1	44.2	44.2	47.3	45.4	102.9
Apple juice, million liters	86.1	74.6	74.0	105.9	100.6	116.8
Mixtures of fruit and vegetable juices, million liters	188.6	187.1	186.8	184.3	188.6	100.0
Sunflower oil and its fractions, unrefined (except chemically modified)	3715.8	4424.0	5354.8	5148.6	5836.2	157.1

Source: calculated according to the data of [12].

It should be noted that state operators are the main players in the market of storage of agricultural products in Ukraine. They have a total storage capacity of approximately 5.6 million tons, or 18% of the total. The Grain Corporation of Ukraine, which includes *Khlib Ukraine*, is the largest elevator owner in the country and the most powerful state operator.

Traders represent the second largest group of warehouse owners who have modern elevators for storing agricultural products. The Swiss company *Glen-core* owns storage facilities with a total capacity of 1.9 million tons (6% of the total) in Ukraine. This company is the largest among private enterprises. *Nibulon* is another major exporter of agricultural food products, with storage capacity of up to 1.6 million tons (5% of total). The infrastructure of this enterprise includes a modern terminal, Mykolayiv port, elevators and river terminals in Dnipropetrovsk, Cherkasy, Poltava and Zaporizhzhia regions. The main integrated agricultural

companies together have a capacity of 6.2 million tons or more than 20% of the total country. Domestic agro-industrial enterprises have invested more than 150-250 US dollars for one ton of storage capacity for agricultural products. In this case, the costs associated with the construction of a new elevator can be reimbursed in 5-7 years.

It should be noted that producers adapt to modern market conditions and begin to develop their own logistics infrastructure. Modern steel elevators and hoppers built by agricultural holdings offer reliable mechanisms for grain quality control, as they are equipped with temperature control, aeration and insect detection technologies. Moreover, the grain can be easily rotated and dried in modern silos.

In recent years, the agricultural sector is characterized by a low level of efficiency (Table 5).

Table 5

**Efficiency indicators of agricultural production in Ukraine, 2017 – 2019**

Efficiency indicators	2017	2018	2019	Deviation of 2019 against 2017, +/-
Financial result before tax, UAH million	68606.5	70770.2	90836.3	22229.8
Enterprises that received profit before tax, as a percentage of the total	86.8	86.8	83.5	-3.3
Enterprises that suffered a loss before tax, as a percentage of the total	13.2	13.2	16.5	3.3
Net profit (loss), UAH million	68276.8	70461.8	90167.0	21890.2
The profitability level of all activities, %	16.5	14.2	16.1	-0.4
The profitability level of operating activities, %	23.2	18.9	19.3	-3.9
Number of employees, thousand people	489.2	479.8	461.5	-27.7

Source: calculated by the authors according to the data of [5].

For the period from 2017 to 2019, the pre-tax financial result increased by UAH 22,229.8 million. Despite the obtained result, the share of enterprises that suffered a loss from operating results increased by 3.3%. It should be noted that the most profitable is the

production of crop products. At the same time, systemic links in the formation of costs are due in no small part, as the costs of agricultural enterprises specializing in the production of crop products are dependent on industrial enterprises (chemical, energy, food industry)

and have significant export-import potential, for example, such products as oilseeds and cereals. Live-stock products are less profitable, although in recent years, thanks to government support, the industry has exceeded the threshold of unprofitability. Today family farms in Ukraine are actively developing, in the activity of which the potential for increasing the volume of dairy products is considered. The investment project "Family Dairy Farms" unites the activities of 87 investors, thanks to which UAH 2.7 million of investments were received. To date, 85 family farms have been opened in Volyn, Rivne, Ternopil, Zhytomyr, Khmelnytsky and Lviv regions. [16].

Live-stock costs depend not only on the significant impact of industrial activities but also on the crop sector (production of fodder crops).

The structure of the production cost of agricultural enterprises of Ukraine for 2019 is shown in table 6. As can be seen from the obtained cost elements, the largest share is material costs, the value of which is 57.7%. The largest share in the cost structure are stocks of mineral

fertilizers and feed. Thus, the share of feed costs is 11.4%, which amounts to UAH 52,678.8 million. In this case, the cost of feed produced in-house and purchased ones are distributed in approximately equal parts. Expenditures on seeds and planting material of the crop industry averaged UAH 38,402.2 million. (8.3%), and the share of expenditures on mineral fertilizers amounted to about 15.0% - UAH 69,506.2 million.

The costs of transport services, which are reflected in the elements: petroleum products and services of other organizations, are quite significant. Thus, the share of petroleum products in the cost of production amounted to almost 8.7%. And the share of spare parts costs was 5.0%. In such conditions, there is an urgent need to develop effective tools for managing sales processes, minimizing costs, organizing effective supply schemes, etc. All this results in the creation of an effective logistics system for the supply of agricultural enterprises on the basis of unified system characteristics.

Table 6

**The structure of the production cost of products (works, services) agriculture in the enterprises of Ukraine for 2019**

	Enterprises		incl. farming enterprise	
	UAH mln	in % against total	UAH mln	in % against total
Costs	463271.6	100.0	78580.2	100.0
Direct material costs	266918.0	57.7	47299.5	60.2
including				
seeds and planting material	38402.2	8.3	8335.2	10.6
feed	52678.8	11.4	2774.4	3.5
of which are purchased	23752.9	5.1	1299.3	1.7
other agricultural products	7653.1	1.7	309.5	0.4
mineral fertilizers	69506.2	15.0	16364.3	20.8
fuels and lubricants	40532.0	8.7	9995.2	12.7
electricity	4578.8	1.0	536.8	0.7
fuel and energy	2651.5	0.6	220.6	0.3
spare parts, repair and construction materials for repair	22942.0	5.0	4661.6	5.9
Direct labor costs	29729.6	6.4	4435.4	5.6
Other direct material costs	98849.9	21.3	18696.2	23.8
Total expenditures	67774.1	14.6	8149.1	10.4

Source: own calculation according to [5].

Effective inventory management (raw materials and supplies) minimizes losses due to irregular supply flow and unplanned inventory movements. Taking into account the seasonality of the operating cycle, inventory management mechanisms solve the problem of periodicity of supply of sales and supply of raw materials to processing enterprises. At the same time, the inventory management mechanism is quite influential on fluctuations in supply and demand for agricultural products. Demand forecasting and consumption analysis characterize the ability to sell products according to expected needs. Seasonality, limited resources, and especially the risk of non-compliance with climatic conditions make the process of pricing of agricultural products dependent not only on inflation expectations and

incomes but also on production technology. Stock forming occurs in various ways: serial stock, cyclic stock, stock of capacity utilization, safety stock, preventative stock [6, p. 8]. The maintenance of stocks entails the corresponding costs associated with: maintaining the physical properties of the stock (costs of depreciation, heating, electricity); with invested funds (assets are withdrawn from the turnover of the enterprise until the moment of realization); with the risk of selling the stock (taking into account the possibility of unclaimed stock). Current liabilities and current assets of agricultural enterprises of Ukraine for 2018 – 2019 are shown in Table 7.

Table 7

**Current liabilities and current assets of agricultural enterprises of Ukraine, 2018 – 2019, UAH million**

No.	Indices	2018	2019	Deviations of 2019 against 2018, %
1	Current financial investments	1876.2	1751.9	93.4
2	Cash	21948.6	23602.4	107.5
3	Payables	176088.4	182410.2	103.6
4	Current assets	654180.7	640995.1	98.0
5	incl. inventories	255983.4	270742.5	105.8
6	current biological assets	23698.8	25311	106.8
7	receivables	325880.5	297732.6	91.4

Source: State Statistics Service of Ukraine, 2020.

The majority of assets of agricultural enterprises in 2018–2019 are concentrated in current assets, where the largest share is available in receivables (about UAH 297,732.6 million). The number of accounts payable increased rapidly and in 2019 amounted to UAH 182,410.2 million. (compared to 2018, it increased by 3.6%). Short-term bank loans, which account for about 20% of all current liabilities, are quite significant in the structure of liabilities. It should be noted that for the period 2018 – 2019, 270742.5 million UAH is accumulated in the stocks of inventory of agricultural enterprises of Ukraine, which is 73.9% of current liabilities of enterprises. At the same time, agricultural enterprises double the risks of sustainability, on the one hand there is a large enough debt to pay, and on the other hand there is no sale of finished goods. This indicates a lack of rhythmic inventory turnover in the operating cycle. Almost a third of inventories are the balances of finished products that pass into the new year and storage conditions which at the beginning of the new year require significant costs for the maintenance of warehouses.

Storage of agricultural products is one of the most important issues of logistics management. First, the possibility of full compliance with the storage conditions of the product provides minimal risks of loss of product quality, and with it the stability of sales prices under the influence of seasonal fluctuations. Second, a properly located warehouse in relation to stores or production facilities minimizes the cost of transportation, packaging, sorting, etc. Third, the optimal financing option (own or leased premises) minimizes depreciation costs for warehouse maintenance costs. All these

factors to some extent increase the role of warehousing in agricultural production.

The efficiency of traffic flow management is aimed at minimizing transport costs. The essence of logistics management of traffic flow is to determine the optimal path of transportation from supplier to consumer, taking into account possible cases of traffic size, capacity of transshipment points, current maintenance costs of vehicles, etc. [7, p. 73 - 84]. The availability of tractors and agricultural machinery in agricultural enterprises of Ukraine in 2017 – 2019 is shown in Table 8. During the last 2017 – 2019, there was a tendency to reduce the resource transport potential. The number of tractors in 2019 decreased by 36,504 units and amounted to 89.5% against the level of 2017. There was a significant reduction in combine harvesters (-10,501 units), which amounted to 79.7% against the level of 2017. The number of plows in 2019 compared to 2017 decreased by 7.8%, seeders – decreased by 2.5%, harrows – decreased by 15.6%. The growth of a small amount of supply was observed only in cultivators, in 2019 their number increased by 1.9% compared to 2017. Thus, for the last 2017 – 2019 there was a reduction in the fleet of tractors and agricultural machinery.

In 2019, Vinnytsia, Poltava, Dnipropetrovsk and Odesa regions had the largest equipment, these are the regions where the activities of large agricultural complexes and agricultural holdings are most concentrated. Prospects for the development of agro-industrial transport logistics depend not only on the availability of tractors and cars but also on the development of work schedules assigned to each type of equipment with optimization of working hours.

Table 8

**Availability of tractors and agricultural machinery in agricultural enterprises of Ukraine in 2017 - 2019, units**

No.	Type of machinery	2017	2018	2019	Deviation of 2019 against 2017, %
1	Tractors	347111	377306	310607	89.5
2	Combine harvesters	51611	42925	41110	79.7
3	Seeding-machines	193809	195922	189013	97.5
4	Plows	336646	351830	310249	92.2
5	Cultivators	189093	210156	192660	101.9
6	Harrows	581578	524819	502567	86.4

\* Source: State Statistics Committee of Ukraine, 2020.

At the same time, it is necessary to pay attention to performance of works according to technological maps on each agricultural crop. It is also necessary to take into account the downtime of cars when transporting products in the fields directly during working with combines and due to the replacement of components

due to breakdowns. In the case of transportation from harvesting points to storage facilities or to direct points of sale, the problem of optimal traffic flow with minimal transport costs for the route is solved. Along with the increase in the amount of equipment in agricultural enterprises of Ukraine, there is a reduction in the energy

capacity of engines. The structure of electricity consumption in agriculture of Ukraine for 2010 - 2019 is shown in Table 9.

Service management is based on the usage of organizational forms: implementation of service through

branches, which are an intermediary structure in communication with the consumer; organization of service through the central office (departure to the place of service); service through sales offices; service through individual representatives of the manufacturer (distributors), working on a contractual basis.

Table 9

Structure of electricity consumption in the agriculture of Ukraine, 2010 – 2019

Years	Coal and peat	Petroleum products	Natural gas	Biofuels and waste	Electricity	Heat energy
2010	0.8	61.9	6.3	0.8	13.9	16.2
2011	0.7	62.0	7.9	0.7	13.6	15.0
2012	0.6	62.1	7.0	0.9	15.1	14.3
2013	0.5	62.3	9.0	0.7	15.1	12.4
2014	0.4	65.6	6.4	0.7	14.9	11.9
2015	0.5	66.4	6.6	1.0	14.7	10.8
2016	0.4	66.7	6.5	0.9	14.1	11.4
2017	0.4	62.4	7.1	1.4	17.0	11.8
2018	0.4	62.0	6.5	1.9	17.6	11.6
2019	0.4	66.5	5.1	1.5	16.7	9.9

\* Source: State Statistics Committee of Ukraine, 2020.

Communication and the availability of information space provide the coordination the flow of orders. The ability to provide timely access to information sources increases the level of competitiveness of the logistics system. The introduction of modern IT technologies in logistics requires the solution of the following issues: minimization of ordering time; consolidation of orders into one order; personification of access; storage of large arrays of information; minimization of transaction time during order processing.

**Conclusion.** In conditions of growing competition in the markets of agricultural products, logistics is defined as a basic component of effective logistics activities of agricultural enterprises. Despite the fact that in recent periods there has been a declining trend in the volume of transportation and provision of material and technical resources of agriculture, there is potential for the formation of efficient logistics activities. Particularly acute is the issue of further implementation of lean production strategies, which will minimize the volume of stocks with low turnover.

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