

# Adaptive Management of Transport Logistics in Agricultural Enterprises

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## Abstract

Agriculture is a complex logistics system with some features and limitations. The logistics system usually operates in conditions of pronounced uncertainty, characteristic random processes, so the aim of the article is to study and develop recommendations for improving the adaptability of transport logistics management in agricultural enterprises. In the article, the authors considered the specifics of logistics processes occurring in agriculture. The importance of cooperation in the development of logistics of the agro-industrial complex formed based on intersectoral cooperation of public transport enterprises, institutions, service and infrastructure organizations, which have separate transport units, united by technological and economic ties, and use a variety of resources of the region for the formation and implementation of transport services. The financial content of cluster development as a tool of competitiveness and innovative activity of agricultural enterprises is reflected, which allows realizing the available potential to increase sales.

**Keywords:** Adaptive management; Agricultural enterprise; Agro-industrial complex; Logistics.

## 1. Introduction

Sustainable socio-economic development of any region, determined by the harmonious development of production, the agro-industrial complex, the social sphere and the environment, is possible with a systematic approach to the institutions and mechanisms of economic management, based both on global factors and taking into account the specifics of each individual territory, its resource and human potential.

The effectiveness of the development of the region's reproductive system is based on the need for advanced, highly efficient development of such priority infrastructure sectors that serve as infrastructure growth points that provide a multiplier effect. One of the most critical infrastructure sectors, corresponding to the region's priority areas, the development of which performs a particular connecting function and has a significant impact on all other elements of the regional infrastructure, is the transport infrastructure.

The logistics system usually operates in conditions of pronounced uncertainty, stochastic environment – for market conditions, transport operations are characterized by random processes [1, 2]. Therefore, in terms of their operation, an essential property of the logistics system is the ability to adapt. High reliability and stability are one of the fundamental principles of its operation.

## 2. Theoretical Basis

The concept of "logistics" in agriculture appeared not so long ago, but several specialists [3-5] and heads of agricultural enterprises managed to assess what effect logistics can have in optimizing costs and increasing agro-industrial efficiency complex.

Logistics in the literature is defined as the science of "material flow management from the primary source to the final consumer with minimal costs associated with the movement of goods and related information flow".

In modern science, the area of responsibility of logistics includes managing human, energy, information, financial and other flows. Such sub-areas of logistics as "bank logistics", "trade logistics", "information logistics",

"agricultural logistics", etc. have emerged.

Analyzing domestic and foreign literature on the merits of the issue [6-8] is possible to identify the following areas that expand the concepts of logistics:

- A new direction in the organization of the movement of goods;
- The theory of planning various flows in human-machine systems;
- A set of various types of activities to obtain the required amount of goods in the right place, at the right time with minimal costs;
- Integration of transportation and production processes;
- The process of planning costs for the movement and storage of goods from production to consumption;
- The form of management of the physical distribution of the product;
- Efficient movement of finished products from the place of production to the place of consumption;
- A new scientific direction related to the development of rational methods management of material and information flows;
- The science of the rational organization of production and consumption [9, 10].

In the literature, there is also such a concept as a "logistics system" – a dynamic, open, stochastic, adaptive complex or extensive feedback system that performs certain logistic functions (LF), for example, an agricultural enterprise, a territorial production complex, a trading enterprise, etc. etc. The logistics system, as a rule, consists of several subsystems and has developed connections with the external environment. Some experts define it as a relatively stable set of structural (functional) divisions of a company and suppliers, consumers, and logistics intermediaries, interconnected in the main and/or associated flows and united by single management to implement a strategic (tactical) logistics plan<sup>1</sup>. The purpose of the logistics system is the delivery of raw materials, components, goods and products in maximum compliance with the requirements of consumers at a minimum (specified) level of costs [2, 11].

Today, managers use four main areas of management of logistics processes. This includes a minimum total cost strategy, a maximum customer service strategy, a maximum competitive advantage strategy, and a short-term profit maximization strategy. All tasks of the enterprise should be interconnected. This is why organizations make sense to take a comprehensive, holistic and integrated approach based on logistics principles.

Agriculture, in our opinion, should be considered as a complex logistics system with some additional features and limitations, among which the following can be distinguished:

- Huge influence of seasonality of works with limited time resources for carrying out their main part;
- The interconnection of all logistic processes with the natural cycle of development in crop production, animal husbandry and poultry farming;
- Lack of territorial localization of production processes, since the processors of agricultural raw materials, are remote from its sources;
- The need for high additional costs for urgent sale, processing or storage of agricultural products, be it finished products or raw materials for industrial processing;
- Requirements for the quality of agricultural products, complicating all logistics processes in the agro-industrial complex and creating additional restrictions in almost every activity area.

In the logistics system of the agro-industrial complex, specialists distinguish the following links (Fig. 1).

**Figure-1.** Links in the logistics system of the agro-industrial complex



The forces of these enterprises and organizations form material flows, directly carry out and control the promotion process. The logistics function is a large group of logistics operations aimed at implementing the tasks of the logistics system (Table 1.). Each link in the logistics chain covers its elements, which together form the material basis of logistics. The material aspects of logistics include, for example, vehicles and equipment, warehousing, communications and management.

All these links, being closely related to each other, have a significant impact on the overall performance of the industry and individual enterprises.

Let us dwell on two interrelated aspects of logistics in the agro-industrial complex - sales logistics and procurement logistics. We believe that it is for agriculture with its specifics, and right now, in the period of total savings and the reduction of all ineffective costs, work on the introduction of logistics systems should begin immediately and everywhere. Much of the optimization of logistics is carried out with the help of agricultural cooperatives.

**Table-1.** The leading logistics functions and their distribution between the various participants in the logistics process

The name of the logistics function	Participant in the logistics process			
	Public transport, forwarding company	Wholesale enterprise	Commercial intermediary organization	Warehouses of finished products of enterprises and workers
Formation of economic relations for the supply of goods or services, their development, adjustment and rationalization	+	+	+	
Definition of objects and directions of material flows		+	+	
Projected estimates of transportation needs	+	+	+	
Determining the sequence of promotion of goods through warehouses, determining the optimal ratio of warehousing in the organization of promotion			+	
Development, location and organization of warehousing		+	+	
Inventory management in the field of circulation.		+	+	
Carrying out of transportations, and also all necessary operations on a way of movement of freights to destinations	+			
Execution of operations that directly precede and complete the transportation of products (preparation for loading, loading and unloading, etc.)		+		+
Management of warehousing operations (transfer and acceptance of products by quantity and quality, storage, sorting, preparation of the necessary range for the buyer, organization of supply in small batches, etc.)		+		+

It should be noted that the number of agricultural enterprises has changed insignificantly over the past 9 years, most of which are left by small enterprises (Fig. 2).

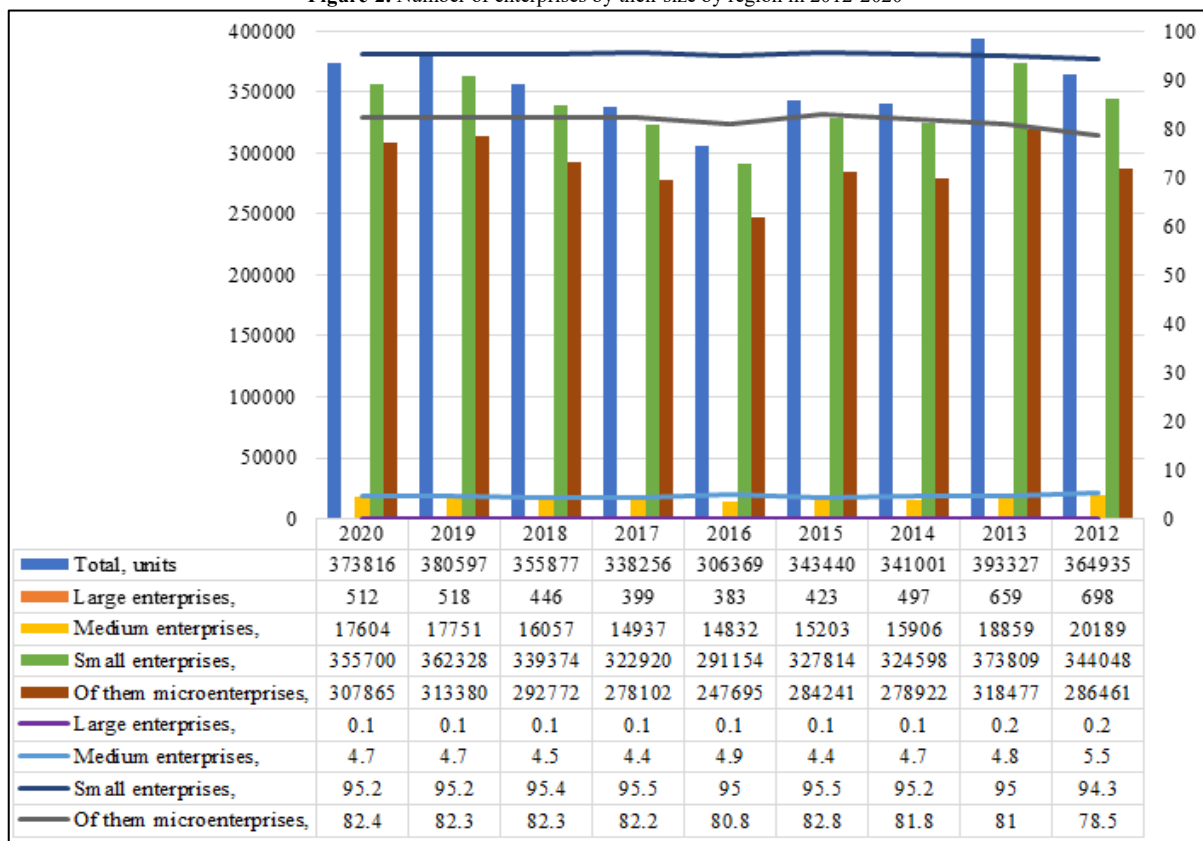
Procurement logistics is aimed at optimizing all costs of rural commodity producers when purchasing raw materials, machinery, compound feed, fertilizers, fuels and lubricants and other resources. This issue is partly solved by the creation of cooperatives in the countryside. Nowadays, small forms of business are cooperating to a greater extent. Nevertheless, medium and large agricultural enterprises are simply obliged to unite organizationally to reduce logistics costs when purchasing various types of raw materials and equipment, not to mention the possibility of lowering purchase prices when combined into a single order for raw materials and equipment to meet the needs of all members of the cooperative.

With regard to marketing logistics in agriculture, its importance and relevance now can hardly be overestimated. On the one hand, marketing logistics is expressed in the form of cooperation in the sale of crops to the rural population. It is necessary to stimulate this kind of cooperation further to generate additional income for rural residents. But for rural producers of various levels, it is necessary to create associations to reduce the level of logistics costs in the sale of finished products and the organization of export operations.

At the present stage of the development of logistics technologies, much attention is paid to solving certain optimization problems, warehousing and distribution processes in industrial, transport and trade enterprises. However, the creation of a transport and logistics system requires careful consideration of all aspects of these processes. As already mentioned, the logistics system usually operates in conditions of pronounced uncertainty, stochastic environment - for market conditions, transport operations are characterized by random processes. Therefore, in terms of their operation, an essential property of the logistics system is the ability to adapt. For the

effective functioning of the transport logistics system of agro-industrial enterprises, it is necessary to build a simulation model with elements of intellectualization to ensure management based on high technology, methods of modelling transport processes, software and organization of information flows.

**Figure-2.** Number of enterprises by their size by region in 2012-2020



Source: developed by the authors based on the data of the State Statistics Service of Ukraine, 2021) [12]

### 3. Results and Discussion

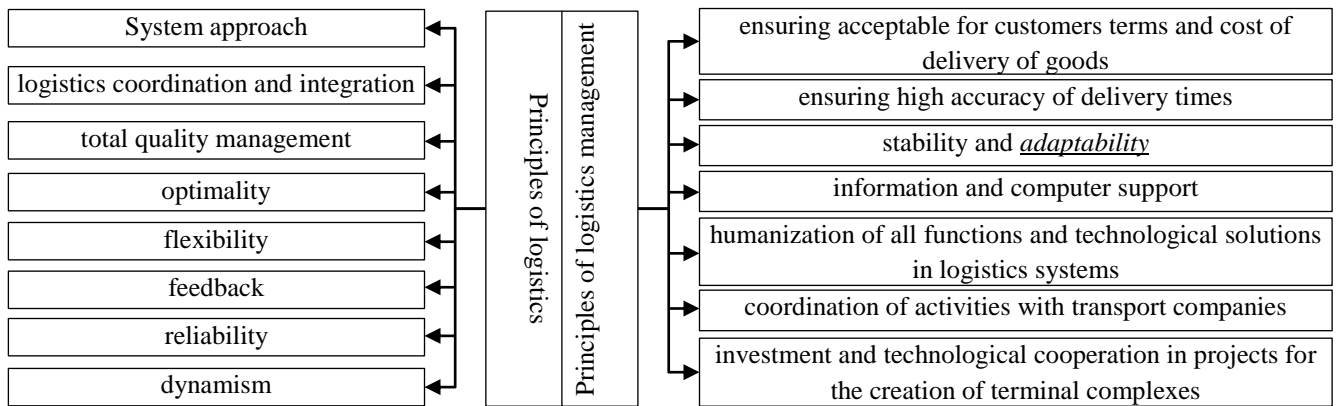
Supply logistics comprehensively covers the planning, management and physical maintenance of material flow and the flow of purchased parts with the necessary information flow to accelerate them and minimize costs for the entire supply logistics process.

Scientists have identified a large set of principles for the implementation of logistics management, in particular: the principle of a systematic approach; total costs; global optimization; logistics coordination and integration; use of trade-off theory to redistribute costs; refusal to produce universal technological and lifting and transport equipment; the principle of development of logistics service; modelling and information and computer support; development of the necessary complex of subsystems; TQM (total quality management) - general quality management; humanization of all functions and technological solutions in the logistics system; stability and adaptability. Given the significant problems in the processes of transportation and warehousing of agricultural products, we consider the need to optimize transport processes and build a warehouse network, in particular - the creation of local, regional and national logistics centres (centres of accumulation and distribution of goods flows), as well as creating an effective inventory management system agricultural products.

The logistics system aims to deliver to a given place the required quantity and range of products maximally prepared for production or personal consumption at a given level of costs. The boundaries of the logistics system are determined by the cycle of turnover of means of production.

The main principles for business logistics can be as follows: coordination of logistics with corporate strategy; improving the organization of the movement of material flows; ensuring the receipt of the necessary information and modern technology and processing; the desire for effective human resource management; maintaining close ties with other firms in developing a strategy; careful development of logistics operations; the desire to consolidate batches of goods; perception of logistics as a unique area of creativity for the strategic orientation of the firm; evaluation of the efficiency of logistics units. Summarizing the above principles, we can distinguish the enterprise's essential logistics management (Fig. 3).

The detailed content of the tasks of each subsystem is discussed in Table 2.

**Figure-3.** System of basic principles for logistics management of the agricultural enterprise**Table-2.** Subsystems of logistics management at the agricultural enterprise

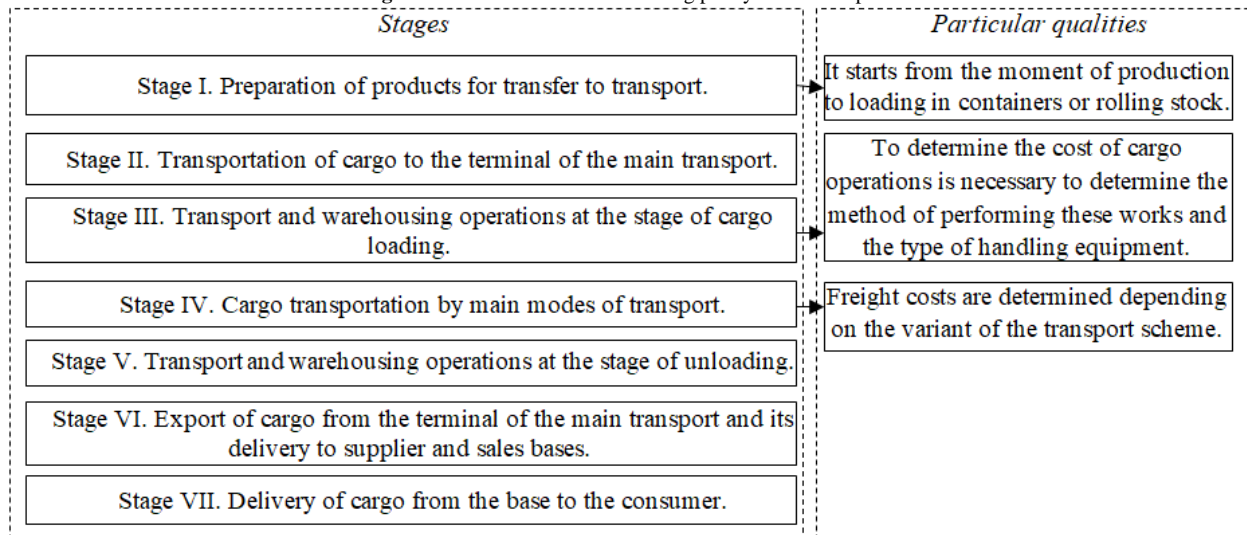
Types of subsystems	Contents of tasks
Supply subsystem	Aimed at improving the efficiency of work by selecting competent suppliers, optimizing the procurement process, developing a procurement management process, using standard working methods, research of the procurement market, the formation of procurement strategies and tactics
Warehouse subsystem	Provides for the improvement of warehousing processes through the introduction of warehousing technologies, taking into account the characteristics of agro-industrial products, improving the quality of warehousing services, their standardization and rational placement
Transport subsystem	Provides development of rational schemes of deliveries, routing of transportations, optimum loading of transport, maintenance of unity of the process of transportation with production and warehouse processes, maintenance of the account on transport
Production subsystem	Implements methods of inventory management, production planning, production support, material flow accounting, product quality improvement
Sales subsystem	Aimed at systematic market research, increasing the speed of processing and processing orders, increasing the level of logistics service, reducing the number of complaints, fines, etc.

To coordinate and combine the supply, production, and marketing goals are necessary to build a logistics concept of the enterprise. It is developed based on the strategic goals of the enterprise, which can be carried out under the influence of market conditions. Hence, only the introduction of logistics will be able to clearly and quickly respond to consumer demand and with minimal costs and stocks to meet it. The lack of a single logistics concept in the enterprise leads to disunity in the enterprise's functional departments. The logistics concept of agro-industrial enterprises should be based on the flexible formation of the logistics organizational structure, which ensures the elimination of artificial borders between departments and short information links in decision-making. The construction of the logistics concept does not depend on the size of the enterprise.

It is impossible to build a typical logistics concept, universal in application. It must be built by the characteristics of a particular production unit (enterprise, firm, corporation). The study of product and market strategy of the enterprise is complemented by the analysis of the environment, which is characterized by the relationship between suppliers and consumers, the pace of consumer demand, competition in supply and marketing markets and other factors.

The decision to use logistics in an agricultural enterprise should be made on the basis of certain expected effects from the implementation of the logistics concept. It should reduce the production cycle and lead times of orders, stocks of materials and finished products, strengthen innovation processes and competitiveness, compliance with contractual obligations, and more.

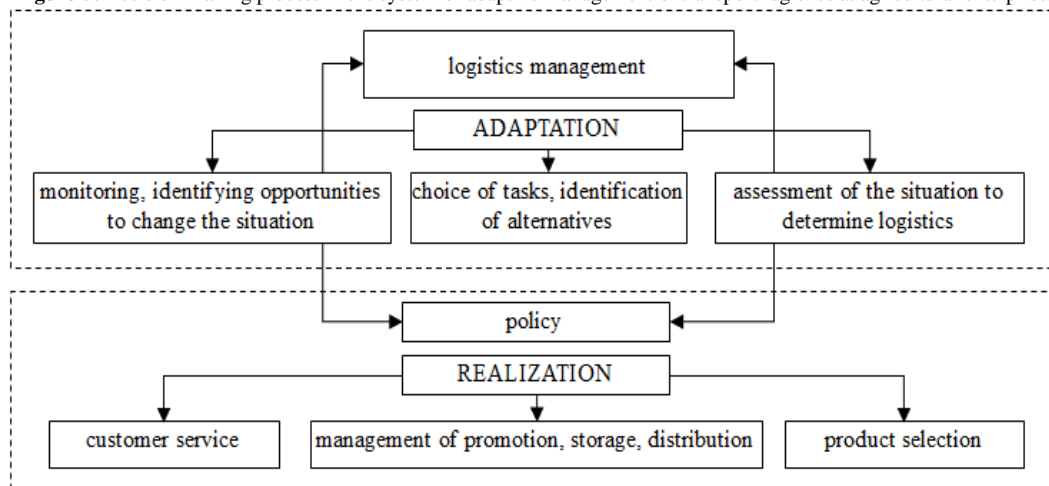


**Figure-4.** Provisions of the accounting policy of the enterprise

At each stage of the process of transportation of products can change technical means (unpacked mode of transport, package, container, use of cars of different brands or other modes of transport), technology and organization of transportation, so the efficiency of transport and logistics system depends on the choice of management at each step transportation.

The main tools of logistics management at the micro-level are its budget as an integral part of the company's overall budget in planning its business activities, logistics indicators, planning of the nomenclature of goods, operations research methods.

Micro-level logistics management includes the management of supply chain and sales functions. Logistics management activities typically include inbound and outbound transportation management, fleet management, warehousing, materials use, order fulfilment, network design logistics, inventory management, supply/demand planning, supplier and reseller interaction management, and outsourcing companies. The decision-making process in the logistics management system is based on the assessment of the logistics situation, the choice of logistics tasks and identify alternatives to the logistics system, implementation of the logistics system (implementation) and monitoring of the logistics system and identify opportunities to change the situation (Fig. 5).

**Figure-5.** Decision-making process in the system of adaptive management of transport logistics at agricultural enterprises

The adaptability of the logistics system and the entire management of the agricultural enterprise will be effective only when all management functions are performed together as a holistic mechanism.

## 4. Conclusions

The introduction of adaptive logistics management in an agricultural enterprise can provide the following real results:

- Reduction of "losses" in sales (in the absence of stocks of necessary products) due to more accurate placement of supplies and control over them. This achieves a dual goal: increase sales and provide a higher level of customer service;
- A logistics system that is able to respond quickly to market changes can reduce the "customer service cycle" and, consequently, reduce their inventory. This gives the supplier an advantage over competitors in the fight for its market share;

- Successfully designed logistics system helps to strengthen the relationship between supplier and consumer. This can be achieved by integrating the means of delivery of the supplier's products and the means of obtaining them by the consumer.
- Effective methods of "physical distribution" give significant cost savings, which can be extended to the consumer in the form of reduced payment for delivery of products, etc.;
- The introduction of an efficient logistics system allows the company to compete more successfully and profitably in certain markets.

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