

Logistics approach to the transportation of products from farms and agricultural enterprises

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Abstract: The foreign economic strategy of the activities of farms and rural enterprises, as well as other producers of agricultural products, is one of the main parts of the foreign economic policy of the Republic of Uzbekistan in the process of entering the world market. The article examines the logistics approach to transporting products from farms and agricultural enterprises focuses on the comprehensive organization and optimization of all stages of transportation from the point of production to the end consumer. This approach aims to ensure efficiency, minimize costs, and preserve product quality.

1 Introduction

The modern economy demands effective solutions for managing supply chains, particularly in the agricultural sector. Products from farms and agricultural enterprises are highly sensitive to transportation conditions, making logistics a critical tool for ensuring their quality and timely delivery. As the demand for eco-friendly products grows and the export potential of the agricultural sector expands, optimizing transportation processes has become a strategic priority.

The logistics approach to transporting agricultural products is based on the comprehensive organization of all stages of goods movement, from harvesting to delivery to the end consumer. This approach enables cost minimization, reduced transportation times, and preservation of product quality. Particular emphasis is placed on leveraging innovative technologies, adhering to regulatory requirements, and developing infrastructure, all of which enhance the competitiveness of farms in both domestic and international markets[1].

The purpose of this article is to explore the key aspects of the logistics approach to transporting products from farms and agricultural enterprises, highlight its advantages, and provide recommendations for optimizing transportation processes.

A number of laws and resolutions on regulating foreign economic activity have been adopted, aimed at increasing export potential, export-oriented and import-substituting production in Uzbekistan. Uzbekistan was expected to bring agricultural exports to \$ 3.5 billion in 2024. In 2023, agricultural exports amounted to nearly \$ 2 billion.

At present, in our republic, with the formation of numerous farm and agricultural products, the production of vegetables, fruits and melons has significantly increased than their consumption per capita. This is primarily due to the possibility of exporting them abroad

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and significant losses in case of non-compliance with the Rules of Cargo Transportation (storage, transportation and processing) [1].

Increasing the export farm and agricultural products and eliminating the causes of their losses is the most urgent task for Uzbekistan at the present stage. Scientists N.N. Ibragimov, R.Y. Abdullaev J.R. Kabulov, M.Kh. Rasulov, M.A. Khadzhimukhametova, R.Y. Tursunkhodzhayeva dealt with the organization of transportation of farms and agricultural products by railway transport[2-6].

Transportation of farm and agricultural goods in containers is an effective solution for transporting products over long distances, and D.I. Ilesaliev, S.R. Abdvakhitov, J.A. Shikhnazarov, A. Ismatullaev and S.U. Saidvaliev dealt with this process. Improving container terminals makes it possible to increase the capacity of railway transport and reduce the delivery time of goods. Containerization ensures the safety of cargo, protection from external factors and simplifies logistics[1-4,6].

The term of cargo delivery plays an important role in the transportation process and the works of Z.G. Adylova, Z.V. Ergasheva, Zh.S. Baratov, D. Boboev, R.Sh. Bozorov, S. Sattarov, S. Khudayberganov and many others are devoted to improving this process.

Improving the efficiency of agricultural production requires close interaction of all subsystems of the production and economic system: cultivation of fruit and vegetable products; collection, storage, distribution; transportation (transferring); sales.

A significant part of finished products is lost due to imperfections and non-compliance with agricultural technology, late collection, poor storage, lack of packaging, high cost of transportation, etc.

After cotton fiber, a wide range of farm and rural products, which are called "Gifts of Uzbekistan" abroad, can be an important item of Uzbekistan's export potential.

Effective management and organization of farm and rural areas is a hard and complex task. All efforts of farmers are focused mainly on growing and selling their products. Farms do not have enough time, skills and resources to prepare and export their products. Therefore, in order to increase the export potential of in Uzbekistan, it is necessary to implement a number of organizational and economic measures based on the creation of modern logistics systems.

Logistics is the organization and management of production, storage, warehousing, transportation and sales of products. Logistics also means the very physical movement of products from producers to end users at the right time, with the right level of quality, the right volume, and with the lowest costs [2, 3].

2 Analysis literature and methodology

The advantages of the logistic approach are as follows:

- reduction in transportation and storage costs;
- minimization of delivery time;
- preservation of product quality;
- enhanced competitiveness of farm products;
- increased export potential for the agricultural sector.

The logistics approach not only optimizes transportation processes but also establishes an efficient supply chain tailored to market needs.

In the conditions of the current state of the economy, railway and road transport, customs and tax legislation, the best (option) direction for increasing the export of farm and rural products is to find ways to improve agrotechnical (including agrochemical) organizational, financial, managerial, legal and regulatory mechanisms. Changes in the organization of production and labor, technology, distribution and storage,

transportation, sales should be aimed at improving productivity, product quality; reducing production costs, improving their safety.

From these positions, the increase in export potential, in symbolic form, can be formalized as follows:

$$Y \in [SR] \ni S_{opt} \Rightarrow \text{Goal}$$

where, S - strategies (decisions) made by management on the use of specific methods of organizing production or spending resources;

R-resources.

S_{opt}-optimal decisions that ensure effective achievement of the goal.

Effective management and functioning of farm and rural areas should be considered from the point of view of necessity, sufficiency and expediency, i.e. the target function will have the form.

$$Z:(B, C, P, R,) \Rightarrow \text{extr}$$

where, B - a set of parameters of the growing subsystem, agrotechnics, farm and agricultural products.

C - set of parameters of the subsystem for collecting, storing and distributing products.

P - set of parameters of the transportation, transportation, and export delivery subsystem.

R - set of parameters of the product sales subsystem.

In market conditions, each of the subtasks (1) is solved in terms of risk (or achieving maximum effect), depending on the goal set, taking into account the relationship with other subtasks. For example, when choosing a strategy for growing products, choose the strategy that best takes into account transportability, safety, presentation, calibration, etc.

Under risk conditions, each strategy can lead to one of many possible outcomes that differ in the probability of occurrence. Solutions to such problems are carried out in the form of a risk matrix.

Risk (DR) means the difference between the maximum and current winnings for the j-th situation. We choose the optimal strategy from the condition of minimum average risk.

$$DR_{opt} = \min DR \{Bq_B, Cq_C, PQ_P, Rq_R\},$$

where, C- the probability of occurrence of situations on various subsystems.

The correctness of decision-making determines the efficiency of farm and rural products. From our point of view, not a single farm or rural enterprise, not a, single construction company, freight forwarding organization, or trade intermediary company is able to independently ensure the effective functioning and solution of the entire chain of tasks from the beginning of sowing and growing to the consumer. The main part of medium - sized and small-scale farm and rural products has a "subsistence economy" to ensure material and technical supply, transportation, marketing and export of products. These functions are burdensome constraints on them in performing their core functions.

In carrying out their activities, interact with carriers, various modes of transport, customers, intermediaries, customs authorities, banks and a number of other counterparties. A small part of farm and rural products resort to the services of freight forwarders, storage warehouses, brokerage offices, which are unable to provide the necessary range of services for exporting their products.

In our opinion, the organization of complex industrial and commercial activities in the conditions of legally permitted economic freedoms and entrepreneurship is most adequate to economic and social realities today. Here we can see the logistics essence and model, which reflects the flow-based nature of farm and agricultural products and its integrity. We consider logistics as a direction related to the development of rational methods for managing material and related financial flows in the context of the transition from a free market to a regulated market economy and vice versa.

To implement fundamental changes based on the use of reengineering principles, it is necessary to create a regional logistics complex (RLC) that ensures the joint optimal functioning of the entire infrastructure (Figure.1), which contributes to an increase in the volume of exports of farm and rural products.

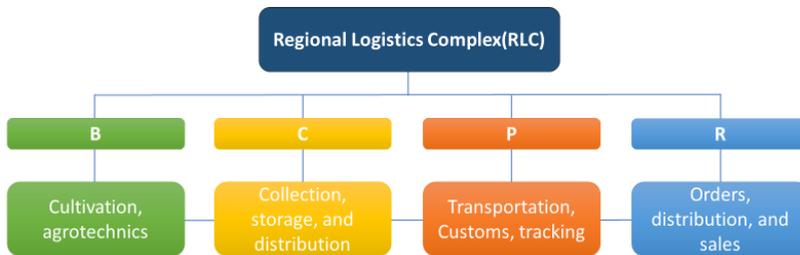


Fig. 1. General model of the regional logistics complex

In this case, a synergistic economic effect is provided. A regional logistics complex is formed from territorial logistics centers (TLCs) within the framework of logistics integration. In turn, the regional logistics complex interacts with international organizations and logistics centers (LC). The formation of international transport corridors and the interaction of LCS requires the development of appropriate infrastructure, the creation of multimodal terminals in transport hubs. For the purpose of a compact description of the problem of synthesis of the regional logistics complex scheme, we introduce the following notation for the generalized model (1):

$$B = B(x_1 x_2 \dots), \tag{1}$$

$$C = C(y_1 y_2 \dots), \tag{2}$$

$$P = P(z_1 z_2 \dots), \tag{3}$$

$$R = R(k_1 k_2 \dots), \tag{4}$$

where, $B(x_1 x_2 \dots)$ is a vector function, the spatial coordinates of which are the parameters of cultivation, agricultural equipment of the products produced;

$C(y_1 y_2 \dots)$ is a vector function which spatial coordinates are the parameters collection, storage of containers, packaging and distribution of products;

$P(z_1 z_2 \dots)$ is a vector function which spatial coordinates are the parameters transportation services, export deliveries;

$R(k_1 k_2 \dots)$ is a vector function which spatial coordinates are the parameters of product sales in the country of import.

The choice of control vectors should be carried out in such a way as to meet the requirements of the generalized model (1).

The formulated problem belongs to the complex types of variational problems that are considered in the theory of optimal processes.

Problem 2 is solved by successive approximations to the optimal value. At the first stage, the choice of R is optimized, at the second P, and at the third C. Based on this premise, we will represent the target functional in the form

$$Z_0 = Z_0^0 + \Delta Z$$

where Z_0^0 an arbitrary value Z_0 is, which is taken as a zero approximation to the solution of the problem;

ΔZ is the increment of the values Z_0 , which is obtained as a result of successive approximations to the solution of problems.

In a similar way, you can present independent arguments for the target functional, namely:

$$R = R^0 + \Delta R \tag{5}$$

$$P = P^0 + \Delta P \tag{6}$$

$$C = C^0 + \Delta C \tag{7}$$

then, excluding the dependent argument B, we obtain

$$\Delta Z_0 = Z_0(R^0 + \Delta R, P^0 + \Delta P, C^0 + \Delta C) - Z_0(R^0, P^0, C^0) \tag{8}$$

Taking into account (9), the problem can be formulated in terms of increments without changing its content: maximize the functional ΔZ_0 under the conditions that ReD_R , PeD_P , CeD_C , where D_R , D_P , D_C a closed set of valid values of vectors.

We call this formulation a problem A_D if the initial solution is assumed to be fixed, i.e., R, P, C given, then the solution of the problem A_D , will be entirely determined by increments of D_R , D_P , D_C . Since the latter are selected in stages, then at the first stage

$$\Delta Z_{01} = Z_0(R^0 + \Delta R, P^0, C^0) \tag{9}$$

At the second stage

$$\Delta Z_{02} = Z_0(R^0 + \Delta R, P^0 + \Delta P, C^0) \tag{10}$$

At the third stage

$$\Delta Z_{03} = Z_0(R^0 + \Delta R, P^0 + \Delta P, C^0 + \Delta C) \tag{11}$$

full increment of the objective function

$$\Delta Z_0 = \Delta Z_{01} + \Delta Z_{02} + \Delta Z_{03} \tag{12}$$

Expressions (10-12) show that the choice of the control vector at each stage affects the results of all subsequent stages. Taking this into account, using expression (13), the process of solving problem A for the maximization case can be described by the following equation:

$$\max_{\Delta R} \Delta Z_0 = f(R^0, P^0, C^0) = \max_{\Delta R} [\Delta Z_{01}(R^0 + \Delta R, P^0, C^0)] + \max_{\Delta R} [\Delta Z_{02}(R^0 + \Delta R, P^0 + \Delta P, C^0)] + \max_{\Delta R} [\Delta Z_{03} = (R^0 + \Delta R, P^0 + \Delta P, C^0 + \Delta C)]$$

Thus, the approach to solving problem A, based on a multi-stage representation of the solution processes and Bellman functional equations, allows us to divide the general problem into a number of simpler and better studied optimization problems. By solving each of these problems separately and combining the solutions according to the dynamic programming principle, you can get a solution to the general problem.

The international transport logistics organization (Figure.2) describes the processes and interactions between participants responsible for moving goods across borders. It involves managing material flows, information systems, and financial transactions to facilitate efficient export and import operations.

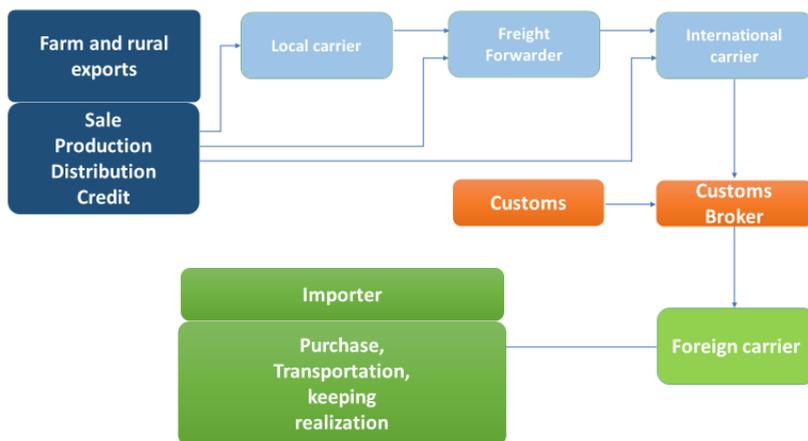


Fig. 2. Scheme of organization of international transport logistics

3 Result and their discussion

A modern regional logistics complex is an enterprise engaged in a variety of activities, including transportation, warehousing, cargo storage, customer service, additional services, and customs clearance. At the same time, the main goals of creating a regional logistics complex are:

1. speed up turnover and maintain production schedules.
2. increasing the transport load factor.
3. freeing (the client) of farm and rural industry from unnecessary worries (processing, customs clearance, stock exchange operations) exclusion of damage or loss of cargo;
4. informing about cargo progress;
5. provision of cargo packing and tare;
6. attracting a potential customer for the products of farm and rural products.

In this regard, terminal logistics technology requires the availability of effective means of integrated technology for performing warehousing, packaging, storage, transportation, and sales operations.

The financial strategy of creating a terminal logistics technology with the appropriate infrastructure, taking into account the large size of investments, should be based on the use of technical financial leasing, venture capital, tax credit, customs postponement of payments, increasing the share of own financial resources by increasing equity, reinvesting profits, and transport tariff discounts. The creation of terminal logistics technology, as a backbone

element of the infrastructure for increasing exports of farm and rural products, can be carried out in an evolutionary way. At the initial stage, individual logistics functions are combined (planning, warehousing, taring, transportation), and at the next stage, organizational and functional activities are combined (warehouses, transport vehicles, auto farms). When interacting with contractors of farm and rural products, the quality of services provided should be assessed based on quality assessment criteria. One of the main ones is reliability: financial, technical, operational, and risky. Financial reliability refers to the ability of a regional logistics complex to provide a sufficient level of efficiency when the parameters deviate from the optimal ones. Financial reliability is supported by its stability, which is expressed by the possibility of making a profit, being solvent, having sources of replenishment of its own working capital, and is a risk assessment criterion. Therefore, reliability and stability are the probability of trouble-free operation, the probability of a high level of fulfillment of obligations, and a reduction in the level of risk (failure).

Risk decision-making factors include: the desire for commercial success, getting more profit; terminal logistics technology activities in conditions of a high level of risk, i.e., with high efficiency, but minimal stability. To reduce risk factors in the activities of the regional logistics complex and territorial logistics centers, it is necessary to achieve operational, technical, financial, and information reliability. Improving operational and technical reliability ensures the quality of transport services, reducing cases of late delivery of goods, regular delivery, and increasing production capacity.

4 Conclusion

Based on the above, the following conclusions can be drawn:

1. A modern regional logistics complex is a multifunctional infrastructure system designed to efficiently manage material, informational, and transportation flows at the regional level. Its establishment aims to enhance the competitiveness of regional enterprises, ensure uninterrupted cargo movement, and support export potential.

2. The primary goal of an RLC is to integrate all participants in the logistics chain—from producers to end consumers. The complex includes warehouse facilities, transportation hubs, data processing centers, and cargo flow management systems. By leveraging modern technologies such as automation, digitalization, and monitoring systems, the RLC ensures the speed and accuracy of all operations.

3. The RLC plays a crucial role in supporting the agricultural sector, acting as a link between farmers, processors, and markets. It helps reduce transportation costs, improve service quality, and minimize time losses. Modern complexes are also focused on environmental sustainability, offering energy-efficient solutions and reducing the carbon footprint.

4. The development and expansion of regional logistics complexes are key drivers of regional economic growth, fostering domestic and international trade.

5. In connection with the creation of a TLC, the following features appear when solving problems:

B-selection of names, varieties, agricultural techniques of their cultivation, forecast of consumption volumes (or futures contracts for grown products) of the grown products;

C - necessary instructions on the harvest schedule, requirements for sorting, packaging and distribution of products through channels for local sale, processing, export;

P - preparation of products for shipment, Rules of cargo transportation, customs clearance of goods, forwarding and transportation;

R - a set of tasks related to the delivery, distribution and sale of products, financial support.

In general, the regional logistics complex will contribute to the development of the export potential of the Republic of Uzbekistan, the technology of competitive production of agricultural and farm products.

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