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Optimizing the economy relations with economic solutions with the help of transport issue

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Abstract. It is shown that the issue of transport is one of the main tasks in economic processes, i.e. minimization of costs of transport services among economic entities. The methods of solving the transport problem are shown in the correct distribution of the costs incurred by the suppliers in the delivery of each product to the consumers in advance, that is, in the creation of an optimal plan.

Keywords: *Transport service; economic entity; transport problem; optimization; open and closed models; North-West method*

1. INTRODUCTION

In recent years, large-scale measures have been implemented in our country aimed at developing the field of transport and transport communications, ensuring a high level of safety of transport, improving the management system in the field of transport, and training qualified specialists for the field.

The modern trends of economic development and the reforms being carried out show that, taking into account the geographical location of the republic, the formation and implementation of a unified transport policy aimed at ensuring the quality and popularity of transport services, and the introduction of modern technologies and intellectual systems of industry management are of particular importance.

Over the next 5 years, more than 840 billion soums will be needed to finance the program, mainly funds from "Uzavtosanoat-leasing" and other leasing companies, loans from commercial banks, private investors' own funds, as well as funds from local budgets and other funds not prohibited by law will be directed. [1]

2. THE CONCEPT OF SOCIO-ECONOMIC DEVELOPMENT

Enterprises are facing certain problems in delivering their products to consumers. For this, it is appropriate to implement the following modeling process:

Several manufacturing plants have the same product inventory. It is necessary to deliver them to consumers. If we know the volume of products offered by a production enterprise, the volume of consumer demand, and the transportation costs for transporting one unit of product from each supplier to each consumer, then the relationship between suppliers and consumers is it is necessary to determine the optimal business relations, as a result of which the consumer's demand for the product depends on the producer's ability, and the main goal is that the transportation costs for the transportation of goods are the least.

Instead, the transportation model is built separately for interchangeable and non-interchangeable products. If the goods are mutually exchangeable, then they can be reduced to a conditional product and solved by the methods of a simple, one-product transport issue.

If it is necessary to go through the processing process before delivering the product to consumers, in this case, the problem of multi-stage transportation is created and solved by special methods. There are static and dynamic transport problems according to the structured period and static and dynamic according to the structured period. The matrix model of the dynamic transport problem is structured in block form and takes into account the time factor.

In some cases, in addition to transportation costs, production costs are also taken into account.

The transportation problem is one of the best-studied linear programming problems from a theoretical and practical point of view, and it is successfully used in the optimal planning of transportation of industrial agricultural products.

It is necessary to distribute the existing load from a_i (i=1, m) unit at point A_i, and from b_j (j=1, m) unit to point B_j. It costs c_{ij}-sum to deliver one unit of cargo from point A_i (i=1, m) to point B_j (j=1, n).

Plan the shipment in such a way that the customer's needs are fully satisfied and the cost of shipping is minimal. For this, if we determine the amount of cargo to be transported from the i th point to the j th point as x_{ij}, the mathematical model of the transport problem can be constructed as follows:

$$\sum x_{ij} = a_i,\ (\text{i=1,m}) \tag{1}$$

$$\sum x_{ij} = b_j,\ (\text{j=1,n}) \tag{2}$$

$$x_{ij} \geq 0,\ (\text{i=1,m, j=1,n}) \tag{3}$$

$$Z_{min} = \sum\sum c_{ij} x_{ij} \tag{4}$$

The condition here is (1) that the product of each producing point is fully distributed, and (2) that the demand of each consumer point is fully satisfied. The total transport costs for transporting the product are represented by a linear function (4).

If the equality $\sum a_i = \sum b_j$ is valid in the transport problem (1)-(4), it is called the yip model of the transport problem. Transport issues are mainly solved on the basis of tables. Using the given information, the initial base plan of the transport issue is drawn up.

Methods of filling out the initial table.

There are many ways to find the initial plan of the transportation issue, and we will get acquainted with some of them.

1. The lowest cost method.

In this method, table cells are filled from the cell with the smallest definition, taking into account supply and demand. Then the next cell with a smaller definition is filled, and so on.

2. North-West method.

In this method, the cells of the table are filled starting from the cell in the first row, the first column, then the next cells in the first row are filled, taking into account the reserve and demand. After the cells of the first line are filled, the cells of the second line are filled taking into account the supply and demand, and so on.

3. Method of diagonals.

The cells on the main diagonal of the table are filled. Taking into account the reserve and excess, the cells above it are filled parallel to the main diagonal. After the upper cells are filled, the cells below the diagonal and parallel to it are filled, taking into account the reserve and the excess.

In some transport problems, the sum of reserves, i.e. the sum of needs a_i can be smaller (larger) than b_j.

Such problems are called open model of the transport problem.

If $\sum a_i < \sum b_j$, all demand for the product could not be satisfied. But even in this case, it is possible to determine the plan of distribution of products at low cost. For this, a fake m+1-th shipping point is introduced into the problem, which makes up the manufactured product $a_{m+1} = \sum b_j - \sum a_i > 0$ units. The transportation costs for transporting the product from this point to all consumer points are assumed to be $c_{m+1} = 0$, j=1,m.

If the inequality $\sum a_i > \sum b_j$, is valid, then n+1 false consumer point is entered and the transportation costs $c_{n+1} = 0$, i=1,n are obtained for transporting the product to this point. The product demand of this point is $b_{n+1} = \sum a_i - \sum b_j > 0$.

A chain of sequences in which only two cells are taken in one row (row or column) of the table. If the starting and ending cells of the chain are located in the same row, it is called a closed chain or cycle.

Understanding the optimal solution. The method of potentials is the first exact method used to solve the transport problem, which was developed in 1949 by Russian scientists L.V. Kantorovich and M.K. Created by Gavurin. The main idea of this method consists of a simplex method adapted to the transportation problem, which is described for the first time without dependence on the methods of solving linear programming problems. Later, a similar method was created by the American scientist Dantzig. The Danzig method is based on the basic ideas of linear programming, and in the American literature, this method is called a modified distribution method. With the help of the method of potentials, starting from the initial base plan, moving to a new base plan that is closer to the optimal solution, after a finite number of iterations, the optimal solution of the problem is found. In order to check that the base plan found in each iteration is the optimal plan, the quantities ui and v_j, called its potential, are assigned to each producer (A_i) and consumer (B_j) point.

Condition of potentials. These potentials are chosen in such a way that the sum of the potentials corresponding to the interconnected points A_i and B_j should be equal to S_{ij} (the trapsport cost of transporting a unit of product from A_i to B_j).

If the plan $H^* = (h^*_{ij})$ is the optimal plan of the transportation problem, then

$$u^*_i + v^*_j = c_{ij} \qquad (x^*_{ij} > 0), \tag{5}$$

$$u^*_i + v^*_j \le c_{ij} \qquad (x^*_{ij} = 0) \tag{6}$$

n+m u^*_i and v^*_j potentials satisfying the conditions match. The following conditions must be met in order to be a starting plan:

a) For each filled (product distributed) cell

$$u_i + v_j = c_{ij} \tag{7}$$

b) for each empty (product not distributed) cell

$$u_i + v_j = c_{ij} \tag{8}$$

If the condition (8) is not fulfilled for at least one empty cell, the initial plan found will not be an optimal plan and max $\left(u_i + v_j\right) = \Delta_{ij}$ ($\Delta_{ij}= u_i + v_j - c_{ij}$) $\Delta_{ij}> 0$ satisfying the condition The (i,j) cell will need to be converted to a filled cell.

Algorithm of methods of potentials. Thus, the algorithm of the method of potentials is as follows:

1. Using one of the above-mentioned methods, the initial plan is found.

2. A system of potentials is constructed to verify that the found plan is an optimal plan. For this purpose, using the formula (6), potential equations of the form (7) are created for each filled cell. It is known that the number of variables of the transport problem that are different from 0 in the plan is $n + m - 1$. So, the system of potential equations consists of a system of $n + m - 1$ equations with n+m unknowns. Since the number of unknowns in this system is greater than the number of equations, in order to find the numerical value of the potentials, it is possible to give an arbitrary value to one of them, zero value for simplicity, and find the others one after the other.

Suppose that ui is known, then v_j is found from (6): $v_j = c_{ij} - u_i$.

If v_j is known, then ui is found as follows: $u_i = c_{ij} - v_j$.

After determining the numerical value of all potentials, $\Delta_{ij}= u_i + v_j - c_{ij}$ for all empty cells. is considered. If $\Delta_{ij}\le 0$, (*i*=1,m; *j*=1,n) for all i and j is appropriate, the initial plan found is the optimal plan.

3. If $\Delta_{ij}\ge 0$ for at least one value of *i* and *j*, the initial base plan is replaced. For this purpose, a closed circuit, a cycle, is created for the cell, where the potential condition is not violated. In the cycle, the cells in which this cell remains empty must not be loaded. Then, clockwise, we put signs (+) on the cell whose potential condition is violated, on the next cell (-) and so on. We create a new plan by moving the load with the least amount of load in the cells marked (-) from the cell marked (-) to the cell marked (+).

4. We check the condition of the potentials for the newly created plan. If the new plan found is not optimal, this step is repeated.

3. CONCLUSION

To sum up, the issue of transport is one of the main tasks in economic processes, i.e. minimization of costs of transport services between economic entities. The issue of transport is the most optimal method for the correct distribution of the costs incurred by the suppliers in delivering each product to the consumers in advance, that is, for creating an optimal plan. The transportation issue is the most important model for the correct organization of cargo distribution, calculating the transportation costs in advance.

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