ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 04,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

METHODS FOR RURAL FARMING

Mamatova Zilolakhan Khabibullokhanovna

Fergana state university associate professor ,

pedagogy sciences according to philosophy doctorate (PhD)

Orchid : 0009-0009-9247-3510

E-mail: mamatova.zilolakhon@gmail.com

Daminova Shahsanam Davlatjon kizi

Fergana State University Practical mathematics 3rd year student , group 22-09 student

E-mail: daminovashohsanam0@gmail.com

Abstract : This the issue of transport in the article theoretical and practical in terms of wide is illuminated . Fergana of the province farmer farms products province in the center to the market the most less cost with to deliver problem analysis The issue is solved step by step with a minimum price . method through solved . Real example optimal plan based on will be compiled and general expenses is reduced .

Keywords : Transport issue **,** closed model transportation issues, busy cells, empty cells, cost matrix, potentials, potential equation, closed loop.

Introduction . The transport issue is the key to the economy. the most important and practical from issues This issue is one of logistics , supply chain and working release processes to optimize is focused on . Each enterprise or working release system for the product from supply to the consumer in delivery expenses big importance has will be . In this transportation expenses reduce and from resources effective use economic in terms of important . The issue of transport theoretical solution through , as well as balance supply , consumers need satisfy , suppliers by working issued products delivery to give efficiency increase possible.Transport The problem is usually linear . to program related is , it is in itself resources maximum at the level effective distribution in mind holds . Each supplier and consumer products , as well as their between transportation expenses This issue is very common . in the fields wide used , including rural farm products to the market delivery in giving , industry working releases between in transporting materials and even international in trade .

This issue is particularly limited resources there is was in conditions , economic efficiency increase for very important . The issue minimum value in solution method and potentials method such as separately methods These methods are used . through , transportation costs optimization , product effective distribution and supplier and consumers in the middle effective communication provision opportunities is studied .

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 04,2025
Journal: https://www.academicpublishers.org/journals/index.php/ijai

Analysis and results

Let's assume , $A_1, A_2, ..., A_m$ produce the same product at each point. At a certain time interval, $A_i \ (i=\overline{1,m})$ at the point working removable product amount a_i to unity equal Let it be . Work removable products $B_1, B_2, ..., B_n$ at points consumption let it be done and every one $B_j \ (j=\overline{1,n})$ consumer being seen time between to the product was demand $b_j \ (j=\overline{1,n})$ to unity equal Let it be .

From this outside $A_1, A_2, ..., A_m$ at points working removable of products general amount $B_1, B_2, ..., B_n$ of points to the product was requirements general to the amount equal , that is

$$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j$$

equality appropriate Suppose to be Let 's assume that every one working release from the point everyone consumption doer to the point product transportation opportunity exists , and A_i from the point B_j to the point the product take to go for spending to be done cost C_{ij} money per unit equal Let it be .

x_{ij} with planned time between A_i from the point B_j to the point take to go of the product general amount we mark .

The transportation issue given parameters and designated the unknowns following to the table we will place .

Table 1

B_j \ A_i	B_1	B_2		B_n	i / c products amount
A_1	C_{11} x_{11}	C_{12} x_{12}	...	C_{1n} x_{1n}	a_1
A_2	C_{21} x_{21}	C_{22} x_{22}	...	C_{2n} x_{2n}	a_2

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE
ORIGINAL ARTICLE
ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 04,2025
Journal: https://www.academicpublishers.org/journals/index.php/ijai

…	…	…	…	…	…
A_m	C_{m1} x_{m1}	C_{m2} x_{m2}	…	C_{mn} x_{mn}	a_m
demand quantity	b_1	b_2	…	b_n	

The matter economic meaning of freight so plan to compose must : 1) every one working release at the point products full be distributed ; 2) each one consumer to the product was demand full satisfy and this with together spending to be done road expenses general Let the value be minimal .

The matter first condition following equations system through expression possible :

$$\begin{aligned} &x_{11}+x_{12}+...+x_{1n}=a_1,\\ &x_{21}+x_{22}+...+x_{2n}=a_2,\\ &..............................\\ &x_{m1}+x_{m2}+...x_{mn}=a_m. \end{aligned} \qquad (1)$$

The matter second condition and following equations system in appearance is expressed as :

$$\begin{aligned} &x_{11}+x_{21}+...+x_{m1}=b_1,\\ &x_{12}+x_{22}+...+x_{m2}=b_2,\\ &.................................\\ &x_{1n}+x_{2n}+...x_{mn}=b_n. \end{aligned} \qquad (2)$$

The matter economic to the meaning according to unknowns negative not to be need , that is

$$x_{ij}>0 \ \ (i=\overline{1,m}; \ \ j=\overline{1,n}). \qquad (3)$$

$i-$working release from the point $j-$consumption doer to the point planned x_{ij} unity the product delivery to give for spending to be done road cost $c_{ij}x_{ij}$ money per unit equal will be .

Planned all products transportation for spending to be done general road expenses

ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 04,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

$$Y = c_{11}x_{11} + c_{12}x_{12} + \ldots + c_{1n}x_{1n} + c_{21}x_{21} + c_{22}x_{22} + \ldots +$$

$$c_{2n}x_{2n} + \ldots + c_{m1}x_{m1} + c_{m2}x_{m2} + \ldots + c_{mn}x_{mn} = \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij}$$

function through is expressed as . The problem on condition according to this function to a minimum aspiration need , that is

$$Y = \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij} \rightarrow \min \qquad (4)$$

Relationships (1) – (4) joint transportation issue mathematician is called a model .

The transportation issue mathematician model following gathered to write in plain sight possible .

$$\sum_{j=1}^{n} x_{ij} = a_i, (i = \overline{1,m}) \qquad (5)$$

$$\sum_{i=1}^{m} x_{ij} = b_j, (j = \overline{1,n}) \qquad (6)$$

$$x_{ij} \quad 0, (i = \overline{1,m}; j = \overline{1,n}) \qquad (7)$$

$$Y = \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij} \rightarrow \min \qquad (8)$$

In question every one a_i, b_j and c_{ij} non-negative numbers that is $a_i \quad 0,\ b_j \quad 0,\ c_{ij} \quad 0.$

in problems (5) – (8)

$$\sum_{i=1}^{m} a_i = \sum_{j=1}^{n} b_j = A$$

equality appropriate if , that is working issued products sum ten was requirements to the sum equal if , then this issue closed We call it a model transportation problem .

Theorem **1.** Any closed model transportation problem to the solution has .

Theorem 2. The transport problem from the conditions structured matrix $r(A)$ color $m+n-1$equal to .

ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 04,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

Theorem 3. If the problem all a_i *va* b_i all from the numbers consists of if the transportation issue solution whole numerical will be .

Theorem 4. Optimal plan for the voluntary transportation problem exists .

The optimal solution to the transportation problem find for potentials method

Potentials method of transportation solution for applied first clear method was born in 1949 Russian scientists LV .Kantorovich and MKGavurin by This method is created main The idea is related to the transportation issue. customized simplex from the method consists of is the first times linear programming issues solution to the methods related not been without described . Later , similar method American scientist Danzig by created . Dancing method linear programming main to their ideas based in American literature this method modified distribution It is called the method .

Potentials method help with elementary basis from the plan from , to the optimal solution closer was new basis to plans passing by go , limited on the thigh from iteration after optimal solution to the problem is found . Each in iteration found basis plan optimal plan that it is check for every one working issuer (A_i) and consumption to the (B_j) point his/her so-called potential u_i and v_j quantity suitable These potentials are so is chosen , in which mutual connected A_i and B_j to points suitable incoming potentials sum c_{ij} to A_i from B_j unit to the product transportation for spending (equal to the cost of transportation) to be need .

Theorem 5. If $X^* = (x_{ij}^*)$ plan optimal plan of the transportation problem if , then to him/her

$$u_i^* + v_j^* = c_{ij} \quad (x_{ij}^* > 0) \qquad (9)$$

$$u_i^* + v_j^* \quad c_{ij} \quad (x_{ij}^* = 0) \qquad (10)$$

the conditions satisfactory $n+m$ one u_i^* and v_j^* potentials suitable arrival necessary and enough .

Proof . **Sufficiency** . Suppose , $X^* = (x_{ij}^*)$ plan for (9), (10) conditions appropriate Let it be . Then optional $X' = (x'_{ij})$ plan for

$$\sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij}^{'} \geq \sum_{i=1}^{m}\sum_{j=1}^{n}(u_i^* + v_j^*)x_{ij}^{'} = \sum_{i=1}^{m} u_i^* \sum_{j=1}^{n} x_{ij}^{'} + \sum_{j=1}^{n} u_i^* \sum_{i=1}^{m} x_{ij}^{'} = \sum_{i=1}^{m} a_i u_i^* + \sum_{j=1}^{n} b_j v_j^* =$$

$$\sum_{i=1}^{m} u_i^* \sum_{j=1}^{n} x_{ij}^{'} + \sum_{j=1}^{n} u_i^* \sum_{i=1}^{m} x_{ij}^{'} = \sum_{i=1}^{m}\sum_{j=1}^{n} c_{ij}x_{ij}^*$$

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 04,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

So , X^* planned linear function value his/her optional X' planned from the value small It's happening . That's why for X^* the plan will be optimal .

So so , potentials method algorithm from the following consists of :

1. From above built of methods from one using , initial basis plan is found .

2. Found plan optimal plan that check for potentials system is made . This from formula (15) for using every one filled box for (17) in the form potential equations It is known that the transport issue different from 0 in the plan was variables number $n+m-1$ ta. So , the potential equations system $n+m$ unknown $n+m-1$ equations from the system consists of In this system unknowns number equations from the number more than happened because of the numerical value of potentials find for from them optional to one clear one value , for example zero value giving the rest one after another find possible . Let's assume , u_i known Let , then from (15) v_j found :

$$v_j = c_{ij} - u_i$$

If v_j known if , then u_i as follows found :

$$v_j = c_{ij} - u_i$$

All the numerical value of potentials clearly after all , everyone empty boxes for

$$\Delta_{ij} = (u_i + v_j - c_{ij})$$

is considered . If all i and j for the

$$\Delta_{ij} \quad 0, \ (i=1,\ldots,m; j=1,\ldots,n)$$

appropriate if , found elementary basis plan optimal plan will be .

3. If i and j of at least one value for A_i if , initial basis plan is replaced . This for

$$\max_{\Delta_{ij}>0} \Delta_{ij} = \Delta_{lk}$$

the condition satisfactory (l,k) box will be filled (x_{lk} unknown) to the base is entered). $x_{lk} = \theta$ suppose as (l,k) to the box θ is entered . Then hour arrow according to (l,k) from the box Starting from the beginning , moving on , filled to the boxes order with (-) and (+) gestures placed As a result closed K outline harvest will be

$$K = K^- \cup K^+$$

ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 04,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

this on the ground K^-, K^+ – with (-) and (+) signs the boxes own inside recipient half contours .

By the following formula θ the numerical value of is found .

$$\theta = \min_{x_{ij}\ K} x_{ij} = x_{pq} \qquad (11)$$

4. New basis plan is :

$$x'_{lk} = \theta,$$
$$x'_{pq} = 0,$$
$$x'_{ij} = x_{ij}, \quad agar \quad x_{ij} \quad K,$$
$$x'_{ij} = x_{ij} + \theta, \quad agar \quad x_{ij} \quad K^+,$$
$$x'_{ij} = x_{ij} - \theta, \quad agar \ x_{ij} \quad K^-.$$

New basis planned filled boxes number $n+m-1$ that there was for (19) condition satisfactory boxes suddenly more than if so , from them one empty to the box turned over and left in the boxes assume the distribution is equal to 0 Found new basis plan for again again potentials system will be found and new optimal plan to be condition is checked . If new basis plan optimal plan if not , then again again in points 3, 4 made affairs The process is repeated until the optimal solution is found . until found , that is all empty boxes for

$$\Delta_{ij} = u_i + v_j - c_{ij} \quad 0$$

condition until done repeated .

Subject : Fergana of the province the following 4 village economy in 2025 autumn in season apple harvest gather when taken :

1. Sixty Agro Service – 120 tons

2. Rishton Fruit - – 80 tons

3. Blood AgroPark – 100 tons

4. Besharik Harvest Agro – 100 tons

This the harvest to the 5 largest supermarket chains in the region delivery to give is being planned . Supermarkets every in one apple The requirement is as follows :

1. Macro – Marg'ilon branch – 70 tons

2. Basket – Blood branch – 90 tons

ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 04,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

3. Baraka Market – Mother Farg center – 60 tons

4. Grand Market – Buwayda district – 80 tons

5. Asia Supermarket – Kuva district – 100 tons

Farmer from their farms 1 ton to supermarkets apples delivery to give expenses in the som as follows

In our case, 4 farmers farm and there are 5 supermarkets . Each delivery to give direction according to expenses schedule given . Solution as follows done increased :

T	B_1	B_2	B_3	B_4	B_5	Z
A_1	70^6	50^8	0^{10}	0^9	0^7	120
A_2	0^9	40^7	40^4	0^2	0^5	80
A_3	0^3	0^4	20^6	80^8	0^6	100
A_4	0^4	0^6	0	0^7	0^5	100
T	70	90	60	80	100	400

$$6 \times 70 + 8 \times 50 + 7 \times 40 + 4 \times 40 + 6 \times 20 + \\ + 8 \times 80 + 3 \times 100 = 2320 \text{ so'm}$$

Farmer from farms apple products to supermarkets delivery to give according to structured this transportation issue is real life logistics problems in solution how economic approaches application obvious shows.Northwest corner method load distribution using compiled and elementary plan calculating Then , the minimum elements method through the most cheap transportation expenses based distribution planned . Both of the method results analysis was done , expenses compared and potentials method optimal plans using conditions checked .

In practice such approaches enterprises and farmer farms for from resources reasonable usage , transportation costs reduce and logistics efficiency to increase service Through this issue student or specialist in transportation optimization mathematician modeling importance understands and real problems analysis to do his/ her skills shapes .

Literature:

1. L. Kantorovich - " Mathematician programming and economic analysis " (1959). Production release optimal plan in processes to compose and resources distribution methods statement done .

ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 04,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

2. GN Nemchinov , " Linear economic models " (1972). Economic in systems linear programming and analysis methods to use dedicated .
3. VM Zhuravlev , " Linear programming and transport issues " (1993). The transport issue solution and his/her practical application about in detail explanations given .
4. BT Pukinel , "Transport and logistics systems optimization " (2002). In transport systems optimality provision and resources effective distribution methods seeing released .
5. AK Kolmogorov , " Linear programming : theory and practice " (1985). Linear programming methods various in the fields use , this including in transport matters application .
6. **Q. Safayeva . Mathematician programming . Learning manual . TMI-2003.**