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Articles are published in Uzbek, Russian, and English, ensuring a wide-reaching audience and fostering cross-cultural academic exchange. As a beacon of academic excellence, the "Journal of Transport" continues to serve as a vital conduit for knowledge dissemination, collaboration, and innovation in the transport sector and related fields.

An integral model for assessing the technical efficiency of a regional transport and logistics system: a case study of Khorezm region

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Abstract: The article examines the technical essence of the regional transport-logistics system, its main parameters, and the theoretical-methodological foundations of its assessment. The interrelation between the transport system and transport potential is explained from the perspective of the "basis → derivative" relationship. The main technical indicators of the transport-logistics system, such as throughput capacity, cargo carrying capacity, operational coefficients, technical efficiency index, and the level of multimodal connectivity, are analyzed. Methods for assessing transport potential based on integral indices, load level, spatial density, and dynamic evaluation models are proposed. In addition, the technical characteristics and existing infrastructure capabilities of the transport-logistics system of the Khorezm region are analyzed.

Keywords: transport-logistics system, transport potential, technical efficiency, throughput capacity, multimodal transport, infrastructure, integral index, digitalization

Hududiy transport-logistika tizimi texnik samaradorligini baholashning integral modeli (Xorazm viloyati misolida)

Murodov A.S.[1][a], Atadjanova Z.S.[1][b]
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Annotatsiya: Maqolada hududiy transport-logistika tizimining texnik mohiyati, uning asosiy parametrlari va baholashning nazariy-metodik asoslari tadqiq etilgan. Transport tizimi va transport salohiyati o‘rtasidagi o‘zaro bog‘liqlik "asos → hosila" munosabati nuqtai nazaridan yoritilgan. Transport-logistika tizimining o‘tkazuvchanlik qobiliyati, yuk ko‘tarish quvvati, ekspluatasion koeffisientlar, texnik samaradorlik indeksi hamda multimodal bog‘lanish darajasi kabi asosiy texnik ko‘rsatkichlari tahlil qilingan. Integral indeks, yuklanish darajasi, fazoviy zichlik va dinamik baholash modellari asosida transport salohiyatini baholash usullari taklif etilgan. Shuningdek, Xorazm viloyati transport-logistika tizimining texnik xususiyatlari va mavjud infratuzilma imkoniyatlari tahlil qilingan.

Kalit so‘zlar: transport-logistika tizimi, transport salohiyati, texnik samaradorlik, o‘tkazuvchanlik qobiliyati, multimodal transport, infratuzilma, integral indeks, raqamlashtirish

1. Kirish

Hududning transport tizimi uning transport salohiyatini shakllantirishning moddiy-texnik va tashkiliy asosi sifatida namoyon bo‘ladi. Transport tizimi hududda yuk va yo‘lovchilar tashishni ta’minlaydigan infratuzilma obyektlari, transport vositalari, boshqaruv va tashkiliy mexanizmlar majmuasidan iborat bo‘lib, u transport xizmatlari ko‘rsatishning joriy holati va amaldagi imkoniyatlarini ifodalaydi[2].

Transport salohiyati esa mazmunan kengroq kategoriya bo‘lib, u nafaqat mavjud tizimning holatini, balki foydalanilmayotgan zaxiralarni, mavjud quvvatlarni, geostrategik joylashuv afzalliklarini hamda yuk va yo‘lovchi oqimlarining istiqboldagi o‘sish imkoniyatlarini o‘z ichiga oladi. Ilmiy manbalarda u "transport resurslari (vositalar, tizimlar va infratuzilma), shuningdek tashkiliy mexanizmlar va jarayonlar majmui" sifatida talqin qilinadi[3].

Shu nuqtai nazardan, transport tizimi va transport salohiyati o‘rtasida "asos → hosila" munosabati mavjud. Rivojlangan, muvozanatlashgan va samarali boshqariladigan transport tizimi yuqori darajadagi transport salohiyatini shakllantirish uchun zarur shart-sharoit yaratadi. Aksincha, tizimdagi eskirish darajasi, infratuzilmadagi "tor joylar", tarmoqlararo bog‘liqlikning pastligi hatto qulay geografik joylashuv sharoitida ham salohiyatni to‘liq ro‘yobga chiqarishga to‘sqinlik qiladi[4].

Bunda o‘zaro bog‘liqlik ikki tomonlama xarakterga ega. Transport salohiyatini amalga oshirish transport tizimini modernizatsiya qilish, infratuzilmani kengaytirish va boshqaruv mexanizmlarini takomillashtirishni talab etadi. Natijada ijobiy teskari aloqa shakllanadi: tizimning rivojlanishi salohiyatni oshiradi, salohiyatning ortishi esa infratuzilmaga investitsiyalarni rag‘batlantiradi.

Tadqiqotlar shuni ko‘rsatadiki, transport majmuasi mintaqaviy integratsiya jarayonlariga hamda iqtisodiy

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rivojlanishga kompleks ta’sir ko‘rsatadi. Transport salohiyatini ro‘yobga chiqarish hudud uchun barqaror daromad manbai va raqobatbardoshlik omili hisoblanadi. Shu bois transport salohiyatini baholashda doimo uning asosi va ayni paytda cheklovchisi bo‘lgan mintaqaviy transport tizimi ko‘rsatkichlari chuqur tahlil qilinadi.

2. Tadqiqot metodologiyasi

Transport-logistika tizimi (TLT) murakkab, ko‘p komponentli va integratsiyalashgan tizim sifatida qaraladi. Uning texnik xususiyatlari va parametrlarini baholashning nazariy asoslari tizimli tahlil, logistika nazariyasi hamda transport iqtisodiyoti kesishgan nuqtada shakllanadi.

TLT samaradorligi ko‘p jihatdan uning texnik parametrlariga bog‘liq bo‘lib, o‘tkazuvchanlik qobiliyati, harakatlanuvchi tarkib unumdorligi, tashish siklining davomiyligi, yuklanish darajasi, aylanish vaqti kabilarni o‘z ichiga oladi. Mazkur parametrlar tizimning umumiy funksional samaradorligini belgilaydi.

Hududiy transport-logistika tizimi – bu ma’lum geografik hududda yuk va yo‘lovchi oqimlarini samarali, uzluksiz, xavfsiz va ekologik jihatdan barqaror harakatlantirishni ta’minlaydigan murakkab texnik-tashkiliy majmua hisoblanad[1]i.

Tizimning texnik mohiyati quyidagi asosiy komponentlar orqali ifodalanadi:

transport infratuzilmasi (yo‘llar, temir yo‘l liniyalari, ko‘priklar, tunnellar, terminallar, yuk ortish-tushirish punktlari, logistika markazlari);

harakat tarkibi (lokomotivlar, vagonlar, avtomobillar, konteynerlar, yuk ko‘tarish qobiliyati va texnik holati);

ekspluatatsion jarayonlar (o‘tkazuvchanlik, tezlik rejimlari, yuklanish darajasi, qaytish koeffitsienti, marshrut optimallashtirish);

texnologik va axborot ta’minoti (aqlli transport tizimlari – ITS, real vaqt rejimida monitoring, raqamli platformalar, Big Data va AI asosidagi optimallashtirish algoritmlari).

Transport-logistika tizimining texnik salohiyati – ma’lum vaqt birligida (soat, sutka, yil) yuk va yo‘lovchi oqimlarini tashish, qayta ishlash, saqlash va yo‘naltirish imkoniyatlarining integral ko‘rsatkichi sifatida ta’riflanadi. Bu salohiyat quyidagi asosiy texnik parametrlar bilan aniqlanadi:

1. O‘tkazuvchanlik (C) – infratuzilma ob’ekti yoki tarmoq orqali bir sutkada (yoki soatda) o‘tishi mumkin bo‘lgan transport birliklari yoki yuk hajmining maksimal miqdori. Matematik ifodasi:

$$C = V_t \cdot p \cdot n \cdot K_f$$

bu yerda:

V_t – o‘rtacha harakat tezligi (km/soat);

ρ – transport oqimi zichligi (birlik/km);

n – yo‘nalishlar yoki polosalar soni;

K_f – xavfsizlik va texnologik foydalanish koeffitsienti (0,75–0,95).

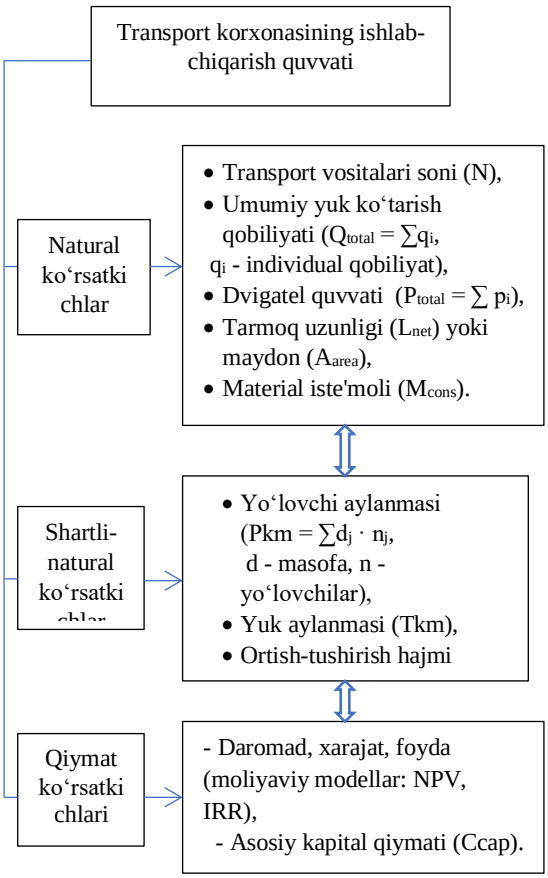
Rus olimlari N.N.Gromov, V.A. Persianov, N.S.Uskovlar transport infratuzilma ob'ektlarining o‘tkazish qobiliyatining me'yoriy ko‘rsatkichlariga transport turlari bo‘yicha asoslab o‘tishgan. Unga ko‘ra transport infratuzilma ob'ektlarining o‘tkazish qobiliyati turlicha va taxminan[5]:

- bir izli temir yo‘l liniyalari bo‘yicha sutkada 24ta dan 65ta juftgacha poezdni;
- ikki izli temir temir yo‘l liniyalari bo‘yicha sutkada bitta yo‘nalishda 73ta dan 200tagacha poezdni;
- yo‘lovchi temir yo‘l diametrlari bo‘yicha bir soatda bitta yo‘nalishda 20ta dan 25 gacha poezdni;
- avtomobil yo‘llari bo‘yicha bir soatda yo‘lning bir polosasi orqali 500tadan 1500 tagacha avtomobillarni o‘tkazadi.

Aniq tarkibli ob'ektlar bo‘yicha o‘tkazish qobiliyati darajasi yana ham turlicha va ular:

- yo‘lovchi stansiyalari bo‘yicha – bir soatda 100 ming passajirgacha
- saralash stansiyalari bo‘yicha sutkada 10-15 mingta vagongacha
- aeroportlar bo‘yicha bir soatda 1100-1200 yo‘lovchiga etadi.
- konteyner terminali uchun: C = 200–500 TEU/sutka (terminal sig‘imiga qarab).

Mazkur me’yoriy ko‘rsatkichlar Rossiya olimlari tomonidan ishlab chiqilgan bo‘lib, transport infratuzilma ob’ektlarining texnik imkoniyatlarini baholashda umumiy metodik asos sifatida xizmat qiladi. Ushbu yondashuvlardan O‘zbekiston transport tizimini tahlil qilishda ham foydalanish mumkin, biroq milliy transport infratuzilmasining texnik holati, harakat intensivligi, logistika oqimlari va hududiy xususiyatlarini hisobga olish zarur.



1-chizma. Transport ishlab-chiqarish quvvati ko‘rsatkichlari

Shuningdek, ular transport-ishlab chiqarish quvvati ko‘rsatkichlari korxonalarning ish rejimi va texnologiyalariga asosan maksimal mahsulot hajmini belgilaydi deb hisoblaydilar va ularni quyidagi uchta guruhga ajratishgan:

2. Yuk ko‘tarish qobiliyati (Q) – transport vositalari va tarmoqning umumiy yuk sig‘imi:

$$Q_{total} = \sum q_i \cdot N_i$$

bu yerda:

qi – i-transport birligining yuk ko‘tarish qobiliyati (tonna);

Ni – shu turdagi vositalar soni.

Integral yuk ko‘tarish qobiliyati:

$$Q_{int} = Q_{total} \cdot K_{zax}$$

(K_{zax} – zaxira koeffitsienti, odatda 1,15 – 1,30).

3. Ekspluatatsion koeffitsientlar tizimi:

Yuklanish darajasi (K_{yuk}):

$K_{yuk} = \frac{Q_{amal}}{Q_{max}}, 0 \le K_{yuk} \le 1$,

Masofadan foydalanish koeffitsienti

(K_{masofa}): $K_{masofa} = \frac{L_{yuk}}{L_{um}}$

Vaqt koeffitsienti

(K_{vaqt}): $K_{vaqt} = \frac{T_{amal}}{T_{reja}}$

Bo‘sh qatnov koeffitsienti ($K_{b.q.}$):

$K_{b.q.} = \frac{L_{bo‘sh}}{L_{um}}$ ideal holatda $\rightarrow 0$ ga intiladi

Ekologik samaradorlik koeffitsienti (K_{eko}):

$$K_{eko} = \frac{N_{EVRO4}}{N_{jami}}$$

Multimodal bog‘lanish koeffitsienti (Kmulti):

$$K_{mult} = \frac{Q_{avto} + Q_{temir} + Q_{boshqa}}{Q_{jami}}$$

4. Zichlik va fazoviy ko‘rsatkichlar:

Transport tarmoq zichligi:

$K_{zich} = \frac{L_{ekspl}}{S}\left(\frac{\text{km}}{\text{km}^2}\right)$ yoki $\frac{L_{ekspl}}{N}$ (km/1000 aholi)

Yuk oqimi zichligi:

$K_{y.oqim} = \frac{PL}{S}$ (tonna-km) / km² yoki $K_{y.oqim} = \frac{PL}{L}$

K_{yoqim} = yoki (tonna-km) / km yo‘l

Multimodal uzel zichligi:

$K_{uzel} = \frac{N_{uzel}}{S}$ (uzel/km²)

5. Texnik samaradorligi indeksi (E) – tarmoqning real yuk aylanmasini maksimal texnik imkoniyatga nisbatan ifodalaydi:

$$E = \frac{PL_{amal}}{(C_{max} \cdot T \cdot K_f}$$

bu yerda:

PL_{amal} – amaldagi yuk aylanmasi (tonna-km);

C_{max} – maksimal o‘tkazuvchanlik (tonna/soat yoki tonna/sutka);

T – vaqt birligi (soat yoki sutka);

K_f – foydalanish koeffitsienti (0,75–0,95).

Ideal holatda E → 1 ga intiladi; E < 0,5 bo‘lsa – katta texnik zaxira mavjud; E > 0,9 bo‘lsa – tarmoq quvvat chegarasida ishlamoqda.

Ushbu parametrlar transport tizimining texnik quvvatini to‘liq tavsiflaydi va hududning fazoviy, iqlimiy, geologik va infratuzilmaviy xususiyatlariga bog‘liq holda o‘zgaradi. Texnik salohiyatni baholashning asosiy maqsadi – mavjud resurslardan maksimal darajada foydalanish darajasini aniqlash, texnik zaxiralarni aniqlash va multimodal texnologiyalar orqali tizimni optimallashtirish imkoniyatlarini baholashdan iborat.

Transport-logistika salohiyatini baholashning matematik asoslari quyidagi usullarga tayangan:

Integral indeks usuli (vaznlangan yig‘indi):

$$\varphi = \sum w_i \cdot K_i, \sum w_i = 1, \quad K_i = \frac{(X_i - X_{min})}{(X_{max} - X_{min})} \in [0;1]$$

Yuklanish darajasi modeli:

$$Y_i = \frac{PL_{amal}}{C_{max}}, Y_i \in [0;1]$$

$Y_i > 0{,}85$ – yuqori yuklanish (cheklov holati);

$Y_i < 0{,}40$ – past yuklanish (katta zaxira).

Fazoviy zichlik va multimodal bog‘lanish modeli:

$$K_{multi} = \frac{\sum(Q_i \cdot K_i)}{Q_{jami}},$$

bu yerda:

K_i – i-transport turi ulushining multimodal uzel bilan bog‘lanish darajasi.

Dinamik baholash modeli (vaqt omilini hisobga olgan holda):

$\varphi_t = \alpha \cdot \varphi_{t-1} + (1-\alpha) \cdot \varphi_{joriy}$, $\alpha \in [0,1]$ – silliqlash koeffitsienti

Xorijiy va mahalliy olimlarning ishlarida (N.N.Gromov, V.A.Persianov, L.B.Mirotin, V.A.Gudkov, A.N.Goryainov, V.A.Nazarichev, T.V.Kuleshova, D.V.Nazarichev va boshqalar) transport salohiyati ko‘pincha bir nechta quyi tizimlar (texnik, ekspluatatsion, tashkiliy, ekologik, raqamli) yig‘indisi sifatida ko‘rib chiqiladi. Shu bilan birga, hududiy xususiyatlarni (chegaradoshlik, mavsumiylik, tranzit potensiali) hisobga olgan holda parametrlarning vazn ahamiyatini o‘zgartirish va dinamik baholash zarurati ta’kidlanadi.

O‘zbekiston Respublikasining transport tizimi rivojlanishining hozirgi bosqichi quyidagi texnik yo‘nalishlar bilan tavsiflanadi:

- raqamli texnologiyalarni joriy etish (ITS, e-CMR, Big Data monitoring);
- multimodal koridorlarni rivojlantirish (avtomobil + temir yo‘l + havo);
- ekologik talablarga mos transport vositalarini (EURO-5/6) ko‘paytirish;
- yuqori o‘tkazuvchanlikli yo‘l va terminal infratuzilmasini modernizatsiya qilish.

Xorazm viloyati misolida transport-logistika tizimining texnik salohiyatini baholash quyidagi xususiyatlarni hisobga olishni talab etadi:

- cheklangan temir yo‘l tarmog‘i (259,8 km, zichlik 34,2 km/1000 km²);
- avtomobil yo‘llarining asosiy ulushi (94,2% umumfoydalaniladigan, zichlik 379 km/1000 km²);
- mavsumiy yuk oqimlari (qishloq xo‘jaligi mahsulotlari, may–oktyabr oylari);
- xalqaro tranzit imkoniyatlari (Turkmaniston chegarasi, A-380 yo‘nalishi);
- raqamlashtirish darajasining pastligi (aqlli bekatlar va monitoring tizimlari soni cheklangan).

Hududiy transport-logistika tizimining texnik salohiyatini baholash nafaqat mavjud infratuzilma parametrlarini aniqlash, balki ularni optimallashtirish, multimodal texnologiyalar orqali integratsiyalash va raqamli boshqaruv tizimlarini joriy etish orqali texnik

samaradorlikni oshirish imkoniyatlarini aniqlashdan iboratdir.

3. Xulosa

Transport-logistika tizimining texnik salohiyati hudud iqtisodiy rivojlanishining muhim omillaridan biri hisoblanadi. Tadqiqot natijalari transport tizimi va transport salohiyati o‘rtasida uzviy bog‘liqlik mavjudligini ko‘rsatdi.

Taklif etilgan integral baholash modeli transport infratuzilmasining texnik holati, ekspluatasion samaradorligi va multimodal integrasiya darajasini kompleks baholash imkonini beradi.

Xorazm viloyati misolida aniqlanishicha, transport-logistika tizimining asosiy muammolari infratuzilmaning cheklanganligi va raqamlashtirish darajasining pastligi bilan bog‘liq. Shu bilan birga, tranzit salohiyati va avtomobil yo‘llari tarmog‘ining rivojlanganligi hudud transport salohiyatini oshirish uchun muhim asos bo‘lib xizmat qiladi.

Kelgusida transport-logistika tizimini baholashda raqamli texnologiyalar, intellektual transport tizimlari va prognoz modellarini keng qo‘llash maqsadga muvofiq hisoblanadi.

Foydalangan adabiyotlar / References

[1] Saparbaevna, A. Z., Dilfuza, U., Raxmatullayevich, R. R., &Soyibovich, M. A. (2021). Digital Logistics as a Factor of Increasing the Volume and Quality of Transport Services. REVISTA GEINTEC-GESTAO INOVACAO E TECNOLOGIAS, 11(4), 2088-2096.

[2] Чернышева Н. В. Транспортная система региона: состав и роль в пространственном развитии // Экономический журнал. — 2020. — № 1 (57). — С. 39–48. DOI: 10.24411/2072-8220-2020-00003 URL:

[3] Рубан В. А. Транспортный потенциал Байкальского региона // Российское предпринимательство. — 2015. — № 4 (274). — С. 593–600. DOI: 10.18334/rp.16.4.103 URL

[4] Комов М. С. Транспортно-транзитный потенциал региона как важнейший фактор его экономического развития // Вестник Евразийской науки. — 2018. — Т. 10. — № 5

[5] Менеджмент на транспорте. Учебное пособие для студ.высш. учеб.заведений / Н.Н.Громов, В.А.Персианов, Н.С.Усков и др. –М.: Издательский центр «Академия», 2003. -258с ISBN 5-7695-1280-6.

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CONTEXT / MUNDARIJA