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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.

Relationships and models of service efficiency on a digital transport platform

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Abstract:

This article examines the issues of effectively organizing the activities of digital transport platforms. The introduction of digital technologies into transport and logistics systems in recent years has become an important factor not only in accelerating the service process but also in improving its quality, the rational use of resources, and the provision of services adapted to the needs of clients. The study analyzes the criteria for assessing the effectiveness of transport services and the economic and mathematical relationships formed on the basis of digital platforms. Also, efficiency models based on such indicators as efficiency, reliability, cost reduction, and optimization of transportation volume in the process of providing services have been developed. These models allow for the formation of innovative approaches to managing services through digital platforms in the transport and logistics system, efficient resource allocation, and ensuring sustainable development in the future. The results of the article will serve as a useful methodological basis for transport and logistics providers, digital system developers, and scientific researchers in their practical activities.

Keywords:

transport and logistics services, cargo delivery, types of activities, regression, variance, normalized cost, efficiency, logistics analysis

Raqamli transport platformasida xizmat ko'rsatish samaradorligi munosabatlari va modellari

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Annotatsiya:

Ushbu maqolada raqamli transport platformalari faoliyatini samarali tashkil etish masalalari o'rganilgan. So'nggi yillarda transport-logistika tizimlarida raqamli texnologiyalarning joriy etilishi nafaqat xizmat ko'rsatish jarayonini tezlashtirish, balki uning sifatini oshirish, resurslardan oqilona foydalanish va mijozlar ehtiyojiga moslashtirilgan xizmatlarni taqdim etishda muhim omil bo'lib xizmat qilmoqda. Tadqiqotda transport xizmatlari samaradorligini baholash mezonlari hamda raqamli platformalar asosida shakllanadigan iqtisodiy-matematik munosabatlar tahlil qilinadi. Shuningdek, xizmat ko'rsatish jarayonida operativlik, ishonchlilik, xarajatlarni kamaytirish va tashish hajmini optimallashtirish kabi ko'rsatkichlar asosida samaradorlik modellari ishlab chiqilgan. Ushbu modellar transport-logistika tizimida raqamli platformalar orqali xizmatlarni boshqarishning innovatsion yondashuvlarini shakllantirish, resurslarni samarali taqsimlash va kelgusida barqaror rivojlanishni ta'minlash imkonini beradi. Maqola natijalari amaliyotda transport-logistika provayderlari, raqamli tizimlar ishlab chiquvchilari hamda ilmiy tadqiqotchilar uchun foydali metodologik asos bo'lib xizmat qiladi.

Kalit so'zlar:

transport-logistik xizmatlar, yuk yetkazib berish, faoliyat turlari, regressiya, dispersiya, normallashtirilgan baho, samaradorlik, logistika tahlili

1. Kirish

Hozirgi kunda raqamli texnologiyalarning jadal rivojlanishi iqtisodiyotning barcha sohalarida, jumladan transport-logistika tizimida ham samaradorlikni oshirishning muhim omili sifatida namoyon bo'lmoqda. Ayniqsa, yuk tashish xizmatlari bozorida raqamli platformalar orqali tashuvchilar va mijozlar o'rtasidagi o'zaro munosabatlarni tartibga solish, ma'lumot almashish jarayonlarini tezlashtirish va operatsiyalarni optimallashtirish ehtiyoji tobora kuchaymoqda [1].

Jizzax shahri misolida amalga oshirilgan tahlillar shuni ko'rsatadiki, an'anaviy usullarda tashkil etilgan yuk tashish jarayonlari ma'lumot uzatishdagi sekinlik, yuk tashuvchi va mijoz o'rtasidagi munosabatlarda shaffoflikning yetarli emasligi, ortiqcha vaqt va mablag' sarflanishi kabi muammolar bilan tavsiflanadi. Bunday holatlar transport-logistika infratuzilmasining samaradorligini pasaytiradi hamda iqtisodiy yo'qotishlarga sabab bo'ladi [2].

Shu bois ishlab chiqilgan raqamli platforma Jizzax shahridagi yuk tashish jarayonlariga joriy etildi va sinov tadqiqotlari amalga oshirildi. Ushbu platforma tashuvchilar

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va mijozlar o'rtasidagi aloqalarni avtomatlashtirish, buyurtmalarni real vaqt rejimida qayd etish va yuk harakatini kuzatish imkoniyatini berdi. Platformaning ishga tushirilishi natijasida foydalanuvchilar sonining ortishi bilan bog'liq holda qator o'zgarishlar kuzatildi, jumladan: tashuvchi va mijoz o'rtasidagi aloqa vaqtining qisqarishi, yuk tashuvchilarning yuk hosil bo'luvchi manzilgacha bo'lgan o'rtacha masofasining kamayishi hamda umumiy yuk tashish hajmining o'sishi [3].

Ushbu o'zgarishlarning ilmiy asosda baholanishi muhim ahamiyatga ega. Xususan, foydalanuvchilar soni, aloqa vaqti, masofa va yuk tashish hajmi kabi ko'rsatkichlar o'rtasidagi o'zaro bog'liqlikni aniqlash orqali raqamli platformaning samaradorlik darajasi chuqur tahlil qilinishi mumkin. Bu jarayonda korrelyatsiya va regressiya tahlillari muhim o'rin tutadi. Chunki ular orqali foydalanuvchilar sonining ortishi va aloqa vaqtini qisqarishi o'rtasidagi manfiy korrelyatsiya, masofa va yuk tashish hajmi o'rtasidagi ijobiy bog'liqlik aniqlanishi mumkin [4].

Shu tarzda tadqiqotning dolzarbligi raqamli platformaning tashuvchi va mijoz o'rtasidagi munosabatlarga ko'rsatayotgan ta'sirini ilmiy jihatdan baholash va uning transport-logistika tizimidagi samaradorlikni oshirishdagi ahamiyati bilan belgilanadi. Tadqiqot ishi qamrab olgan geografik hudud Jizzax shahrini o'z ichiga oladi. Jizzax shahrida yuk tashish faoliyatining asosiy ko'rsatkichlarining raqamli platformalar asosidagi logistik yechimlarga bog'liqligini tavsiflovchi statistikasi bo'yicha tizimli tadqiqot o'tkazildi. Tadqiqotda parametrlarning bir yoki bir nechta mustaqil o'zgaruvchilarga bog'liqligini aniqlash maqsadida statistik tadqiqot usullari toifasiga kiruvchi korrelyatsion va regression tahlillar amalga oshirildi [5].

2. Tadqiqot metodologiyasi

Quyidagi ma'lumotlarga asosanib normal chiziqli tenglamalar tizimining koeffitsiyentlarini jadval yordamida hisoblab chiqamiz (1-jadval).

Natijaviy belgilarning o'rtacha darajasi ($\bar{Y}_x$) bilan omil (x) o'rtasidagi korrelyatsion bog'lanishni ifodalaydigan regressiyaning chiziqli tenglamasi quyidagicha aniqlanadi [6]:

$$\bar{Y}_x = a_0 + a_1x; \quad (1)$$

Bu yerda,

a_0 - ozod had

a_1 - regressiya tenglamasining koeffitsiyenti

Bunda regressiya tenglamasining parametrlarini aniqlash uchun quyidagi normal chiziqli tenglamalardan foydalanildi

$$\begin{aligned} n a_0 + a_1 \sum x &= \sum y \\ a_0 \sum x + a_1 \sum x^2 &= \sum xy \end{aligned} \quad (2)$$

Bu yerda,

n - to'plamning miqdori

$X_1, X_2, \dots, X_n$ - omil belgilarining haqiqiy qiymatlari;

$y_1, y_2, \dots, y_n$ - natijaviy belgilarning haqiqiy qiymatlari.

Tizimning parametrlarga nisbatan umumiy yechimi quyidagicha ko'rinishda bo'ladi

$$a_0 = - \frac{\sum y \sum x^2 - \sum yx * \sum x}{n \sum x^2 - (\sum x)^2} \quad (3)$$

Bu boshlang'ich nuqta bo'lib, $x=0$ bo'lgan holda y qanday qiymatga ega bo'lishini ko'rsatadi.

Agar a_0 manfiy bo'lsa, bu degani ta'sir etuvchi omil yo'q holatda natija (foydalanish darajasi) minimal yoki yo'qolib ketishini anglatadi.

$$a_1 = \frac{n \sum yx - \sum y * \sum x}{n \sum x^2 - (\sum x)^2} \quad (4)$$

Bu regressiya chizig'ining moyillik koeffitsienti.

$a_1 > 0$ bo'lsa — omilning natijaga ta'siri **musbat**, ya'ni omil ortgan sari y ham ortadi.

$a_1 < 0$ bo'lsa — ta'sir **salbiy**, ya'ni omil ko'paygani bilan natija pasayadi.

1-jadval

Platforma orkali yukni bron kilishda sarflanadigan o'rtacha vaqtning o'zgarishi bo'yicha hasob natijalari

t/r	Platformada n foydalanuvchilar sonining o'zgarishi - (x)	Platforma orkali yukni bron kilishda sarflanadigan o'rtacha vaqtning o'zgarishi (y)	X ²	x y	Y _x = 22.4 4 - 0.06 6x
1	2	24	4	48	22,3 08
2	4	23,8	16	95,2	22,1 76
3	6	23,6	36	141,6	22,0 44
4	9	23	81	207	21,8 46
5	10	22,8	100	228	21,7 8
6	13	22,5	169	292,5	21,5 82
7	15	22	225	330	21,4 5
8	19	21,7	361	412,3	21,1 86
9	22	21,5	484	473	20,9 88
10	27	21,1	729	569,7	20,6 58
11	30	21	900	630	20,4 6
12	32	19,9	1024	636,8	20,3 28
13	35	19,7	1225	689,5	20,1 3
14	39	19	1521	741	19,8 66
15	42	18,5	1764	777	19,6 68
16	46	18,4	2116	846,4	19,4 04
17	50	18,2	2500	910	19,1 4
18	55	18	3025	990	18,8 1
19	60	17,7	3600	1062	18,4 8
20	65	17,2	4225	1118	18,1 5
21	69	17	4761	1173	17,8 86
22	70	16,8	4900	1176	17,8 2



23	75	16,6	5625	1245	17,4 9
24	77	16,2	5929	1247, 4	17,3 58
25	81	16	6561	1296	17,0 94
26	85	15,5	7225	1317, 5	16,8 3
27	87	15,3	7569	1331, 1	16,6 98
28	92	15,1	8464	1389, 2	16,3 68
29	100	15	1000 0	1500	15,8 4
30	120	14,7	1440 0	1764	14,5 2
31	134	14,4	1795 6	1929, 6	13,5 96
32	140	14,2	1960 0	1988	13,2
33	144	14	2073 6	2016	12,9 36
34	148	13,5	2190 4	1998	12,6 72
35	151	13,6	2280 1	2053, 6	12,4 74
36	155	13,2	2402 5	2046	12,2 1
37	157	13	2464 9	2041	12,0 78
38	162	12,5	2624 4	2025	11,7 48
39	166	12	2755 6	1992	11,4 84
40	170	10	2890 0	1700	11,2 2
Ja mi	2964	702,2	3339 10	44426 ,4	

$$40a_0 + 2964a_1 = 702.2;$$

$$2964a_0 + 333910a_1 = 44426.4 \quad (5)$$

Har bir tenglamaning hadlarini a_0 koeffitsiyenti oldidagi soniga bo'lib chiqamiz

$$a_0 + 74.1 a_1 = 17.55 ;$$

$$a_0 + 112.6 a_1 = 14.99 . \quad (6)$$

Ikkinchi tenglamadan birinchisini ayirib chiqsak u holda:

$$38.5a_1 = -2.56 , \text{ bu yerda } a_1 = \frac{-2.56}{38.5} = -0.066 \quad (7)$$

a_1 qiymatni birinchi tenglamaga qo'yib, a_0 ning qiymatini aniqlaymiz:

$$a_0 + 74.1 \cdot (-0.066) = 17.55$$

$$a_0 = 17.55 + 4.89 = 22.44 \quad (8)$$

Tenglama parametrlari $a_0 = 22.44$, $a_1 = -0.066$

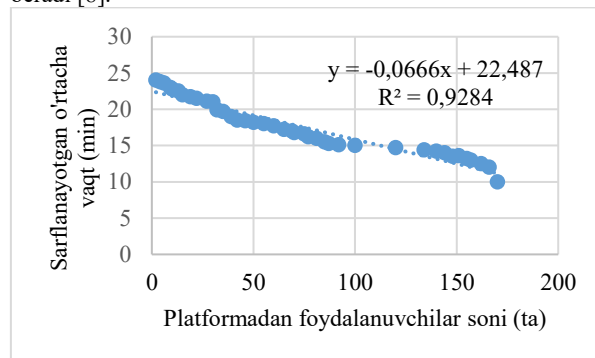
Olib borilgan hisob-kitoblar natijasiga ko'ra, platforma orqali yukni bron qilishda sarflanadigan o'rtacha vaqt (y) bilan platformadan foydalanuvchilar sonining o'zgarishi (x) o'rtasida barqaror va sezilarli salbiy korrelyatsion bog'lanish mavjud. Ya'ni, foydalanuvchilar soni ortishi bilan vaqt sarfi izchil ravishda kamayib boradi. Qurilgan chiziqli regressiya tenglamasi ushbu jarayonning matematik modelini aks ettiradi [7]:

$$Y_x = 22.44 - 0.066x$$

Bu yerda $a_0 = 22.44$ platformadan minimal foydalanish holatidagi o'rtacha vaqtni, $a_1 = -0.066$ esa har bir qo'shimcha foydalanuvchi hisobiga bron qilish vaqti 0.066 birlikka qisqarishini ko'rsatadi.

Shunday qilib, tahlil natijalari platformadan foydalanuvchilar soni ko'payishi bilan xizmat ko'rsatish

samaradorligi ortib, yukni bron qilish jarayoni vaqti sezilarli ravishda qisqarayotganini isbotlaydi (1-rasm). Bu esa raqamli transport platformalarida resurslardan samarali foydalanish va xizmat ko'rsatish sifatini oshirish imkonini beradi [8].



1-rasm. Platformadan foydalanuvchilar sonining o'rtasida sarflanayotgan o'rtacha vaqtning o'zgarishiga bog'liqligi

Bizning misolimizda platformadan foydalanuvchilar sonining ortishi yukni bron qilish uchun sarflanadigan o'rtacha vaqtning kamayishiga ta'sir etuvchi omil (2-jadval).

2-jadval
Statistik ko'rsatkichlarning regression hisob natijalari

Regression statistika	Ko'rsatkich qiymati
Ko'p darajali R	0,963381
R-kvadrat	0,928103
normallashtirilgan R-kvadrat	0,92616
Standart xatolik	0,98842

Regression hisob bo'yicha olingan natija ko'rsatkichlarning ta'siri yetarlicha bog'liqlik mavjud va ko'rsatkichlar ustidagi tahlillarni chuqurroq bajarishga asos deb hisoblash mumkin (R –kvadrat 0.92) (3 va 4-jadvallar).

3-jadval

Dispersion tahlil natijalari

	df	SS	MS	F ning ahamiyatligi
Regressiya	1	431,4218	431,4218	2,92E-05
qoldiq	14	164,3282	11,73773	
jami	15	595,75		

4-jadval

Regression tahlil natijalari

	Koeffitsiyentlar	Standart xatolik	t-statistika	P-ko'rsatkich
y	22,36025	0,277087	80,69764	21,7988155

3. Xulosa

Olib borilgan regressiya tahlili natijalari platformadan foydalanuvchilar soni bilan yukni bron qilishda sarflanadigan vaqt orasidagi bog'lanishni yuqori aniqlik bilan ifodalaydi. Xususan Ko'p darajali korrelyatsiya koeffitsienti ($R=0.96$) juda yuqori qiymat bo'lib, omillar orasida kuchli bog'liqlik mavjudligini ko'rsatadi. $R^2=0.92$ natijasi yukni bron qilish vaqtidagi o'zgarishlarning 92% qismi platformadan foydalanuvchilar soni bilan



izohlanishini anglatadi. Bu esa modelning prognoz qilishda ishonchli ekanligini ko'rsatadi. Standart xato (0.98) past qiymatda bo'lib, prognoz va real natijalar o'rtasidagi farq katta emasligini anglatadi [9].

Dispersion tahlil natijalariga ko'ra, F-statistika va uning ahamiyatlilik darajasi ($p < 0.05$) regressiya tenglamasining umumiy statistik ahamiyatli ekanligini tasdiqlaydi.

Shunday qilib, tahlil natijalari platformadan foydalanuvchilar sonining ortishi yukni bron qilish vaqtiga sezilarli va salbiy ta'sir ko'rsatishini, ya'ni foydalanish ko'paygan sari xizmat vaqti qisqarayotganini ilmiy jihatdan asoslaydi.

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