Emro Science and Education
International open-access scientific journal
Journal homepage: https://journal.emro.uz

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Vol. 2 No. 2 (2026) · "Milliy statistika tizimida yangi bosqich: barqaror rivojlanish maqsadlari, xalqar... DOI: 10.5281/zenodo.24320312

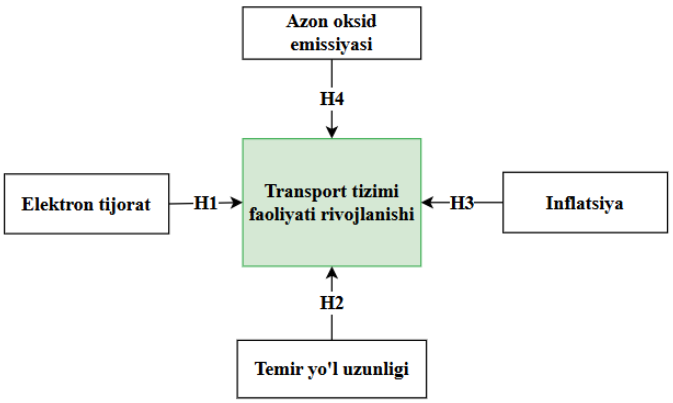
"MILLIY STATISTIKA TIZIMIDA YANGI BOSQICH: BARQAROR RIVOJLANISH MAQSADLARI, XALQARO STANDARTLAR VA ZAMONAVIY TENDENSIYALAR"

O'ZBEKISTONDA TRANSPORT TIZIMI RIVOJLANISH OMILLARINING IQTISODIY-EKONOMETRIK TAHLILI: ZAMONAVIY YONDASHUVLAR

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O'zbekistonda transport tizimi faoliyatining rivojlanishiga ta'sir etuvchi omillarning ekonometrik tahlil qilishga bag'ishlangan ushbu paragrafimizda miqdoriy yondashuvdan foydalandik. Jumladan, O'zbekistonda 2000-yildan 2023-yilgacha bo'lgan vaqt oralig'ida transport tizimini aks ettiruvchi bog'liq o'zgaruvchi va quyida tanlab olingan unga ta'sir etuvchi omillar bo'yicha ilgari surayotgan ilmiy farazlarimiz (gipotezamiz)ni ekonometrik modellarshirish xususan, OLS (ordinary least suares - oddiy eng kichik kvadratlar) ko'p omilli vaqtli qatorlar modelida tekshirishni amalga oshirdik.

1-rasmda OLS modelimizda tekshirish uchun ilgari surayotgan ilmiy farazlarimiz tasvirlangan.



1-rasm. OLS modelida qo'yilayotgan ilmiy farazlar[219]

Mazkur gipoteza testi quyidagi 1-rasmda keltirilgan tartibda amalga oshirildi. Ushbu rasmdagi H harfi ingliz tilidagi "hypothesis" (gipoteza, ilmiy faraz)ning bosh harfi hisoblanadi.

Bizning ilmiy farzalarimiz (gipotezalarimiz) quyidagicha:

$H1_0$: transportda yuk tashish hajmining o'zgarishi (lnTransport_tash_yuk) va elektron tijorat (lnElektron_tijorat)ning rivojlanishi o'rtasida bog'liqlik mavjud emas;

[219] Muallif tomonidan tuzilgan

Published: 05.06.2026

Cite this article: Ruhiddin Zayniddinov (2026). O'zbekistonda transport tizimi rivojlanish omillarining iqtisodiy-ekonometrik tahlili: zamonaviy yondashuvlar. Emro Science and Education, 2(2). https://doi.org/10.5281/zenodo.24320312

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$H1_1$: transportda yuk tashish hajmining oshishi (lnTransport_tash_yuk) va elektron tijorat (lnElektron_tijorat)ning rivojlanishi o‘rtasida hech qanday bog‘liqlik mavjud;

$H2_0$: transportda yuk tashish hajmining o‘zgarishi (lnTransport_tash_yuk) va umumfoydalaniladigan temir yo‘llar uzunligi (lnTemir_yol_uzun) ortishi o‘rtasida bog‘liqlik mavjud emas;

$H2_1$: transportda yuk tashish hajmining o‘zgarishi (lnTransport_tash_yuk) va umumfoydalaniladigan temir yo‘llar uzunligi (lnTemir_yol_uzun) ortishi o‘rtasida bog‘liqlik mavjud;

$H3_0$: transportda yuk tashish hajmining o‘zgarishi (lnTransport_tash_yuk) va inflatsiya (lnInflatsiya) darajasining oshishi o‘rtasida bog‘liqlik mavjud emas;

$H3_1$: transportda yuk tashish hajmining o‘zgarishi (lnTransport_tash_yuk) va inflatsiya (lnInflatsiya) darajasining oshishi o‘rtasida bog‘liqlik mavjud;

$H4_0$: transportda yuk tashish hajmining o‘zgarishi (lnTransport_tash_yuk) va transportlarning azon oksid N02 moddalari emissiyasi (lnAzotoksidemis) o‘rtasida bog‘liqlik mavjud emas;

$H4_1$: transportda yuk tashish hajmining o‘zgarishi (lnTransport_tash_yuk) va transportlarning azon oksid N02 moddalari emissiyasi (lnAzotoksidemis) o‘rtasida bog’liqlik mavjud.

H_0– bu bizni nol gipotezamiz va H_1 – bu bizni muqobil gipotezamiz (1)

Tadqiqotimizda qamrab olinayotgan bog‘liq va mustaqil o‘zgaruvchilarni tanlab olishda bizdan oldin ushbu yo‘nalishda tadqiqot olib borgan xorijiy va mahalliy olimlarning ilmiy ishlari natijalariga tayanildi.

Tadqiqotimizning OLS modelida bog‘liq o‘zgaruvchilar sifatida foydalanilayotgan transportda yuk tashish hajmi (lnTransport_tash_yuk) va transport xizmatlari (lnTransport_xiz) ko‘rsatkichlari statistikasi O‘zbekiston Respublikasi Davlat statistika qo‘mitasining rasmiy sayti (stat.uz)[220]dan, mustaqil o‘zgaruvchilar bo‘lgan elektron tijorat (lnElektron_tijorat), transportlarning azon oksid N02 moddalari emissiyasi (lnAzon_oks_em_NO2), umumfoydalaniladigan temir yo‘llar uzunligi (lnTemir_yol_uzun) va inflatsiya (lnInflatsiya) darajasining statistikasi Jahon bankining rasmiy sayti (data.worldbank.org)[221]dan olindi.

Tadqiqotimizda 2000-yildan 2023-yilgacha O‘zbekistonda transport tizimi faoliyatini ko‘rsatib beruvchi ko‘rsatkich va yuqorida ko‘rsatib o‘tilgan mustaqil omillar o‘rtasidagi bog‘liqlikni o‘rganish maqsadida ko‘p omilli vaqtli qatorlardan foydalangan holda quyidagi ekonometrik model va tenglama ishlab chiqildi.

Chiziqli model - (Ordinary Least Square (OLS) Method for Linear Regression).

[220] https://stat.uz/uz/rasmiy-statistika/services-2
[221] https://data.worldbank.org/country/uzbekistan

Ekonometrik modelning umumiy ko‘rinishi quyidagicha ifodalanadi[222]:

$$Y_i = \beta_0 + \beta_1 X_i + \beta_2 X_i + \cdots + \beta_n X_i + \varepsilon_i \qquad (1)$$

Bu yerda: Y - bog‘liq o‘zgaruvchining kuzatilayotgan qiymati (izohlanuvchi o‘zgaruvchi, natija);

β_0: regression tenglamaning o‘zgarmas koeffisienti (a’zosi);

β_1 - β_n: regressiya koeffisienti, agar x o‘zgaruvchi bir o‘lchov birligiga oshirilsa, u natijaviy omil o‘rtacha qancha miqdorga o‘zgarishini ko‘rsatadi.

ε_i: tasodifiy tarkibiy qism (xato).

Bog‘liq o‘zgaruvchimiz “transportda yuk tashish hajmi (lnTransport_tash_yuk)”ni statsionarlikka Dikkey-Fuller testida tekshirganimizda nostatsionar ekanligi aniqlangan bo‘lsa, statistik test qiymati manfiy son sifatida kichik qiymatni tashkil etib statsionarlik mavjudligi bir marta differensiallangandan keyin amalga oshdi. Shuningdek, Mak Kinnon (MacKinnon)[223] qiymati ehtimolligi (r-value)=0.0157 qiymatni tashkil etib stasionarlik mavjudligini ko‘rsatadi (1-jadval).

Navbatdagi qadamda mustaqil o‘zgaruvchilarimizning ko‘rsatkichlarini Dikkey-Fuller (Dickey-Fuller) testida tekshirganimizda barcha mustaqil o‘zgaruvchilar nostasionar ekanlgi aniqlandi, lekin barchasi bir marta differensiallangandan so‘ng statsionarlikka erishildi (1-jadval).

1-jadval. Bog‘liq va mustaqil o‘zgaruvchilar bo‘yicha Dikkey-Fuller testi[224]

Bog‘liq va mustaqil omillar nomi	Statistik test (Test Statistic)	Tanqidiy qiymat 1% (Critical Value)	Tanqidiy qiymat 5% (Critical Value)	Tanqidiy qiymat 10% (Critical Value)	Kuzatuvlar (Obs)	Ehtimolligi (MacKinnon approximate p-value for Z(t))
Transport yuk tashuvi	-3.283	-3.574	-2.927	-2.598	54	0.0157
Elektron tijorat	-6.206	-3.736	-2.994	-2.628	27	0.0000
Temir yo‘l uzunligi	-8.391	-3.587	-2.933	-2.601	49	0.0000

[222] Pavelescu, Florin-Marius. “Features of the Ordinary Least Square (OLS) Method. Implications for the estimation methodology”. Romanian Journal of Economic Forecasting 1 (2004): 85-101.

[223] Beh, Eric J.. “Exploring How to Simply Approximate the P-value of a Chi-squared Statistic”. Austrian Journal of Statistics 47 (2018): 63-75.

[224] STATA dasturi natijasiga ko‘ra muallif tomonidan tuzilgan

Inflatsiya	-2.988	-3.580	-2.930	-2.600	50	0.0361
Azon oksidi emissiyasi	-4.041	-3.574	-2.927	-2.598	54	0.0012

2-jadvalda eng kichik kvadratlar usuli (Ordinary least squares - OLS) chiziqli regressiya natijalari keltirilgan. Ushbu keltirilgan hisob-kitoblar bo‘yicha quyidagi ko‘p omilli OLS model shakllantirildi:

$$\text{lnTransport_tash_yuk}_i = 5.555 + .08\ lnElektron_tijorat_i + 0.531\ lnTemir_yol_uzun_i - .11\ lnInflatsiya_i + \varepsilon_i \quad (2)$$

2-jadval. Chiziqli regressiya tahlili[225]

lnTransport_tash_yuk	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnElektron_tijorat	.08	.008	9.62	0	.063	.098	***
lnTemir_yol_uzun	.531	.112	4.74	0	.298	.763	***
lnInflatsiya	-.108	.052	-2.10	.048	-.215	-.001	**
lnAzotoksidemis	.012	.041	0.30	.769	-.073	.098	
Constant	5.555	.878	6.33	0	3.735	7.376	***
Mean dependent var		10.205	SD dependent var			0.283	
R-squared		0.980	Number of obs			27	
F-test		266.289	Prob > F			0.000	
Akaike crit. (AIC)		-87.902	Bayesian crit. (BIC)			-81.423	

*** $p<.01$, ** $p<.05$, * $p<.1$

Mazkur model bog‘liq o‘zgaruvchi bo‘lgan transportda yuk tashish hajmi (lnTransport_tash_yuk) va mustaqil o‘zgaruvchilar elektron tijorat (lnElektron_tijorat), umumfoydalaniladigan temir yo‘llar uzunligi (lnTemir_yol_uzun), inflatsiya (lnInflatsiya) o‘rtasida uzoq muddatli bog‘lanish borligini ko‘rsatadi.

OLS modeli natijalaridan shunday xulosaga kelish mumkinki, mamlakatda elektron tijorat (lnElektron_tijorat)ning rivojlanishi bo‘yicha amalga oshiriladigan

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ishlarni bir foizga oshirish transportda yuk tashish hajmi (lnTransport_tash_yuk)ni qo‘shimcha ravishda 8 foizga ortishiga olib kelar ekan.

Shuningdek, qolgan mustaqil o‘zgaruvchilarning ta’siriga to‘xtalib o‘tadigan bo‘lsak, umumfoydalaniladigan temir yo‘llar uzunligi (lnTemir_yol_uzun) ya’ni yangi temir yo‘l liniyalari qurilishining bir foizga ortishi transportda yuk tashish hajmi (lnTransport_tash_yuk)ni qo‘shimcha ravishda 53,1 foizga ortishiga olib kelar ekan. Bu albatta, keltirilayotgan modelda qayd etilgan eng yuqori natija bo‘lib, mamlakatda yuk va yo‘lovchi tashilishida temir yo‘llarning ahamiyati yuqori ekanligi hamda so‘ngi o‘n yillikda yangi temir yo‘l liniyalari qurilishi jadal sur’atlarni aks ettirgani bilan bog‘liq deyishimiz mumkin. Bundan tashqari, bog‘liq o‘zgaruvchimizga salbiy ta’sir ko‘rsatgan mustaqil o‘zgaruvchi ham mavjud bo‘lib, inflatsiya (lnInflatsiya)ning bir foizga oshishi transportda yuk tashish hajmi (lnTransport_tash_yuk)ni 11 foizga kamayishiga olib kelar ekan.

So‘ngi mustaqil o‘zgaruvchimiz hisoblangan transportlarning azon oksid N02 moddalari emissiyasi (lnAzon_oks_em_NO2)ning transportda yuk tashish hajmi (lnTransport_tash_yuk)ga ta’siri borasidagi H4 – ilmiy farazimiz rad etildi. Buning sababi, t-testimizning p-qiymati statistiklik jihatdan ahamiyasiz deb topilishida bo‘ldi.

Tadqiqotimizni davom ettirgan holda, navbatdagi qadamda mazkur modelimizni diagnostika tahlilini dunyoda keng foydalaniladigan Gaus Markov shartlari bo‘yicha amalga oshiramiz.

Gaus Markovning birinchi shartiga ko‘ra qoldiqlar model bilan bog‘lanmagan bo‘lishi kerak. Agar o‘zaro bog‘liq bo‘lsa geteroskedastik holati deyiladi. Bu bo‘yicha tekshirishning uch xil usuli grafiklar usuli, korrelyatsion jadval hamda test ya’ni Breush-Shpogan testi orqali bajariladi.

Biz modelimizni eng ishonchli va aniq usul bo‘lgan test, Breush-Shpogan testi[226] tekshirishni amalga oshiramiz.

Breush-Shpogan testining p-qiymati 0.05 dan katta bo‘lib, ya’ni 0.25 qayd etilib, ushbu test mezoniga ko‘ra gomoskodastiklik holati deyiladi va qoldiqlar model bilan bog‘lanmaganini ko‘rsatadi.

3-jadval. Brash-Shpogan/Kook-Veisberg testi natijasi[227]

O‘zgaruvchi	Ehtimolligi. chi-kvadrat(1) (Chi2(1))	Ehtimolligi (Prob >chi2)

[226] Akewugberu, H. O., Umar, S. M. BREUSCH-PAGAN TEST: A comprehensive evaluation of its performance in detecting heteroscedasticity across linear, exponential, quadratic, and square root structures using monte carlo simulations. FUDMA Journal of Sciences (FJS) ISSN online: 2616-1370 ISSN print: 2645 - 2944 Vol. 8 No. 6, December, 2024, pp 233 – 239. DOI: https://doi.org/10.33003/fjs-2024-0806-2826

[227] STATA dasturi natijasiga ko‘ra muallif tomonidan tuzilgan

lnTransport_tash_yuk	1.32	0.2500

Modelimizni tekshirishning ikkinchi sharti modelning qoldiqlari o‘zaro bog‘liq bo‘lmasligi kerak. Agar, bog‘liq bo‘lsa avtokorrelyatsiya holati deyiladi. Uchinchi shartda modelizmini baholash uchun Breush-Godfriy testidan foydalanamiz.

4-jadval. Breush-Godfri avtokorrelatsiyasi testi natijasi [228]

Laglar (lags (p))	Ehtimolligi. chi-kvadrat(1) (chi2)	Ozodlik darajasi (df)	Ehtimolligi (Prob>chi2)
1	0.969	1	0.325

Breush-Godfri testi[229] natijasidan kelib chiqqan holda qoldiqlar o‘rtasida avtokorrelatsiya mavjud emasligini ayta olamiz. Chunki, R-kvadrat ehtimolligi darajasi 0,05 dan katta bo‘lib, ya’ni 0.32ni tashkil etganligi sababli, qoldiqlarning avtokorrelyatsiya mavjud emasligi bo‘yicha ilmiy faraz qabul qiladi.

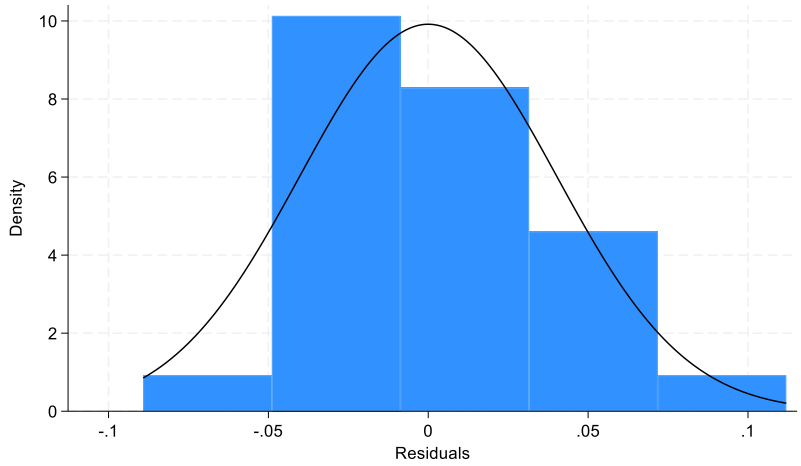
5-jadval. Shapiro-Vilk testi natijasi [230]

O‘zgaruvchi	Kuzatuv	W	V	z	Ehtimolligi (Prob>z)
qoldiq	27	0.964	1.047	0.095	0.77627

Gaus Markovning navbatdagi ya’ni uchinchi sharti, modelda qoldiqlar normal taqsimotga ega bo‘lishi kerak. Modelni ushbu shartga tekshirishni grafik va test usullari mavjud. Modelni ushbu shartga tekshirishni test usulidan boshlaymiz. Shapiro-Vilk (Shapiro Willke) testi qiymati 0.77 ni tashkil etdi va ushbu qiymat ham p>0.05 dan kattaligini inobatga olib ushbu shart ham bajarilganligini ko‘rishimiz mumkin (5-jadval).

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[228] STATA dasturi natijasi
[229] Hyun, Joo-Yeon, Hyeongwook Mun, Tae-Hwan Kim and Jinook Jeong. “The effect of a variance shift on the Breusch–Godfrey's LM test.” Applied Economics Letters 17 (2010): 399 - 404.
[230] STATA dasturi natijasi



2-rasm. Qoldiqlarning normal taqsimoti grafigi[231]

Yuqoridagi 2-rasmda ham keltirilgan ma’lumotlardan ko‘rishimiz mumkinki, qoldiqlar normal taqsimotga ega ekan.

Gauss Markovni to‘rtinchi sharti bo‘yicha model qurishda mustaqil o‘zgaruvchilar orasida yuqori korrelyatsiya koeffisienti (multikollinarlik) hisobga olinishi kerak. Quyidagi 6-jadval ma’lumotlaridan ko‘rishimiz mumkinki, o‘zgaruvchilarmiz orasida multikollinarlik holati qayd etilmagan. Sababi, quyidagi testning talabi bo‘yicha multikollinarlik koeffisienti 10 dan yuqori bo‘lsa, o‘zgaruvchilar orasida yuqori multikollinarlik mavjud bo‘ladi[232].

6-jadval. Mustaqil omillarning multikoleniarlikka tekshirish natijalari[233]

O‘zgaruvchi	Multikollinarlik (VIF)	Multikollinarlik (1/VIF)
lnElektron tijorat	7.808	.128
lnAzotoksidemis	6.416	.156
lnTemir yol uzun	2.153	.464
lnInflatsiya	1.99	.503
O‘rtacha (VIF)	4.592	

Bizning test natijamizga qaraydigan bo‘lsak, biror bir o‘zgaruvchining multikollinarlik koeffisienti 10ga yaqin yoki 10dan yuqori emas. O‘zgaruvchilarning o‘rtacha VIF testi natijasi ham 4.59 ni tashkil etgan hamda multikollinarlik holati qayd etilmaganini ko‘rsatgan.

[231] O‘sha manba
[232] Salmer'on, Rom'an, Catalina Garc’ia and Jos'e Garc'ia. “Overcoming the inconsistences of the variance inflation factor: a redefined VIF and a test to detect statistical troubling multicollinearity.” arXiv: Methodology (2020): n. pag.
[233] STATA dasturi natijasiga ko‘ra muallif tomonidan tuzilgan

Olib borgan tadqiqotimiz natijasida quyidagi xulosalarni shakllantirdik.

OLS modeli natijasida topilgan yangiliklar:

-mamlakatda elektron tijoratning rivojlanishi bo‘yicha amalga oshiriladigan ishlarni bir foizga oshirish transport xizmatlaridan keladigan daromadlarni qo‘shimcha ravishda 8 foizga ortishiga olib keladi;

-temir yo‘l liniyalari qurilishining bir foizga ortishi transport xizmatlaridan keladigan daromadlarni qo‘shimcha ravishda 53,1 foizga ortishiga olib keladi;

-inflatsiya darajasining bir foizga oshishi transport xizmatlaridan keladigan daromadlarni 11 foizga qisqarishiga sabab bo‘ladi.

Ushbu natijalar asosida hukumatga transport sektorini barqaror rivojlantirish uchun elektron tijoratni qo‘llab-quvvatlash, temir yo‘l infratuzilmasiga investitsiyalarni kengaytirish hamda inflatsiyani jilovlashga qaratilgan makroiqtisodiy siyosatni kuchaytirish bo‘yicha chora-tadbirlarni amalga oshirish tavsiya etiladi.

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"MILLIY STATISTIKA TIZIMIDA YANGI BOSQICH: BARQAROR RIVOJLANISH MAQSADLARI, XALQARO STANDARTLAR VA ZAMONAVIY TENDENSIYALAR"

APPLICATION OF NON-PARAMETRIC METHODS TO ENHANCE STATISTICAL ACCURACY WITHIN UZBEKISTAN'S NATIONAL DATA SYSTEM

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ABSTRACT

This article investigates the role and practical significance of non-parametric tests in modern statistical analysis. The relevance of the research is determined by the necessity of enhancing the accuracy of data and the quality of hypothesis testing during the alignment of the national statistical system with international standards. The article analyzes the limitations of traditional parametric methods, specifically their shortcomings in cases where data does not follow a normal distribution. The advantages of non-parametric tests (Mann-Whitney-Wilcoxon test, Wilcoxon Signed-Rank test, Sign test, Kruskal-Wallis Test, Spearman rank-correlation coefficient) are scientifically substantiated, highlighting their flexibility regarding sample size and distribution shape. Furthermore, the effectiveness of these methods in identifying intergroup differences based on real-world statistical data is demonstrated. The findings serve to improve analytical processes within national statistical practices and ensure the reliability of forecasts.

Keywords: national statistical system, non-parametric tests, normal distribution, Mann-Whitney-Wilcoxon test, aviation demographics, statistical hypothesis, data analysis.

INTRODUCTION

Aligning the national statistical system with international methodological standards and enhancing the accuracy of data analysis are fundamental to evaluating the effectiveness of a country's economic policy. In recent years, the Republic of Uzbekistan has initiated comprehensive reforms to modernize its statistical infrastructure, primarily guided by the Resolution of the President of the Republic of Uzbekistan dated August 3, 2020, No. PP-4796, "On measures to further improve and develop the national statistical system of the Republic of Uzbekistan."[234] This decree approved the National Strategy for the Development of Statistics for 2020–2025, which emphasizes the transition to advanced analytical methods, the digitalization of data collection, and the integration of international

[234] President of the Republic of Uzbekistan. (2020). Resolution No. PP-4796: On measures to further improve and develop the national statistical system of the Republic of Uzbekistan. https://lex.uz/docs/-4926736