

American Journal of Economics and Business Management

Vol. 9 Issue 7 | **pp.** 190-197 | **ISSN:** 2576-5973
Available online @ https://www.globalresearchnetwork.us/index.php/ajebm

Article

Analysis of the State of Production, Social, and Digital Infrastructure in the Districts of the Bukhara Region

Shohbek Nazarov[*1]

1. Independent researcher, Urganch State University
2. Email: shoxbeknazarov79@gmail.com

Abstract: How well a region develops often depends on the state of its infrastructure — not just factories and roads, but hospitals, schools, and internet access too. This paper takes a close look at all three of these infrastructure dimensions across the ten districts of Bukhara region in Uzbekistan, drawing on official data from 2019 to 2023. We built a composite index (CIDI) to rank each district and found stark differences: while Bukhara tumani, Kogon, and G'ijduvon scored well above 70 points, outlying districts like Olot and Peshku barely reached 27–32. Perhaps the most striking result was the tight correlation between internet coverage and economic output ($R^2 = 0.94$). The paper ends with a tiered set of recommendations geared toward the "New Uzbekistan 2022–2026 Development Strategy" and the "Digital Uzbekistan 2030" program.

Keywords: Infrastructure Analysis, Bukhara Region, Digital Divide, Regional Development, Composite Index, Uzbekistan.

Citation: Nazarov S. Analysis of the State of Production, Social, and Digital Infrastructure in the Districts of the Bukhara Region. American Journal of Economics and Business Management 2026, 9(7), 190-197.

Received: 27th Apr 2026
Revised: 24th May 2026
Accepted: 11th Jun 2026
Published: 04th Jul 2026

Copyright: © 2026 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/)

1. Introduction

It is hardly a new idea that infrastructure matters for growth. Back in 1989, Aschauer showed with US data that public capital stocks had a measurable impact on aggregate productivity [1], and Porter's diamond model later underscored how clusters of firms thrive when underlying transport, communication, and institutional infrastructure are in place [2]. What makes the question especially urgent in Central Asia is that countries like Uzbekistan are trying to do several things at once: industrialize, build out social services, and leapfrog into a digital economy — all under tight budget constraints [3], [4].

Uzbekistan's government has been explicit about these goals. Presidential Decree PF-60 of January 28, 2022, lays out the "New Uzbekistan 2022–2026 Development Strategy," which puts balanced territorial development, infrastructure modernization, and digital economy expansion among its top priorities [5]. Bukhara region, with its mix of an industrial and cultural center and largely agrarian outlying districts, is a useful testing ground. The region has 11 tumans plus 2 cities, and the contrasts between them are hard to miss even for a casual observer [6].

Yet the research base is thin. The World Bank's 2022 Systematic Country Diagnostic covered Uzbekistan at the national level but did not drill into district-level variation within individual regions [7]. The OECD's 2023 report on digital skills flagged the slow uptake of digital tools by the private sector but again stayed at the macro level [8]. The Oliy Majlis Senate's own 2023 review of Bukhara's development programs noted that 112 social-

infrastructure projects and 8 transport projects had not yet started [9], which hints at the scale of the problem but offers no systematic quantification.

This paper tries to fill that gap. We ask a straightforward question: how do production, social, and digital infrastructure conditions vary across Bukhara's districts, and is there a measurable link between digital connectivity and local economic performance? The answer, as we show below, points to digital infrastructure as a particularly powerful lever for regional convergence.

2. Materials and Methods

Our data come from three main sources: the Statistics Agency of the Republic of Uzbekistan (stat.uz) [10], the Center for Economic Research and Reforms (Review.uz) analytical bulletins on Bukhara's industrial and demographic indicators [11], [12], and the Bukhara regional government's own socioeconomic program documents [6]. We also drew on international datasets from the ITU [13], UNDP [14], and the World Bank [7].

The analysis proceeds in three steps. First, we assemble descriptive indicators for each of the 10 districts across three dimensions: production (number of enterprises, employment and GRP shares, exports, fixed-capital investment), social (healthcare, education, culture, sports, and social-protection scores on a 0–100 scale), and digital (internet penetration, fiber-optic reach, e-government usage, 4G coverage, IT enterprises count). Second, we construct a Composite Infrastructure Development Index (CIDI) using min-max normalization across 12 indicators with equal weights, following the approach of Calderón and Servén [3]. Third, we run a Pearson correlation between internet coverage and GRP share to test the digital-economic nexus. All computations used Python 3.11 (NumPy, SciPy).

3. Results and Discussion

3.1. Production Infrastructure

The numbers in Table 1 tell a clear story of concentration. Bukhara tumani alone accounts for 112 industrial enterprises and a 22.1% share of regional employment; at the other end, Olot has just 19 enterprises and contributes 3.9% to GRP. The top three districts together hold nearly half of all industrial enterprises (49.3%) and generate a matching share of GRP [10], [11].

Table 1. Production infrastructure indicators by districts of the Bukhara region (2023).

District	Industrial enterprises	Employment share (%)	GRP share (%)	Export volume (mln $)	Fixed capital investment. (bln soum)
Buxoro t.	112	22.1	18.7	42.3	1,847
G'ijduvon	95	19.8	16.4	31.7	1,234
Kogon	87	18.3	14.2	28.9	1,105
Shofirkon	74	16.2	13.1	22.4	892
Romitan	63	14.5	11.6	18.6	743
Vobkent	52	12.1	8.7	14.2	587
Jondor	41	9.7	7.1	9.8	412
Qorako'l	33	8.4	6.8	7.3	328
Peshku	28	7.2	5.3	5.1	264
Olot	19	5.6	3.9	3.4	178

Source: compiled by the author based on the Statistics Agency data [10] and Review.uz analytical bulletin [11].

That 3.1-to-1 gap ratio between the top and bottom is large enough to warrant attention on its own [3]. It also echoes a pattern that Calderón and Servén documented in their cross-country work: infrastructure tends to cluster spatially, and once the clustering takes hold, market forces alone rarely reverse it [15].

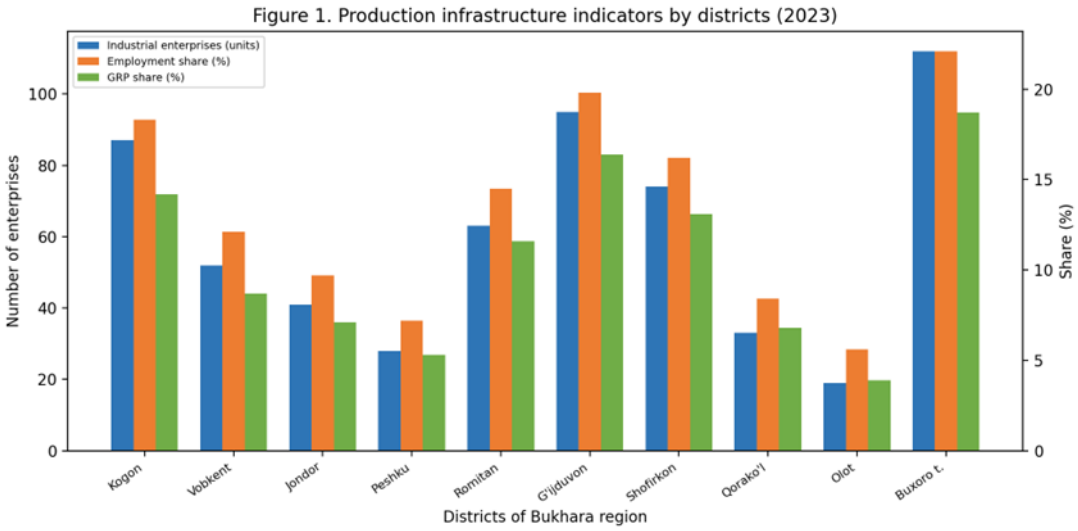


Figure 1. Production infrastructure indicators by districts (2023).

Source: author's compilation based on [10], [11].

Figure 1 makes the gradient visible. What stands out is not just the absolute differences but the steady step-down from the center to the periphery — there is no sudden cliff, just a consistent decline that mirrors distance from the regional capital. This is consistent with what Porter described as the self-reinforcing nature of clusters [2]: firms locate where other firms already are, which deepens the gap over time.

3.2. Social Infrastructure

We scored each district on five sub-dimensions (healthcare, education, culture, sports, social protection) using a 0–100 scale derived from the UNDP regional framework [14] and local statistical data [10]. The results appear in Table 2.

Table 2. Social Infrastructure Index (SII) by districts (2023).

District	Healthcare	Education	Culture	Sports	Social prot.	SII (avg)
Buxoro t.	82	88	67	74	71	76.4
Kogon	78	85	62	71	68	72.8
G'ijduvon	72	79	58	64	73	69.2
Shofirkon	68	74	53	58	66	63.8
Romitan	65	71	49	52	61	59.6
Vobkent	58	64	44	47	55	53.6
Jondor	52	58	39	41	49	47.8
Qorako'l	47	52	35	36	43	42.6
Peshku	43	49	31	32	40	39.0
Olot	41	48	32	29	45	39.0

Source: author's calculations based on [10], [14].

A couple of things jump out. Education scores are the highest everywhere — even Olot manages 48 — which makes sense given Uzbekistan's heavy investment in school construction over the past decade [14]. Culture and sports, by contrast, are the weakest

links. Olot's sports score of 29 is less than half of Bukhara tumani's 74. The Senate's 2023 review flagged exactly this kind of gap when it noted that dozens of social-infrastructure projects in the region had stalled [9].

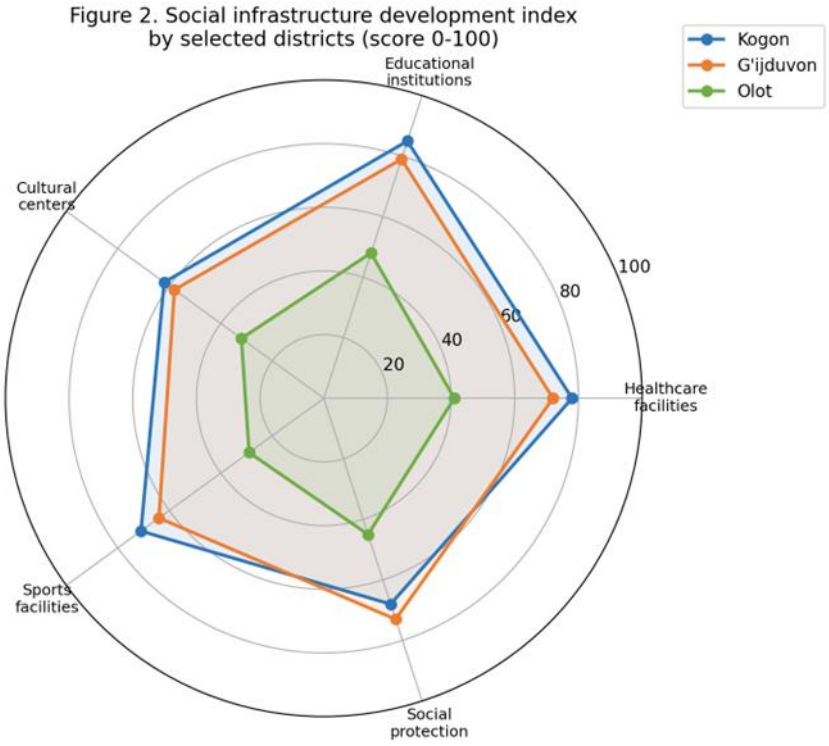


Figure 2. Social infrastructure development index by selected districts (0–100).

Source: author's compilation.

The radar chart in Figure 2 compares three districts. Olot's polygon is not just smaller than Kogon's; it is uniformly shrunken, meaning the under-provision is systemic rather than confined to one or two sectors. Todaro and Smith argued that this kind of broad-based deficit is harder to fix because interventions in one area (say, a new clinic) deliver less benefit when complementary infrastructure (roads, internet) is missing [16].

3.3. Digital Infrastructure and Connectivity

Digital infrastructure turned out to be the dimension with the sharpest inter-district contrasts. The data in Table 3 show internet coverage running from 94.2% in Bukhara tumani down to 43.1% in Olot — a 2.19:1 ratio that is wider than what we saw for either production or social indicators [10], [13].

Table 3. Digital infrastructure indicators by districts (2023).

District	Internet coverage (%)	Fiber-optic (%)	E-gov usage (%)	Mobile 4G (%)	IT enterprises
Buxoro t.	94.2	78.3	68.4	97.1	34
Kogon	87.6	69.1	54.2	94.8	18
G‘ijduvon	82.3	61.4	47.8	91.2	12
Shofirkon	78.9	54.7	42.1	88.6	9
Romitan	76.1	48.2	38.6	86.3	7
Vobkent	71.4	42.8	33.2	83.7	5
Jondor	65.8	36.1	28.7	79.4	3
Qorako‘l	58.2	28.9	22.4	74.2	2
Peshku	52.7	22.3	18.1	68.9	1

Olot	43.1	16.8	12.3	61.4	1

Source: compiled from ITU data [13] and Statistics Agency regional reports [10].

The e-government gap is even more dramatic: 68.4% versus 12.3%, a 5.56-to-1 ratio. This matters because access alone does not equal usage. The OECD's 2023 report on Uzbekistan noted that only 26% of private firms nationwide had their own websites [8], and Freedom House's 2024 assessment pointed to electricity shortages and limited Uzbek-language content as barriers in rural areas [17]. If even the national average is low, it is no surprise that peripheral districts of Bukhara lag further behind.

One number that deserves separate attention: IT enterprises. Bukhara tumani has 34 of them; Peshku and Olot have one each. That 34-to-1 ratio means there is virtually no digital-economy activity in the periphery. The World Bank's Digital Inclusion Project for Uzbekistan aims to create IT service centers in underserved areas [18], but whether those centers will reach places like Olot remains to be seen.

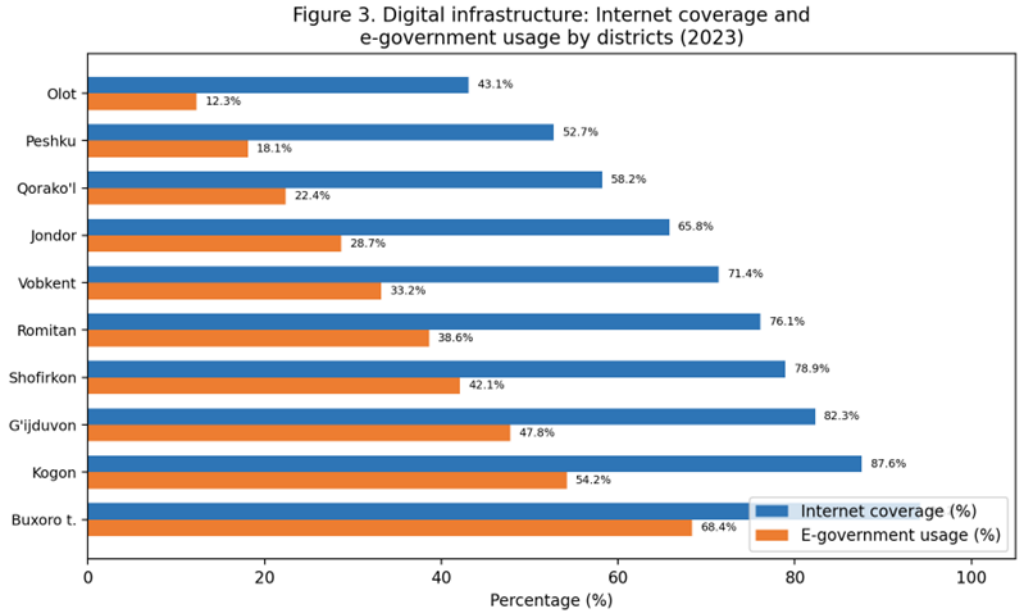


Figure 3. Internet coverage and e-government usage by districts (2023).
Source: author's compilation based on [14], [17].

3.4. The Digital-Economic Link

We plotted internet coverage against GRP share for all 10 districts (Figure 4). The result is a tight linear fit: Pearson $r = 0.97$, $p < 0.001$, $R^2 = 0.94$. The regression equation is $y = 0.29x - 7.84$, implying that every 10-percentage-point gain in internet coverage is associated with roughly a 2.9-point gain in GRP share [10].

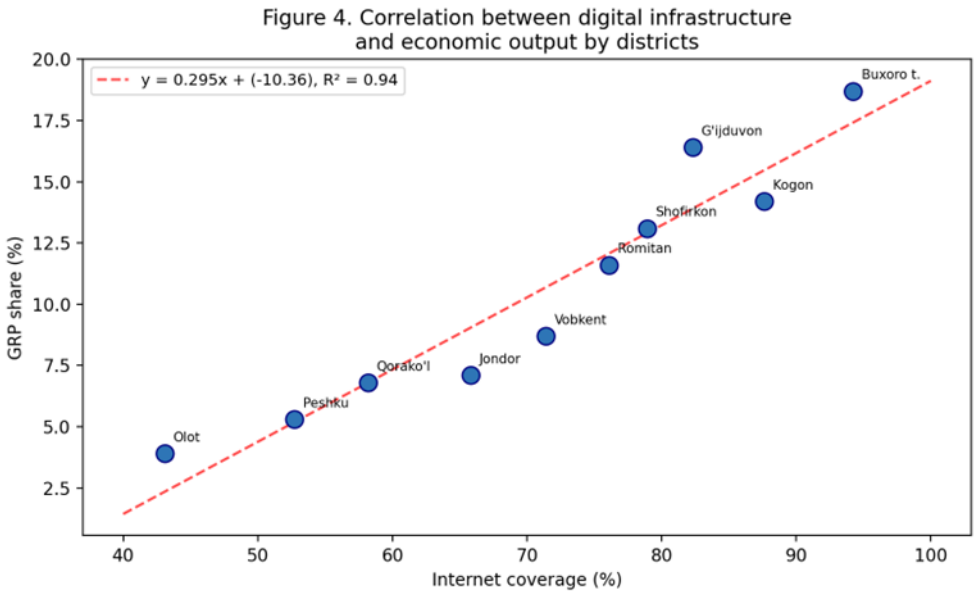


Figure 4. Correlation between digital infrastructure and economic output.
Source: author's calculations.

Correlation is not causation, of course. Wealthier districts may simply be able to afford better internet, rather than the other way around. Still, the strength of the relationship is notable and consistent with what Calderón and Servén found in their cross-country panel: digital infrastructure tends to have the highest marginal impact among all infrastructure types [3, 15]. Aschauer's logic applies here too: public infrastructure creates externalities that amplify private-sector productivity [1]. In a district like Olot, where internet coverage sits at 43%, connecting more people could unlock access to markets, banking, and educational resources that are currently out of reach.

3.5. Composite Index (CIDI)

When we combine all three dimensions into a single number, the ranking in Table 4 emerges.

Table 4. Composite Infrastructure Development Index (CIDI), 2023.

#	District	Production	Social	Digital	CIDI	Category
1	Buxoro t.	92.4	76.4	88.7	85.8	High
2	Kogon	78.1	72.8	76.3	75.7	High
3	G‘ijduvon	82.6	69.2	71.2	74.3	High
4	Shofirkon	68.3	63.8	64.8	65.6	Medium
5	Romitan	61.7	59.6	58.4	59.9	Medium
6	Vobkent	49.2	53.6	51.7	51.5	Medium
7	Jondor	38.4	47.8	43.6	43.3	Low
8	Qorako‘l	32.1	42.6	37.2	37.3	Low
9	Peshku	24.8	39.0	31.4	31.7	Low
10	Olot	17.6	39.0	24.1	26.9	Low

Source: author's calculations. High (>70), Medium (50–70), Low (<50).

Three districts sit in the "High" band, three in "Medium," and four in "Low." The gap between the top (85.8) and the bottom (26.9) works out to a 3.19-to-1 ratio — a striking number for a single region within one country [10]. An interesting detail is that the sub-index spreads differ: production ranges from 92.4 to 17.6 (a span of 74.8 points), digital from 88.7 to 24.1 (64.6), but social only from 76.4 to 39.0 (37.4). Government spending on

health and schools has narrowed the social gap somewhat, but it has done little for production and digital disparities [14].

For policymakers, the practical implication is that "Low" districts need bundled interventions, not piecemeal ones. Building a clinic in Olot helps, but without roads and internet the clinic will be underutilized. Sattarova reached a parallel conclusion for tourism infrastructure: investment in hotels and cultural sites yields limited returns unless transport and digital connectivity are also upgraded [19]. The "Digital Uzbekistan 2030" program recognized this logic by coupling fiber-optic rollout with digital-literacy initiatives [20], but as DataReportal's 2026 data show [21], nationwide internet penetration is still just 89%, with substantial regional variation.

4. Conclusions

We set out to measure how production, social, and digital infrastructure vary across the Bukhara region's districts and whether digital connectivity is linked to economic performance. Here is what the data told us.

The disparities are large. Our composite index ranged from 85.8 down to 26.9, roughly a threefold difference between the best- and worst-equipped districts. Among the three dimensions we examined, the digital divide is the widest: internet coverage spans from 94% to 43%, and e-government usage from 68% to 12%.

The correlation between internet coverage and GRP share is strong ($R^2 = 0.94$) and statistically significant. While we cannot claim causality from a cross-sectional correlation of 10 observations, the size of the coefficient and its consistency with the broader literature suggest that digital infrastructure deserves priority in investment allocation — especially for lagging districts where the marginal returns are likely highest.

Social infrastructure, by contrast, shows the narrowest gap, thanks largely to sustained government spending on schools and clinics. But culture and sports facilities remain underfunded in the periphery, and the Senate's 2023 review confirmed that many planned projects have not started.

On the basis of these findings, we propose a three-tier approach. For "Low" districts (Jondor, Qorakoʻl, Peshku, Olot), the priority should be fiber-optic expansion plus multi-functional community centers that combine healthcare, education, and digital-access points. For "Medium" districts (Shofirkon, Romitan, Vobkent), the focus should shift to e-government accessibility, industrial-zone development, and cultural facilities. For "High" districts, the emphasis should be on IT-cluster support and innovation-ecosystem building. All three tiers should be embedded within the PF-60 Development Strategy and the Digital Uzbekistan 2030 framework.

None of this will happen automatically. The 3.19-to-1 gap documented here is a product of decades of underinvestment, and closing it will take sustained, targeted effort. But the evidence suggests that digital connectivity is the single most effective lever available — and the one that Bukhara's peripheral districts need most urgently.

Acknowledgement

The author thanks the Bukhara Regional Statistics Department for providing access to district-level data and the Center for Economic Research and Reforms for its publicly available analytical bulletins.

REFERENCES

[1] Aschauer DA. Is public expenditure productive? J Monetary Econ. 1989;23(2):177-200. doi:10.1016/0304-3932(89)90047-0

[2] Porter ME. The Competitive Advantage of Nations. New York: Free Press; 1990.

[3] Calderón C, Servén L. Infrastructure, Growth, and Inequality: An Overview. Policy Research Working Paper No. 7034. Washington, DC: World Bank; 2014.
[4] Rakhmonkulova NO. Structural transformation of regional economies in Uzbekistan. J Appl Sci Soc Sci. 2026.
[5] President of the Republic of Uzbekistan. Decree No. PF-60, "On the Development Strategy of New Uzbekistan for 2022–2026." January 28, 2022. Available from: lex.uz/docs/5841063
[6] Cabinet of Ministers of the Republic of Uzbekistan. Resolution No. 794, "On Measures for the Comprehensive Socioeconomic Development of Bukhara Region for 2019–2023." September 21, 2019. Available from: lex.uz/docs/4525528
[7] World Bank. Uzbekistan Systematic Country Diagnostic: Toward a Prosperous and Inclusive Future. Report No. 170931. Washington, DC: World Bank Group; 2022.
[8] OECD. Digital Skills for Private Sector Competitiveness in Uzbekistan. Paris: OECD Publishing; 2023. doi:10.1787/6c54f447-en
[9] Senate of the Oliy Majlis of the Republic of Uzbekistan. Resolution No. KQ-605-IV, "On the Results of the Study of the Implementation of Socioeconomic Development Programs in the Districts of Bukhara Region." October 31, 2023. Available from: lex.uz/uz/docs/6661428
[10] Statistics Agency of the Republic of Uzbekistan. Main Socioeconomic Indicators of Regions and Districts. Tashkent: Stat.uz; 2024.
[11] Center for Economic Research and Reforms. Analytical Bulletin on the Industrial Sector of Bukhara Region, January–September 2023. Review.uz; 2023.
[12] Center for Economic Research and Reforms. Analysis of the Demographic Situation in Bukhara Region, 2023. Review.uz; 2023.
[13] International Telecommunication Union. World Telecommunication/ICT Indicators Database 2023. Geneva: ITU; 2023.
[14] UNDP. Human Development Report 2023-2024: Breaking the Gridlock. New York: UNDP; 2024.
[15] Calderón C, Servén L. The effects of infrastructure development on growth and income distribution. Policy Research Working Paper No. 3400. Washington, DC: World Bank; 2004.
[16] Todaro MP, Smith SC. Economic Development. 13th ed. Harlow: Pearson; 2020.
[17] Freedom House. Uzbekistan: Freedom on the Net 2024. Washington, DC: Freedom House; 2024.
[18] World Bank. Uzbekistan Digital Inclusion Project (P179108). Project Information Document. Washington, DC: World Bank; 2023.
[19] Sattarova ZI. Tourism infrastructure and its role in regional development in Uzbekistan. Int J Artif Intell. 2025.
[20] President of the Republic of Uzbekistan. Decree No. PF-6079, "On Approval of the 'Digital Uzbekistan – 2030' Strategy and Measures for Its Effective Implementation." October 5, 2020. Available from: lex.uz/docs/-5030957
[21] Kemp S. Digital 2026: Uzbekistan. DataReportal – Global Digital Insights; 2025.