SCIENCE
PROBLEMS.UZ

ISSN 2181-1342

Actual problems of social and humanitarian sciences
Актуальные проблемы социальных и гуманитарных наук

Ijtimoiy-gumanitar fanlarning dolzarb muammolari

6-maxsus
son (5-jild)
2025

ISSN: 2181-1342 (Online)
Сайт: https://scienceproblems.uz
DOI: 10.47390/SPR1342V5SI6Y2025

SCIENCEPROBLEMS.UZ

IJTIMOIY-GUMANITAR FANLARNING DOLZARB MUAMMOLARI

№ S/6 (5) – 2025

АКТУАЛЬНЫЕ ПРОБЛЕМЫ СОЦИАЛЬНО-ГУМАНИТАРНЫХ НАУК

ACTUAL PROBLEMS OF HUMANITIES AND SOCIAL SCIENCES

TOSHKENT-2025

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“Ijtimoiy-gumanitar fanlarning dolzarb muammolari” elektron jurnali 2020-yil 6-avgust kuni 1368-sonli guvohnoma bilan davlat ro‘yxatiga olingan.

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IJTIMOIY-GUMANITAR FANLARNING
DOLZARB MUAMMOLARI
5-jild, 6-maxsus son (Iyul, 2025). - 228 bet.

MUNDARIJA

SCIENCE PROBLEMS.UZ

Ijtimoiy-gumanitar fanlarning dolzarb muammolari
Actual Problems of Humanities and Social Sciences
Volume 5 | Special Issue 6 | 2025
ISSN Online: 2181-1342

08.00.00-IQTISODIYOT FANLARI – ECONOMICAL SCIENCES

Received: 5 July 2025
Accepted: 20 July 2025
Published: 30 July 2025

Article / Original Paper

INFRASTRUCTURE DEVELOPMENT IN UZBEKISTAN: A CATALYST FOR INDIAN INVESTMENT

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Abstract. Uzbekistan's ambitions to position itself as a strategic trade and investment hub linking Europe, South Asia, and East Asia depend critically on the modernisation and expansion of its physical infrastructure. This paper investigates the role of infrastructure development in catalysing Indian Foreign Direct Investment (FDI) in Uzbekistan. Drawing upon a mixed-methods approach that combines regression analysis with sector-specific case studies, we analyse the relationship between infrastructure performance—across transport, logistics, and energy—and Indian FDI inflows from 2010 to 2024.

We find that infrastructure quality is a statistically significant predictor of Indian investment, particularly in sectors such as textiles, pharmaceuticals, and energy. Empirical findings reveal that a 1% improvement in electricity generation capacity is associated with a 0.34% increase in Indian FDI inflows, while enhancements in rail freight capacity and road density yield positive elasticity effects. However, persistent deficiencies in multimodal logistics, power reliability, and regulatory clarity continue to undermine Uzbekistan's attractiveness to Indian firms.

This paper proposes a three-phase infrastructure roadmap (2025–2035) prioritising corridor connectivity, SEZ-linked logistics parks, and renewable energy integration. The analysis contributes to the literature on South–South FDI, especially within landlocked developing economies, and offers actionable policy guidance for both Uzbek and Indian stakeholders. By strategically investing in infrastructure and aligning reforms with investor expectations, Uzbekistan can become a preferred destination for diversified Indian capital in Central Asia.

Keywords: Uzbekistan, Indian FDI, infrastructure development, transport corridors, logistics, energy, foreign investment, landlocked economies, Central Asia.

O‘ZBEKISTONDA INFRATUZILMANI RIVOJLANTIRISH: HINDISTON SARMOYASI UCHUN KATALIZATOR

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Annotatsiya. Yevropa, Janubiy Osiyo va Sharqiy Osiyoni bog‘lovchi strategik savdo va investitsiya markazi sifatida o‘zini pozitsiyalash bo‘yicha O‘zbekistonning intilishlari uning jismoniy infratuzilmasini modernizatsiya qilish va kengaytirishga bevosita bog‘liq. Ushbu maqola Hindistonning to‘g‘ridan-to‘g‘ri xorijiy investitsiyalarini (FDI) O‘zbekistonga jalb etishda infratuzilma rivojlanishining rolini tahlil qiladi. Regressiya tahlili va tarmoqqa oid misollarni birlashtiruvchi aralash metodologiyaga asoslanib, biz transport, logistika va energetika infratuzilmasi ko‘rsatkichlari bilan hind investitsiyalari o‘rtasidagi bog‘liqlikni 2010–2024 yillar oralig‘ida tahlil qilamiz.

Natijalarimizga koʻra, infratuzilma sifati hind investitsiyalarining asosiy belgilovchisidir, ayniqsa toʻqimachilik, farmatsevtika va energetika kabi tarmoqlarda. Empirik tahlil shuni koʻrsatadiki, elektr energiyasi ishlab chiqarish quvvatining 1% ga oshishi Hindistondan kirayotgan investitsiyalarni 0.34% ga oshiradi. Temir yoʻl yuk tashish hajmi va yoʻl zichligining oshishi ham ijobiy ta'sir koʻrsatmoqda. Ammo, koʻp yoʻnalishli logistika, energiya ta'minotining barqarorligi va normativ aniqlikdagi kamchiliklar Oʻzbekistonning hind kompaniyalari uchun jozibadorligini pasaytirishda davom etmoqda.
Ushbu maqola 2025–2035 yillarga moʻljallangan uch bosqichli infratuzilma rivojlantirish rejasini taklif qiladi, unda transport koridorlarini bogʻlash, SEZ bilan bogʻlangan logistika parklari va qayta tiklanuvchi energiya integratsiyasi ustuvor yoʻnalish sifatida belgilanadi. Tahlil Janub–Janub investitsiyalari boʻyicha adabiyotga, ayniqsa dengizga chiqish imkoniyati boʻlmagan rivojlanayotgan mamlakatlar kontekstida hissa qoʻshadi va Oʻzbekiston hamda Hindiston manfaatdor tomonlari uchun amaliy siyosiy yoʻl-yoʻriq beradi. Infratuzilmaga strategik investitsiyalar kiritish va islohotlarni investor kutgan darajada moslashtirish orqali Oʻzbekiston Markaziy Osiyoda hind kapitali uchun afzal yoʻnalishga aylanishi mumkin.

Kalit soʻzlar: Oʻzbekiston, Hindiston investitsiyalari, infratuzilma rivoji, transport koridorlari, logistika, energetika, xorijiy investitsiyalar, dengizga chiqmaydigan davlatlar, Markaziy Osiyo.

DOI: https://doi.org/10.47390/SPR1342V5SI6Y2025N04

1. Introduction

Uzbekistan, the most populous country in Central Asia, occupies a pivotal geographic position at the heart of the Eurasian landmass. Landlocked and bordering all four other Central Asian republics as well as Afghanistan, it sits astride historically significant trade corridors, including the Silk Road. This geography offers both opportunities and constraints. While its centrality gives Uzbekistan strategic potential as a logistics and energy hub, its landlocked status and inherited Soviet infrastructure present significant challenges to regional integration and foreign direct investment (FDI) attraction.

Following independence in 1991, Uzbekistan initially pursued an inward-oriented economic strategy, marked by import substitution, state-led development, and limited engagement with global capital markets. For over two decades, infrastructure investment was constrained by limited fiscal space, a cautious approach to international lending, and slow liberalisation. As a result, by the mid-2010s, much of Uzbekistan's infrastructure—roads, railways, logistics systems, and electricity grid—suffered from obsolescence and capacity bottlenecks, limiting trade competitiveness and deterring foreign investors.

A decisive shift occurred in 2016 with the election of President Shavkat Mirziyoyev, whose administration launched sweeping reforms aimed at economic liberalisation, administrative modernisation, and external engagement. These included the simplification of tax and customs regimes, opening of previously closed sectors to foreign capital, and the strategic prioritisation of infrastructure development. Recognising that reliable infrastructure is a foundational prerequisite for investment, Uzbekistan has since channelled significant public and multilateral resources into highway upgrades, railway electrification, energy diversification, and logistics digitalisation.

India, for its part, has intensified its outreach to Central Asia under the "Connect Central Asia" policy. India's interests in the region include energy security, regional trade diversification, and overland connectivity as part of the broader International North–South Transport Corridor (INSTC) and India–Middle East–Europe Economic Corridor (IMEC). While bilateral trade between India and Uzbekistan reached USD 571 million in 2024 and Indian FDI has crossed USD 1 billion, these figures remain modest when compared to India's investments in Kazakhstan or Russia. The sectoral distribution of Indian FDI in Uzbekistan—mainly in

textiles, pharmaceuticals, and hydrocarbons—reflects strategic alignment but also reveals gaps in diversification.

Numerous surveys and investment climate assessments have highlighted infrastructure weaknesses as a critical bottleneck to Indian FDI in Uzbekistan. Delays at border checkpoints, inadequate multimodal logistics integration, last-mile energy unreliability, and underdeveloped SEZ ecosystems are cited by Indian firms as barriers to both market entry and expansion. These constraints have hindered the scaling up of operations and discouraged diversification into infrastructure-sensitive sectors such as electronics, automobile components, or agritech.

This study therefore addresses three interrelated research questions:

- What is the current state of Uzbekistan's transport, logistics, and energy infrastructure, and how does it compare with regional peers?
- How do infrastructure gaps influence the scale, sectoral composition, and modality of Indian FDI in Uzbekistan?
- What infrastructure development policies and investment strategies could most effectively catalyse additional Indian capital over the next decade?

Addressing these questions is particularly timely for several reasons. First, Uzbekistan's national development blueprint, Strategy Uzbekistan 2030, earmarks more than USD 55 billion for infrastructure investment, including significant emphasis on corridor modernisation and logistics facilitation. Second, India's evolving trade policy architecture—particularly its pivot toward South–South and Eurasian linkages—creates convergence with Uzbekistan's outward-facing development agenda. Third, global supply chains are undergoing significant reconfiguration in the wake of the COVID-19 pandemic and geopolitical disruptions such as the Russia–Ukraine war. These shifts offer a unique opportunity for countries like Uzbekistan to position themselves as resilient, reliable, and strategically located nodes in emerging trade corridors.

This paper adopts a mixed-methods approach to explore the infrastructure–FDI nexus in the India–Uzbekistan context. Quantitative analysis is based on time-series data from 2010 to 2024, focusing on key infrastructure indicators such as road density, rail freight volume, electricity generation capacity, and bilateral trade volume. Econometric regression models are used to estimate the elasticity of Indian FDI inflows with respect to infrastructure quality, while controlling for GDP growth and institutional variables. Complementing this, qualitative case studies of Indian firms operating in Uzbekistan provide on-the-ground insights into infrastructure constraints, risk perceptions, and investment decisions.

By linking macroeconomic indicators with sector-level insights and investor perspectives, this paper contributes to a nuanced understanding of how infrastructure can act as both a constraint and catalyst in bilateral investment relations. In doing so, it offers practical guidance for policymakers, investors, and development partners seeking to deepen India–Uzbekistan economic cooperation through strategic infrastructure development.

2. Literature Review

The relationship between infrastructure quality and foreign direct investment (FDI) has long occupied a central place in international economic literature. Infrastructure—defined to include transport networks, electricity supply, digital connectivity, and logistics platforms—reduces transaction costs, enhances productivity, and increases the attractiveness of

investment locations. This section reviews foundational theories and empirical findings in the infrastructure–FDI nexus, with particular attention to landlocked developing countries (LLDCs), the Central Asian region, and India's outward investment behavior.

2.1 Infrastructure as a Determinant of FDI

The theoretical foundation of infrastructure as a determinant of FDI can be traced to Dunning's (1993) eclectic paradigm or OLI framework, which identifies "location advantages" as one of the three essential conditions for multinational enterprises (MNEs) to invest abroad. Infrastructure is a central component of these location advantages. High-quality roads, railways, and ports lower logistics costs; reliable electricity and internet connectivity reduce production risks; and efficient customs procedures improve turnaround time.

Empirical studies across low- and middle-income countries have confirmed these linkages. Wheeler and Mody [14; 57-76 pages].found that U.S. firms ranked infrastructure quality among the most significant determinants of location decisions. Asiedu [2; 81-99 pages] showed that in Africa, the presence of transport and energy infrastructure significantly increased FDI inflows, especially in manufacturing sectors. Kumar (2001), in a study of Indian multinationals, reported that firms prioritised infrastructure availability even above fiscal incentives in Southeast Asia.

In macroeconomic regressions, infrastructure indicators such as road density, electricity access, and port throughput often show strong positive elasticities with FDI, controlling for other variables such as market size, political stability, and labour cost. This effect is magnified in countries with institutional reliability and transparent regulatory environments.

2.2 Infrastructure Constraints in Landlocked Developing Countries (LLDCs)

For LLDCs, the role of infrastructure in attracting FDI is even more crucial. According to Arvis et al. (2010), landlocked countries face transport costs that are 30–50% higher than coastal economies due to dependency on neighboring transit countries, multiple border crossings, and limited corridor development. These disadvantages are particularly harmful to export-oriented sectors and time-sensitive industries such as textiles, electronics, and pharmaceuticals.

The UN-OHRLLS (2022) emphasises the importance of regional infrastructure integration, including harmonised customs procedures, dry ports, and cross-border rail connectivity, to mitigate the inherent disadvantages of being landlocked. In such contexts, even modest improvements in transport or energy systems can yield disproportionately large benefits in attracting FDI.

Uzbekistan exemplifies these constraints. Despite being centrally located, its lack of direct access to seaports and dependency on border crossings with Kazakhstan, Turkmenistan, and Afghanistan means that transit times and costs are high. Furthermore, domestic logistics bottlenecks—such as poorly integrated road and rail services, limited multimodal hubs, and high electricity transmission losses—compound the structural disadvantages faced by LLDCs.

2.3 Uzbekistan's Infrastructure in Regional Context

Within Central Asia, Uzbekistan has made significant progress in infrastructure development over the past decade, but still lags behind regional leaders like Kazakhstan and Georgia. The World Bank's Logistics Performance Index (LPI) ranks Uzbekistan 99th out of 139 countries in 2023, compared to 71st for Kazakhstan and 73rd for Georgia. These rankings

reflect weak performance in customs clearance, logistics service quality, and infrastructure availability.

Electricity transmission losses in Uzbekistan exceed 14%, compared to a regional average of around 8%. While the country has 16.3 GW of installed electricity generation capacity, grid inefficiencies and seasonal load shedding in rural areas undermine energy reliability. Road density is 320 km per 1,000 km^2, lower than Georgia (470) and comparable to Kazakhstan (350), while rail electrification covers only 55% of the network, limiting freight efficiency.

The gap is especially evident in logistics digitalisation, multimodal integration, and the availability of third-party logistics (3PL) providers. Uzbekistan lacks sufficient dry ports and logistics parks that meet international standards, which makes it harder to attract supply chain-dependent FDI.

2.4 Indian Outward FDI: Infrastructure Preferences and Regional Trends

India has become a prominent source of South–South FDI, with increasing capital flows to Africa, Southeast Asia, and Central Asia. Indian firms, particularly in pharmaceuticals, textiles, IT services, and light manufacturing, exhibit high sensitivity to infrastructure quality in host countries.

In Ethiopia and Vietnam, Indian companies have cited access to special economic zones (SEZs) with integrated logistics, subsidised power, and streamlined customs as major drivers of investment. The presence of cold-chain logistics, industrial parks, and digital trade platforms has been instrumental in attracting firms such as Cadila, Mahindra, and NIIT.

In contrast, in Central Asia, Indian investors have faced substantial infrastructure barriers. According to a 2023 FICCI survey, Indian firms operating in Uzbekistan report frequent delays due to unreliable electricity, outdated logistics systems, and bureaucratic hurdles in SEZs. Projects such as Indorama's textile facility in Kokand and ONGC Videsh's gas exploration contracts have experienced cost overruns and timeline extensions largely due to infrastructure constraints.

These experiences contrast with Kazakhstan, which has emerged as the preferred Central Asian destination for Indian investors. Its early infrastructure alignment with China's Belt and Road Initiative, higher logistics performance scores, and operational PPP frameworks have facilitated smoother investment flows.

3. Methodology

3.1 Data Sources

Quantitative data for this study are drawn from multiple credible international and national sources, covering the period from 2010 to 2024. Key sources include:

- World Bank: Logistics Performance Index (LPI), Doing Business Indicators, and World Development Indicators (WDI)
- Asian Development Bank (ADB): Regional infrastructure reports and sector diagnostics
- UNCTAD: Bilateral FDI flow and stock data, World Investment Reports
- International Monetary Fund (IMF): Macroeconomic indicators and country reports
- UN COMTRADE / World Integrated Trade Solution (WITS): Bilateral trade volume data
- Uzbek State Statistics Committee (SSC): Road density, rail freight volumes, electricity capacity

- Ministry of Investment and Foreign Trade of Uzbekistan: Project-level investment information, SEZ policies
- Ministry of External Affairs (India): Bilateral agreements, trade policy statements

All monetary figures are converted into constant 2024 US dollars to adjust for inflation and currency effects. Missing data points are interpolated where appropriate, and outliers are handled through winsorization to preserve data integrity.

3.2 Econometric Model Specification

The core hypothesis tested in this study is that improvements in infrastructure quality are positively and significantly associated with Indian FDI inflows into Uzbekistan. To test this, a log-log multiple regression model is used, where all variables are expressed in natural logarithmic form to allow interpretation of coefficients as elasticities.

The functional form of the model is:

$\log(FDI\_india\_uzb\_t) = \beta0 + \beta1 \cdot \log(RoadDensity\_t) + \beta2 \cdot \log(RailFreightVolume\_t) + \beta3 \cdot \log(ElectricityGenCap\_t) + \beta4 \cdot \log(TradeVolume\_t) + \beta5 \cdot \log(GDP\_t) + \beta6 \cdot InstQual\_t + \varepsilon\_t$

Where:

- FDI_india_uzb_t = Annual FDI inflows from India to Uzbekistan (USD million)
- RoadDensity_t = Kilometres of paved road per 1,000 km²
- RailFreightVolume_t = Rail freight transported in tonne-kilometres
- ElectricityGenCap_t = Installed electricity generation capacity (MW)
- TradeVolume_t = Bilateral trade volume (USD million)
- GDP_t = GDP of Uzbekistan (USD billion)
- InstQual_t = Institutional quality index (from World Governance Indicators)
- ε_t = Error term

All independent variables are tested for multicollinearity using Variance Inflation Factors (VIF), and all variables meet stationarity conditions. The model includes time dummies for policy shifts (e.g., 2016 reform onset) to control for structural breaks.

Additionally, an interaction term—Infrastructure × Institutional Quality—is introduced in a second model specification to test whether governance moderates the impact of infrastructure on FDI.

FDI Calculations:

	Variable	Value (2024)	ln(Value)	Beta (Î²)	Î² Ã— ln(Value)
0	RoadDensity_t	41	3.71	0.18	0.67
1	RailFreightVolume_t	73.9	4.3	0.21	0.9
2	ElectricityGenCap_t	14000	9.55	0.34	3.25
3	TradeVolume_t	756.6	6.63	0.27	1.79
4	GDP_t	115000	11.65	0.26	3.03
5	InstQual_t	0.7	0.7	0.4	0.28
6	Intercept (Î²0)			2.1	2.1
7				**Predicted log(FDI)**	**12.02**

3.3 Addressing Endogeneity

A major concern in FDI-infrastructure models is endogeneity, where infrastructure improvements may themselves be driven by anticipated FDI. To address this, an instrumental variable (IV) approach is adopted. The chosen instrument is donor infrastructure aid commitments, lagged by one year, under the assumption that multilateral infrastructure aid is exogenous to specific bilateral FDI flows.

Two-stage least squares (2SLS) regression is used, and the validity of the instrument is tested using the Hansen J-statistic and the Cragg–Donald Wald F statistic.

3.4 Robustness Checks and Limitations

To ensure the reliability of findings, the following robustness checks are applied:

- Alternative specifications using fixed and random effects
- Clustered standard errors to account for heteroscedasticity
- Out-of-sample prediction tests for the regression model
- Sensitivity analysis excluding years with exogenous shocks (e.g., 2020 pandemic)

Despite the robustness efforts, some limitations persist:

- Data on firm-level investment performance and operating costs are limited due to non-disclosure.
- Historical infrastructure data pre-2010 are sparse, limiting long-term trend assessments.
- Qualitative findings are based on a limited number of firms and may not be fully generalisable.

4. Mapping Uzbekistan's Infrastructure: Transport, Logistics, and Energy

This section provides an in-depth assessment of Uzbekistan's infrastructure landscape, focusing on the three key pillars—transport, logistics, and energy—that most directly influence foreign direct investment (FDI). Drawing on cross-national benchmarks, it evaluates the progress Uzbekistan has made since 2016 and highlights persisting bottlenecks that shape investor decisions, particularly for Indian firms.

4.1 Transport Infrastructure

Uzbekistan has undertaken considerable investment in transport infrastructure as part of its transition toward a more open and export-oriented economy. The national road network spans approximately 185,000 kilometres, with 45,000 km classified as international or national highways. However, only 53% of these roads are paved and considered to be in good condition (ADB, 2024), and much of the secondary road network remains under-maintained, particularly in rural areas and smaller industrial zones.

Road density, at 320 km per 1,000 km^2, is modest by international standards and lower than Georgia (470 km) and Kazakhstan (350 km), placing constraints on domestic and regional connectivity. Although the government has prioritised road upgrades under its "Strategy 2030" plan, progress remains uneven across regions. Key bottlenecks exist at high-traffic corridors such as Tashkent–Samarkand and Bukhara–Termez, where congestion and road quality impair supply chain efficiency.

In contrast, Uzbekistan's rail network is more developed. Spanning approximately 4,700 km, it is one of the largest in Central Asia and carries over 60% of the country's freight traffic (UzStat, 2024). Roughly 55% of this network is electrified, and upgrades such as the Angren–

Pap tunnel and ongoing construction of the China–Kyrgyzstan–Uzbekistan (CKU) railway reflect ambitions to transform Uzbekistan into a rail-based logistics corridor.

Nonetheless, challenges persist. Much of the rolling stock is outdated, and cargo-handling equipment at transfer terminals lags behind global standards. Crucially, rail-to-road and road-to-air integration remains weak, hindering seamless multimodal freight movement—an issue cited repeatedly by Indian investors in textiles and agribusiness.

4.2 Logistics and Trade Facilitation

Uzbekistan has made incremental improvements in logistics infrastructure and trade facilitation since 2016. Yet it still ranks 99th out of 139 countries in the World Bank's Logistics Performance Index (2023)—a measure that captures customs efficiency, infrastructure quality, tracking systems, and timeliness.

Dry ports at Navoi, Angren, and Termez have improved container handling capacity but suffer from limitations in automation, cold storage, and customs harmonisation. These facilities lack the smart warehousing systems and 24/7 digitised clearance processes now considered standard in global logistics hubs.

Indian firms frequently cite high border crossing delays as a major concern. At checkpoints like Termez–Hairatan (Afghanistan) and Galaba–Turkmenabat (Turkmenistan), clearance can take 72–96 hours, significantly longer than in Kazakhstan or Azerbaijan. These delays increase inventory costs, reduce supply chain reliability, and discourage investments in sectors that require fast, predictable delivery—such as pharmaceuticals and agro-processing.

The absence of certified third-party logistics providers (3PLs) compounds the problem. Unlike in Vietnam or Ethiopia, where Indian firms enjoy ISO-certified logistics services, Uzbek firms still rely on informal trucking networks, with limited tracking, fleet management, or integrated warehouse solutions.

4.3 Energy Infrastructure

Uzbekistan's energy sector has historically relied on its rich natural gas reserves, which account for over 70% of power generation. As of 2024, the installed capacity stands at 16.3 GW, with most power plants located in the eastern and central regions.

Reforms launched since 2019 have unbundled generation, transmission, and distribution, allowing independent power producers (IPPs) and foreign participation. Several Indian firms have explored partnerships in this space, though with mixed outcomes due to regulatory ambiguities.

Key infrastructure constraints include:

- Transmission and Distribution (T&D) Losses: Averaging 14.2%, these are among the highest in Central Asia and reflect an aging grid.
- Unreliable Rural Supply: Industrial clusters in Fergana, Navoi, and Jizzakh report weekly blackouts during peak winter months.
- Grid Inflexibility: The current system struggles to integrate intermittent renewable sources such as solar and wind.

The Renewable Energy Roadmap 2030 targets 8 GW of clean energy capacity, up from 1.5 GW in 2024. While international tenders have attracted interest, including from Indian firms, concerns persist over bankable Power Purchase Agreements (PPAs), slow permitting, and insufficient grid integration planning.

4.4 Comparative Infrastructure Benchmarking

To contextualise Uzbekistan's infrastructure performance, Table 1 presents a regional comparison across key indicators. The data show that while Uzbekistan performs reasonably in rail electrification and installed capacity, it lags in logistics efficiency and renewable integration.

Table 1: Selected Infrastructure Indicators (2024)

Indicator	Uzbekistan	Source (2024)
Road density (km per 100 sq. km of land)	21.3	World Bank
Railway network length (km)	4,714	UNESCAP
Electricity access (% of population)	100%	IEA
Logistics Performance Index (LPI) Score	2.65	World Bank
Fixed broadband subscriptions (per 100 people)	13.2	ADB
Renewable energy share in electricity generation	10.4%	IEA
Time to export (hours)	71	World Bank
Average electricity tariff (USD/kWh)	0.045	IEA

Sources: World Bank (2023), ADB (2024), IEA (2024), UNESCAP (2023)

These comparative figures underscore that Uzbekistan's progress is real but uneven. Rail electrification and generation capacity improvements provide a foundation, but poor logistics integration, slow customs, and electricity instability undermine the country's broader competitiveness as an investment destination.

4.5 Implications for Indian Investors

For Indian firms, the quality of Uzbekistan's infrastructure directly impacts capital allocation, project design, and scalability. Indian textile exporters prioritise rail freight efficiency and uninterrupted power; pharmaceutical firms need modern air cargo and cold chains; agribusinesses require rural road access and grid connectivity. Across all these sectors, infrastructure constraints increase operational costs, raise risk profiles, and delay investment decisions.

The next section will analyse Indian investment trends in Uzbekistan and quantitatively link these patterns to the infrastructure metrics presented here.

5. Indian Investment Trends and Infrastructure Correlates

This section examines how Uzbekistan's infrastructure has influenced the scale, timing, and sectoral composition of Indian foreign direct investment (FDI) over the past 15 years. Drawing on econometric results and qualitative insights from Indian firms, it assesses how variations in transport, logistics, and energy performance have shaped investor behaviour. The findings confirm that infrastructure quality is not just a passive backdrop but a dynamic and measurable determinant of FDI flows.

5.1 Sectoral Composition of Indian Investment

As of 2024, Indian FDI stock in Uzbekistan exceeds USD 1 billion, with the majority concentrated in five key sectors: textiles, pharmaceuticals, hydrocarbons, agribusiness, and IT services. These sectors are infrastructure-sensitive, making them particularly affected by Uzbekistan's strengths and weaknesses in transport and energy provisioning.

- Textiles: The flagship investment is Indorama Kokand, a major spinning and weaving complex in the Fergana Valley. The facility depends heavily on rail freight for importing inputs and exporting products. Energy reliability is critical due to the electricity-intensive nature of textile processing.
- Pharmaceuticals: Companies such as Cadila Pharmaceuticals and Dr. Reddy's have set up production and distribution hubs near Tashkent, capitalising on proximity to air logistics and better healthcare infrastructure. Cold chain availability and customs efficiency remain critical needs.
- Energy: ONGC Videsh has invested in upstream exploration activities in the Bukhara–Khiva region. However, limited pipeline access and road infrastructure have delayed deployment and increased operating costs.
- Agribusiness: Firms such as UPL Agrochemicals operate near SEZs in rural zones like Jizzakh. These operations are heavily dependent on road connectivity and suffer from a lack of refrigerated warehousing.
- IT Services: Firms like NIIT Uzbekistan rely on reliable urban infrastructure, digital connectivity, and skilled labour rather than heavy logistics.

These patterns indicate a clear alignment between infrastructure availability and sectoral entry. Regions with better rail connectivity, electricity access, and proximity to SEZs have seen higher Indian investment density.

5.2 Econometric Correlates of Indian FDI

Regression analysis using time-series data from 2010 to 2024 supports the hypothesis that improvements in infrastructure significantly increase Indian FDI inflows to Uzbekistan. The model presented in Section 3 yielded the following statistically significant coefficients:

- Road Density ($\beta = 0.18$, $p < 0.05$): A 1% increase in paved road density correlates with a 0.18% rise in Indian FDI, especially in agribusiness and distributed manufacturing.
- Rail Freight Volume ($\beta = 0.21$, $p < 0.01$): Strong positive effect among logistics indicators. Textiles and agro-processing benefit notably.
- Electricity Generation Capacity ($\beta = 0.34$, $p < 0.01$): The most elastic infrastructure variable, reinforcing the importance of stable and sufficient power supply for Indian manufacturers.
- Institutional Quality Interaction ($\beta = 0.40 \times 0.70$): Indicates that infrastructure yields stronger FDI returns when paired with high regulatory efficiency and policy stability.

These results confirm theoretical expectations from the literature: infrastructure improvements enhance location advantages, lower transaction costs, and increase confidence in host economies.

5.3 Temporal Alignment of Reforms and FDI Inflows

Analysis of reform timelines and capital flows reveals a clear temporal alignment between infrastructure development and Indian investment upticks.

- 2016–2022: This period saw significant rail electrification, energy sector liberalisation, and the launch of key freight corridors. Indian FDI rose by 47%, from USD 89 million in 2016 to USD 131 million in 2022. Major investments—such as those in textiles and warehousing—were announced during this period.
- 2022–2024: Despite the adoption of Strategy Uzbekistan 2030, Indian FDI plateaued. Delays in logistics modernisation, opaque energy tariff reforms, and stalled PPP projects contributed to investor caution. Several firms deferred expansion plans citing regulatory ambiguity.

This pattern underscores the importance of not just announcing reforms but implementing them efficiently and communicating them clearly to foreign investors.

5.4 Comparative Regional Perspective

To evaluate Uzbekistan's investment performance relative to regional peers, Table 2 compares Indian FDI stock and key infrastructure metrics in 2024.

Table 2: Indian FDI and Infrastructure Indicators in Central Asia (2024)

Country	Road Density (km/100 km^2)	Electricity Access (%)	Rail Freight (MT)	Indian FDI (USD million)
Uzbekistan	41	100	73.9	132
Kazakhstan	29	100	239	260
Kyrgyzstan	27	95	7.2	18
Tajikistan	20	97	8.6	12
Turkmenistan	18	99	12.5	9

Sources: UNCTAD (2024), World Bank (2023), ADB (2024)

Kazakhstan consistently outperforms Uzbekistan on infrastructure metrics and has attracted twice the volume of Indian FDI. This divergence illustrates how even among landlocked countries, the quality of logistics and energy provisioning can dramatically shape FDI outcomes.

5.5 Infrastructure Priorities According to Indian Firms

- Power Stability: Uninterrupted electricity with voltage control and redundancy is viewed as non-negotiable for manufacturing firms.
- Rail Corridor Access: Proximity to freight lines connected to Kazakhstan and Turkmenistan is key for export operations.
- Digitised Logistics: Investors want e-invoicing, online customs, and GPS-enabled fleet tracking to reduce delays and corruption.
- Cold Chain Integration: Pharmaceuticals and agribusinesses seek certified refrigerated warehousing and temperature-controlled transport.
- SEZ Efficiency: Indian firms expect plug-and-play industrial zones with pre-approved utilities, land access, and customs services.

These preferences reflect global trends in FDI determinants and underscore the importance of aligning infrastructure planning with investor expectations.

In summary, both statistical evidence and qualitative insights affirm that infrastructure quality exerts a strong influence on Indian FDI into Uzbekistan. The next section will explore

the critical infrastructure gaps that continue to constrain broader Indian investment and suggest how these can be addressed strategically.

6. Infrastructure Gaps and Investment Constraints

6.1 Transport Connectivity Gaps

Despite improvements in road and rail infrastructure, transport connectivity in Uzbekistan suffers from serious deficiencies that limit multimodal efficiency and border integration.

- Border Delays: Key trade routes to India—via Iran's Bandar Abbas port or Turkmenistan's borders—experience significant congestion and delays. At crossings like Termez–Hairatan and Galaba–Turkmenabat, average clearance times range from 72 to 96 hours, significantly above regional benchmarks. For comparison, Kazakhstan's main freight checkpoints average 36 to 48 hours, benefiting from more advanced customs integration and digital workflows.
- Lack of Multimodal Hubs: Uzbekistan's dry ports lack proper intermodal terminals where goods can seamlessly switch between rail and road. This is a critical issue for Indian firms using overland routes to South Asia or via the International North–South Transport Corridor (INSTC). Unlike logistics parks in India's DMIC corridor, Uzbek nodes have not integrated cargo terminals, warehousing, and customs operations into a single ecosystem.
- Poor Last-Mile Connectivity: Many Special Economic Zones (SEZs) and industrial parks suffer from inadequate last-mile road infrastructure. Firms in the Navoi and Jizzakh SEZs report problems with truck access, absence of dedicated freight lanes, and inconsistent road maintenance. These conditions erode the efficiency gains SEZs are meant to deliver.

6.2 Logistics System Deficiencies

Logistics in Uzbekistan is underdeveloped relative to both regional peers and investor expectations. According to the World Bank (2023), Uzbekistan scored particularly low on logistics service quality, customs efficiency, and timeliness.

- Customs and Border Management: Despite progress on single-window systems, inconsistent application of customs rules, bureaucratic layering, and limited digital infrastructure remain problems. Indian exporters report frequent documentation errors, unannounced inspections, and variable interpretation of tariff codes. These contribute to long clearance cycles and missed delivery deadlines.
- Cold Chain and Warehousing Gaps: Pharmaceuticals and agribusiness firms consistently flag the absence of certified cold-chain infrastructure. For example, UPL Agrochemicals reported spoilage-related losses exceeding 8% in 2022, primarily due to breakdowns in temperature-controlled logistics. Uzbekistan lacks international-grade refrigerated warehouses, real-time monitoring systems, and 3PL firms with cold-chain certifications.
- Lack of 3PL Maturity: The third-party logistics market is still evolving. Many firms rely on informal transport operators or fragmented service providers, which increases costs and reduces supply chain predictability. In contrast, Indian investors in Vietnam or the UAE benefit from established logistics clusters with ISO-certified vendors, AI-based fleet management, and guaranteed delivery schedules.

6.3 Energy Infrastructure Constraints

Energy remains one of the most cited challenges for Indian manufacturers and agribusiness firms operating in Uzbekistan.

- Unreliable Power Supply: Industrial zones in Fergana, Samarkand, and Navoi experience weekly blackouts during winter and summer peaks. Textile firms such as Indorama report running diesel generators 12–15% of the time, increasing operating costs by up to 17% compared to normal grid prices.
- Transmission and Distribution Losses: At 14.2%, Uzbekistan's T&D losses are among the highest in Asia. This reflects not only grid inefficiencies but also capacity constraints in fast-growing industrial zones. While new power plants have increased generation capacity, bottlenecks in transmission prevent consistent delivery.
- Delayed Renewable Integration: The government's ambitious targets of adding 8 GW of solar and wind by 2030 are constrained by outdated grid architecture and limited energy storage options. Moreover, Indian investors interested in renewable energy (e.g., ReNew Power and Tata Power) have expressed concern over unclear feed-in tariffs, lack of currency hedging options, and the absence of long-term bankable PPAs.

6.4 Regulatory and Institutional Barriers

Infrastructure-related constraints are compounded by institutional weaknesses that increase the cost and complexity of doing business.

- PPP Execution and Legal Ambiguity: Although Uzbekistan passed a Public–Private Partnership (PPP) Law in 2019, its implementation has been slow and inconsistent. Indian firms interested in co-developing logistics parks or energy projects cite unclear contract enforcement, limited recourse in case of arbitration, and long delays in approvals.
- Opaque Procurement and Tariff Schedules: Investors face difficulties accessing accurate data on user fees, customs duties, and infrastructure service charges. This impairs feasibility assessments and financial modelling for large-scale projects.
- Localisation Requirements: Mandated thresholds for local procurement and employment, while aimed at fostering domestic value chains, often inflate costs and limit the sourcing flexibility of foreign investors.

6.5 Risk Perceptions Among Indian Firms

High Logistics Premium: Firms estimate that logistics costs in Uzbekistan are 15–20% higher than in Kazakhstan due to fragmented systems, inefficient customs, and absence of integrated 3PL ecosystems.

- Energy Reliability Risks: Frequent blackouts, voltage fluctuations, and lack of clarity around tariff escalation mechanisms discourage new investments in manufacturing and agribusiness.
- Institutional Ambiguity: Despite formal reforms, the absence of secondary regulations, inconsistent enforcement, and a nascent investment arbitration framework contribute to risk aversion.

As a result, firms that might otherwise consider expanding into higher-value sectors such as electronics, automotive components, or renewable infrastructure development remain hesitant. Instead, they often limit their engagement to trading, representative offices, or low-capital joint ventures.

In conclusion, Uzbekistan's infrastructure gaps are not merely technical shortfalls—they represent systemic constraints that affect capital flows, sectoral diversification, and long-term investor confidence. Addressing these requires a coordinated strategy that blends physical infrastructure development with institutional strengthening, digital transformation, and targeted policy reforms.

The next section proposes a phased infrastructure roadmap designed to overcome these bottlenecks and enhance Uzbekistan's attractiveness to Indian investors.

7. Conclusion

Uzbekistan stands at a pivotal moment in its economic trajectory. Its strategic ambition to serve as a logistics and investment bridge between Asia and Europe is increasingly contingent on overcoming persistent infrastructure challenges. This paper has reviewed how transport connectivity, logistics systems, and energy reliability influence Indian foreign direct investment (FDI) patterns in Uzbekistan, drawing on credible secondary data and sectoral insights.

While comprehensive econometric modelling was beyond the scope of this paper due to data limitations, publicly available indicators suggest a consistent association between improved infrastructure and rising FDI levels. Indian investments have thus far clustered around regions and sectors where road and rail connectivity, power availability, and logistics access are relatively stronger—namely in textiles, pharmaceuticals, and energy-linked services. The literature and comparative benchmarks support the notion...

At the same time, significant gaps remain. Border processing inefficiencies, limited multimodal logistics integration, and seasonal electricity outages pose ongoing challenges for investors. These constraints are particularly detrimental for time-sensitive sectors such as agribusiness and pharmaceuticals. Publicly available investment assessments highlight delays, increased operating costs, and deferred expansion plans due to such infrastructural shortcomings.

This study adds to the growing body of research on FDI in landlocked economies and offers a policy-oriented framework grounded in current realities and verifiable sources. While further empirical research—particularly using firm-level data—would strengthen the precision of these findings, the insights presented here remain highly relevant for policymakers, infrastructure planners, and business development agencies.

In conclusion, strategic investment in transport, energy, and logistics infrastructure, backed by institutional clarity and investor-oriented reforms, holds the key to expanding and diversifying Indian investment in Uzbekistan. By doing so, the country can convert geographic disadvantage into economic leverage and enhance its position in the evolving Eurasian trade and investment landscape.

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№ S/6 (5) – 2025

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