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FULL LENGTH ARTICLE

Ways to Improve Uzbekistan's Logistics Indicators for the Development of International Trade

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ABSTRACT

This paper examines how logistics-related factors influence export performance in Uzbekistan. Using annual time-series data for 2007–2023, descriptive statistics, correlation analysis, and ordinary least-squares regression are used to assess infrastructure quality, transportation efficiency, and technology availability as determinants of exports of goods and services as a share of GDP. Internet use has a positive and statistically significant association with export performance. Infrastructure quality is positively associated with exports, although the relationship is weakly significant, while transportation efficiency has a weak negative association. The findings identify technological advancement as the strongest observed correlate of export competitiveness and motivate policy attention to digital infrastructure alongside sustained investment in logistics and transport systems to support export growth in Uzbekistan.

Keywords: Logistics performance ▪ Export efficiency ▪ Infrastructure quality ▪ Transportation efficiency ▪ Technology availability

1. INTRODUCTION

Logistics is an important part of economies worldwide. Countries invest in logistics and production systems to participate in international trade, where adequate infrastructure, streamlined customs procedures, and low transportation costs are essential. Logistics costs vary across regions: the source study reports that Germany accounts for about 30% of European logistics costs, France, Italy, and the United Kingdom about 15% each, and Spain about 10%. It also describes faster growth in logistics expenses in the Pacific region than in North America. Across the previous decade, global logistics costs reportedly increased by an average of 30% [1]. Asian economies, including Uzbekistan, face logistics costs that are high relative to those of developed European countries.

Uzbekistan faces challenges that include underdeveloped distribution infrastructure, ineffective use of transport infrastructure, and low adoption of technology. Limited information about how infrastructure, transport efficiency, and technological change affect logistics and exports also complicates the design of economic reforms. This study examines how inadequate infrastructure affects dispatch times and how modern transportation and technology may influence export performance by reducing transport costs and strengthening the international competitiveness of the trucking industry.

The study addresses two questions: How do inadequate infrastructure, limited modern transportation, and underdeveloped technology affect logistics performance and the ease of exporting in Uzbekistan? How important are infrastructure, transportation efficiency, and technology availability in making the country's export sector more competitive?

The analysis focuses on the effects of infrastructure quality, modern technology, and transportation systems on logistics

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performance and export outcomes. By examining these relationships in Uzbekistan, it aims to address a gap in research on how infrastructure and technology limitations affect transit time and exports. The findings are intended to inform governments, economic planners, policymakers, international organizations, and investors seeking to modernize export-import systems, reduce costs, and improve logistics performance. The paper proceeds with a literature review, methodology, results, discussion, and conclusions with policy recommendations.

2. LITERATURE REVIEW

Research on logistics performance in developing economies, including Uzbekistan, has grown in recent years. Logistics information systems are important to the wider economy and to the development of effective logistics processes and cargo movement in Uzbekistan [1]. However, evidence remains limited for countries that combine underdeveloped infrastructure, inefficient transportation, and less streamlined customs procedures.

Samatov et al. [2] examined the contribution of logistics activities to Uzbekistan's economy using cargo transportation, freight turnover, and trade indicators for 2018–2020. They found that logistics services support economic growth, while weak infrastructure, low innovation, and poor service quality remain challenges. They emphasized reducing logistics costs, which they report can exceed 70% of product expenses, and recommended multimodal logistics centers and digital technologies to improve integration into global trade networks. More broadly, studies of Uzbekistan's logistics sector emphasize government policy, infrastructure projects, regional cooperation, transport-network limitations, supply-chain gaps, and the need for new technology and management practices.

Jalolova et al. [3] analyzed Uzbekistan's transport system using the Logistics Performance Index and identified issues that constrain its growth. Their study highlighted the importance of increasing the country's transit potential and developing effective transport and logistics services.

Although logistics performance has been studied in developed and developing economies, the effects of low-quality infrastructure and limited technology on transit time and export statistics remain insufficiently understood for Uzbekistan. Existing work often focuses on large economies with advanced logistics systems. This study addresses that gap by examining how transport efficiency and infrastructure quality relate to export performance in Uzbekistan.

3. RESEARCH METHODOLOGY

3.1 Theoretical Framework

The theoretical foundation combines New Institutional Economics (NIE) and Supply Chain Efficiency Theory. NIE emphasizes that institutional quality—including customs procedures, regulatory transparency, and governance—affects trade performance and logistics development [4]. In developing economies, inadequate infrastructure can raise transaction costs and reduce exporters' competitiveness, while inefficient institutions can hinder economic integration and trade expansion.

Makhumudov (2024) describes logistics as a fundamental driver of economic development in Uzbekistan. Given the country's landlocked position, logistics effectiveness is important for maintaining stable trade relationships and moving goods. That analysis links improvements in infrastructure and transport systems with economic growth indicators. Together, these theoretical perspectives provide a basis for identifying phased and sustainable opportunities to improve logistics performance.

3.2 Empirical Framework

The country-specific empirical analysis examines how infrastructure quality, transportation capacity, and technology adoption relate to logistics performance and international trade outcomes in Uzbekistan. It combines descriptive statistics, pairwise correlation analysis, and ordinary least-squares (OLS) regression. Annual time-series data cover 2007–2023 and were collected from the World Bank, UNCTAD, OECD Trade Facilitation Indicators, and the Logistics Performance Index (LPI). Microsoft Excel 2023 and Stata 17.0 were used to manage and analyze the data.

3.2.1 Model Construction

The econometric model expresses the contribution of infrastructure quality, transportation efficiency, and technology availability to export performance. The dependent variable, Y, is export performance, measured through export growth or trade volume. The independent variables are the Infrastructure Quality Index (IQI), Transportation Efficiency Index (TEI), and Technology Availability (TA); ε denotes the error term. The study's estimation tables refer to these indicators as INF, TRANS, and TECH, respectively.

$$Y_{\text{Export}} = \beta_0 + \beta_1 \text{IQI} + \beta_2 \text{TEI} + \beta_3 \text{TA} + \varepsilon \qquad (1)$$

The reported regression also includes a linear year trend.

4. RESULTS

This section examines the relationship between infrastructure quality, transportation efficiency, technology availability, logistics performance, and export outcomes in Uzbekistan. Descriptive statistics summarize the variables; correlation analysis evaluates pairwise relationships; and regression analysis estimates the effects of infrastructure, transportation, and technology on exports.

4.1 Descriptive Statistics

Table 2 summarizes the study variables. Exports averaged 23.68% of GDP over the observation period, with values ranging from 12.33% to 41.17%. Technology availability had a mean of 43.14, indicating substantial growth in Internet use. Transportation efficiency averaged 3.23, while infrastructure quality averaged 2.44, indicating moderate logistics-infrastructure development.

4.2 Graphical Analysis

Figure 1 presents trends in export performance and the main logistics-related indicators in Uzbekistan from 2007 to 2023. Exports of goods and services as a share of GDP fluctuate, falling substantially in the mid-2010s before a gradual re-

Table 1. Data description, source, and format

Code	Variable	Definition	Source	Format
TRC	Transport costs	Cost of exporting and importing a standard container	World Bank (LPI), 2023	CSV/Excel
INF	Infrastructure quality	Transport and logistics infrastructure rating	World Bank, 2023	CSV/Excel
TECH	Technology availability	Individuals using the Internet (% of population)	World Bank (Doing Business), 2023	CSV/Excel
EXP	Exports of goods and services	Total exports as a percentage of GDP	World Bank (WDI), 2023	CSV/Excel

Source: Processed by the author.

Table 2. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Years	17	2015	5.049752	2007	2023
TECH	17	43.13918	27.4906	7.4906	89.0136
INF	17	2.444539	0.2134034	2	2.75
TRANS	17	3.227229	0.3586493	2.73	3.845
EXP	17	23.67572	8.108473	12.33307	41.16852

Source: Created by the author in Stata 17.0.

covery. Internet use rises steadily. Infrastructure quality and transport efficiency show moderate but uneven changes over the period. The figure provides a visual overview of the indicators examined in the correlation and regression analyses.

4.3 Correlation Analysis

Table 3 reports pairwise correlations. Export performance is negatively correlated with infrastructure quality, transportation efficiency, and technology availability, but these relationships are not statistically significant at conventional levels. Infrastructure quality and transportation efficiency are positively correlated. The study treats multicollinearity as a manageable concern and proceeds with the OLS analysis.

Table 3. Pairwise correlation test results

Variable	EXP	INF	TRANS	TECH
EXP	1.000	—	—	—
INF	−0.3276 (0.1993)	1.000	—	—
TRANS	−0.4055 (0.1065)	0.6999 (0.0018)	1.000	—
TECH	−0.4004 (0.1112)	0.3974 (0.1142)	0.0199 (0.9396)	1.000

Source: Created by the author in Stata 17.0. Parenthetical values are reported with the correlations in the source.

4.2 Graphical analysis

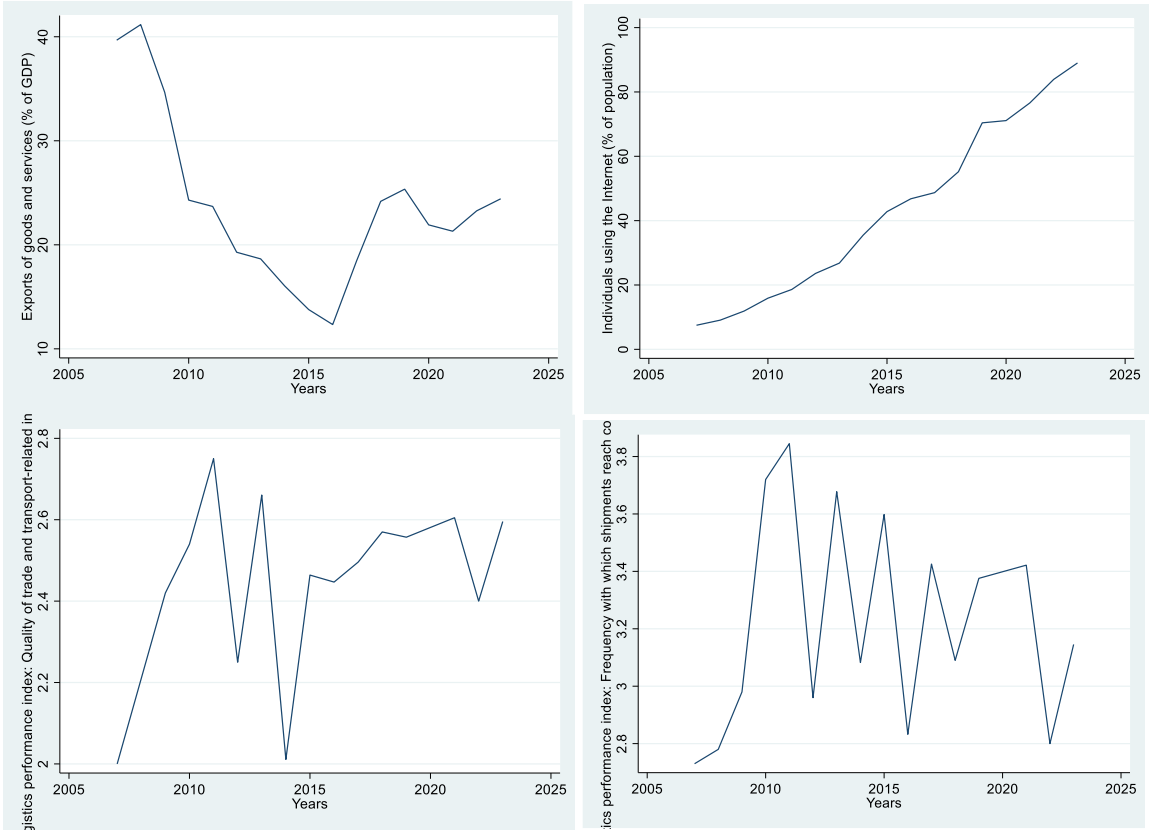


Figure 1. Trends of export performance and key logistics-related indicators in Uzbekistan, 2007–2023 (a) Exports of goods and services (% of GDP); (b) Internet use (% of population); (c) LPI quality of trade and transport infrastructure; and (d) LPI shipment timeliness.

Source: World Bank (WDI, LPI); calculated by the author.

In Figure 1, export performance and major logistics-related indicators undergo dynamics in Uzbekistan from 2007 until 2023. The trends show evident fluctuations in the export of goods and services as percentages of GDP, with a major slump in the mid-2010s and a gradual recovery in the recent past. On the contrary,

4.4 Regression Results

Table 4 presents OLS estimates for infrastructure quality, transportation efficiency, and technology availability as predictors of exports of goods and services as a percentage of GDP. The model is statistically significant (Prob. $> F = 0.002$) and has an R^2 of 0.732. Technology availability, measured by Internet use, has a positive and statistically significant coefficient at the 1% level. Infrastructure quality has a positive, weakly significant association with exports. Transportation efficiency has a negative, weakly significant coefficient. The year-trend coefficient is negative and statistically significant, suggesting that broader structural and external changes also affected export dynamics during the study period.

Table 4. OLS regression results

Dependent variable: Exports of goods and services (% of GDP)

Variable	Coefficient	Std. Error	t-value	p-value
Infrastructure quality (INF)	17.867	9.564	1.87	0.086
Transportation efficiency (TRANS)	−9.631	5.236	−1.84	0.091
Technology availability (TECH)	1.314	0.358	3.67	0.003
Year (trend)	−8.149	1.970	−4.14	0.001
Constant	16374.10	3947.01	4.15	0.001

Significance notation reported in the source: $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.10$.

5. DISCUSSION

The results indicate that technology availability is an important correlate of export performance in Uzbekistan. The positive, statistically significant coefficient for Internet use is consistent with the role of digital access in connecting exporters to international markets, improving information flows, and reducing transaction costs. This interpretation is in line with earlier studies of digital infrastructure and international trade (Freund and Weinhold, 2004; Clarke and Wallsten, 2006; Ahmed and Ridzuan, 2023) [5, 6].

Infrastructure quality has a positive but weakly significant relationship with exports. Improvements in trade- and transport-related infrastructure may support export growth, but their effects can take time to emerge because of the long-term nature of infrastructure investment [7, 8]. The limited short-term significance in this study is consistent with that gradual effect.

Transportation efficiency has a negative, weakly significant coefficient. Short-term operational inefficiencies and structural adjustments may constrain export performance during an initial period of adaptation, before efficiency gains are realized. Similar considerations are discussed in research on logistics performance and international trade [9].

The negative and statistically significant year trend suggests that broader structural and external factors influenced exports during the study period. Global economic shocks, commodity-price volatility, and domestic economic restructuring are among the factors that may affect export dynamics in transition economies [10, 11]. Overall, the findings emphasize technology's contribution while recognizing the complementary, longer-term roles of infrastructure and transport improvements.

6. CONCLUSIONS AND POLICY RECOMMENDATIONS

This study examined the effects of infrastructure quality, transportation efficiency, and technology availability on export performance in Uzbekistan using annual time-series data and OLS analysis. Internet use, the proxy for technology availability, has a positive and statistically significant association with exports. This result is consistent with the role of digital development in improving market access and lowering information costs. Infrastructure quality has a positive but weakly significant association, suggesting that infrastructure improvements may support export growth over a longer horizon. Transportation efficiency has a negative, weakly significant coefficient, reflecting short-term structural or operational constraints in the transport sector.

The results motivate three policy priorities. First, policymakers should prioritize digital infrastructure investment and broaden Internet access to support exporting firms and their integration into global markets. Second, investment in transport and logistics infrastructure should continue to strengthen long-term export competitiveness. Third, reforms should improve coordination, reliability, and efficiency in the transport sector to address structural bottlenecks.

The study is limited by its relatively small sample and by the availability of some logistics indicators for only selected years. Future research could add explanatory variables, extend the time period, or compare countries to develop a deeper understanding of the relationship between logistics development and export performance in developing economies.

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