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

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Abstract

The paper advances an analysis of the role of logistics in respect to various factors contributing to the export performance of Uzbekistan. The study relied on annual time-series data obtained from 2007 to 2023, and descriptive statistics, correlation analysis, and ordinary least-squares regression were employed to take into consideration the effects of infrastructure quality, transportation efficiency, and technology availability on exports of goods and services in relation to GDP. The empirical findings suggest that via Internet usage, technology availability positively with statistical significance affects export performance. Infrastructure quality has a positive, albeit statistically weakly significant association with exports, and transportation efficiency negatively associates weakly. It can be concluded based on the studies' results that technological advancement is the main factor affecting export competitiveness, while infrastructure and transport systems mainly contribute to this long-term. This analysis is of major policy importance, stressing further improvements in digital infrastructure as well as investments in logistics and transport systems to cater for sustainable export growth in Uzbekistan.

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

1. Introduction

Logistics is one of the most considerable part of economy above worldwide. European, American and Asian countries are spending large sums to show the principles of logistics into production processes. Almost each country tries to be in International trade and their most urgent side is having adequate infrastructure, simplified customs procedures and low transport costs. For example, 30% of European logistics costs are in Germany, about 15% in France, Italy and the UK, 10% in Spain. The highest growth rates of logistics costs are in the Pacific region, the lowest cost growth in North America. On average, logistics costs in the world have increased by 30% over the past decade. (Menglikulov et al., 2023) While Europe was indicating relatively stable and more predictable parameter, Asian region demonstrates higher growth rates in logistics expenses. In many developing Asian countries including Uzbekistan, logistics costs noticeably higher compared to developed European nations.

However, some significant challenges for Uzbekistan might be the lack of development in distribution infrastructure, inapt use of transport infrastructure, and low technology adoption, which can be considered some of the major factors for poor performance in logistics. In addition, the absence of full information related to infrastructure development, transport efficiency, and technology advancements impacting logistics development and export efficiency could be a significant issue for designing economic reform policies.
In order to address those issues, research aims to examine inadequate infrastructure in the country and how this affect dispatch times. Moreover, this study focuses on how modern transportation and technology contributes to positive changes in the Export balance that is lessening transportation costs or making trucking industry competitive internationally.

What are the influences of inadequate infrastructure, a lack of modern transportation, and underdeveloped technology on logistics performance and exporting ease in Uzbekistan?

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How important is the availability of factors such as infrastructure, transportation efficiency, and technology in making the export sector in Uzbekistan more competitive?

This paper discusses the impact of the quality of infrastructure, modern technologies, and transportation infrastructure on the performance of logistics and export balance. Within the context, the area has not explored the implications of inadequate development for infrastructure, technologies, and transport efficiency adequately, and therefore, the need for research is relevant. The results of this study are useful for governments, economic planners, and policymakers, as they can make informed decisions to modernize Export Import trading systems. Eventually, reduce costs, and achieves higher logistics performance index in global economy. International organizations and investors will also have more wide options which can increase economic growth of Uzbekistan. From an academic point of view, the study fills a scientific gap in this previously insufficiently studied area by analyzing the link between the infrastructure and Export performance. Consequently, the study contributes to overcoming some of the existing challenges: poor development of distribution infrastructure, lack of modern means of transportation, and shortage of technological resources. It provides scientific and practical insights that support the improvement of logistics performance and export efficiency in developing countries.

The study consists of six sections. Section 2 gives a review of the literature, Section 3 illustrates a data description, methods of research. Following that, Section 4 shows the results of the research, and Section 5 discusses the results from the data. Finally, Section 6 includes a conclusion of the study and recommendations.

2. Literature Review

In recent years, the study of logistic performance in a developing country like Uzbekistan has gained a significant attention among scholars. Several researchers have found that the logistics information system has a high role in the world and in the economy of the Republic of Uzbekistan, in order to create effective logistics systems and speed up the process of cargo (Bakhtiyor Menglikulov et al, 2023).Logistics role has been widely studied almost in every country over the world, but there are a few studies and countries with well-developed infrastructure, efficient transportation an streamlined customs procedures. This literature review examines the existing findings of research on the topic, providing methodologies, debates in the field. By analyzing previous studies, the review aims to identify gaps where further research is needed and analyze different logistical and administrative inefficiencies and cargo delay, export performance relations in the Republic of Uzbekistan.

Gaffor Samatov et al (2023) investigated the importance of logistics activities in improving Uzbekistan's economy. Their study analyzed cargo transportation, freight turnover, and trade indicators between 2018 and 2020. Results show that logistics services have a strong impact on economic growth, yet the sector faces issues such as weak infrastructure, low innovation, and poor service quality. The authors emphasized that reducing logistics costs, which account for over 70% of product expenses, can significantly increase profitability and competitiveness. They concluded that developing multimodal logistics centers and introducing digital technologies are essential for enhancing Uzbekistan's integration into global trade networks. Recent research regarding logistics in Uzbekistan focus on government policy, infrastructure projects, and regional cooperation in terms of development. The studies showed that Uzbekistan grapples with the challenges of poor transport network and supply chain gaps while it increasingly provides evidence for using new technologies and better management practices for improved logistics efficiency and competitiveness. The scientific literature also highlights findings of Jalolova Madina et al. (2022), who stated crucial role of logistics in both the global and Uzbek economies. They examined the country's transport system using Logistics Performance Index and found several problems that limit its growth. The result of their study aimed at increasing the country's transit potential and creating an effective system of transport and logistics services.

Although the logistics performance and issues of this sector have been broadly studied in the case of developed and developing countries, how low-quality infrastructure and lack of technology has impact on transit time also export statistics is not fully understood yet. The existing literature mainly focuses on large economies with advanced Logistics Performance Index such as Singapore, the USA and China. However, Uzbekistan with having strong demands for high logistics standards, still do not receive sufficient attention from the academic community. In particular, empirical studies and the influence of infrastructure on export indicators and dispatch time are not available. The main purpose of this study is to fill a scientific gap by analyzing how efficient transportation and infrastructure quality influence the efficiency of export in Uzbekistan.

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3. Research Methodology

3.1 Theoretical framework

The theoretical foundation of this research is based on New Institutional Economics (NIE) and the Supply Chain Efficiency Theory. New Institutional Economics highlights how institutional quality, including customs procedures, regulatory transparency, and governance, directly affects trade performance and logistics development (North, 1990). In many developing economies, inadequate infrastructure increases transaction costs and reduces the competitiveness of exporters. This aligns with the idea that inefficient institutions hinder economic integration and trade expansion. According to another study (Samariddin Makhumudov, 2024) we can understand the logistics sector in Uzbekistan serves as a fundamental driver of economic development. Due to the nation's landlocked position, logistics effectiveness becomes essential for maintaining stable trade relations and ensuring the smooth movement of goods. Their analysis shows that improvements in infrastructure and transport systems have a measurable impact on growth indicators, which supports the main idea of the theory used in study. This model provides a useful foundation for analyzing how countries have strengthened their logistics sectors and helps determine where Uzbekistan currently stands. These theoretical insights jointly support the identification of strategic, sustainable, and phased growth opportunities for improving logistics performance in the country.

3.2 Empirical Framework

This study uses a country-specific empirical analysis to examine how logistics-related factors such as infrastructure quality, transportation capacity, and technological adoption affect Uzbekistan's logistics performance and international trade outcomes. The empirical framework combines descriptive statistical analysis with correlation-based evaluation to identify the determinants that most strongly influence logistics efficiency in Uzbekistan.

This research is based on annual time-series data, time-series for Uzbekistan covering the period 2007-2023, collected from reliable international databases including the World Bank (WB), UNCTAD, OECD Trade Facilitation Indicators, and the Logistics Performance Index (LPI). The selection of indicators reflects key components of logistics performance and trade competitiveness. In this study, Microsoft Excel 2023 and STATA 17.0 were used as the main software, which helped in the management and analysis of the collected data. Each variable was operationalized as follows:

Table 1: Data description, source, and format

Sign	Variables	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 & Services	Total exports as % of GDP	World Bank (WDI), 2023	CSV/Excel

Source: processed by the author.

Model Construction

The econometric model expresses how the four major factors contribute to export performance.

Dependent Variable (Y): Export Performance measured through export growth rate or trade volume

Independent Variables (X):

- X_1: Infrastructure Quality Index
- X_2: Transportation Efficiency Index
- X_3: Technology Availability

ε = Error term

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The model can be written as: $Y(Export) = \beta_0 + \beta_1 IQI + \beta_2 TEI + \beta_3 TA + \varepsilon$

This model helps determine the extent to which infrastructure quality, transport efficiency, and technological factors affect export outcomes.

4. Results

This section will present the empirical evidence of a study examining infrastructure quality, transportation efficiency, and technological development in relation to logistics performance and export outcomes in Uzbekistan. The study's main goal is to determine how some key logistics indicators, namely those related to infrastructure development, transport capacity, and technology adoption, impact export performance and logistics performance within the country. To achieve that, descriptive statistics are first used to summarize the distribution and fundamental properties of the selected variables. A correlation analysis follows to determine the strength and direction of the relationships among the logistics indicators and export performance, and finally, regression analysis is going to be used to statistically evaluate the impact of various factors related to infrastructure, transportation, and technology on logistics efficiency and export outcomes. The results of the analysis are linked to the objectives of the research and specific features of logistics and trade in Uzbekistan.

4.1. Descriptive statistics

Table 2: Descriptive statistics

Variable	Obs	[ean	Std. Dev.	Min	Max
Years	17	2015	5.049752	2007	2023
TECH	17	43.13918	7.4906	7.4906	89.0136
INF	17	1.444539	0.213403 4	2	2.75
TRANS	17	3.227229	0.358649 3	2.73	3.845
EXP	17	23.67572	8.108473	12.33307	41.16852

Source: created by the author in STATA 17.0

Descriptive statistics for the study constructs are given in Table 2. The results show moderate export performance for the observed period in Uzbekistan indicated by an average export value of 23.68 percent of GDP (EXP). Export values were between 12.33 and 41.17, with considerable fluctuations observed from time to time.

With respect to the mean values of independent variables, the variable technology availability (TECH) has the highest average value of 43.14 and indicates a considerable increase in Internet usage over the years. Transportation efficiency (TRANS) has a mean of 3.23, while the average for infrastructure quality (INF) is lower, at 2.44, indicating moderate development of logistics infrastructure. Overall, descriptive statistics provide preliminary insight into the distribution and characteristics of the variables that were considered in the study and form a basis for further correlation and regression analysis.

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4.2 Graphical analysis

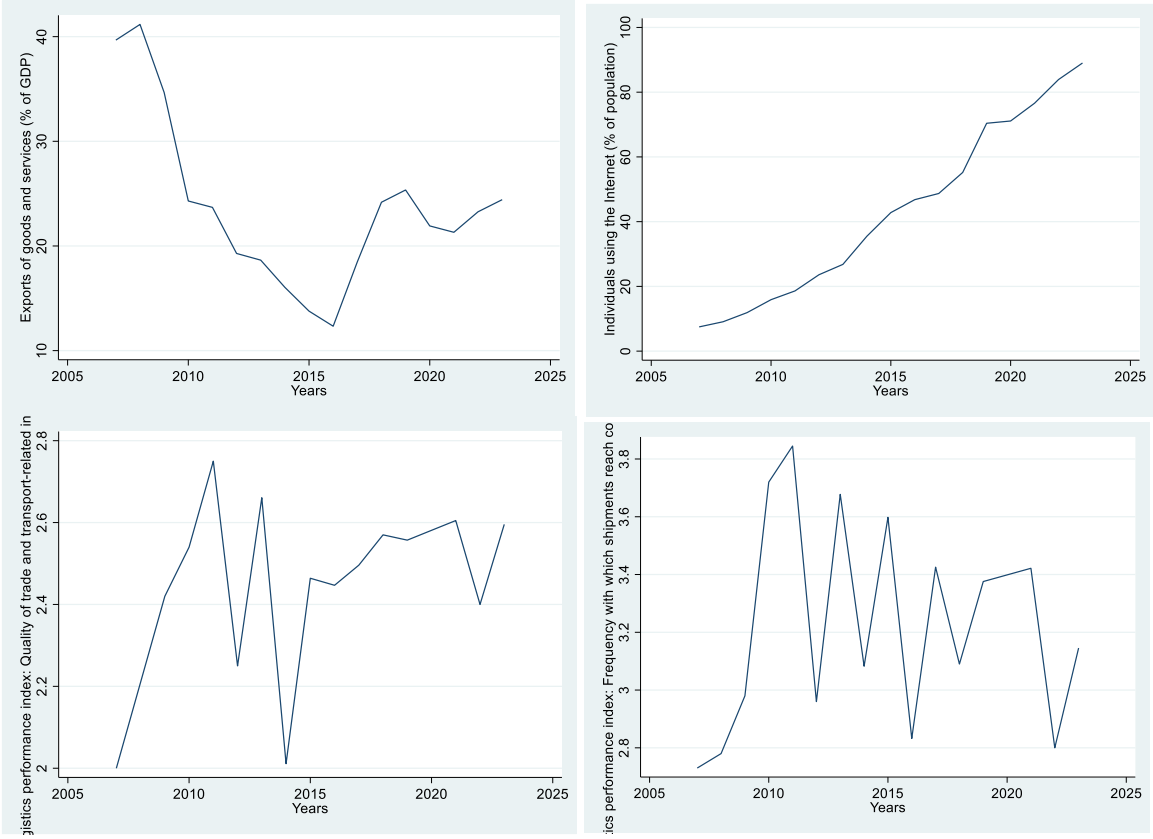

Figure 1. Time trends of export performance and key logistics-related indicators in Uzbekistan (2007–2023)

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, technology availability, as measured by Internet usage, shows a very strong and consistent growth trend. Infrastructure quality and transport efficiency reveal moderate fluctuations reflecting gradual improvement over a timeline with some periods of instability. All in all, the figure provides a visual overview of the changing interrelationship between logistics-related factors and export performance, which will serve as a basis for further correlation and regression analysis.

4.2 Correlation analysis

Table 3: Pairwise Correlation test results

Variables	**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

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Table 3 is composed by the pairwise correlation matrix of the primary variables. Also, export performance bears a negative relation with infrastructure quality, transportation efficiency and their availability of technology, which are, nevertheless, not significant. The infrastructure quality and transportation efficiency are relatively correlated but still below the threshold indication, which shows serious multicollinearity. Overall, the result indicates that multicollinearity is not an important concern and thus proves the OLS regression model usable.

4.3 Regression results

Table 4: OLS regression results

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

Variables	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

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

To analyze OLS regression results involves estimating coefficients, testing for significance, and estimating global explanatory power for the model. Table 4 presents OLS regression results for infrastructure quality, transportation efficiency, and technology availability on export performance in Uzbekistan.

The model is statistically significant, as denoted by the F-statistics (Prob > F = 0.002), which explains a relatively high degree of variability in exports (R-squared value = 0.732). Technology availability, as measured by Internet usage, was found to significantly and positively influence exports at the 1% level, furthering our understanding of how digital development plays an important role in increasing export performance. Infrastructure quality shows a positive but weakly significant relationship with exports, implying that improving trade and transport-related infrastructure will enhance export growth, albeit with gradually arising effects over a course of time. Transportation efficiency, on the other hand, has a negative and weakly significant coefficient, implying that alterations in transport performance over a short time do not facilitate direct growth in export level.

In addition, the time trend variable presents a negative sign and an adequate level of significance, which reflects the externalities and structural alterations that further influenced the export dynamics within the timeline examined. The regression results tend to suggest that technological development stands as the major illuminant factor for improved export performance in Uzbekistan, while improvements to infrastructure and transportation serve as an adjunct role but apply over a longer duration.

5. Discussion

The results of the investigation are significant in that they give an indication of the factors in logistics at play in export performance in Uzbekistan. The regression results indicate that the availability of technology is critical in improving exports. The positive and statistically significant coefficient of Internet usage suggests that the digitization includes easy access for exporters to international markets, an improvement in information flows, and a reduction in transaction costs. This is consistent with what prior studies have found in regard to the implication of digital infrastructure in promoting international trade and export competitiveness in developing economies (Freund & Weinhold, 2004; Clarke & Wallsten, 2006; Ahmed & Ridzuan, 2023).

Quality of infrastructure has a positive but rather weak correlation with the performance of exports. A general trend on the development of trade- and transport-related infrastructure advancement expects such improvements to spur export growth, yet the limited importance of statistical significance may be explained by the long-term nature of investments in infrastructure. This is also cited by several studies claiming that infrastructure development yields a gradual effect on exports because projects typically take time before they yield their present values of future economic benefits (Calderón & Servén, 2014; Portugal-Perez & Wilson,

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2012). It is, therefore, reasonable to postulate that infrastructure quality may not have a strong short-term impact on performance export of Uzbekistan.

Transportation efficiency has been found to show negative and weakly significant coefficient. Something similar has been put forward in the literature, which posits that short-term inefficiencies and structural adjustments within the transport sector constraint export performance in the initial period of adaptation (Martí, Puertas, & García, 2014). In developing economies, transport reforms may, in the short run, raise operational costs before efficiency gains are realized. They therefore establish a temporary negative association with export outcomes.

The negative and statistically significant time trend shows that export performance has been influenced by broader structural and external factors over the time of the study. Factors usually included among superstructure and external ones affecting export dynamics in transition economies are global economic shocks, volatility of commodity prices, and ongoing domestic economic restructuring (World Bank, 2020; UNCTAD, 2022). In short, they indicate that although infrastructure quality and transport efficiency remain important components in the development of logistics, at least for now, factors such as technological advancement have held the most weight in making even further inroads into improving export performance in Uzbekistan.

6. Conclusions and Policy Recommendations

The contemporary study analyzed the effects of infrastructure quality, transportation efficiency, and technology availability on export performance in Uzbekistan using time-series data and the OLS procedure. The outcomes indicate that technological availability, proxied by Internet usage, is exerting a positive and statistically significant effect on exports. This finding confirms the role of digital development in creating access to markets as well as lowering information costs, thereby assisting in participating in international trade, thereby playing an important role in enhancing export performance.

On the contrary, infrastructure quality shows a positive weakly significant impact on exports, indicating that improvements in trade and transport-related infrastructure induces export growth in the long run. However, its limited short-term significance indicates that infrastructure impact is gradual in developing economies requiring time for large-scale investments before any tangible measurable effects are observed. The transportation efficiency shows a negative weakly significant effect on export performance reflecting short-term structural and operational problems in the transport sector which might act as constraints on initial export growth before the efficiency gains.

Depending on the above findings, several policy recommendations can be offered. First, policymakers should prioritize investments in digital infrastructure and the expansion of Internet accessibility to support export firms and smooth integration in the global market. Second, investments in transport and logistics infrastructure must continue to provide long-term competitiveness for exports. Third, specific reforms are needed that enhance coordination, reliability, and efficiency within the transport sector to relieve the structural bottlenecks that impede export performance.

No matter the contribution this study made, it has its shortcomings. The analysis was based on a relatively small sample size, and some logistics indicators were available only for selected years. Future research may extend this study by including additional explanatory variables, increasing time frames, or conducting cross-national comparisons for in-depth understanding relative to the relationship between logistics development and export performance of other developing economies.

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