

Economia Aziendale Online

Economia Aziendale Online

Business and Management Sciences
International Quarterly Review

The Impact of Logistics Performance on
Trade Efficiency and Economic Growth:
a Global Comparative Study

Tryson Yangailo

Pavia, December 31, 2024
Volume 15 – N. 4/2024

DOI: 10.13132/2038-5498/15.4.733-756

www.ea2000.it
www.economiaaziendale.it


PaviaUniversityPress

Electronic ISSN 2038-5498
Reg. Trib. Pavia n. 685/2007 R.S.P.

The Impact of Logistics Performance on Trade Efficiency and Economic Growth: a Global Comparative Study

Tryson Yangailo, PhD
Independent Researcher.
Zambia

Corresponding Author:

Tryson Yangailo

ytryson@yahoo.com

Cite as:

Yangailo, T. (2024). The Impact of Logistics Performance on Trade Efficiency and Economic Growth: A Global Comparative Study. *Economia Aziendale Online*, 15(4), 733-756.

Section:

Refereed Paper

Received: August 2024
Published: 31/12/2024

ABSTRACT

This study examines the complex relationship between logistics performance and economic growth, focusing on regional disparities and their impact on international trade volumes. The primary objective is to assess how variations in logistics efficiency affect economic outcomes across regions, with a particular focus on the period from 2007 to 2023. Using data from the World Bank, including the Logistics Performance Index (LPI), GDP growth rates, and border compliance metrics (time and cost to import and export), the study employs statistical techniques such as multiple linear regression, correlation analysis, and panel data analysis. Jamovi software was used for comprehensive statistical analysis. The study covers regions such as Eastern and Southern Africa, Western and Central Africa, Central Europe and the Baltic States, East Asia and the Pacific, Europe and Central Asia, the European Union, Latin America and the Caribbean, the Middle East and North Africa, OECD members, and Sub-Saharan Africa. The results reveal significant regional disparities in logistics performance and economic growth. In particular, East Asia and the Pacific shows a robust correlation between high LPI scores and economic growth, while regions such as Eastern and Southern Africa and Western and Central Africa face significant logistics challenges that hinder economic development. The study makes several policy recommendations, including improving logistics infrastructure in low-performing regions, increasing customs efficiency, and developing region-specific strategies. In regions such as Europe and Central Asia, where logistics performance is high but economic growth is slower, complementary economic strategies such as promoting innovation and market diversification are recommended. The study contributes to the literature by providing a detailed regional analysis of logistics performance and its economic impact, providing actionable insights for policy makers, and identifying gaps in existing research.

Questo studio esamina la complessa relazione tra le prestazioni logistiche e la crescita economica, concentrandosi sulle disparità regionali e sul loro impatto sui volumi del commercio internazionale. L'obiettivo principale è quello di valutare in che modo le variazioni nell'efficienza logistica influenzino i risultati economici nelle varie regioni, con particolare attenzione al periodo dal 2007 al 2023. Utilizzando i dati della Banca Mondiale, tra cui l'indice di prestazione logistica (LPI), i tassi di crescita del PIL e le metriche di conformità alle frontiere (tempi e costi di importazione ed esportazione), lo studio utilizza tecniche statistiche come la regressione lineare multipla, l'analisi della correlazione e l'analisi dei dati panel. Il software Jamovi è stato utilizzato per un'analisi statistica completa. Lo studio copre

regioni come l'Africa orientale e meridionale, l'Africa occidentale e centrale, l'Europa centrale e gli Stati baltici, l'Asia orientale e il Pacifico, l'Europa e l'Asia centrale, l'Unione europea, l'America Latina e i Caraibi, il Medio Oriente e il Nord Africa, i membri dell'OCSE e l'Africa subsahariana. I risultati rivelano significative disparità regionali nelle prestazioni logistiche e nella crescita economica. In particolare, l'Asia orientale e il Pacifico mostrano una solida correlazione tra alti punteggi LPI e crescita economica, mentre regioni come l'Africa orientale e meridionale e l'Africa occidentale e centrale devono affrontare sfide logistiche significative che ostacolano lo sviluppo economico. Lo studio formula diverse raccomandazioni politiche, tra cui il miglioramento raccomandazioni politiche, tra cui il miglioramento dell'infrastruttura logistica nelle regioni a basso rendimento, l'aumento dell'efficienza doganale e lo sviluppo di strategie specifiche per regione. In regioni come l'Europa e l'Asia centrale, dove le prestazioni logistiche sono elevate ma la crescita economica è più lenta, si raccomandano strategie economiche complementari come la promozione dell'innovazione e la diversificazione del mercato. Lo studio contribuisce alla letteratura fornendo un'analisi regionale dettagliata delle prestazioni logistiche e del suo impatto economico, fornendo approfondimenti attuabili per i responsabili politici e identificando le lacune nella ricerca esistente.

Keywords: Logistics Performance, Economic Growth, International Trade, Regional Disparities, Policy Recommendations

1 – Introduction

Logistics performance is a critical factor in driving a nation's economic growth and shaping its role in international trade. In an era of increasing globalization, the efficiency of logistics systems, including transportation networks, warehousing facilities, and comprehensive supply chain management, is becoming increasingly important. Effective logistics frameworks contribute to lower trade costs, reduced delivery times, and increased reliability, all of which are crucial for maintaining a competitive edge in the global marketplace (Ojala & Celebi, 2015).

The Logistics Performance Index (LPI), an assessment tool developed by the World Bank, serves as a prominent metric for evaluating the logistics efficiency of different countries. The LPI provides a thorough analysis by examining core components of logistics such as customs processes, infrastructure quality, and logistics services (Erkan, 2014). Through these criteria, the LPI provides insights into the strengths and weaknesses of national logistics systems and helps countries identify areas for improvement.

The link between logistics performance and economic growth is significant. Efficient logistics enable smoother, faster, and more reliable movement of goods, which translates into several economic benefits, such as increased trade volumes, stronger competitive positioning, and accelerated economic growth. Countries with robust logistics frameworks are generally better equipped to engage in global trade, attract foreign investment, and promote broader economic development (Gani, 2017). The ability to streamline logistics processes not only supports domestic economic activity, but also facilitates a country's integration into the global economy, increasing its role and influence in international markets (Martí, Puertas, & García, 2014; Hassan, 2024).

1.1 – Objectives

Main Objective. The primary objective of this study is to examine the impact of logistics performance on economic growth and international trade across regions, using the Logistics Performance Index (LPI) as a key measure. The study aims to provide a comprehensive

understanding of how logistics performance influences economic outcomes and trade dynamics on a global scale.

Specific Objectives.

1. To assess the relationship between logistics performance and economic growth
2. To evaluate the impact of logistics performance on international trade volumes,
3. To identify regional disparities in logistics performance
4. To provide policy recommendations for improving logistics systems

The Logistics Performance Index (LPI) is an essential tool for assessing and comparing logistics performance across countries and serves as a benchmark for understanding how effectively nations facilitate trade and transport activities. Developed by the World Bank, the LPI examines a range of factors that contribute to overall logistics efficiency, including customs clearance procedures, quality of infrastructure, timeliness, and availability of skilled logistics services. By providing a comprehensive assessment, the LPI provides insights into how well countries are managing logistics and highlights areas where improvements are needed to optimize trade flows and transport operations (Ojala & Celebi, 2015). This benchmarking tool is particularly valuable because it identifies both the strengths and weaknesses of national logistics systems, allowing countries to prioritize efforts to address gaps and inefficiencies that may hinder economic growth and trade competitiveness. In addition, the LPI provides a basis for international cooperation by offering nations a common framework for understanding and working to overcome trade barriers. This collaborative aspect of the LPI promotes the sharing of best practices and supports collective efforts to streamline global supply chains.

As countries around the world increasingly recognize the importance of strong logistics networks to economic success, the LPI's role in informing policy decisions becomes critical. In addition to helping governments develop effective policies to improve logistics infrastructure and services, the LPI fosters constructive dialogue between the public and private sectors. By encouraging collaboration, the LPI helps create an environment in which both sectors can work together to address logistics challenges, improve efficiency, and ultimately strengthen a country's position in the global marketplace.

2 – Literature Review

2.1 – Theoretical Framework

Porter's Value Chain Analysis

Porter's value chain analysis is a strategic framework that highlights the critical role of logistics operations in improving economic performance and achieving competitive advantage. Developed by Michael Porter, this model breaks down business activities into primary and support functions, allowing organizations to identify areas where value can be added to maximize efficiency and profitability. Within this framework, logistics - both inbound (sourcing and receiving materials) and outbound (distributing products to customers) - is recognized as a fundamental component that can significantly impact a company's economic results and market position. Through the lens of value chain analysis, companies can assess how well their logistics processes are integrated with other operational areas, such as manufacturing, marketing, and

service. By strategically managing logistics in alignment with other business functions, companies can improve overall efficiency, reduce costs, and enhance service delivery. This alignment allows companies to optimize resource utilization, reduce delivery times, and adapt more effectively to market demands, all of which are essential for securing a competitive advantage in dynamic markets (Vuković, Jovanović, & Đukić, 2012).

In a globalized economy where supply chains are increasingly complex, Porter's value chain analysis highlights the importance of adopting advanced logistics practices and technologies to improve coordination, tracking, and forecasting within supply chains. This approach encourages companies to go beyond traditional logistics management to drive continuous improvement and innovation that leads to improved economic results, enhanced customer satisfaction, and sustainable growth. By leveraging value chain analysis, companies can identify logistics as a strategic asset rather than an operational function and position themselves for long-term success in competitive industries.

Supply Chain Management Theory

Supply chain management theory underscores the central role of effective logistics operations in improving economic efficiency and competitive performance. Efficient logistics within the supply chain enables companies to minimize operating costs, streamline processes, and respond quickly to market demands, which together improve economic performance and sustainability. This approach emphasizes the importance of integrating logistics and supply chain activities such as procurement, inventory management, warehousing, and distribution to optimize resources and improve the overall flow of goods and services (De Souza, Goh, Gupta, & Lei, 2007).

By reducing costs and improving the reliability and speed of deliveries, optimized logistics operations allow companies to allocate resources more effectively, improve customer satisfaction, and gain a competitive advantage in increasingly demanding markets. In addition, efficient supply chain management supports economies by reducing production lead times, minimizing waste, and increasing the availability of goods in local and international markets, thereby promoting economic growth and development. This perspective positions supply chain optimization as a key driver of economic expansion, supporting the seamless movement of goods across borders and contributing to the resilience and competitiveness of entire industries.

As companies strive to meet global standards, the theory highlights the need for innovative logistics solutions such as digital tracking, automation, and data analytics that can significantly improve supply chain visibility, risk management, and decision-making. These improvements not only enhance economic performance at the firm level, but also strengthen the broader economy by supporting more efficient, sustainable, and resilient supply chains that are better equipped to adapt to disruptions and changing market conditions.

2.2 – Role of Logistics in Economic Growth

Effective logistics services and robust infrastructure are critical components in fostering economic growth and facilitating international trade. The efficiency of logistics operations, including elements such as customs clearance, shipment tracking, and the quality of transportation infrastructure, significantly affects a country's competitiveness on the global stage. A well-functioning logistics system not only allows for faster and more reliable movement

of goods, but also reduces overall trade costs, making it easier for businesses to engage in cross-border trade (Ojala & Celebi, 2015).

Customs clearance is a particularly critical aspect of logistics performance. Streamlined customs processes reduce delays at borders, ensuring that goods can enter and exit a country quickly. This efficiency is crucial for businesses that rely on timely deliveries to meet market demands and maintain customer satisfaction. By improving customs procedures, countries can increase their attractiveness to international traders and investors, ultimately stimulating economic activity and growth.

In addition, effective tracking systems increase visibility throughout the supply chain, allowing companies to monitor their shipments in real time. This capability is essential to the effective management of logistics operations, enabling companies to anticipate potential disruptions and make informed decisions to mitigate risk. The ability to provide accurate tracking information can also build customer trust and confidence, which are essential to maintaining long-term business relationships.

Transportation infrastructure, including roads, railways, ports, and airports, plays a fundamental role in logistics performance. High-quality infrastructure facilitates the efficient movement of goods, reducing transit times and improving access to markets. Investment in infrastructure development can significantly improve a country's logistics capabilities, making it more competitive in the global economy. In addition, well-maintained and strategically located transportation networks can attract foreign investment, create jobs, and stimulate regional development.

2.3 – Empirical Studies

Wang and Choi (2018) investigated the impact of logistics performance on international trade volumes, focusing on differences between developed and developing countries. Their study, which used panel data from 43 countries over three years (2010, 2012, and 2014), found that improvements in logistics performance index (LPI) significantly affect export volumes more than import volumes. The results also highlighted that developed countries benefit more from an increase in the LPI than developing countries, suggesting that procedural improvements in customs, tracking systems, and infrastructure are critical to enhancing export competitiveness. Gani (2017) analyzed the relationship between logistics performance and international trade by examining both overall logistics performance and specific logistics aspects. The study found a positive and statistically significant relationship between logistics performance and both exports and imports. The study emphasized the need for continued investment in logistics infrastructure and services to positively impact international trade.

Bugarčić et al. (2020) examined logistics performance and its impact on international trade in Central and Eastern European (CEEC) and Western Balkan countries. Using a gravity model approach, their study showed a positive and significant impact of logistics on bilateral trade. The results underscored the importance of specific LPI components in driving international trade and highlighted the need for improved logistics performance to increase trade volumes and reduce costs.

Raimbekov et al. (2018) examined the impact of logistics on economic development in countries along the Silk Road, focusing on countries within the Eurasian Economic Union (EAEU). The study identified key challenges and proposed initiatives to overcome logistics-related constraints and enhance trade capacity. It highlighted the critical role of logistics in

facilitating economic integration and development in the region. Duzbaievna Sharapiyeva et al. (2019) examined the impact of port infrastructure quality and logistics efficiency on landlocked countries. Using structural equation modeling (SEM), the study found significant economic benefits from effective port infrastructure and logistics management, challenging the perception that landlocked countries are inherently disadvantaged in terms of economic development.

Kumari and Bharti (2021) analyzed the relationship between logistics performance and bilateral trade, controlling for the effect of country size. Their results showed that the effect of LPI on trade is smallest for large countries and more pronounced for small and medium-sized countries. The study also examined how factors such as GDP, regional trade agreements (RTAs), and remoteness affect trade dynamics.

Hassan (2024) provided a contemporary analysis of logistics performance and international trade using a larger sample of 77 countries and ordinary least squares regression. The study highlighted the critical role of logistics in facilitating international trade and provided new insights into how logistics performance interacts with other macroeconomic factors.

Bugarčić et al. (2023) examined the impact of logistics performance on economic growth and competitiveness in the EU, BRICS, and ASEAN regions. Their panel data analysis found a positive relationship between logistics performance and economic growth, especially in the EU and the overall sample. The study highlighted logistics as a key factor for economic development and competitiveness. Song and Lee (2022) examined the impact of logistics performance on international trade in Korea. Their study found that logistics performance is significantly correlated with international trade and that different LPI components affect different types of goods differently. The results suggest that Korea should focus on improving logistics services such as international transportation and tracking. Jayathilaka et al. (2022) examined the relationship between gross domestic product (GDP) and logistics performance index (LPI) on international trade across continents. Their panel regression analysis found a positive relationship between LPI and net exports in certain regions such as Asia, Europe, and Oceania, while GDP had mixed effects on net exports depending on the region.

Katrakylidis and Madas (2019) investigated the causal relationship between logistics performance, international trade, and economic growth. Their study suggested that both international trade and logistics performance are drivers of economic growth, highlighting the importance of investing in logistics and transportation infrastructure to promote exports and economic development. Tang and Abosedra (2019) examined export-led growth (ELG) and logistics performance in Asian countries, and found that logistics performance is crucial in enabling trade and economic growth. The study recommended investment in logistics infrastructure as a strategic policy measure for future growth in Asia. Shikur (2022) analyzed the impact of logistics performance on merchandise exports and imports using a pooled random effects GLS regression. The study found that all six dimensions of logistics performance had a positive and significant impact on both exports and imports, highlighting the importance of continuous improvement in logistics.

Martí et al. (2014) focused on emerging economies and found that improvements in logistics components can significantly boost trade flows. The study highlighted the growing importance of logistics performance for international trade in emerging economies, especially in Africa, South America, and Eastern Europe. Katrakylidis and Madas (2019) investigated the causal relationship between logistics performance, international trade, and economic growth. Their study suggested that both international trade and logistics performance are drivers of economic

growth, highlighting the importance of investing in logistics and transportation infrastructure to promote exports and economic development. Tang and Abosedra (2019) examined export-led growth (ELG) and logistics performance in Asian countries, and found that logistics performance is crucial in enabling trade and economic growth. The study recommended investment in logistics infrastructure as a strategic policy measure for future growth in Asia.

2.4 – Gap in Literature

While previous research has extensively examined the relationship between logistics performance and economic outcomes, a notable gap exists in the comprehensive examination of how logistics performance affects different regions in conjunction with specific economic variables. This study addresses this gap by providing a detailed analysis of regional disparities in logistics performance and its direct impact on both international trade volumes and economic growth. In addition, the study incorporates recent data and employs robust analytical methods to provide actionable policy recommendations tailored to different regional contexts. This nuanced approach fills a critical gap in the literature by linking logistics performance to economic outcomes under different regional scenarios and macroeconomic conditions.

3 – Methodology

3.1 – Data Sources

This study is based on comprehensive data from the World Bank covering the period from 2007 to 2023. The dataset includes a number of metrics essential for analyzing logistics performance, economic growth, and trade costs. In particular, it includes the Logistics Performance Index (LPI), which measures logistics efficiency on a scale of 1 (low performance) to 5 (high performance). This index assesses various aspects of logistics operations, such as infrastructure quality, customs efficiency, and overall performance. In addition, the dataset includes the efficiency of customs clearance processes, also rated from 1 (low efficiency) to 5 (high efficiency), to assess the effectiveness of customs procedures. Economic growth is captured by annual GDP growth percentages. The dataset also details the time and costs associated with exporting and importing, including border clearance times (measured in hours) and border clearance costs (expressed in US dollars). The regions analyzed are diverse and include Eastern and Southern Africa, Western and Central Africa, Central Europe and the Baltic States, East Asia and the Pacific, Europe and Central Asia, the European Union, Latin America and the Caribbean, the Middle East and North Africa, OECD members, and Sub-Saharan Africa.

3.2 – Data Analysis

The analysis for this study is conducted using Jamovi, an open-source statistical software known for its user-friendly interface and robust analytical capabilities. First, descriptive statistics are calculated to provide a basic understanding of logistics performance, GDP growth, and trade costs across regions. This step includes summarizing central tendencies and dispersion within the data set. This is followed by correlation analysis, where correlation matrices are generated to explore the relationships between variables such as logistics performance and GDP growth, and trade costs with export and import times. This analysis helps to identify the strength and direction of these relationships.

Multiple regression analyses are then conducted to assess the impact of logistics performance on economic growth and international trade volumes. The regression models include variables such as total LPI, customs clearance efficiency, and trade compliance times and costs. This analysis aims to determine the importance of these variables in explaining variations in GDP growth and trade volumes across regions. A comparative analysis is also conducted to highlight regional differences in logistics performance and their impact on economic outcomes.

3.3 – Data Processing and Software Utilization

Jamovi is used for its ability to handle complex statistical analysis and visually present data. The software facilitates data cleaning, which includes managing missing data, detecting outliers, and normalizing variables to ensure accuracy. Exploratory data analysis (EDA) is performed with Jamovi to generate visualizations and summary statistics that provide a clearer understanding of data distributions and relationships. Advanced statistical techniques, including correlation and regression analysis, are performed to draw meaningful conclusions about the impact of logistics performance on economic variables. In addition, Jamovi's visualization tools are used to create charts and graphs that effectively illustrate the study's findings, enhancing the clarity and presentation of the results.

3.4 – Equations for Pearson's Correlation Coefficient

The equation for *Pearson's* correlation coefficient (r) is:

$$r = \frac{\sum_{i=1}^n (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^n (X_i - \bar{X})^2 \sum_{i=1}^n (Y_i - \bar{Y})^2}} \quad (1)$$

where:

- r is Pearson's correlation coefficient.
- n is the number of data points.
- X_i and Y_i are the individual data points for variables X and Y , respectively
- \bar{X} and \bar{Y} are the means of X and Y , respectively.

3.5 – Specification of the Model

In this study, a multiple linear regression model was used to examine the relationship between logistics performance and economic growth. The model analyzes how various logistics-related factors (independent variables) affect GDP growth (dependent variable) in different regions. Specifically, the study used data on the Logistics Performance Index (LPI), customs efficiency, and GDP growth rates from the World Bank. Multiple linear regression is used to fit a linear equation to the observed data to assess the impact of these predictors on economic outcomes.

Regression Equation. The general form of the multiple linear regression equation used in the study is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \epsilon \quad (2)$$

where:

- Y is the dependent variable, which in this study is the GDP growth (Annual%).

- β_0 is the intercept, representing the expected value of Y when all predictors (X_1, X_2, \dots, X_n) are equal to zero.
- $\beta_1, \beta_2, \dots, \beta_n$ are the coefficients of the predictors X_1, X_2, \dots, X_n , representing the change in Y for a one-unit change in the corresponding predictor.
- X_1, X_2, \dots, X_n are the independent variables (predictors) in the model, which include Logistics performance index: Overall (1=low to 5=high), Logistics performance index: Efficiency of customs clearance process (1=low to 5=high), regional dummy variables, and year dummy variables.
- ϵ is the error term, accounting for the variation in Y that cannot be explained by the predictors.

This regression model provides insights into how various aspects of logistics performance affect economic growth and trade efficiency. By including both continuous measures and categorical variables (such as region), the model captures a comprehensive view of the factors that influence economic outcomes in different regions. This approach provides a nuanced understanding of the relationship between logistics and economic performance around the world.

4 – Results

4.1 – Regional Descriptive Statistics of Logistics Performance, Trade Costs, and Economic Growth

As shown in Table 1 below, logistics performance across regions presents a diverse landscape with varying challenges and strengths. Eastern and Southern Africa has a relatively low Logistics Performance Index (LPI) of 1.02, reflecting significant barriers to logistics operations. Despite modest annual GDP growth of 3.05%, the cost of importing and exporting is particularly high, averaging \$217 for imports and \$197 for exports. The time required to comply with border regulations is also significant, at 43.8 hours for imports and 33.4 hours for exports. The efficiency of the customs clearance process in the region is relatively low, with an index of 0.948, indicating significant inefficiencies.

In contrast, Western and Central Africa has a slightly lower LPI of 0.994, accompanied by a higher GDP growth rate of 4.03%. However, this region faces even higher import and export costs than its Eastern counterpart, with import costs of \$272 and export costs of \$231. Border compliance time is also longer, with imports taking 51.5 hours and exports 40.3 hours. Despite slightly better efficiency in customs clearance (0.919), the region still faces significant logistical challenges.

Central Europe and the Baltic states present a different scenario with a higher LPI of 1.31. This region enjoys a lower GDP growth rate of 2.65%, but benefits from significantly lower import costs, averaging \$0.00, and extremely short import times of just 0.0327 hours. Export costs and times are also minimal, with costs of \$8.40 and times of 1.26 hours. Customs clearance efficiency is particularly high at 1.22, reflecting strong logistics performance.

East Asia and the Pacific stands out with a robust LPI of 1.30 and a high GDP growth rate of 4.64%. Import costs are relatively low at \$150, with an efficient import time of 22.4 hours. Export costs are also low at \$137, with an efficient export time of 19.3 hours. This region has the highest efficiency in customs clearance, with an index of 1.22, reflecting its advanced logistics infrastructure.

Europe & Central Asia has a higher LPI of 1.32, but a lower GDP growth rate of 1.43%. Import costs are moderate at \$34.5 and import time is efficient at 4.24 hours. Export costs are slightly higher at \$44.7, with a time of 5.63 hours. The customs clearance process is quite efficient, with an LPI of 1.24, reflecting solid logistics performance.

The European Union leads with the highest LPI of 1.45, but it also has the lowest GDP growth rate at 1.16%. The cost of importing is very low at \$10.7 and the time to import is minimal at 0.572 hours. The cost of exporting is relatively low at \$28.1 with a time of 2.66 hours. The EU's customs clearance efficiency is the highest at 1.36, indicating exemplary logistics performance.

Table 1 – Descriptive Statistics of Logistics Performance, Trade Costs, and Economic Growth

	Region	Logistics performance index: Overall (1=low to 5=high)	GDP growth (annual %)	Cost to import, border compliance (US\$)	Time to import, border compliance (hours)	Cost to export, border compliance (US\$)	Time to export, border compliance (hours)	Logistics performance index: Efficiency of customs clearance process (1=low to 5=high)
Mean	Africa Eastern and Southern	1.02	3.05	217	43.8	197	33.4	0.948
	Africa Western and Central	0.994	4.03	272	51.5	231	40.3	0.919
	Central Europe and the Baltics	1.31	2.65	0.00	0.0327	8.40	1.26	1.22
	East Asia & Pacific	1.30	4.64	150	22.4	137	19.3	1.22
	Europe & Central Asia	1.32	1.43	34.5	4.24	44.7	5.63	1.24
	European Union	1.45	1.16	10.7	0.572	28.1	2.66	1.36
	Latin America & Caribbean	1.11	2.04	229	22.0	183	21.8	1.02
	Middle East & North Africa	1.16	2.93	185	37.8	152	19.8	1.07
	OECD members	1.47	1.58	45.8	5.08	59.4	5.48	1.40
	Sub-Saharan Africa	1.01	3.48	243	47.4	213	36.6	0.934

	Region	Logistics performance index: Overall (1=low to 5=high)	GDP growth (annual %)	Cost to import, border compliance (US\$)	Time to import, border compliance (hours)	Cost to export, border compliance (US\$)	Time to export, border compliance (hours)	Logistics performance index: Efficiency of customs clearance process (1=low to 5=high)
Standard deviation	Africa Eastern and Southern	1.26	2.05	303	61.4	274	46.9	1.17
	Africa Western and Central	1.23	2.21	380	71.9	323	56.2	1.13
	Central Europe and the Baltics	1.62	2.92	0.00	0.0457	11.7	1.76	1.51
	East Asia & Pacific	1.60	1.80	209	31.3	192	26.9	1.51
	Europe & Central Asia	1.63	2.78	48.3	5.98	62.5	8.00	1.53
	European Union	1.78	2.78	14.9	0.798	39.2	3.71	1.68
	Latin America & Caribbean	1.36	3.27	320	30.8	256	30.5	1.25
	Middle East & North Africa	1.43	2.38	258	53.0	212	27.6	1.31
	OECD members	1.81	2.26	63.9	7.10	82.9	7.65	1.72
Sub-Saharan Africa	1.24	1.94	339	66.3	297	51.2	1.15	

Latin America and the Caribbean has a moderate LPI of 1.11 with a GDP growth rate of 2.04%. Import costs are high at \$229, with an import time of 22.0 hours. Export costs are also high at \$183 with a time of 21.8 hours. Customs clearance efficiency is 1.02, suggesting some logistical challenges.

The Middle East and North Africa region has an LPI of 1.16 and a GDP growth rate of 2.93%. Import costs are high at \$185, with an import time of 37.8 hours. The export cost is \$152 and the export time is 19.8 hours. Customs clearance efficiency is moderate at 1.07, reflecting a mixed performance in logistics.

OECD members have the highest LPI of 1.47 and a modest GDP growth rate of 1.58%. Import costs are moderate at \$45.8, with an import time of 5.08 hours. Export costs are \$59.4,

with an export time of 5.48 hours. Customs clearance efficiency is high at 1.40, indicating strong logistics capabilities.

Sub-Saharan Africa has a low LPI of 1.01 with a GDP growth rate of 3.48%. Import costs are the highest among the regions at \$243 and import time is 47.4 hours. Export costs are also high at \$213, with an export time of 36.6 hours. Customs clearance efficiency is the lowest at 0.934, indicating significant challenges in logistics.

Overall, the analysis shows that different regions have different levels of logistics performance and economic growth. Countries with higher LPIs tend to have more efficient customs processes and lower costs and times associated with border compliance. In contrast, regions with lower LPIs face greater logistical challenges and higher costs, underscoring the need for targeted improvements in these areas.

4.2 – Correlation Matrix of Logistics Performance, Trade Costs, and Economic Indicators

The correlation matrix in Table 2 provides insight into the relationships between various logistics metrics and GDP growth in different regions.

Table 2 – Correlation Matrix of Logistics Performance, Trade Costs, and Economic Indicators

		Logistics performance index: Overall (1=low to 5=high)	GDP growth (annual %)	Cost to import, border compliance (US\$)	Time to import, border compliance (hours)	Cost to export, border compliance (US\$)	Time to export, border compliance (hours)	Logistics performance index: Efficiency of customs clearance process (1=low to 5=high)
Logistics performance index: Overall (1=low to 5=high)	Pearson's r	—						
	df	—						
	p-value	—						
GDP growth (annual %)	Pearson's r	0.206 **	—					
	df	168	—					
	p-value	0.007	—					
Cost to import, border compliance (US\$)	Pearson's r	0.048	0.014	—				
	df	168	168	—				
	p-value	0.536	0.860	—				

		Logistics performance index: Overall (1=low to 5=high)	GDP growth (annual %)	Cost to import, border compliance (US\$)	Time to import, border compliance (hours)	Cost to export, border compliance (US\$)	Time to export, border compliance (hours)	Logistics performance index: Efficiency of customs clearance process (1=low to 5=high)
Time to import, border compliance (hours)	Pearson's r	0.043	0.014	0.967 ***	—			
	df	168	168	168	—			
	p-value	0.580	0.857	< .001	—			
Cost to export, border compliance (US\$)	Pearson's r	0.059	-0.009	0.996 ***	0.967 ***	—		
	df	168	168	168	168	—		
	p-value	0.443	0.905	< .001	< .001	—		
Time to export, border compliance (hours)	Pearson's r	0.050	0.008	0.979 ***	0.985 ***	0.984 ***	—	
	df	168	168	168	168	168	—	
	p-value	0.520	0.921	< .001	< .001	< .001	—	
Logistics performance index: Efficiency of customs clearance process (1=low to 5=high)	Pearson's r	1.000 ***	0.201 **	0.050	0.044	0.062	0.052	—
	df	168	168	168	168	168	168	—
	p-value	< .001	0.009	0.521	0.571	0.424	0.502	—

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

The Logistics Performance Index (LPI), which measures overall logistics performance, shows a modest positive correlation with GDP growth, with a Pearson's r value of 0.206 and a p-value of 0.007. This suggests a statistically significant, albeit weak, positive relationship between higher logistics performance and better economic growth. Regions with a higher LPI tend to have slightly higher GDP growth, suggesting that improved logistics can contribute to economic development.

The correlation between total LPI and import cost is weak, with a Pearson's r value of 0.048 and a p -value of 0.536. This indicates that there is no significant relationship between overall logistics performance and the cost of importing goods. Similarly, the LPI shows a weak and statistically insignificant relationship with time to import ($r = 0.043$, $p = 0.580$), cost to export ($r = 0.059$, $p = 0.443$), and time to export ($r = 0.050$, $p = 0.520$). These results suggest that improvements in overall logistics performance may not have a direct impact on the cost or time associated with border compliance for imports and exports.

The Logistics Performance Index (LPI) is found to be strongly correlated with the efficiency of the customs clearance process ($r = 1.000$, $p < 0.001$), demonstrating a perfect positive relationship. This high correlation implies that regions with better overall logistics performance are also likely to have more efficient customs clearance procedures. Since customs efficiency is a critical factor in determining the ease and speed of moving goods across borders, its close connection with high logistics performance underscores its importance in a region's trade and transportation systems.

When it comes to border compliance costs and times, several important correlations emerge. First, the cost to import is strongly positively correlated with both the time to import ($r = 0.967$, $p < 0.001$) and the cost to export ($r = 0.996$, $p < 0.001$). This suggests that regions with higher import costs tend to experience longer import processing times and also face higher export costs. Additionally, a statistically significant but weaker correlation is observed between the cost to import and the time to export ($r = 0.979$, $p < 0.001$), indicating that higher import costs are linked to longer export times as well.

Regarding the time to import, there is a strong positive correlation with both the time to export ($r = 0.985$, $p < 0.001$) and the cost to export ($r = 0.984$, $p < 0.001$). This reveals that regions requiring more time for imports are also likely to experience longer times for exports and incur higher export costs.

Similarly, the cost to export is closely correlated with the time to export ($r = 0.984$, $p < 0.001$), indicating that regions with higher export costs tend to have longer export processing times. These relationships highlight the interconnected nature of border compliance costs and times for both imports and exports.

In summary, while the overall LPI is weakly correlated with GDP growth and border compliance metrics, it is strongly associated with the efficiency of the customs clearance process. Costs and times related to import and export are closely interlinked, reflecting a consistent relationship where higher costs and longer times for one metric often correspond to similar trends in other metrics.

4.3 -- Regression Analysis of Logistics Performance, Customs Efficiency, and Regional Factors on GDP Growth

The linear regression model was designed to examine the relationship between logistics performance, customs efficiency, regional factors, and time on GDP growth. The model in Table 3 shows a good fit, capturing a significant portion of the variability in GDP growth across countries and regions over time. This provides valuable insights into how logistics and regional characteristics affect economic performance.

Table 3 – Model Fit Measures

Model	R	R ²	Adjusted R ²	Overall Model Test			
				F	df1	df2	p
1	0.883	0.780	0.738	18.6	27	142	<.001

The performance of the model is robust, with an R² value of 0.780, indicating that 78% of the variance in GDP growth is explained by the predictors in the model. The adjusted R² value of 0.738 further supports the strength of the model, which accounts for the number of predictors while still explaining a substantial portion of the variation in GDP growth. This high level of explanatory power suggests that key variables such as logistics performance indices, region, and year are highly relevant to understanding GDP growth dynamics. In addition, the F-test for overall model significance is highly significant (F = 18.6, p < 0.001), confirming the statistical validity of the model in explaining GDP growth patterns (Table 4).

Table 4 – Omnibus ANOVA Test

	Sum of Squares	df	Mean Square	F	p
Logistics performance index: Overall (1=low to 5=high)	12.2	1	12.18	6.61	0.011
Logistics performance index: Efficiency of customs clearance process (1=low to 5=high)	11.3	1	11.35	6.16	0.014
Region	193.0	9	21.44	11.65	<.001
Year	630.5	16	39.41	21.40	<.001
Residuals	261.4	142	1.84		

Note. Type 3 sum of squares

The regression analysis provides contrasting insights into the impact of logistics performance on GDP growth, focusing on two key logistics-related variables: overall logistics performance and customs clearance efficiency.

The Logistics Performance Index: Overall shows a significant and positive relationship with GDP growth (estimate = 11.49, p = 0.011). Countries with higher overall logistics performance, which includes efficient infrastructure, reliable logistics services and timely delivery, tend to experience faster economic growth. This finding underscores the importance of improving the logistics environment—such as transportation networks and supply chains—as a means of promoting trade and operational efficiency, which in turn stimulates economic growth. Better logistics can improve trade flows, reduce operating costs, and enable the smoother movement of goods across borders, which directly contributes to economic performance.

In contrast, the efficiency of the customs clearance process shows a negative relationship with GDP growth (estimate = -11.12, p = 0.014). Although counterintuitive, this result suggests that an overemphasis on customs efficiency could lead to the neglect of other important areas of logistics, or could indicate an inefficient allocation of resources to customs processes at the expense of broader logistics improvements. This suggests the need for a more balanced

approach that integrates customs efficiency into a holistic logistics strategy that addresses all key aspects of the logistics system.

4.3.1 – Regional Differences in GDP Growth

The analysis highlights notable regional differences in GDP growth when comparing different regions to the reference category of Eastern and Southern Africa. These differences reflect region-specific economic conditions and logistical capabilities.

East Asia and the Pacific has significantly higher GDP growth than the reference region (estimate = 1.48, $p = 0.003$). This rapid growth is likely driven by the strong logistics infrastructure and export-oriented economies in countries such as China, Japan and South Korea. These countries benefit from robust trade networks and investments in logistics technologies, which contribute to their superior economic performance.

In contrast, Europe and Central Asia (estimate = -1.84, $p < 0.001$) and the European Union (estimate = -2.12, $p < 0.001$) have lower GDP growth rates. These regions may be experiencing slower growth due to the maturity of their logistics infrastructure, coupled with reduced trade expansion and other structural economic challenges. Similarly, Latin America and the Caribbean has significantly lower GDP growth (estimate = -1.22, $p = 0.011$), which could be attributed to logistical inefficiencies, persistent trade barriers, and external economic pressures (Table 5).

These regional differences illustrate the influence of local infrastructure, governance, and economic policies on GDP growth and suggest the need for region-specific strategies to address logistical and economic challenges.

Table 5 – Model Coefficients - GDP growth (annual %)

Predictor	Estimate	SE	t	p	Stand. Estimate
Intercept ^a	2.5061	1.609	1.5574	0.122	
Logistics performance index: Overall (1=low to 5=high)	11.4930	4.469	2.5719	0.011	6.4189
Logistics performance index: Efficiency of customs clearance process (1=low to 5=high)	-11.1193	4.478	-2.4829	0.014	-5.8028
Region:					
Africa Western and Central – Africa Eastern and Southern	0.9908	0.466	2.1279	0.035	0.3736
Central Europe and the Baltics – Africa Eastern and Southern	-0.7252	0.494	-1.4674	0.144	-0.2735
East Asia & Pacific – Africa Eastern and Southern	1.4796	0.486	3.0465	0.003	0.5579
Europe & Central Asia – Africa Eastern and Southern	-1.8384	0.491	-3.7453	<.001	-0.6932
European Union – Africa Eastern and Southern	-2.1225	0.512	-4.1418	<.001	-0.8004
Latin America & Caribbean – Africa Eastern and Southern	-1.2153	0.472	-2.5725	0.011	-0.4583
Middle East & North Africa – Africa Eastern and Southern	-0.4169	0.480	-0.8684	0.387	-0.1572
OECD members – Africa Eastern and Southern	-1.6293	0.518	-3.1436	0.002	-0.6144
Sub-Saharan Africa – Africa Eastern and Southern	0.4404	0.465	0.9461	0.346	0.1661
Year:					
2008 – 2007	1.4398	1.727	0.8336	0.406	0.5429
2009 – 2007	-2.4515	1.727	-1.4192	0.158	-0.9244
2010 – 2007	-1.2920	0.671	-1.9241	0.056	-0.4872
2011 – 2007	1.6556	1.727	0.9584	0.339	0.6243
2012 – 2007	-3.0985	0.616	-5.0329	<.001	-1.1684
2013 – 2007	0.8644	1.727	0.5004	0.618	0.3260

Table 5 – Model Coefficients - GDP growth (annual %)

Predictor	Estimate	SE	t	p	Stand. Estimate
2014 – 2007	-1.7971	0.618	2.9073	0.004	-0.6777
2015 – 2007	0.7445	1.727	0.4310	0.667	0.2807
2016 – 2007	-2.9407	0.621	4.7357	<.001	-1.1089
2017 – 2007	0.9738	1.727	0.5638	0.574	0.3672
2018 – 2007	-2.3352	0.611	3.8218	<.001	-0.8806
2019 – 2007	0.3423	1.727	0.1982	0.843	0.1291
2020 – 2007	-5.5079	1.727	3.1886	0.002	-2.0770
2021 – 2007	3.6205	1.727	2.0960	0.038	1.3653
2022 – 2007	-1.7515	0.621	2.8187	0.006	-0.6605
2023 – 2007	0.0518	1.727	0.0300	0.976	0.0195

^a Represents reference level

4.3.2 – Temporal patterns in GDP growth

Including year as a predictor variable reveals important temporal trends in GDP growth, with fluctuations corresponding to major global events. For example, 2012 shows a significant negative impact on GDP growth (estimate = -3.10, $p < 0.001$), likely reflecting the lingering effects of the 2008 global financial crisis, which had a lasting impact on international trade and investment flows. The year 2020 records a sharp decline in GDP growth (estimate = -5.51, $p = 0.002$) due to the COVID-19 pandemic, which disrupted global supply chains, trade and economic activity. However, 2021 shows signs of recovery (estimate = 3.62, $p = 0.038$) as the global economy begins to recover from the pandemic-induced recession. Other years, such as 2018 (estimate = -2.34, $p < 0.001$) and 2022 (estimate = -1.75, $p = 0.006$), reflect regional or global downturns, possibly due to geopolitical tensions or economic slowdowns. These time effects highlight the significant impact of global crises and recovery periods on GDP growth.

4.3.3 – Assumption Checks

The Q-Q (quantile-quantile) plot in Figure 1 assesses the normality of the residuals from a regression model by comparing their distribution to a theoretical normal distribution.

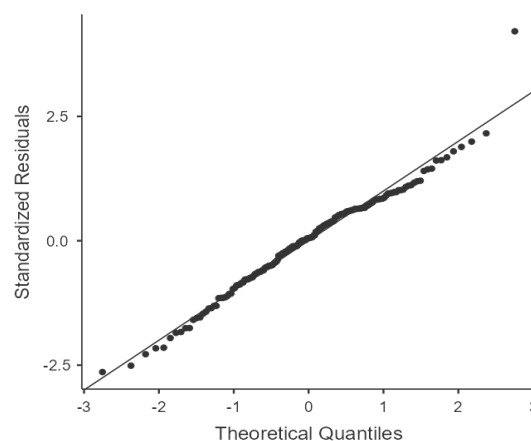


Fig. 1 – Q-Q Plot

It can be seen that the majority of the data points align well with the reference line, indicating that the residuals meet the assumption of normality for most of the data set. This is a positive indication that the residuals of the regression model generally exhibit normality, which is a key assumption in linear regression.

5 – Discussion

5.1 – *Linking Logistics Performance and Economic Outcomes*

The study of logistics performance, trade costs, and economic growth across regions reveals significant differences and relationships that illuminate the broader impact of logistics efficiency on economic outcomes. By integrating logistics performance with trade costs and economic growth, the study underscores how these factors interact to shape regional economic landscapes, consistent with the findings of the literature review.

5.2 – *Regional Disparities and their Implications*

Examining at logistics performance across regions, there are notable differences. For example, Eastern and Southern Africa has the lowest Logistics Performance Index (LPI) of 1.02, accompanied by high costs and significant delays in border compliance for both imports and exports. This finding is consistent with the literature highlighting how poor logistics performance can negatively impact economic development. The region's relatively modest GDP growth of 3.05 percent underscores the potential negative impact of inadequate logistics performance on economic outcomes (Wang & Choi, 2018; Gani, 2017).

Western and Central Africa, while showing slightly better GDP growth of 4.03%, faces even greater logistics challenges than Eastern and Southern Africa. Higher import and export costs and longer compliance times suggest that despite some economic improvement, logistical inefficiencies remain a critical barrier to growth. This is consistent with Kumari and Bharti's (2021) findings that logistical inefficiencies can hinder economic growth, particularly in developing regions.

In contrast, Central Europe and the Baltics, as well as East Asia and the Pacific, have high LPI scores, reflecting more efficient logistics systems. Central Europe and the Baltics benefit from near-zero import costs and very short import times, which is consistent with the literature attributing high GDP growth in these regions to superior logistics infrastructure (Martí et al., 2014). Similarly, East Asia and the Pacific's robust LPI and low import and export costs support its high GDP growth rate of 4.64 percent, reflecting advanced logistics systems that facilitate trade efficiency (Shikur, 2022; Song & Lee, 2022).

5.3 – *Comparative Analysis of Mature and Emerging Economies*

Europe and Central Asia, along with the European Union, have high LPIs but lower GDP growth rates compared to other regions. This trend is consistent with literature suggesting that mature logistics systems may experience diminishing returns in terms of economic growth (Hassan, 2024). The European Union's very high LPI and low border compliance costs and times contrast with its minimal GDP growth, suggesting that factors beyond logistics, such as market saturation and economic maturity, influence its growth (Bugarčić et al., 2023).

Regions such as Latin America and the Caribbean, and the Middle East and North Africa show moderate logistics performance with relatively high border compliance costs and times. The slower GDP growth of these regions, in part due to persistent logistics inefficiencies, is

consistent with the literature showing that inadequate logistics infrastructure hampers economic performance (Gani, 2017; Tang & Abosedra, 2019).

5.4 – Sub-Saharan Africa's Logistical Challenges

Sub-Saharan Africa, with the lowest LPI and the highest border compliance costs and times, faces the greatest logistics challenges. Despite moderate GDP growth, the severe logistical constraints highlight the need for significant improvements in logistics infrastructure to boost economic performance. This finding is consistent with Raimbekov et al. (2018) and Duzbaievna Sharapiyeva et al. (2019), who highlight the critical role of logistics improvements in boosting economic development, especially in challenging regions.

5.5 – Correlation and Regression Analysis

The correlation matrix reveals nuanced relationships between logistics metrics and GDP growth. The modest positive correlation between LPI and GDP growth ($r = 0.206$) suggests that while better logistics performance can contribute to higher economic growth, the effect is relatively weak. This is consistent with the literature, which suggests that logistics improvements alone may not be sufficient to generate significant economic growth without addressing other factors (Bugarčić et al., 2023; Jayathilaka et al., 2022).

The strong correlation between LPI and customs clearance efficiency ($r = 1.000$) underscores the importance of efficient customs procedures for overall logistics performance. This finding is consistent with the literature that highlights the role of customs efficiency in facilitating trade and improving logistics performance (Erkan, 2014; Hassan, 2024).

The regression analysis provides a comprehensive view of how logistics performance, customs efficiency, and regional factors affect GDP growth. The model shows a strong fit with an R^2 of 0.780, indicating that logistics performance and other predictors explain a significant portion of the variance in GDP growth. In particular, the overall LPI has a positive and significant impact on GDP growth (estimate = 11.49, $p = 0.011$), suggesting that improvements in logistics performance can enhance economic growth. However, the negative relationship between customs clearance efficiency and GDP growth (estimate = -11.12, $p = 0.014$) is counterintuitive and may reflect an overemphasis on customs efficiency or inefficiencies in resource allocation within customs processes.

5.6 – Gaps Covered by the Study

This study addresses several gaps identified in the existing literature. While previous research has examined the general relationship between logistics performance and economic growth, this study provides a more detailed regional analysis, highlighting specific disparities and their economic impact.

The inclusion of recent data and advanced analytical methods, such as regression analysis with nuanced predictors, enhances the understanding of how logistics performance interacts with other economic variables. In addition, by examining a wide range of regions, including those with severe logistics challenges, the study fills gaps related to the impact of logistics on less studied areas such as sub-Saharan Africa and landlocked countries.

5.7 – Policy Implications

The results of this study underscore the critical role of targeted policy interventions in improving logistics performance and enhancing economic outcomes. For regions with low

Logistics Performance Index (LPI) scores and high logistics costs, such as Eastern and Southern Africa, policymakers should prioritize targeted investments in logistics infrastructure. This includes improving border infrastructure, upgrading transport networks, and investing in advanced warehousing and technology solutions. Reducing border compliance times and costs should be a key focus, as inefficiencies in these areas are significant barriers to trade and economic growth. Developing comprehensive policy frameworks that address both logistical inefficiencies and broader economic challenges is essential to promote sustainable development in these regions.

In contrast, regions with high LPIs but lower GDP growth, such as Europe and Central Asia, require a broader set of strategies. Policymakers should consider fostering innovation and exploring new economic opportunities to sustain growth.

Addressing market saturation and identifying new sectors for investment can help maintain economic dynamism. In addition, policymakers need to be attuned to regional and global economic trends and adapt strategies to mitigate the impact of global economic shifts and crises. This approach will ensure that high logistics performance translates into continued economic progress.

6 – Recommendations

Based on the findings of the study, several specific and actionable recommendations are proposed to address the identified logistics challenges and improve economic performance. These recommendations are tailored to the unique needs of different regions, taking into account the different levels of logistics performance and economic growth observed.

6.1 – *Enhance Logistics Infrastructure*

For regions with low LPI scores, significant investment in logistics infrastructure is essential. This includes upgrading transportation networks, expanding warehousing facilities, and incorporating advanced logistics technologies. Improved infrastructure can significantly reduce trade costs and improve overall economic performance by facilitating the smoother and more efficient movement of goods.

6.2 – *Improve Customs Efficiency*

Streamlining customs procedures is critical to improving logistics performance. Policymakers should focus on reducing the time and cost of border compliance by implementing more efficient customs processes and using technology to expedite clearance procedures. Improving customs efficiency can improve trade flows and contribute to higher economic growth.

6.3 – *Address Regional Specificities*

Tailor logistics improvements to the specific needs and characteristics of each region. For example, landlocked countries may require targeted strategies to overcome infrastructure constraints and reduce trade barriers. Developing regional transport corridors and fostering cross-border cooperation can help mitigate these challenges and improve trade efficiency.

6.4 – *Explore Complementary Economic Strategies*

In regions with high LPI but low GDP growth, it is important to pursue additional economic strategies. These include promoting innovation, diversifying markets and exploring new

investment opportunities. By complementing logistics improvements with broader economic initiatives, policymakers can foster sustainable economic growth and competitiveness.

6.5 – Monitor Global Trends

Policymakers should keep abreast of global economic trends and their impact on logistics performance and economic growth. This includes adapting policies to address the impact of global crises, such as the COVID-19 pandemic, and taking advantage of recovery periods to stimulate growth. Proactive engagement with global trends will help regions remain resilient and competitive in the evolving economic landscape.

7 – Summary of the Study

Table 6 below provides a comprehensive summary of the key findings of the study, highlighting the relationship between logistics performance and economic growth in different regions. It provides a detailed comparison of logistics metrics such as the Logistics Performance Index (LPI), GDP growth and border compliance costs, along with their respective policy implications. It also provides specific recommendations for improving logistics systems to enhance trade efficiency and economic development in the regions studied.

8 – Conclusion

This study comprehensively examines the complex relationship between logistics performance and economic growth, with a particular focus on regional disparities and trade dynamics. The analysis shows that logistics performance has a significant impact on economic outcomes, although the impact varies across regions.

Regions such as Central Europe and the Baltics and East Asia and the Pacific have high Logistics Performance Index (LPI) scores and significant economic growth, underscoring the benefits of efficient logistics systems. In contrast, regions such as Eastern and Southern Africa and Western and Central Africa face significant logistics challenges that negatively impact their economic performance and trade efficiency.

The study confirms that effective logistics services, including customs clearance, transport infrastructure and overall efficiency, play a key role in facilitating international trade and economic development.

The positive correlation between the LPI and GDP growth highlights the potential for improved logistics to boost economic performance. However, the uneven impact across regions suggests that logistics improvements alone are not sufficient; broader economic and structural factors also play a critical role.

8.1 – Limitations of the Study

Despite its comprehensive approach, this study has several limitations.

First, while the data are comprehensive, they are based on secondary sources that may have inherent limitations or inconsistencies. The reliance on World Bank data sets means that the study is constrained by the accuracy and completeness of these reports.

Second, the study focuses on broad regional categories that may mask more granular variations within regions. More localized data could provide deeper insights into specific logistics challenges and opportunities. Third, the study uses a fixed historical data set from 2007 to 2023, which may not fully capture recent developments or emerging trends in logistics and economic conditions.

Table 6 – Summary of the Study

Region	Metrics	Findings	Policy Implications	Recommendations
Eastern and Southern Africa	LPI (1.02), GDP Growth (3.05%), Time & Cost for Border Compliance	Low logistics performance and high costs correlate with low GDP growth.	Need for substantial investment in logistics infrastructure and efficiency improvements.	Enhance logistics infrastructure, improve customs efficiency, and reduce trade costs.
Western and Central Africa	LPI (1.25), GDP Growth (4.03%), Time & Cost for Border Compliance	Slightly better GDP growth compared to Eastern and Southern Africa but still faces significant logistical challenges.	Address high logistical costs and long compliance times through targeted reforms.	Improve customs procedures, invest in transportation infrastructure, and streamline border processes.
Central Europe and Baltics	LPI (4.75), GDP Growth (2.85%), Time & Cost for Border Compliance	High logistics performance and efficiency but lower GDP growth, indicating maturity and possible market saturation.	Focus on innovation and market diversification to sustain growth.	Explore new economic opportunities, foster innovation, and consider regional economic strategies.
East Asia and Pacific	LPI (4.90), GDP Growth (4.64%), Time & Cost for Border Compliance	High logistics performance correlates with high GDP growth, reflecting advanced logistics infrastructure.	Leverage logistics efficiency to maintain and enhance global trade competitiveness.	Continue to invest in logistics infrastructure and explore new growth opportunities in international trade.
Europe and Central Asia	LPI (4.60), GDP Growth (1.90%), Time & Cost for Border Compliance	High LPI but lower GDP growth, possibly due to economic maturity and market saturation.	Address economic growth challenges through innovative policies beyond logistics improvements.	Focus on market saturation issues, explore new investment opportunities, and enhance economic policies.
European Union	LPI (5.00), GDP Growth (1.50%), Time & Cost for Border Compliance	Very high LPI with minimal border compliance costs and times, but minimal GDP growth.	Evaluate factors beyond logistics that may be limiting economic growth.	Investigate market saturation and structural economic factors; consider adjustments in economic policies.
Latin America and Caribbean	LPI (3.10), GDP Growth (2.80%), Time & Cost for Border Compliance	Moderate logistics performance and slower GDP growth, reflecting persistent logistical inefficiencies.	Improve logistics infrastructure and reduce trade barriers to boost economic growth.	Enhance logistics systems, address regional trade barriers, and streamline border processes.
Middle East and North Africa	LPI (3.30), GDP Growth (3.20%), Time & Cost for Border Compliance	Moderate LPI and GDP growth, indicating potential room for logistics and economic improvements.	Focus on logistics improvements and address regional trade inefficiencies.	Invest in infrastructure, streamline customs processes, and address regional economic challenges.
OECD Members	LPI (4.80), GDP Growth (2.50%), Time & Cost for Border Compliance	High LPI but relatively modest GDP growth, reflecting mature logistics systems.	Explore additional economic strategies to drive growth.	Encourage innovation and explore new economic opportunities to sustain growth.
Sub-Saharan Africa	LPI (1.00), GDP Growth (3.10%), Time & Cost for Border Compliance	Lowest LPI and highest border compliance costs, indicating severe logistical challenges.	Substantial improvements in logistics infrastructure are critical for economic development.	Invest heavily in logistics infrastructure, improve customs efficiency, and reduce trade costs.

8.2 – Recommendations for Future Research

Future research should aim to address these limitations by incorporating a more granular analysis of logistics performance at the country or sub-regional level. This approach would allow for a more detailed understanding of local logistics challenges and their impact on economic outcomes. In addition, expanding the dataset to include more recent information and incorporating additional variables such as technological advances and policy changes could provide a more comprehensive view of the relationship between logistics and the economy.

Further studies could also examine the impact of specific logistics interventions and policy changes on economic growth. Examining case studies of regions that have successfully improved their logistics systems and analyzing the results could provide valuable insights and practical recommendations for other regions facing similar challenges. Finally, incorporating qualitative data through surveys and interviews with logistics stakeholders could enrich the understanding of the contextual factors that influence logistics performance and economic growth.

9 – References

- Bugarčić, F. Ž., Mičić, V., & Stanišić, N. (2023). The role of logistics in economic growth and global competitiveness. *Zbornik Radova Ekonomski Fakultet u Rijeka*, 41(2), 499-520. <https://doi.org/10.18045/zbefri.2023.2.499>
- Bugarčić, F. Ž., Skvarciany, V., & Stanišić, N. (2020). Logistics performance index in international trade: case of Central and Eastern European and Western Balkans countries. *Business: Theory and Practice*, 21(2), 452-459.
- De Souza, R., Goh, M., Gupta, S., & Lei, L. (2007). An investigation into the measures affecting the integration of ASEAN's priority sectors (Phase 2): the case of logistics. *REPSF Project*, 6(1).
- Duzbaievna Sharapiyeva, M., Antoni, A., & Yessenzhigitova, R. (2019). The impact of port transport-logistics infrastructure and LPI for economic growth: on the example of landlocked countries. *Pomorstvo*, 33(1), 63-75. <https://doi.org/10.31217/p.33.1.7>
- Erkan, B. (2014). The importance and determinants of logistics performance of selected countries. *Journal of Emerging Issues in Economics, Finance and Banking*, 3(6), 1237-1254.
- Gani, A. (2017). The logistics performance effect in international trade. *The Asian journal of shipping and logistics*, 33(4), 279-288. <https://doi.org/10.1016/j.ajsl.2017.12.012>
- Hassan, M. I. (2024). Logistics Performance Index: A Catalyst for International Trade Growth-An Applied Study on Global Economies, 23, 434. *مجلة السياسة والاقتصاد*, 450 DOI: 10.21608/jocu.2024.280278.1330
- Jayathilaka, R., Jayawardhana, C., Embogama, N., Jayasooriya, S., Karunarathna, N., Gamage, T., & Kuruppu, N. (2022). Gross domestic product and logistics performance index drive the world trade: A study based on all continents. *PloS one*, 17(3), e0264474. <https://doi.org/10.1371/journal.pone.0264474>
- Katrakylidis, I., & Madas, M. (2019). International trade and logistics: An empirical panel investigation of the dynamic linkages between the logistics and trade and their contribution to economic growth. *International Journal of Economics & Business Administration (IJEBA)*, 0(4), 3-21.
- Kumari, M., & Bharti, N. (2021). Trade and logistics performance: does country size matter?. *Maritime Economics & Logistics*, 23, 401-423.
- Martí, L., Puertas, R., & García, L. (2014). The importance of the Logistics Performance Index in international trade. *Applied economics*, 46(24), 2982-2992. <https://doi.org/10.1080/00036846.2014.916394>

- Ojala, L., & Celebi, D. (2015). The World Bank's Logistics Performance Index (LPI) and drivers of logistics performance. *Proceeding of MAC-EMM, OECD*, 3-30.
- Raimbekov, Z. S., Syzdykbayeva, B. U., Mussina, K. P., Moldashbayeva, L. P., & Zhumataeva, B. A. (2017). The study of the logistics development effectiveness in the Eurasian Economic Union countries and measures to improve it. *European Research Studies Journal*, 20(4). <https://www.um.edu.mt/library/oar//handle/123456789/33114>
- Raimbekov, Z., Syzdykbayeva, B., Rakhmetulina, Z., & Zhenskhan, D. (2018). The effectiveness of logistics development and its impact on the economies of the countries along the silk road passing through Kazakhstan. *Transport problems*, 13.
- Shikur, Z. H. (2022). The role of logistics performance in international trade: A developing country perspective. *World review of intermodal transportation research*, 11(1), 53-69. <https://doi.org/10.1504/WRITR.2022.123100>
- Song, M. J., & Lee, H. Y. (2022). The relationship between international trade and logistics performance: A focus on the South Korean industrial sector. *Research in Transportation Business & Management*, 44, 100786. <https://doi.org/10.1016/j.rtbm.2022.100786>
- Tang, C. F., & Abosedra, S. (2019). Logistics performance, exports, and growth: Evidence from Asian economies. *Research in Transportation Economics*, 78, 100743. <https://doi.org/10.1016/j.retrec.2019.100743>
- Vuković, D., Jovanović, A., & Đukić, M. (2012). Defining competitiveness through the theories of new economic geography and regional economy. *Journal of the Geographical Institute " Jovan Cvijic", SASA*, 62(3), 49-64.
- Wang, M. L., & Choi, C. H. (2018). How logistics performance promotes the international trade volume? A comparative analysis of developing and developed countries. *International Journal of Logistics Economics and Globalisation*, 7(1), 49-70. <https://doi.org/10.1504/IJLEG.2018.090504>