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Article

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Asian Journal of Shipping and Logistics (AJSL)

Provided in Cooperation with:

Korean Association of Shipping and Logistics, Seoul

Suggested Citation: Mai Ngoc Tran (2024) : Impact of green logistics on Vietnam's regional trade, Asian Journal of Shipping and Logistics (AJSL), ISSN 2352-4871, Elsevier, Amsterdam, Vol. 40, Iss. 2, pp. 126-132,
<https://doi.org/10.1016/j.ajsl.2024.04.001>

This Version is available at:

<https://hdl.handle.net/10419/329741>

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Impact of green logistics on Vietnam's regional trade

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ARTICLE INFO

JEL classifications:

F14
F18
Q56

Keywords:

Green logistics
Trade performance
Vietnam
Regional trade agreements
Green logistics performance index (GLPI)
Principal component analysis (PCA)
Sustainability
CPTPP
RCEP
ASEAN
APEC

ABSTRACT

This study investigates the impact of green logistics on Vietnam's regional trade within the frameworks of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), Regional Comprehensive Economic Partnership (RCEP), Association of Southeast Asian Nations (ASEAN), and Asia-Pacific Economic Cooperation (APEC) from 2007 to 2020. Employing a newly formulated Green Logistics Performance Index (GLPI) derived through Principal Component Analysis (PCA), the research assesses how sustainable logistics practices influence trade performance. An extended gravity model is utilized to analyze the impact of green logistics across different regional trade agreements. The findings suggest that improved green logistics correlate positively with enhanced trade outcomes, highlighting the dual benefits of sustainability efforts in the environmental and economic realms. The study contributes to the limited empirical research on the intersection of green logistics and trade in Vietnam, offering a methodological approach for future analyses in this field. It provides valuable insights for businesses and policymakers aiming to align economic growth with sustainability objectives.

1. Introduction

In the current global era, characterized by a rapid pace of globalization and increasing environmental awareness, the role of green logistics has become crucial in shaping regional trade dynamics. Focusing on logistics, a sector historically marked by high fuel consumption and significant environmental impacts (He et al., 2017; Rashidi & Cullinane, 2019), the transformative role of green logistics is significant. Green logistics involves the integration of sustainable practices across various logistics dimensions, including transportation, warehousing, packaging, and reverse logistics. The adoption of green logistics practices not only mitigates environmental impacts but also offers economic benefits through process optimization and operational cost reductions (Dekker et al., 2012). The critical role of green logistics is environmental protection, social advancement, and economic growth, highlighting its significance in promoting green economic activities and reducing emissions like carbon dioxide (Karaman et al., 2020; Khan et al., 2019; Li et al., 2021).

Vietnam is a nation experiencing rapid economic growth in South-east Asia, the significance of green logistics in Vietnam's context is accentuated by its strategic geographical location stands as a critical node in the intricate web of regional and global trade. Its active

participation in major Free Trade Agreements (FTAs) like the Regional Comprehensive Economic Partnership (RCEP) and the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP) not only positions it strategically on the global stage but also underscores the vital role of green logistics in its trade dynamics. As evidenced by the robust growth in Vietnam's regional trade, with a notable increase in exports to ASEAN countries from 15 billion USD in 2010 to approximately 25 billion USD in 2019, the country's trade dynamics present a compelling case for studying the influence of green logistics. The rising global demand for environmental standards in trade, coupled with commitments by trade regions towards sustainable development, has made green logistics a pivotal element for Vietnamese enterprises. It not only helps in meeting international standards but also enhances the country's global reputation (Khan et al., 2020). Green logistics practices, by offering efficient and eco-friendly transportation solutions, improve competitive capabilities, expand export opportunities, and maximize the benefits of participating in international trade regions.

However, the research landscape in Vietnam regarding the impact of logistics, especially green logistics, on international trade remains limited. Previous studies have largely focused on theoretical and macro-practical aspects, with a scarcity of empirical research to measure the impacts. This study aims to bridge this gap by proposing a methodology

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<https://doi.org/10.1016/j.ajsl.2024.04.001>

Received 12 December 2023; Accepted 22 April 2024

Available online 9 May 2024

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for calculating the Green Logistics Performance Index (GLPI) using Principal Component Analysis (PCA). This index will be instrumental in assessing the impact of green logistics on Vietnam’s trade with partners in regions such as CPTPP, RCEP, ASEAN, and APEC from 2007 to 2020, using an extended gravity model. This approach not only enriches the academic discourse but also offers practical insights for policymakers and businesses in formulating and adjusting policies to foster the adoption of green logistics, illuminating the path toward aligning economic pursuits with sustainability goals.

2. Literature review

The concept of green logistics first emerged in the 1990 s with the goal of minimizing environmental impacts from logistics activities, such as greenhouse gas emissions, noise pollution, and waste, while achieving balanced development in economic, social, and environmental aspects (Srivastava, 2007). Green logistics extends beyond the scope of traditional logistics in both strategic and operational aspects. It can be seen as a modernization of the traditional approach, incorporating environmental principles into an existing system rather than a complete replacement. Unlike traditional logistics, which primarily aims at cost reduction (Bajdor, 2012), green logistics emphasizes waste minimization, energy efficiency improvement, use of renewable energy sources, and optimization of transportation and distribution processes (Murphy & Poist, 2000). Although initially implementing green logistics may incur higher costs compared to traditional approaches, the long-term accrued benefits include lower costs (Carter & Rogers, 2008) and sustainable business models (Seuring & Müller, 2008). While green logistics can improve environmental impacts (Dekker et al., 2012), its implementation is influenced by factors such as government environmental regulations, customer expectations, internal company management, supplier management, social factors, and competitive capabilities (Mangla et al., 2016; Sharma et al., 2023; Tseng & Chiu, 2013).

In recent times, the focus on green logistics has increased, but literature on its relationship with regional trade remains limited, mainly due to challenges in measuring the concept of green logistics, a multifaceted concept intertwining environmental sustainability with logistical efficiency. To address this challenge, researchers have attempted to create composite indices that blend traditional logistics metrics with environmental considerations. Kim and Min (2011) constructed the Green Logistics Performance Index (GLPI) by integrating the Logistics Performance Index (LPI) and the Environmental Performance Index (EPI). Building on this approach, Mariano et al. (2017) introduced the Low-Carbon Logistics Performance Index. This index aims to measure logistics performance alongside carbon emissions in the transport sector, providing a comprehensive view of a country’s success in reducing CO2 emissions through efficient logistics. In another study, Lu et al. (2019) developed the Environmental Logistics Performance Index (ELPI), which combines LPI, CO2 emissions, and oil consumption data to assess the green logistics practices of 112 countries. (Fan et al., 2022) took a different methodological approach by employing the entropy method to construct the GLPI, analyzing its impact on China’s export trade within the RCEP framework, and highlighting the growing importance of green logistics in shaping trade dynamics within regional trade agreements. Additionally, Tan et al. (2020) explored the integration of blockchain technology in green logistics, indicating a trend toward technological innovation in achieving sustainable logistics operations. Policy aspects of green logistics have also been addressed, as seen in the work of Zhang et al. (2020), who analyzed factors influencing Green Logistics Performance based on grounded theory. Khan et al. (2019) further expanded the scope by examining the influence of environmental, social, and economic indicators on GLPI in the South Asian Association for Regional Cooperation (SAARC) countries, illustrating the broader impacts of green logistics on the region.

While the existing literature has made strides in developing green logistics indices and exploring the impact of green logistics on

international trade, there’s a notable lack of specific focus on its relationship with regional trade, especially in the context of specific economic regions or trade agreements. Given Vietnam’s unique position in Southeast Asia and its active participation in various regional trade agreements, a detailed study on how green logistics impacts Vietnam’s regional trade is needed. This research aims to fill the gap in the literature by constructing a GLPI index and analyzing its impact on regional trade. By doing so, this study not only contributes to the theoretical understanding of green logistics in a developing country context but also provides practical insights for policy-making and business strategy development. It seeks to demonstrate how Vietnam can balance its rapid economic growth with environmental sustainability through effective green logistics practices.

3. Methodology

This study employs the Principal Component Analysis (PCA), a statistical technique renowned for its effectiveness in reducing data dimensionality while preserving essential information (Hasan & Abdulazeez, 2021). The PCA’s primary role in this research is to develop the GLPI, an index designed to offer a comprehensive and efficient representation of green logistics performance. In the development of GLPI, source component variables were selected from esteemed and authoritative platforms to ensure data integrity and relevance. The traditional logistics factors are derived from the World Bank’s Logistics Performance Index (LPI), and the environmental factors are obtained from Climate Watch. The environmental factors are inversely valued, a methodological decision aimed at accurately reflecting their detrimental effects on green logistics performance. This inversion is critical in converting raw environmental data into meaningful metrics that genuinely capture the essence of green logistics. The PCA is processed to identify key "principal components" through linear combinations of the transformed variables (Maćkiewicz & Ratajczak, 1993). This process is instrumental in extracting the most significant information, thereby reducing data complexity without compromising the richness of the original dataset. The GLPI is subsequently calculated based on two principal components identified by PCA. Component 1 incorporates elements from the LPI, encapsulating traditional logistics metrics, while, Component 2 is composed of vital environmental factors, including greenhouse gas emissions (Table 1). Each component’s contribution to the GLPI is weighted based on its variance retention, ensuring a balanced and comprehensive representation of green logistics performance.

This paper conducts an empirical study on the impact of green logistics on Vietnam’s export trade with countries in regions such as CPTPP, RCEP, APEC, and ASEAN using the gravity model. This model incorporates variables like Gross Domestic Product (GDP), distance (DIS), population (POP), and economic openness (OPEN), along with dummy variables for regional trade agreements like CPTPP, RCEP, APEC, and ASEAN (Table 2). Each dummy variable assumes a value of 1 if the trade partner country is a member of the respective region and 0 otherwise. The gravity model equation is as follows:

$$\text{LnTRADE}_{ij} = \beta_0 + \beta_1 \text{LnGLPI}_{jt} + \beta_2 \text{GDP}_{jt} + \beta_3 \text{LnDIS}_{ij} + \beta_4 \text{LnPOP}_{jt} + \beta_5 \text{LnOPEN}_{jt} + \beta_6 \text{ASEAN}_{jt} + \beta_7 \text{APEC}_{jt} + \beta_8 \text{CPTPP}_{jt} + \beta_9 \text{RCEP}_{jt} + u_{ijt}$$

Table 3 compiles data from 840 observations across 60 countries, spanning from 2007 to 2020. This rich dataset is sourced from

Table 1
GLPI’s component variables.

Principal components	Component variables	Sources
Logistics factors	Custom, Infra, Ship, Service, Tracing, Timeliness	World Bank
Green factors	CO2, N2O, CH4, FGAS	Climate Watch

Table 2
Variable Definitions and Data Sources.

Variables	Description	Expected impact	Data source
EXPij	Vietnam’s export to other countries		World Integrated Trade Solution (WITS)
IMPij	Vietnam’s import to other countries		World Integrated Trade Solution (WITS)
GDPit, GDPjt	Vietnam’s GDP, other countries’ GDP	+	World Bank (WB)
DISij	Distance between Vietnam and other countries	-	DistanceFromTo
GLPIjt	Green logistics performance	+	
OPENjt	Trade (%GDP)	-	World Bank (WB)
POPjt	Population	+	World Bank (WB)
ASEANj	ASEAN member countries	+	ASEAN main portal
APECj	APEC member countries	+	Asia-Pacific Economic Cooperation main portal
CPTPPj	CPTPP member countries	+	Australian Government, Department of Foreign Affairs and Trade
RCEPj	RCEP member countries	+	ASEAN main portal

Table 3
Descriptive statistics.

Variables	Observations (N)	Mean	Std. dev	Min	Max
log_N2O	840	7.041	1.450	3.497	10.919
log_FGAS	840	5.720	1.670	2.639	10.222
log_CO2	840	9.251	1.830	2.303	13.845
log_CH4	840	7.838	1.640	4.205	11.684
log_TRAC	840	1.200	0.169	0.711	1.531
log_TIME	840	1.302	0.138	0.747	1.588
log_LOGS	840	1.165	0.181	0.560	1.573
log_ITRN	840	1.151	0.141	0.683	1.486
log_INFR	840	1.143	0.213	0.405	1.491
log_CUST	840	1.099	0.201	0.391	1.445
log_vnexp	840	12.784	2.067	6.848	18.159
log_vnimp	840	12.435	2.158	6.980	18.246
log_GDP	840	26.445	1.657	22.009	30.694
log_DIS	840	2.229	0.984	0.259	6.695
log_POP	840	16.877	1.566	13.887	21.068

authoritative sources such as the World Integrated Trade Solution (WITS), World Bank (WB) and the official websites of significant regional trade agreements, including APEC, CPTPP, ASEAN, and RCEP. The data is converted into logarithmic form to normalize for further analysis. The notable variability in the standard deviations of critical environmental metrics such as log_N2O, log_FGAS, log_CO2, and log_CH4 indicates a wide range of environmental impacts attributed to these greenhouse gases. Logistics variables like log_TRAC, log_TIME, and log_LOGS, log_ITRN, log_INFR, log_CUST have average values that point to a moderate level of logistics performance, with minimal fluctuation, suggesting consistency in logistics processes. Trade values, depicted through log_vnexp and log_vnimp, show substantial averages, indicating high trade activities, while exhibiting moderate variability across the dataset. Key economic indicators include log_GDP and log_POP, both displaying high mean values, with log_GDP particularly showing a consistent trend, signaling stable economic conditions in the observed countries. The log_DIS variable captures the diverse geographical distances involved in Vietnam’s trade relationships. Its broad range and significant variability highlight the varied distances across Vietnam’s trading network.

4. Empirical results

4.1. Descriptive statistics of GLPI

This section presents an empirical analysis of the GLPI trends from 2007 to 2020, providing insights into the evolution of green logistics practices across various regional trade agreements.

Table 4 indicates varying degrees of progress in green logistics across ASEAN, RCEP, CPTPP, and APEC regions. ASEAN shows a gradual increase in GLPI scores from 1.90 in 2007 to a peak of 2.05 in 2020, with a slight dip to 1.91 in 2016. The mean GLPI over this period is 1.98, reflecting steady progress with minor setbacks. RCEP started with a GLPI of 2.03 in 2007 and exhibits a general upward trend, reaching 2.14 in 2020. Its mean GLPI is 2.07, which is higher than that of ASEAN, indicating a relatively stronger and consistent emphasis on green logistics practices. CPTPP maintains the highest GLPI scores across all regions, starting at 2.29 in 2007 and consistently remaining around this value, with a peak at 2.31 in 2014. The mean GLPI for CPTPP is 2.24, signifying a high and stable commitment to green logistics, with less variability compared to the other regions. APEC had the lowest starting GLPI score of 2.04 in 2007 but demonstrates incremental growth, achieving 2.06 by 2020. With a mean GLPI of 2.06, APEC shows a modest yet consistent improvement.

Comparing the regions, CPTPP shows the most robust performance in green logistics, while RCEP indicates a strong and steady improvement. ASEAN progresses at a slightly slower pace, with some fluctuations, but maintains an upward trajectory. APEC has the most modest improvement, which may be due to the group’s larger and more diverse membership, reflecting varying levels of green logistics integration. Overall, all regions have made progress over the years, highlighting a collective shift towards more sustainable logistics practices (Fig. 1).

Australia, Canada, Chile, New Zealand, and Singapore show high GLPI scores across the board for the trade blocs in which they participate, indicating strong and consistent performance in green logistics (Fig. 2). Australia and Singapore, in particular, have some of the highest scores, suggesting they may be leaders in implementing sustainable logistics practices. The data indicates that higher-income countries tend to have higher GLPI scores, which may correlate with more resources dedicated to sustainable practices in logistics. Emerging economies exhibit lower scores, which may be improved with increased investment and focus on sustainable logistics practices. Economic development, policy implementation, technological adoption, and investment in infrastructure likely play significant roles in these disparities.

Vietnam’s positioning within the GLPI rankings across various economic groupings sheds light on its commitment to sustainable logistics practices in different contexts (Table 5). Globally, Vietnam stands at a commendable 38th place out of 98, which places it well within the upper half of the index. This demonstrates that Vietnam’s efforts in green logistics are being recognized on the world stage, outpacing more than half of the countries in the global comparison. Regionally, within ASEAN, Vietnam is ranked 4th out of 7 countries, indicating a robust standing in Southeast Asian green logistics, trailing just behind the top performers. This suggests that within its immediate economic vicinity, Vietnam is a significant proponent of sustainable logistics initiatives. In the broader contexts of RCEP and CPTPP, Vietnam holds the 8th position out of 12 and 10 countries, respectively. These mid-range rankings imply that while Vietnam is not at the forefront in these groups, its performance is still competitive, with ample opportunity for advancement. In the APEC forum, Vietnam’s rank of 10th out of 16 signifies a moderate position. This ranking in the lower-middle segment among diverse economies points to the potential for Vietnam to enhance its green logistics strategies to climb higher in the APEC standings.

4.2. Regression analysis

Table 6 presents the results of regression analysis where Vietnam’s

Table 4
GLPI from 2007 to 2020 of regional areas.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean
ASEAN	1.90	1.92	1.94	1.95	1.96	1.97	1.99	2.02	1.97	1.91	1.95	1.98	2.02	2.05	1.98
RCEP	2.03	2.06	2.08	2.06	2.04	2.03	2.06	2.08	2.04	2.01	2.04	2.07	2.10	2.14	2.07
CPTPP	2.29	2.29	2.28	2.27	2.26	2.26	2.29	2.31	2.29	2.28	2.28	2.28	2.28	2.28	2.24
APEC	2.04	2.06	2.09	2.07	2.06	2.05	2.07	2.09	2.07	2.05	2.05	2.05	2.05	2.06	2.06

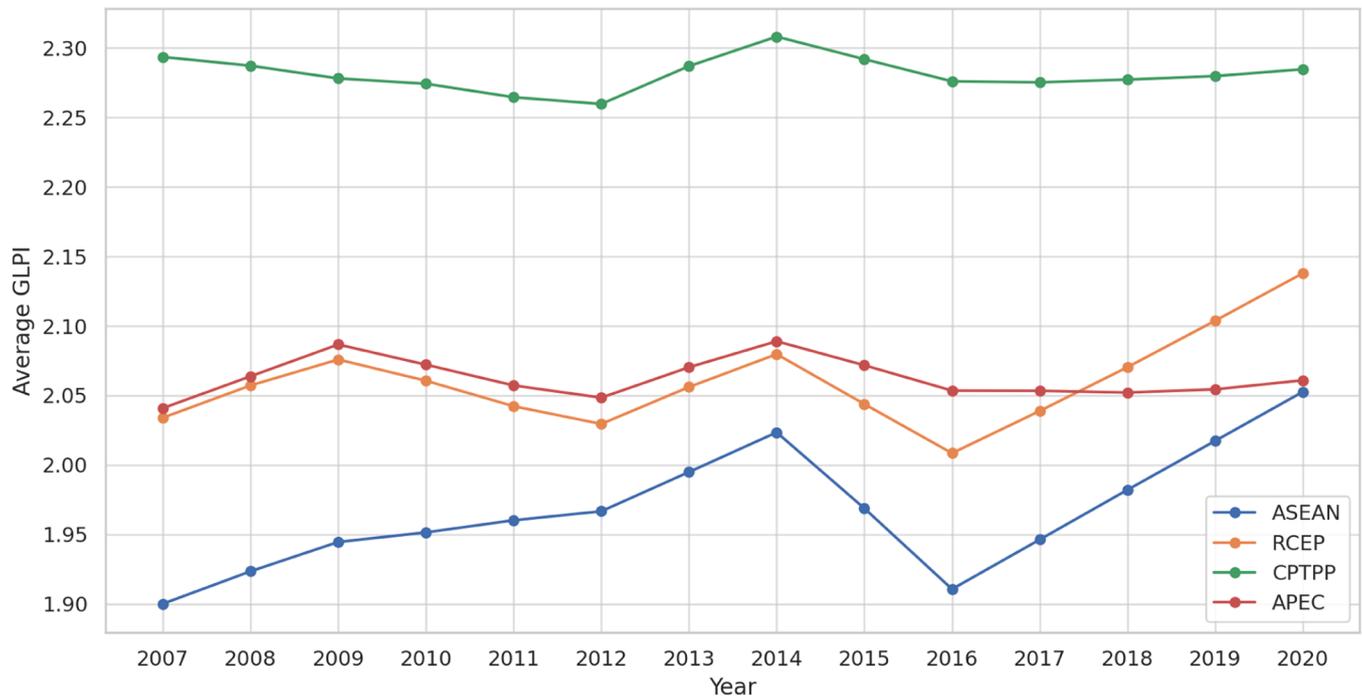


Fig. 1. GLPI Trends from 2007 to 2020.

export (log_vnexp) and import (log_vnimp) values are used as dependent variables across five different models, each corresponding to different regional trade agreements — GLOBAL, RCEP, APEC, CPTPP, and ASEAN. The independent variables include the natural logarithm of the Green Logistics Performance Index (LnGLPI), GDP (LnGDP), distance (LnDIS), population (LnPOP), economic openness (LnOPEN), and dummy variables for the regional trade groups.

LnGLPI has a positive and statistically significant impact on Vietnam’s exports in all models except the GLOBAL and CPTPP model for imports. This suggests that an increase in green logistics performance is generally associated with an increase in exports. This finding implies that better green logistics practices in Vietnam — such as efficient and sustainable transportation and supply chain management — are likely contributing to increased exports. Businesses may be leveraging Vietnam’s greener logistics as a competitive advantage in international markets, possibly because global consumers and businesses are increasingly favoring environmentally friendly products and services. The positive correlation between GLPI and exports suggests that sustainable practices can lead to economic benefits, not just environmental ones. However, the lack of significance of LnGLPI in the GLOBAL and CPTPP model for imports indicates that the benefits of green logistics on trade might be more pronounced on the export side than the import side in the case of Vietnam. Several factors could contribute to this phenomenon. Firstly, global markets may place a greater emphasis on sustainability, thereby influencing exports more significantly than imports. Secondly, export-oriented industries in Vietnam may be further ahead in the adoption of green logistics practices compared to sectors that are more focused on domestic consumption or imports. Thirdly, the structure and specific provisions of trade agreements, such as those within

the CPTPP, may determine how green logistics impacts trade flows, where other elements such as tariff rates and trade barriers could exert a more direct influence on imports. For policymakers and business leaders, these findings highlight the necessity to tailor green logistics strategies differently for export versus import operations. Policymakers, in particular, should consider how trade agreements and domestic regulations can support the adoption of green logistics practices that not only enhance export performance but also address the less apparent impact on imports. Such strategies could ensure a balanced approach to economic growth and environmental sustainability, potentially redefining the competitive landscape for Vietnam in both regional and global markets.

LnGDP is consistently positive and significant across all models for exports and imports, indicating that higher GDP is associated with higher trade values. Higher GDP typically reflects a larger economic size and, consequently, greater capacity for both production and consumption, leading to increased trade activity (O. Krugman, 2015). This is because countries with larger economies have more resources to engage in trade and a higher demand for diverse goods and services, which often results in a higher volume of exports and imports. The positive association between LnGDP and trade values in this regression analysis is consistent with the broader consensus in international trade literature, reinforcing the importance of economic size as a predictor of trade activity.

LnDIS shows mixed effects; it’s negative in the RCEP, APEC, and CPTPP models for export and aligns with the negative coefficients of LnDIS in some models, where increasing distance between trading partners correlates with reduced trade volumes; and positive in the full model for export suggesting that distance may sometimes have a

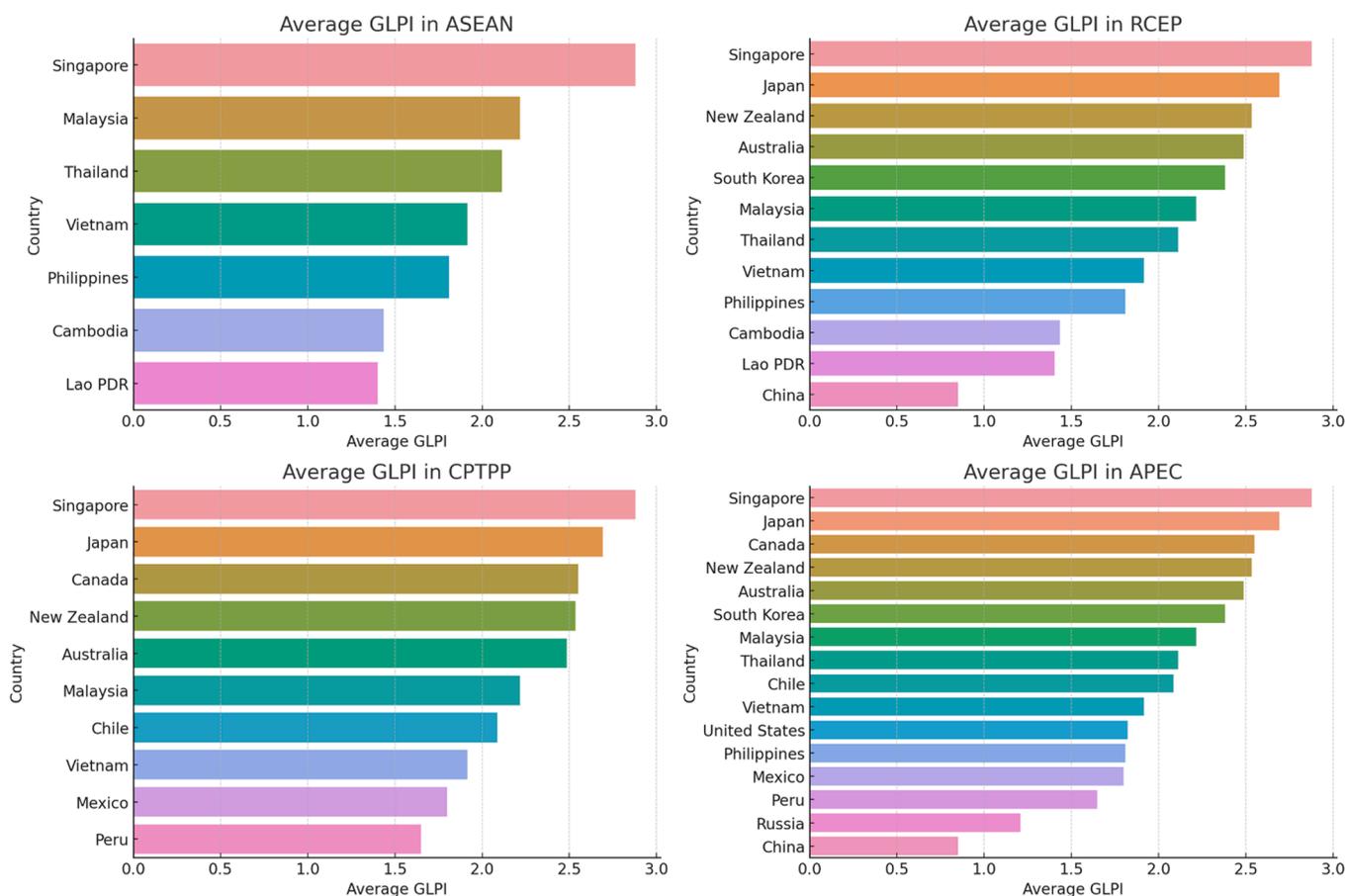


Fig. 2. GLPI in different trade regions.

Table 5

Vietnam’s GLPI rankings.

Ranking Category	Rank of Vietnam	Total Countries in Group
GLOBAL	38	98
ASEAN	4	7
RCEP	8	12
CPTPP	8	10
APEC	10	16

positive relationship with trade. This could be explained by modern logistical advancements and trade agreements that reduce the effective impact of distance on trade. For instance, countries far apart may still have strong trade relationships if they have efficient logistics, free trade agreements, or shared sea routes that facilitate easy trade flow (Helman et al., 2008). Interestingly, LnDIS shows a positive impact in RCEP, APEC, and ASEAN models for Vietnam’s imports, indicating that favorable trade agreements within these blocs potentially reduce or eliminate tariffs, offsetting the traditional costs of distance. The trend might also reflect Vietnam’s growing stature as a regional hub, attracting imports for redistribution, or the influx of foreign direct investment necessitating the import of capital goods from distant countries. These factors demonstrate Vietnam’s nuanced integration into regional economies, where the benefits of securing diverse, quality imports eclipse the deterring effects of geographical distance.

LnPOP is positive and significant in most cases, suggesting larger population sizes are associated with higher trade volumes. This relationship can be attributed to larger populations potentially offering a bigger workforce, creating a larger domestic market, and providing a broader base for innovation and specialization, which can lead to increased production and, consequently, more trade (Krugman &

Obstfeld, 2009).

LnOPEN shows a strong positive effect on both exports and imports in most models, implying that more open economies have higher trade volumes. Economic openness generally includes trade liberalization policies such as reduced tariffs and non-tariff barriers, which can facilitate a greater flow of goods and services between countries. This positive association aligns with the conclusions of classic trade theories, which suggest that countries stand to gain from trade through comparative advantages and resource allocations (Krugman, 2015).

The regional dummy variables (APEC, ASEAN, CPTPP, RCEP) show varied impacts on trade. For example, being part of APEC or ASEAN is associated with higher exports in some models but not others. Firstly, the APEC and ASEAN memberships having varied impacts on trade suggest that the benefits of being part of these blocs are not uniform across all types of trade. This could be due to the diverse economic profiles and strategic priorities of member countries within these groups. APEC, with its wider geographic span and more varied economic development levels among member countries, might not always present uniform trade advantages for Vietnam. On the other hand, ASEAN, being a more regionally focused and integrated group, may offer more consistent trade benefits due to shared regional goals and similar economic development stages (Balassa & Stoutjesdijk, 1975). Secondly, the differential impact highlighted by the regional dummy variables aligns with previous research, which suggests that trade agreements can have asymmetric effects on member countries, often contingent on the specific terms of the agreement and how they align with a country’s economic structure (Fan et al., 2023). For instance, Vietnam’s exports could be bolstered by ASEAN due to tariff reductions and trade facilitation measures within the region, whereas APEC’s broader focus might not translate to immediate trade volume increases for all member countries.

Table 6
Regression results.

Variables	Model 1 GLOBAL		Model 2 RCEP		Model 3 APEC		Model 4 CPTPP		Model 5 ASEAN	
	log_vnexp	log_vnimp	log_vnexp	log_vnimp	log_vnexp	log_vnimp	log_vnexp	log_vnimp	log_vnexp	log_vnimp
LnGLPI	0.887 ***	0.250	1.642 ***	-7.119 ***	1.306 ***	-3.850 **	0.254	-7.023 ***	0.817 **	-1.724
	0.185	0.189	0.195	1.684	0.231	1.476	0.763	1.152	0.395	1.822
LnGDP	0.589 ***	0.665 ***	0.053 **	0.637 ***	0.775 ***	1.181 ***	-0.852 ***	0.200	-1.170 ***	-1.108 ***
	0.053	0.054	0.132	0.135	0.082	0.132	0.244	0.196	0.124	0.189
LnDIS	0.141 ***	0.039	-0.079 ***	0.188 ***	-0.118 ***	0.074 ***	-7.176 ***	-5.215 ***	0.053	0.439 ***
	0.041	0.042	0.032	0.038	0.040	0.039	0.978	0.699	0.035	0.043
LnPOP	0.512 ***	0.380 ***	1.242 ***	1.005 ***	0.442	0.081 ***	0.549 ***	-0.050	0.596 ***	-0.111
	0.057	0.058	0.150	0.143	0.113	0.076	0.198	0.107	0.198	0.244
LnOPEN	0.724 ***	0.636 ***	1.348 ***	2.377 ***	0.604	1.326 ***	1.953 ***	0.601 **	0.656 *	-0.111
	0.107	0.110	0.169	0.180	0.159	0.147	0.359	0.274	0.368	0.429
APEC	0.222	0.111	-2.672 ***	0.861 **	-	-	-	-	2.537 ***	6.506 ***
	0.184	0.188	0.320	0.373	-	-	-	-	0.537	0.588
ASEAN	0.366	0.171	-1.119 ***	-2.122 ***	0.359	-0.400 *	-13.791 ***	-7.897 ***	-	-
	0.232	0.237	0.303	0.315	0.252	0.216	1.987	1.457	-	-
CPTPP	-0.174	-0.279	0.616 ***	0.704 ***	-0.443 ***	-0.761 ***	-	-	0.507 ***	1.784 ***
	0.177	0.180	0.206	0.225	0.164	0.150	-	-	0.170	0.225
RCEP	1.464 ***	2.366 ***	-	-	0.758 ***	2.385 ***	-4.260 ***	-2.293 ***	-	-
	0.172	0.175	-	-	0.140	0.143	0.779	0.570	-	-
_cons	-15.691	-14.933	-12.317	-12.103	-17.950	-15.998	37.983	37.512	28.679	42.989
	1.091	1.113	1.688	2.014	1.888	1.760	7.668	5.852	5.845	6.772
N	840	840	140	140	210	207	126	123	70	70
R2	0.7343	0.7461	0.7779	0.8486	0.7738	0.8427	0.837	0.9176	0.6587	0.9382
AIC	2509.794	2543.419	261.845	270.759	507.393	473.768	260.944	189.889	18.836	38.071
BIC	2557.128	2590.753	288.319	297.233	537.517	503.762	283.635	212.386	36.824	56.059

5. Conclusion, limitation and suggestion for future research

This study originates from a growing recognition of the importance of sustainable practices in the logistics sector, acknowledging that such practices are not only environmentally beneficial but also contribute to economic and operational efficiencies. It seeks to explore the impact of green logistics on Vietnam’s trade relationships with regional partners, an area that has yet to be extensively explored in existing literature. This study has provided an insightful examination of the impact of green logistics on Vietnam’s regional trade from 2007 to 2020, employing a novel GLPI calculated via PCA. The research reveals a significant positive correlation between green logistics practices and Vietnam’s export performance, underscoring the potential of sustainable logistics not only in enhancing environmental protection but also in boosting economic and operational efficiencies within the trade sector. The study’s unique contribution lies in its focus on green logistics in Vietnam’s context and its development of the GLPI, offering new insights into the relationship between sustainability in logistics and trade performance.

Despite its contributions, this study acknowledges several limitations. The scope was confined to available data from 2007 to 2020, which may not capture the full effects of recent policies or global economic shifts. Additionally, the complexity of trade dynamics means that not all influencing factors may have been accounted for, such as political changes, non-tariff barriers, or specific industry logistics practices. The PCA-based GLPI, while innovative, may not encompass all nuances of green logistics performance.

Future research should consider these limitations and could extend this study in several ways. Incorporating more contemporary data could allow for a temporal analysis that more effectively captures the influence of recent global economic shifts and policy changes on green logistics and trade. Employing a longitudinal study design might enable researchers to establish stronger causal relationships. Adding qualitative data, such as in-depth interviews with industry experts or case studies, could provide deeper insights into how green logistics practices impact trade. A broader set of variables reflecting infrastructural, technological, and policy advancements could be included to enrich the analysis. Comparative studies with other countries in similar economic stages could also provide a more comprehensive understanding of the role of green logistics in regional trade. Lastly, an exploration into the impact of

specific green logistics initiatives and investments would be valuable to policymakers and businesses aiming to boost trade through sustainable practices.

Declaration of Competing Interest

No potential conflict of interest was reported by the author.

Acknowledgments

This work is a research output belonging to the Research Working Group NCM.04/2023 of the Banking Academy of Vietnam and funded by the Banking Academy of Vietnam.

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