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Analysis of Logistics Performance and its Impact on Total Bilateral Trade between Colombia and China

Análisis del desempeño logístico y su impacto en el comercio bilateral total entre Colombia y China

Análise do desempenho logístico e seu impacto no comércio bilateral total entre a Colômbia e a China

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Artículo de investigación

Abstract

The purpose of this research was to analyze the logistics performance between Colombia and China and its impact on bilateral trade. The hypothesis regarding how logistics infrastructure and trade policies contribute to the transit of goods was formulated. To achieve this objective, a mixed methodological approach with a predominant quantitative focus was employed. This approach involved conducting a literature review and designing a survey-type instrument. The collected data were processed using the Statistical Package for the Social Sciences (SPSS) Software, version 29.0. The sample consisted of 162 importers selected through a non-probabilistic convenience sampling method. The findings support the hypothesis that emphasizes the necessity for continual improvement of logistical aspects to enhance the nation's development and competitiveness. In conclusion, the research suggests the importance of fostering agreements and alliances to promote bilateral trade.

Keywords: Colombia; China; logistics performance; trade; logistics infrastructure; trade policies.

JEL: F13 Trade Policy; Protection; Promotion; Trade Negotiations; International Organizations.

Resumen

La presente investigación tuvo como finalidad analizar el desempeño logístico entre Colombia y China y su impacto en el comercio bilateral, se planteó la hipótesis de: ¿cómo la infraestructura logística y políticas comerciales contribuyen al tránsito de las mercancías? Para ello, se realizó una ruta metodológica de carácter mixto con mayor enfoque en el cuantitativo con un alcance descriptivo, mediante una revisión de literatura y diseño del instrumento tipo encuesta, los datos fueron procesados por el Software Statistical Package for the Social Sciences, versión 29.0. La muestra compiló a 162 importadores mediante un muestreo no probabilístico por conveniencia. Los hallazgos respaldan la hipótesis sobre la necesidad del mejoramiento permanente de aspectos logísticos para el desarrollo y competitividad de la nación, finalmente, se concluye con el acrecentamiento de acuerdos y alianzas para el impulso del comercio bilateral.

Palabras clave: Colombia; China; desempeño logístico; comercio; infraestructura logística; políticas comerciales.

JEL: F13 Política comercial; Protección; Promoción; Negociaciones comerciales; Organizaciones internacionales

Resumo

O objetivo desta pesquisa foi analisar o desempenho logístico entre a Colômbia e a China e seu impacto no comércio bilateral. A hipótese foi: como a infraestrutura logística e as políticas comerciais contribuem para o trânsito de mercadorias? Para tanto, foi utilizada uma abordagem metodológica mista com enfoque quantitativo e escopo descritivo, por meio de uma revisão da literatura e da elaboração de um instrumento do tipo pesquisa,

cujos dados foram processados pelo software Statistical Package for the Social Sciences, versão 29.0. A amostra foi composta por 162 importadores por meio de amostragem não probabilística por conveniência. Os resultados apoiam a hipótese sobre a necessidade de melhoria permanente dos aspectos logísticos para o desenvolvimento e a competitividade da nação e, por fim, conclui-se com o aumento de acordos e alianças para a promoção do comércio bilateral.

Palavras-chave: Colômbia; China; desempenho logístico; comércio; infraestrutura logística; políticas comerciais.

JEL: F13 Política Comercial; Proteção; Promoção; Negociações Comerciais; Política Comercial; Organizações Internacionais.

Introduction

The logistics performance of a region holds great relevance for its social and economic development, as it contributes to the efficient management of the supply chain, transportation means, and distribution of goods, thereby enhancing the optimal flow of goods and services internationally (Baena et al. 2023). In this context, the continuous need arises to address the challenges posed by the proposed free market phenomena and optimize procedures to incorporate the new industrial revolution into organizations. This necessitates adaptation to technological advancements for data acquisition, analysis, and processing. Hence, this proposal addresses what (Bustamante et al. 2022a) have termed as market analysis for the intelligent planning and development of logistics strategies.

Consequently, logistics performance aids in identifying the primary logistics opportunities and challenges for regional development, assisting organizations and governments in decision-making for continuous improvement in logistics processes. However, as noted by (Zapateiro 2020), management systems are essential for planning, evaluating, and monitoring logistics performance indicators. This commitment has facilitated the understanding of market-influencing variables and the exploitation of existing opportunities between Colombia and China to strengthen their commercial relationship.

Given the above, the role of bilateral trade between these nations has become increasingly significant in the global context, owing to the strategic importance of their dynamic and expanding economies. Bilateral trade not

only promotes economic growth but also fosters social ties, cooperation, and knowledge transfer across various productive sectors.

The analysis of logistics performance between Colombia and China emerges as a fundamental pillar for ensuring a sustainable, long-term commercial relationship. Through the comprehension of logistics variables and their facilitation in the exchange process of goods and services, connectivity and competitiveness of organizations from both nations are enhanced. This encompasses logistics and port management, as emphasized by (Ramaldes et al. 2023), as integral components of infrastructure crucial for the development of international trade. However, it also highlights unexplored aspects from sustainability and security perspectives, and their implications on cross-border trade. This underscores the need for a multidisciplinary approach, incorporating considerations of consumerism, to devise practices aimed at minimizing environmental and societal impacts in a global market context.

To enhance the logistics performance between Colombia and China, it is essential to focus on strengthening infrastructure and investing in modern transportation systems. Upgrading ports and road networks will not only reduce costs and delivery times but also facilitate smoother trade flows between the two nations. Additionally, establishing strategic logistics hubs can significantly improve the distribution of goods, ensuring that both countries can capitalize on their respective markets. By fostering collaboration between public and private sectors, we can create a more efficient logistics framework that supports bilateral trade while addressing emerging challenges in the global marketplace.

Moreover, a comprehensive approach to analyzing bilateral trade must encompass various factors beyond logistics, such as economic, political, and social influences. Conducting in-depth research on these variables will provide valuable insights into the dynamics of trade relations between Colombia and China. Furthermore, promoting sustainable practices within the logistics sector is crucial for minimizing environmental impacts while enhancing competitiveness, both countries can work towards a more resilient and equitable trading partnership that benefits all stakeholders involved.

Consequently, this research aims to analyze the logistics performance between Colombia-China and its impact on total bilateral trade, considering the measurement variables of the logistics performance index to identify op-

portunities for improvement in the binational relationship through solutions that promote commercial exchange more effectively.

The study is structured into six main sections. The first section comprises the introduction of the research topic. The second section reviews the theoretical framework and provides relevant background information on logistics performance. The third section outlines the research methods implemented. The fourth section presents the obtained results. In the fifth section, the implications of the findings are discussed. Finally, the sixth section presents the conclusions, which contribute to a deeper understanding of logistics performance and its significance in the current international trade context.

Background

For this section, three categories were established; 1. International logistics, 2. Evaluation and performance of logistics 3. International trade.

In the first category (03) researches stand out, the first developed by Chang et al. (2022) who inspected international logistics as a source of competitive advantage of organizations, through a methodology of structural methods; they found that organizations that carry out efficient international logistics planning and strategies manage to improve their positioning in the market, therefore they develop a vision of different variables that drive the logistics industry. The second one carried out by (He et al. 2021); they relate international logistics and electronic commerce as a result that accounts for the dynamics of cross-border responses to market demand. The findings advise the governments of each country to develop sustainable policies to guarantee balance and efficient flow of goods. In regards to the third research stated by (Yan et al. 2022); they exposed the disturbances or situations that international trade presents if there is no adequate logistics process, it highlighted the various types of risks that influence international logistics; the results propose an index for measuring risk for prevention towards organizations.

In the second category (03) studies were characterized. The first was carried out by (Del Ángel et al. 2022), it evaluated the logistics of an SME

and its relationship with organizational performance, reflected in operational performance and productivity, under a performance assessment methodology as a risk mitigation strategy during logistics activity, the results exposed opportunities of improvement in the production system for a correct inventory flow and relationship with suppliers. The second project was conducted by (Sanchez et al. 2023), they evaluated logistics operators and their impact internationally through a methodology that exposed the most implemented logistics means during the supply chain; the findings reflected shortcomings in integrations and intermediation in the links of the chain. The third carried out by (Campos et al. 2023) related the supply chain as part of the strategy in organizations including service management, operations to reduce costs derived from logistics performance; the findings allowed establishing the supply chain as a strategic axis in the business environment for organizational success.

In the third category (03) researches were identified. The first one conducted by Prats (2023) in which he relates international trade as an engine of development for Latin America, he detailed a panorama that mainly outlines challenges after the economic opening of the region, and influence of free trade agreements for economic development, the results revealed the relevance of generating diversification strategies for increasing the competitiveness of countries. The second project by (Rueda & Geraldine 2023) highlighted the role of the comparative advantage of nations for organizations to increase their trade flow by taking advantage of the resources of each country by reducing the costs of entry to new markets, the findings highlighted the importance of logistics infrastructure for the generation of public policies that promote sustainable development strategies in the global market. Finally, the third research carried out by (Tuo 2024) established the relationship of international trade with the costs in the supply chain and the impact on the income of organizations in relation to the price and cost offered, therefore, it suggested the inclusion of technological innovation in organizations for the planning and data processing for the decision making process and in this way improving logistics risks and costs by considering internal and external variables.

Theoretical Framework

Throughout history, logistics and transportation have undergone significant evolution to align with the evolving needs of commerce, industries, and consumers. They are now recognized as crucial components for efficiently driving operations in a globalized market, ensuring the smooth functioning of the entire supply chain without disruptions (Marinucci 2020).

With this in mind, this section outlines the pertinent theoretical foundations that underpin the study:

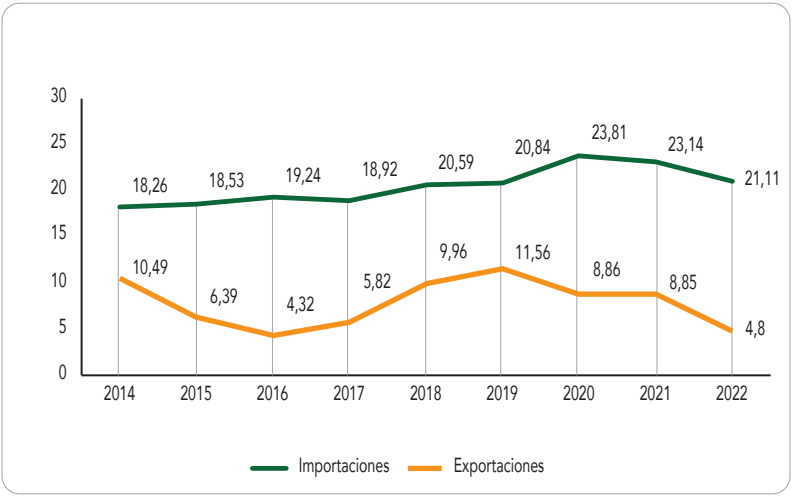
Bilateral Relations

In recent years, bilateral relations between the People's Republic of China and the Republic of Colombia have significantly strengthened, particularly in terms of trade and cooperation. This has led to diplomatic agreements aimed at collaborative efforts, as highlighted by (Borda & Berger 2012), who delve into the role of military negotiations and the evolution of human rights and political aspects in fostering socio-economic stability. Nevertheless, the author acknowledges the existence of parity in this commercial relationship concerning the flow of goods and services through tariff reduction. Consequently, China emerges as a potential economic partner for Colombia in terms of both exports and imports. Figure 1, presents the bilateral trade and relations between China and Colombia during the period (2014-2024).

According to Figure 1, the analyzed data on bilateral trade indicates that Colombia has been experiencing a trade deficit, with a noticeable increase in recent years. This trend has raised concerns across multiple economic sectors, prompting the need for support from the national government to implement measures aimed at achieving a balance in the trade deficit in the coming years, as noted by the (Ministry of Trade, Industry, and Tourism 2023).

The main products exported to the Chinese market include HS code 2709 —crude petroleum oils or bituminous minerals, and HS code 2701— coals and briquettes from the mining-energy sector. On the other hand, the primary goods imported from China consist of HS code 8517 —telephones and HS

Figure 1
Bilateral Trade between China and Colombia (2014-2022)



Source: Author's own work. Adapted from DIAN-DANE data.

code 8471— automatic data processing machines. This dynamic reflects the country's tendency to export raw materials with low added value while importing goods with high degrees of transformation, as observed in its trade balance. Thus, (Bustamante et al. 2022b) analyze market trends and emphasize the necessity to diversify the economy to mitigate the trade deficit.

In light of these factors, the development of strategies and policies to fully leverage bilateral relations is deemed crucial, as articulated by (Pérez, 2023). This underscores the nation's commitment to diversification in free trade, achieved through bolstering the dynamism of export culture towards this region and enhancing infrastructure conditions to foster a more competitive environment within the established agreements.

Collectively, these analytical scenarios facilitate the comprehension of two key elements: diversification and fortification of bilateral relations for the development and advancement of the nation. (Galán et al. 2023) propose measuring logistical operations in the global market to identify criteria for measurement and evaluation of the outcomes of this relationship, thereby fostering value creation through the constructs of comparative and competi-

tive advantages as strategies for local development (Bustamante & Murillo 2023).

International Commercial Logistics

International commercial logistics is a significant domain in today's market, as organizations increasingly seek to expand their presence in international markets through the planning, coordination, and control of the flow of goods and services to meet customer satisfaction, as noted by (Chang et al. 2022). It is imperative to ensure mechanisms that drive international logistics for the integration of variables, including technology, infrastructure, etc., and their relationship with organizations' competitive advantages to develop economies of scale for optimal and efficient growth. This involves cost reductions and poses challenges for organizations in the global supply chain, such as customs, transportation costs, exchange rate risks, inventory management, among others. Understanding the aforementioned as a logistics network entails an integrated process of factors (Zhang et al. 2021).

This research landscape addresses the imperative of optimizing organizational logistics processes to ensure a competitive and efficient environment in the current market.

Theories of international trade

The connection between logistics variables and established theories of international trade, particularly global value chains (GVCs), is crucial for understanding the dynamics of modern trade. Logistics performance significantly influences GVC participation, as efficient logistics systems reduce costs and enhance the movement of goods across borders. This is particularly relevant in a fragmented production environment where components are sourced globally. Theories surrounding GVCs emphasize that production processes are no longer confined to a single location; instead, they span multiple countries, necessitating robust logistics frameworks to manage these complex networks effectively. By integrating logistics performance with GVC theories, researchers can better analyze how logistical efficiencies contribute

to competitive advantage and trade volume, ultimately shaping economic outcomes for countries involved in international trade.

Furthermore, the empirical literature highlights that logistics performance not only affects the volume of trade but also the quality of participation in GVCs. For instance, countries with superior logistics capabilities tend to engage more deeply in value-added activities rather than merely exporting raw materials. This shift towards higher-value contributions in global supply chains is essential for economic development, especially for emerging economies seeking to enhance their industrial capabilities. By explicitly linking logistics variables to recognized theories of international trade, scholars can provide a more nuanced understanding of how logistics impacts GVC dynamics, thereby informing policy decisions aimed at improving trade infrastructure and fostering economic growth through enhanced global integration (Bustamante & Agudelo 2024).

Methods

For this study, a methodological approach was employed within the framework of a quantitative research design, as advocated by (Yucra & Bernedo 2020), who emphasize the epistemological significance of statistical analysis for ensuring reliable results. In this context, the study's scope was defined descriptively, utilizing a deductive method to analyze the problem statement concerning logistic performance and its impact on bilateral trade. Data collection involved the use of survey techniques and databases. This facilitated the design and validation of a questionnaire by experts to ensure the instrument's quality and robustness. The questionnaire aimed to capture perceptions of logistic performance in the commercial relationship between Colombia and China, comprising 11 elements investigated and evaluated on a Likert scale with five response options: 1. Completely Disagree, 2. Somewhat Disagree, 3. Neither Agree nor Disagree, 4. Somewhat Agree, and 5. Completely Agree. The instrument was designed using a Google Form, with consent sought for its administration.

The target population comprised importers within the Colombian national territory. A sample of (162) subjects was selected using convenience

sampling. Subsequently, data processing was conducted using the Statistical Package for Social Sciences (SPSS) software, version 29.0. The processing of cases is detailed below. Table 1, lists the results obtained after processing the cases of the instrument.

Table 1
Case Processing of the Instrument

Summary of Case Processing			
		N	**%**
Cases	Valid	162	100,0
	Excluded	0	0,0
	Total	162	100,0
a. Listwise deletion is based on all variables in the procedure.			

Source: Author's own work.

As depicted in Table 1, the conducted procedure demonstrates that all data (162), accounting for 100%, were deemed valid; no data were excluded from the study.

Results

In regard to the data processing conducted using SPSS software version 29.0, the reliability findings obtained in the study are presented below (Table 2).

Table 2
Reliability Statistics of the Instrument

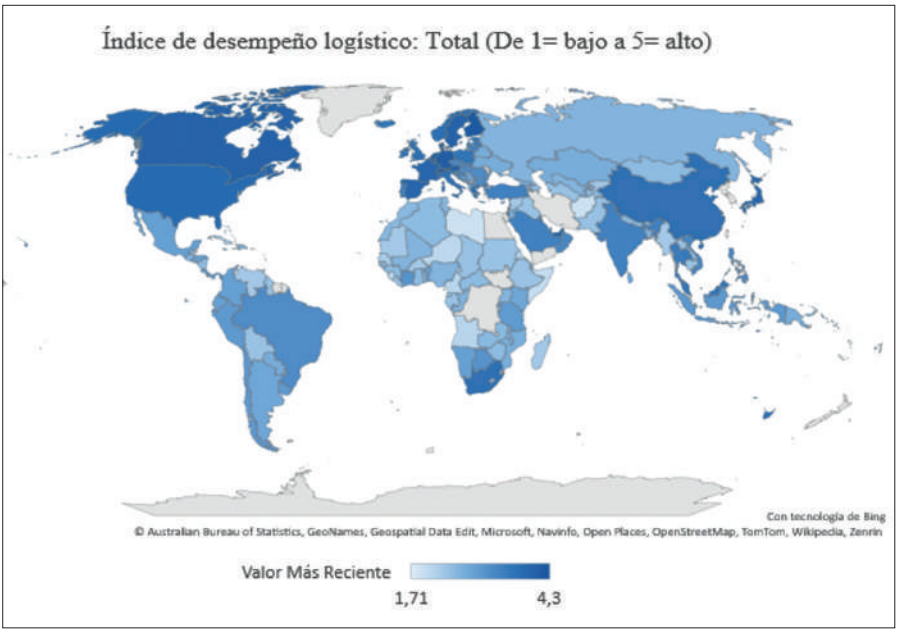
Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha based on standardized items	Number of items
0,903	0,905	11

Source: Author's own work.

The validity and reliability of the results were ensured through the use of Cronbach's Alpha index, as recommended by (Elosua Oliden y D. Zumbo 2008). This index helps identify the internal consistency of the instrument, with higher values indicating better reliability. As observed in Table 4, the index was 0,903, signifying excellent consistency and reliability in the obtained responses.

Descriptive data reflect the presence of multiple factors for calculating the Logistics Performance Index (LPI), as indicated by the (World Bank 2023). This index helps identify challenges and opportunities in commercial logistics and comprises six components: customs score, infrastructure score, international shipments score, logistics competence score, tracking and tracing score, and punctuality score. Countries are rated on a scale from 1 (low) to 5 (high). Figure 2 illustrates the Logistics Performance Index for the year 2023.

Figure 2
Logistics Performance Index (2023)



Source: Author's own work, utilizing data from the World Bank, LPI 2023.

To analyze Figure 2, it is evident that Colombia is positioned at (66), obtaining an average score of (2.9), while China is positioned at (19) out of a total of (139) countries with an average score of (3,7). This indicates that among the mentioned variables, China outperforms Colombia, contributing to better distribution and logistical processes at an international level. There are opportunities for improvement in bilateral trade relations. According to (González et al. 2022), they discuss the management of the index and its contribution to value generation for the country's growth driven by the 4.0 revolution, aligning with the realities of the national context.

Under this premise, the development of strategies to enhance efficiency by adapting to the needs and trends of global trade is highlighted. In Tables 3-4 below, each country's scores are detailed.

Table 3
Logistics Performance Index for Colombia (2018-2023)

Indicator	2018		2023		Variation	
	Rank	Score	Rank	Score	Rank	Score
Logistics Performance Index	58	2,94	66	2,9	6	-0,4
Customs	75	2,61	84	2,5	9	-0,11
Infrastructure	72	2,67	59	2,9	3	0,23
International Shipments	46	3,19	57	3,0	11	-0,19
Competitiveness and quality of logistics services	56	2,87	57	3,1	1	-0,23
Punctuality	81	3,17	65	3,2	6	0,03
Tracking and tracing	53	3,08	62	3,1	9	-0,02

Source: Author's own work, utilizing data from the World Bank's LPI 2023.

As evidenced in Table 3, for the Colombian context, there is a notable decline in the ranking across (4) out of the (6) evaluated components, resulting in a drop of (6) positions in the global ranking by 2023, representing a variation of (-0.4). Another variable assessed by the index concerns customs, which saw a decrease of (9) positions by 2023 with a score variation of (-0.11). This indicates an adverse trend in bureaucratic and customs-related processes, as highlighted by (La Noire 2019) regarding the syste-

matization of customs procedures to facilitate and expedite international trade in accordance with global standards. In terms of infrastructure, there was an improvement, with Colombia positioned at (59) in 2023, showing a positive variation of (0.23) compared to 2018. This reflects government efforts towards infrastructure enhancement, although it also underscores the need for improvements in infrastructure quality to boost international trade. Regarding international shipments, there was a decline of (-11), suggesting measures for enhancing efficiency and modernizing logistic transportation methods (Zamora & Pedraza 2013). In assessing competitiveness and the quality of logistic services, there was a slight decrease of (-1) in the ranking, with a variation of (-0.23). However, in terms of punctuality, there was an improvement, moving from position (81) in 2018 to (65) by 2023, demonstrating efficiency in delivery times. Finally, in terms of tracking and tracing, a decline is evident, dropping from position (53) in 2018 to (62) by 2023, indicating the necessity for implementing improvement initiatives to enhance national competitiveness. Table 4, below shows China's logistics performance.

Table 4
Logistics Performance Index China (2018-2023)

Indicator	2018		2023		Variation	
	Rank	Score	Rank	Score	Rank	Score
Logistics Performance Index	26	3,66	19	3,7	7	0,04
Customs	31	3,29	31	3,3	0	0.01
Infrastructure	20	3,75	14	4,0	6	0,25
International Shipments	18	3,54	14	3,6	4	0,06
Competitiveness and quality of logistics services	27	3,59	20	3,8	7	0,21
Punctuality	27	3,84	30	3,7	-3	-0,14
Tracking and tracing	27	3,65	23	3,8	4	0,15

Source: Author's own work, utilizing data from the World Bank's LPI 2023.

For the performance of the Chinese case, as presented in Table 4, improvements are observed in (5) out of the total (6) components compared to 2018. China occupied the (19th) position out of 139 countries evaluated,

gaining (7) positions globally. As for customs evaluation, it remained at the same (31st) position, while infrastructure managed to ascend (6) positions with a variation of (0.25). Regarding international shipments, its score increased from (14) to ascend (4) positions with a variation of (0,06). Concerning competitiveness and the quality of logistic services, it ascended (7) steps, reaching the (20th) position with a variation representing (0,21). In terms of tracking and tracing, its score increased from (3,65) to (3.8), obtaining a variation of (0,15) and positioning itself at the (23rd) place. These aforementioned variables signify significant advancements in the logistic performance, reflecting a commitment to developing competitive and comparative advantages for the industries within Chinese territory due to its high dynamism in foreign trade. However, challenges are evident in terms of punctuality, decreasing (-3) positions globally from (27th) to (30th) with a variation representing (-0.14) for ensuring satisfaction and assurance in logistic processes. Table 5, shows the degree of correlation of each of the questions asked in the instrument.

Table 5
Correlation Matrix among Elements

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1.	1	0,732	0,581	0,565	0,597	0,4	0,435	0,353	0,44	0,375	0,457
2.	0,732	1	0,567	0,584	0,617	0,294	0,331	0,303	0,348	0,387	0,361
3.	0,581	0,567	1	0,799	0,58	0,2	0,251	0,201	0,319	0,208	0,134
4.	0,565	0,584	0,799	1	0,619	0,205	0,239	0,193	0,31	0,175	0,111
5.	0,597	0,617	0,58	0,619	1	0,379	0,382	0,333	0,292	0,315	0,295
6.	0,4	0,294	0,2	0,205	0,379	1	0,829	0,693	0,634	0,678	0,699
7.	0,435	0,331	0,251	0,239	0,382	0,829	1	0,766	0,668	0,711	0,756
8.	0,353	0,303	0,201	0,193	0,333	0,693	0,766	1	0,622	0,698	0,706
9.	0,44	0,348	0,319	0,31	0,292	0,634	0,668	0,622	1	0,584	0,507
10.	0,375	0,387	0,208	0,175	0,315	0,678	0,711	0,698	0,584	1	0,775
11.	0,46	0,36	0,13	0,11	0,3	0,7	0,76	0,71	0,51	0,78	1

Source: Author's own work.

Regarding the correlation among all (11) researched elements in the instrument, the results indicate a strong relationship among some of them, as evidenced by a predominantly positive evaluation. This information is essential for analyzing the perceptions of logistic performance within the Colombian and Chinese contexts and their implications for the commercial relationship. Table 6, shows the statistical summary of the elements.

Table 6
Summary Element Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum
Element mean	3,660	3,302	4,037	0,735	1,222
Element variances	1,221	0,983	1,502	0,519	1,528
Covariances among elements	0,560	0,160	1,181	1,020	7,374
Correlations among elements	0,465	0,111	0,829	0,719	7,485

Source: Author's own work.

Meanwhile, as presented in Table 6, the summary statistics reveal that the mean of the elements is 3.6. Additionally, the correlations among elements vary between 0.111 and 0.829. The covariances display significant variability, ranging from 1.60 to 1.181. Thus, the data indicate a significant relationship within the analyzed dataset.

Table 7
Findings regarding Colombia's export dynamics

Aspect	Description
Dependence on Exports	Colombia's economy has shifted from a reliance on coffee in the 1970s to a heavy dependence on oil and coal, which accounted for 55 % of goods exports in 2022.
Market Concentration	The top ten export destinations represented 70 % of total exports in 2022, with the United States and China accounting for nearly half of this figure.
Export Diversification	Despite efforts to diversify, the export basket remains concentrated, with five products making up about 65 % of total goods exports.

Aspect	Description
Logistics and Trade Barriers	High non-tariff barriers and logistical challenges hinder Colombia's trade competitiveness, affecting its ability to integrate into global value chains.
Service Sector Growth	Colombia has seen significant growth in service exports, particularly in travel and transport, indicating a positive trend towards diversification in this area.
Policy Implications	A well-executed export diversification strategy is essential for reducing reliance on commodities and enhancing long-term economic growth (DNP 2020).

Source: Author's own work.

For another hand, The qualitative results (DNP, 2020). presented highlight Colombia's significant dependence on commodity exports, particularly oil and coal, which together accounted for 55% of goods exports in 2022. This reliance has led to a high concentration of exports, making the economy vulnerable to fluctuations in global commodity prices. The data indicates that while Colombia has made strides in diversifying its export markets, the composition of its export basket remains heavily skewed towards mineral and extractive industries. This situation poses challenges for economic stability, especially given that lower international prices for these commodities have exacerbated trade deficits since 2014 (DNP 2020).

Moreover, the findings suggest that Colombia's trade competitiveness is hindered by structural issues within its export framework. The concentration index for Colombian exports has shown little improvement over the years, indicating a lack of diversification compared to other emerging market economies. Despite efforts to enhance productivity and explore non-traditional sectors, the overwhelming dominance of oil and mining in the export landscape continues to limit growth potential (DNP 2020).

Discussion

The analysis of the results contributes to the examination and evaluation of the data, enabling the identification of areas for improvement in the logistics performance index for strategic decision-making to enhance the

commercial relationship between both countries, based on a sample of (162) importers from (14) departments within the national territory. The following findings are presented to facilitate the implementation of strategies aimed at fostering the growth and effectiveness of the logistics chain.

Emphasis is placed on the importance of developing specific actions in the logistics realm to positively influence economic development, thus achieving a balance in the perceptions of the bilateral relationship. Table 8, shows the data processing for each of the variables of the instrument.

Table 8
Perceptions of logistic performance according to the sample

Variable	(1) Completely disagree	(2) Somewhat disagree	(3) Neither disagree nor agree	(4) Somewhat agree	(5) Completely agree
1. Are you satisfied with the average delivery time of products imported from China to Colombia?	7	19	31	75	30
2. Do you agree with the average transportation cost of products imported from China to Colombia?	11	10	31	74	36
3. Do you consider the existence of adequate infrastructure for importing Chinese goods to Colombia?	7	34	27	52	42
4. Are you in agreement with the investment made in technology to improve logistics between Colombia and China?	9	24	26	50	53
5. What level of satisfaction do you have regarding the relationship between logistics costs and gross profit in the country?	8	10	19	64	61

Variable	(1) Completely disagree	(2) Somewhat disagree	(3) Neither disagree nor agree	(4) Somewhat agree	(5) Completely agree
6. What level of satisfaction regarding the tracking index of goods and services imported from China do you have?	9	16	37	71	29
7. What is the quality of service index throughout the entire logistics process until arrival in the country?	9	14	38	79	22
8. How satisfied are you with the specific requirements and procedures that must be met to import products from China to Colombia, including the nationalization process and the payment of customs duties?	8	14	44	75	21
9. Do you consider Chinese investment in infrastructure and logistics projects favorable to the Colombian economy?	9	27	59	40	27
10. Do you consider the international logistics operation efficient for the volume of imports to the Colombian market?	9	17	29	70	37
11. Do you believe that agreements between Colombia and China can facilitate trade and increase the volume of imports?	9	14	13	52	74
Total	**95**	**199**	**354**	**702**	**432**

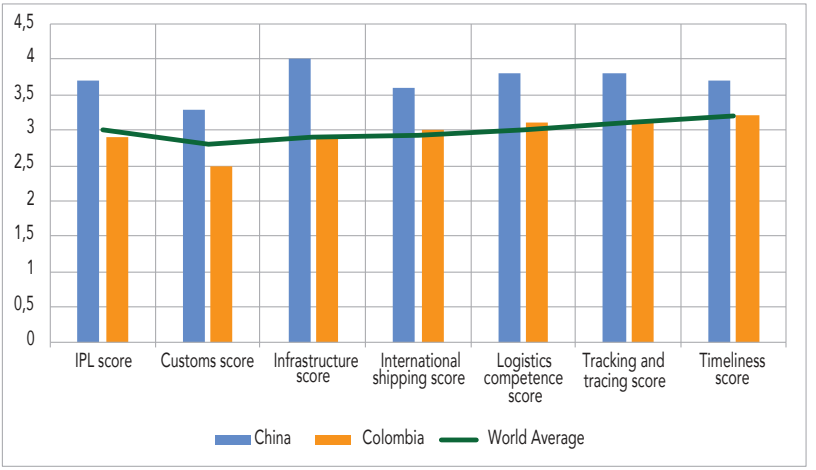
Source: Author's own work.

As shown in Table 8, logistic operations were assessed to understand the most significant evaluations, with (4) indicating considerable agreement, totaling 702 records, followed by (5) signifying complete agreement, with a total of 432 records. Subsequently, (3) representing neutrality, had 199 evaluations each. Thus, perceptions of the logistic performance index are predominantly distributed among these (3) levels, suggesting ongoing efforts within organizations to address logistic challenges for enhancing infrastructure, punctuality, service management, and overall efficiency to achieve continuous improvement and ensure customer satisfaction (Bustamante & Agudelo 2024). Finally, figure 3 shows the Logistics Performance Index (LPI) comparison between Colombia and China in 2023.

The findings suggest that the implementation of the World Trade Organization's (WTO) Trade Facilitation Agreement (TFA) and the World Customs Organization's (WCO) SAFE Framework could be crucial for addressing deficiencies in Colombia's international trade, particularly in its relationship with China, its main trading partner. In 2023, Colombia exported approximately $2469 billion to China, with agricultural products such as coffee and avocado standing out. The simplification of customs procedures promoted by the TFA could reduce costs and transaction times, facilitating access to this expanding market. Additionally, the SAFE framework would enhance security in logistics chains, generating trust among trade actors. The synergy between these agreements could not only help balance Colombia's trade deficit with China but also foster a more robust and sustainable trade relationship, thus driving the country's economic growth in the global context.

The comparison of the logistics performance index between Colombia, China, and the global average for 2023 reveals that, as previously stated, Colombia experienced a decline in the global ranking. However, there are slight improvements noted in the components of infrastructure and punctuality compared to previous years. Therefore, Colombia must continue working on all fronts, especially in customs procedures, tracking, and tracing. Regarding the Asian country, which saw an improvement in the same ranking, positioning itself well above the global average, it demonstrates significant investments in its expansion plan, enhancing the efficiency of transportation and distribution processes for goods (Aviles & Wong González 2019).

Figure 3
Comparison of the LPI between Colombia and China (2023)



Source: Author's own work, using data from the World Bank, LPI 2023.

Conclusion

The logistics performance index between Colombia and China and its impact on bilateral trade has proven to be a determining factor for strengthening bilateral commercial relations. This indicator reflects performance in terms of customs, infrastructure, international shipments, competitiveness and quality of logistic services, punctuality, tracking, and tracing, thereby facilitating the efficiency of logistical operations and fostering the smooth exchange of goods and services between both countries.

For the Colombian case, efforts and improvements in terms of customs, tracking, and tracing were evident with the aim of enhancing competitiveness in the international market, highlighting the optimization of logistic services. In terms of the perceptions of local importers, it is noted that they are partially in agreement with the scenarios in constructing comparative and competitive advantages, indicating a panorama of challenges and opportunities for improvement in the logistic chain to effectively boost international trade.

In the context of bilateral trade relations between Colombia and China, the Port of Chancay can be a catalyst to strengthen trade between the two countries. As Colombia seeks to diversify its exports to Asia, the existence of an efficient port such as Chancay will facilitate access to this vast market. This could not only help balance the trade balance between Colombia and China, but also boost Colombia's economic growth by enabling greater competitiveness of its agricultural and manufactured products in the Chinese market.

On the other hand, for the Chinese case, the government's strengthening in most logistic processes was highlighted as a strategy for its expansion in the global market, achieving efficiency in the logistic chain and cost reduction compared to the international average.

Regarding the study's delimitations and limitations, they relate to the representativeness and sample of the study object. The academic community is invited to consider this research as a foundation for future studies to expand and delve deeper into the topic.

In summary, the study revealed the importance of logistic performance in the expansion of organizations to promote commercial cooperation, facilitating the flow of goods and services between Colombia and China through the development of policies by the states to optimize supply chains, incorporating technological developments and efficient strategies for sustainable development in this relationship.

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DECLARACIÓN DE CONFLICTO DE INTERESES

Los autores declaran no tener ningún conflicto de interés financiero, académico ni personal que pueda haber influido en la realización del estudio.

DECLARACIÓN DE ÉTICA

Los autores declaran haber cumplido con los principios éticos durante el proceso de investigación.

DECLARACIÓN DE CONTRIBUCIÓN DE AUTORÍA

Harold Bustamante Matoma participó en la conceptualización, curación de datos, análisis formal, investigación, metodología, supervisión, administración del proyecto, *software*, supervisión, validación, visualización, redacción del borrador original, redacción, revisión y edición. Jorge Vargas González participó en la conceptualización, curación de datos, análisis formal, investigación, metodología, supervisión, administración del proyecto, *software*, supervisión, validación, visualización, redacción del borrador original, redacción, revisión y edición.