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Article

Peruvian Agro-Exports' Competitiveness: An Assessment of the Export Development of Its Main Products

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Abstract: This study analyzed the competitiveness of Peru's exports of grapes, blueberries, avocados, and asparagus from 2019 to 2023. Data were obtained from the customs declarations of all exporting companies of the analyzed products, along with data from the International Trade Center. Competitiveness was measured using the absolute revealed comparative advantage (RCA) index. The results indicate notable growth in the exports of grapes and blueberries, while asparagus and avocados face challenges in market and exporter diversification. The RCA index suggests a strong and stable specialization in these products. This study concludes with specific recommendations for institutions such as Ministerio de Desarrollo Agrario y Riego (MIDAGRI), Comisión de Promoción del Perú para la Exportación y el Turismo (PROMPERÚ), Asociación de Exportadores (ADEX), and Instituto Nacional de Innovación Agraria (INIA), aimed at enhancing competitiveness through market diversification.

Keywords: agro-exports; Peru; international competitiveness; RCA; export development



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1. Introduction

The Peruvian agro-export sector has demonstrated notable growth and dynamism, especially in recent years, driven by its strategic geographical advantages, favorable climatic conditions, and dedicated efforts towards modernization and quality enhancement. This study holds significance for the Peruvian agro-export sector by providing an analysis of its four main products, serving as an indispensable tool for understanding Peru's strategic position in international business. Furthermore, the research goes beyond the mere assessment of competitiveness, venturing into the exploration of export growth over time. This approach offers a more detailed understanding as it examines the quantitative growth of exports, including market diversity expansion and the analysis of participating companies. Ultimately, it represents a significant contribution to the academic literature in the fields of international trade and agricultural economics. Its value extends beyond understanding the dynamics of the agro-export sector, as it provides a valuable resource for academics and students to grasp the complex dynamics of agro-exports in emerging economies like Peru's. The competitiveness of agro-exports is a topic of utmost importance in the global economy (De Melo and De Carvalho 2024). Internationally, these challenges can be categorized into several fundamental aspects that affect agriculture and its product exports (Femeena et al. 2012). Climate change and environmental issues are among the most significant challenges (Bortz and Toftum 2023). Alterations in climatic patterns, including changes in rainfall and temperature regimes, have a direct impact on agricultural productivity (Liu et al. 2022). The need to adopt sustainable agricultural practices and responsible use of natural resources has become increasingly important and crucial (Laosutsan et al. 2019). Soil degradation, water scarcity, and biodiversity loss are environmental issues that not only threaten the

long-term viability of the agro-export sector but also raise serious questions about the sustainability of current practices (Wang 2018). Furthermore, globalization has created a highly competitive market, requiring agricultural producers to be cost-efficient and quickly adapt to changing market demands (Morales-Marín et al. 2018). The international prices of agricultural products significantly impact the economic stability of exporting countries, underscoring the need for adaptive strategies. On the other hand, trade barriers, both tariff and non-tariff, present a considerable obstacle to the sector (Fiankor and Santeramo 2023). Additionally, protectionist policies of some countries, along with stringent sanitary and phytosanitary regulations, can limit access to key markets (Thorbecke et al. 2021). The dependence on bilateral or multi-lateral trade agreements can also affect the stability of exports (Ando et al. 2022). Moreover, technological innovation plays a crucial role in improving productivity and efficiency. However, the adoption of advanced technologies is often hindered by a lack of investment, infrastructure, and limited access to training and technical assistance (Esquivias et al. 2023).

The technological gap between developed and developing countries is a critical factor, as are logistical and supply chain processes (Peano et al. 2017). Efficiency in transportation and logistics is vital to ensure the quality and freshness of agricultural products, especially perishables (Orjuela-Castro et al. 2021). High transportation costs and inadequate infrastructure can significantly increase operational costs and affect the competitiveness of exports (Rai et al. 2022). Access to financing is another essential aspect, especially for small and medium agricultural producers, who often face difficulties in accessing credit and financing to invest in technological improvements or expand their production (Meng et al. 2023). In the social and labor sphere, working conditions and labor rights in the agricultural sector are of great concern. Issues such as labor exploitation, child labor, and inadequate working conditions not only affect the quality of life of workers but can also negatively impact the perception of products in international markets (Phan 2022). Many developing countries rely heavily on a limited number of primary products for their exports, making them vulnerable to market fluctuations and changes in global demand (Hu et al. 2023). This dependence underscores the need for strategies to diversify both production and export markets (Hossain et al. 2023). Lastly, global consumption patterns are changing, with an increasing focus on organic, ethical, and sustainable products (K. Sharma et al. 2023). Adapting to these emerging trends is a considerable challenge for producers who lack the means or knowledge to modify their productive practices according to these new market demands (Sihombing et al. 2021).

Examining the development of the main agro-export products in five specific countries, particular challenges faced by each in this sector are revealed. In Brazil, despite its prominence in soybean and sugar cane production, the critical challenge of diversifying its agricultural production arises (De Paula Junior 2020). This diversification is essential to reduce dependence on a few crops in the face of market fluctuations (Copetti et al. 2013). Additionally, environmental sustainability has become a significant concern, especially due to deforestation in the Amazon, raising serious doubts about the long-term viability of its agricultural practices (Escobar et al. 2020). Another significant obstacle in Brazil is poor logistical infrastructure, which increases operational costs and decreases the competitiveness of its agricultural exports (Figueira and de Oliveira 2023). In the United States, trade wars, particularly the conflict with China, have negatively impacted farmers, especially soy producers. The debate over agricultural subsidies and their influence on global competition continues to be a relevant discussion point (Dilawari et al. 2022). Despite being a leader in technological innovation, the challenge for the United States lies in maintaining constant adaptation to new technologies and sustainable practices to preserve its competitive edge (Ojede 2015). India faces significant challenges related to productivity and efficiency in its agricultural sector, exacerbated by dependence (Mruthyunjaya 2023). Socio-economic issues, such as rural poverty, farmer indebtedness, and small farm sizes, limit its ability to compete in international markets (Singh and Jyoti 2023). In Kenya, the economy relies

heavily on a limited number of agricultural products for export, such as tea and flowers, making it vulnerable to market fluctuations (Wainaina et al. 2018).

Climatic challenges and extreme weather events disproportionately affect the country, negatively impacting agricultural production (Wanyonyi et al. 2023). Additionally, restricted access to international markets and inadequate financing represent barriers to sector growth. Australia, on the other hand, faces critical issues related to climate change and water resource management, especially in crop production like wheat (Ressia et al. 2022). Recent trade tensions with China have jeopardized important export markets for its agricultural products. Moreover, adapting to strict sanitary and phytosanitary regulations in export markets is a constant challenge for Australia (He et al. 2018). These countries illustrate the diversity of challenges faced by the agro-export sector globally. Each country exhibits a unique set of challenges, reflecting the complexity and dynamic nature of competitiveness in the field of agricultural exports. In Peru, the competitiveness of agro-exports faces a variety of complex challenges ranging from productive diversification to infrastructure and access to technology.

Despite having experienced significant growth in products like blueberries, grapes, avocados, and asparagus, the Peruvian economy still needs to expand its export portfolio to avoid excessive dependence on a few products (Pantaleón Santa María et al. 2022). This dependence could lead to economic vulnerability to demand shifts and price variations, underscoring the importance of exploring new markets and diversifying exportable products (Rojas and Sánchez 2023). In terms of infrastructure and logistics, Peru has seen improvements, yet still faces challenges (Nonalaya et al. 2021). High internal transportation costs and inefficiency in ports are factors that increase export costs and decrease the competitiveness of Peruvian products in the international market (Bossio Valdivia et al. 2017). These logistical aspects are crucial to ensure that products reach international markets in optimal conditions and cost-effectively (Ramos et al. 2019). Access to technology and capital is another challenge for many agricultural producers in Peru. Limited resources restrict producers' ability to improve productivity and product quality and to adapt to the changing demands of global markets (Juarez Malaver 2022). Climate change and the need for environmental sustainability present additional challenges. The effects of climate change are impacting weather patterns and consequently agricultural production. Moreover, the growing international pressure to adopt sustainable agricultural practices requires significant investments and changes in cultivation practices (Coayla and Jiménez 2022).

This is crucial not only for the long-term viability of the agricultural sector but also to meet international expectations on sustainability (Mills-Novoa 2020). Complying with the strict sanitary and phytosanitary standards of international markets is another challenge (Leyva Morales 2023). Maintaining high-quality standards is essential for accessing and remaining in demanding markets, implying a continuous need for investment in quality and compliance with regulations (Parco Espinoza and Mallqui Cunurana 2022). Training and technical education are essential to improve competitiveness. The lack of these opportunities among farmers can limit their ability to adopt better agricultural practices and advanced technologies (Larrea-Gallegos et al. 2019), directly impacting the quality and competitiveness of their products (Carbonell Santillán 2023). Finally, Peru's international trade relations with key countries and economic blocs (Manrique Talledo and Muñoz Peláez 2021) have a significant influence on its ability to export. Successful trade negotiations and the opening of new markets are crucial for the expansion of agro-exports (Urcia Armas and Vivanco Caceres 2022).

The goal is to provide actionable recommendations for policymakers, industry leaders, and exporters to enhance Peru's competitiveness and ensure sustainable growth, contributing valuable insights to international trade and agricultural economics.

From a theoretical perspective, by exploring and analyzing theories related to the competitiveness and trade of agricultural products, this study enriches the academic understanding of these topics and offers new perspectives that can be applied in other contexts and studies. From a practical perspective, by focusing on the evaluation of the

development of the main products, this study provides valuable information for producers and exporters, helping them to better understand market dynamics and optimize their strategies and operations. Socially, by encouraging improved competitiveness, higher income and employment can be generated in the agricultural sector, which in turn can contribute to poverty reduction and social development in rural areas.

Nations benefit from specializing in the production of goods where they have a comparative advantage, that is, where they are relatively more efficient than other countries (Krugman and Obstfeld 2006). In the context of agro-exports, this theory suggests that a country should specialize in the production and export of agricultural products in which it has a comparative advantage, such as in certain crops that benefit from its climate, soil, or agricultural expertise.

Competitiveness: Competitiveness refers to the ability of producers, industries, and the country to produce and export products efficiently and profitably in the international market, with aspects such as productivity, product quality, production and supply chain efficiency, market adaptability, and long-term sustainability (Esterhuizen and van Rooyen 2006). Internal factors include agricultural technology, producers' skills and knowledge, production process efficiency, the quality of inputs and natural resources (Muhammediyev 2023), and supporting infrastructure (like irrigation systems, storage, and logistics). External factors encompass global demand and consumer preferences, international market conditions (R. Zhou et al. 2023), trade policies and tariffs, and global competition. Additionally, sustainability factors related to sustainable production practices (Sharma et al. 2023), natural resource management, and adaptation to climate change are increasingly important to maintain competitiveness in the environmentally conscious global market (Saptana et al. 2023).

The Balassa model of revealed comparative advantage represents a fundamental analytical tool in the study of competitiveness in international trade applied to many studies (Das et al. 2024; Luhwago et al. 2023; De Melo and De Carvalho 2024; Nong et al. 2023; Raman et al. 2023; Saptana et al. 2023; A. Sharma et al. 2023; Shukla et al. 2023; Topcu 2023). Developed by Béla Balassa in 1965, this indicator measures a country's comparative advantage in a specific product, based on actual trade performance rather than theoretical resource endowments (Balassa 1965). Balassa's formula calculates the ratio of a product in a country's total exports relative to the ratio of that same product in total global exports. A value greater than one indicates a revealed comparative advantage, suggesting that the country is relatively more efficient in producing and exporting that product compared to other countries. The application of the revealed comparative advantage indicator in international trade analysis helps identify the products in which a country has real competitive advantages (Hidayat et al. 2023). Focusing on actual trade data, the Balassa model provides a more accurate and practical assessment of comparative advantage, which can significantly differ from predictions based solely on classic economic theory (Tarihoran et al. 2023).

Historically, Peru has undergone a significant transformation in its agricultural sector, evolving from an economy traditionally centered on domestic consumption to a more export-oriented focus. This shift has been driven by a combination of factors, including favorable government policies, investments in infrastructure, and improvements in agricultural practices.

Peru's main agro-export products have shown outstanding performance in the international market. Products like blueberries, coffee, grapes, asparagus, ginger, and avocado have not only gained significant presence in international markets but also demonstrate sustainability over time, leveraging their unique climatic conditions, biodiversity, weather, and the ability of their farmers and companies to adapt to international market demands (Arbulú Ballesteros et al. 2024; Montes Ninaquispe et al. 2024, 2023b).

Globally, the demand for agricultural products has significantly influenced the boom in Peruvian agro-exports (Montes Ninaquispe et al. 2023a). The growing preference in international markets for fresh and high-quality products has opened significant opportunities.

Integrating sustainable practices in agriculture is crucial to ensure the sector's ongoing viability, addressing issues like efficient resource management, soil and water conservation, and carbon footprint reduction (Salmoral et al. 2020). This move towards sustainability not only meets ecological and social responsibilities but also aligns with global market trends, where consumers and trade partners increasingly demand products that adhere to environmental and ethical standards (Z. Zhou et al. 2024). In this regard, sustainable agricultural practices become a differentiating factor that can enhance the competitiveness of agro-exports by improving product quality, fostering innovation, and meeting international standards for sustainable production (Lan and Kien 2021). Finally, the primary objective of this study is proposed: To describe the competitiveness of Peru's agricultural exports by evaluating the export development of its main products. To achieve this, Peru's position among the world's largest exporters will be analyzed, followed by an analysis of the export reality indicators of the products, and finally, the calculation of the RCA competitiveness index.

2. Material and Methods

The research was conducted under a quantitative approach, aimed at collecting and analyzing numerical data to establish patterns and trends in the behavior of Peruvian agro-exports as in previous studies on international trade (Pantaleón Santa María et al. 2021). From this perspective, this study was approached with a descriptive scope, aimed at characterizing and detailing the fundamental properties of the involved variables, without establishing cause-and-effect relationships between them as in Monja Monja Paico's (2023) study. The methodological design adopted was non-experimental, as it was based on the observation and analysis of variables without direct manipulation or control by the researcher (Corona Lisboa 2016). This approach was consistent with the nature of the research, which did not seek to alter the natural conditions of the phenomena studied, but rather to describe them as they appeared in their real context.

In terms of its typology, the research was classified as basic. This orientation implied an approach focused on increasing theoretical knowledge regarding the export competitiveness of the selected products, without an applied focus or aimed at solving specific practical problems (Herbas Torrico and Gonzales 2018). However, the findings could lay the groundwork for future applied studies. Regarding the study population, the most exported sub-items of Peru according to SUNAT Customs records (SUNAT 2023), the official customs body of the country, were selected. The products identified for analysis were grapes, blueberries, avocados, and asparagus, corresponding to the harmonized system subheadings 080610, 081040, 080440, and 070920, respectively (Ministerio de Economía y Finanzas del Perú 2022). The study period covered five years, from 2019 to 2023, determined by the availability of data from the official source until October 2023. The source for evaluating the standardized revealed comparative advantage of these products was the International Trade Center, based on UN COMTRADE statistics and accessible through the TRADEMAP commercial tool (International Trade Center 2024), complementing information related to Peru with the web platform of Peru's customs (Sunat Customs). The sample for the study was equivalent to the population, which implied an exhaustive analysis of each of the mentioned products.

Regarding the application of the Balassa indicator, the methodological design involves a detailed analysis of the country's agricultural exports compared to global trade. There are some limitations with the Balassa indicator as it does not consider internal production capacity or governmental policies that may influence exportation. The formula is expressed as follows:

$$IB = \frac{\frac{X_k^i}{X^i}}{\frac{X_k}{X}} \quad (1)$$

where X_k^i represents the total value of exports of a specific product k from country i , while X^i expresses the total exports made by country " i ". On the other hand expresses the total

exports carried out by country “*i*”. On the other hand, X_k indicates the total value of exports of product *k* from all over the world, while X represents the total exports made in the world. Based on the RCA, another much more accurate indicator was created, as evidenced when applied in some studies (Elsalih et al. 2021; Erkan and Bozduman 2022; Andrés González-Moralejo et al. 2021; Hasan et al. 2024; Saki et al. 2019; Seleka and Dlamini 2020). The formula is as follows:

$$IB = \frac{RCA_k^i - 1}{RCA_k^i + 1} \quad (2)$$

Understanding the results:

[−1,0) -> The country “*i*” does not have a revealed comparative advantage in product “*k*”;
(0,1] -> The country “*i*” has a revealed comparative advantage in product “*k*”.

3. Results

Table 1 presents the global grape exports in millions of USD by the major exporters from 2019 to 2023. During this period, Peru stands out as the country with the highest growth in its exports, increasing by 114.9% from USD 811.8 million in 2019 to USD 1745.5 million in 2023, with a high standard deviation of USD 353.6 million, indicating significant fluctuations. The most significant year for Chile was 2021, with an increase of 109.5% reaching USD 1732.7 million, but it also exhibited a high standard deviation of USD 386.0 million, reflecting variability. China experienced its highest export volume in 2020, with a 22.8% increase compared to 2019, showing moderate variability with a standard deviation of USD 202.0 million. In terms of the least variation, the United States of America shows a relatively stable trend, with a decrease of 10.1% from USD 855.1 million in 2019 to USD 768.4 million in 2023 and a low standard deviation of USD 39.7 million, indicating more stable export values. The average annual growth of exports across all countries shows considerable variability, with Peru having the highest average annual increase, while countries like Chile and China exhibit a decreasing trend.

Table 1. Global grape exports in millions of USD.

Exporters	2019	2020	2021	2022	2023
Chile	953.1	933.2	826.9	1732.7	811.2
Peru	811.8	991.1	1195.8	1292.4	1745.5
Italy	724.6	839.3	891.9	772.0	887.8
South Africa	521.2	520.2	708.5	764.3	615.2
United States of America	855.1	822.3	777.0	764.1	768.4
Netherlands	721.7	794.6	920.7	749.2	1029.3
China	987.2	1212.7	757.1	726.7	813.9
Spain	343.2	471.3	516.3	424.0	356.1

Note. Data taken from [International Trade Center \(2024\)](#).

Table 2 highlights an upward trend in Peruvian grape exports. During this period, the net weight of exports experienced a notable growth of 72.3%, with an average annual growth rate of 14.3%. Similarly, the FOB value increased by 102%, corresponding to an average annual growth rate of 19.6%. However, the number of destination countries and exporting companies showed fluctuations and a slight overall decrease, reflecting potential challenges in market diversification and the sustainability of the number of exporters. The year 2023 stood out as the best year in terms of both net weight and FOB value, while 2022 was the worst year in terms of the number of exporting companies, with a decrease of 9.4% compared to the previous year. The standard deviation of the net weight (99.5) and FOB value (358.3) indicates significant variability in these indicators over the analyzed period.

Table 2. Basic indicators of Peruvian grape exports.

Years	2019	2020	2021	2022	2023
Destination countries	59	56	58	53	55
Number of companies	157	140	149	132	140
Net weight thousand MT	376.5	442.4	513.1	554.7	648.6
FOB value million USD	877.5	1035.5	1249.8	1345.9	1772.6

Note. Data taken from the DAM registered in [SUNAT \(2023\)](#).

Table 3 presents the absolute revealed comparative advantage (ARCA) index in grapes. The consistent upward trend in the ARCA index indicates a strengthening of comparative advantage over this period. The highest average annual growth rate during this period was approximately 0.84%, while the lowest was around 0.21%. The average annual growth rate across the years was 0.42%, with a standard deviation of 0.0073. This steady increase reflects a positive development in the country's ability to compete in the global grape market, demonstrating enhanced efficiency and performance in grape production and export relative to other countries.

Table 3. Index of absolute revealed comparative advantage in grapes.

Year	2018	2019	2020	2021	2022	2023
Index	0.948	0.951	0.959	0.961	0.966	0.968

Note. Data taken from the DAM registered in [SUNAT \(2023\)](#).

Table 4 presents the global blueberry exports. Peru stands out with the highest annual percentage growth, achieving an average annual growth rate of 20.04%, accompanied by a standard deviation of 5.43, indicating moderate variability. The Netherlands shows significant growth with an average annual growth rate of 16.75% and a standard deviation of 16.53, reflecting considerable variability in its exports. Chile, on the other hand, experiences a constant decline with a negative average annual growth rate of −7.39% and a standard deviation of 10.74, indicating moderate variability in its decreases. Spain presents an average annual growth rate of 10.67% with a standard deviation of 23.69, suggesting significant fluctuations. The United States maintains relative stability with an average annual growth rate of 5.55% and a standard deviation of 11.32, indicating moderate variations. Canada records an average annual growth rate of 6.28% and a standard deviation of 15.97, reflecting considerable variability. Finally, South Africa shows an average annual growth rate of 11.86% and a standard deviation of 10.31, indicating stability with slight annual variations.

Table 4. Global blueberry exports in million USD.

Exporters	2020	2021	2022	2022	2023
Peru	809.62	1002.98	1201.36	1350.98	1675.97
Netherlands	408.73	499.84	561.61	542.31	736.41
Chile	571.19	527.01	563.61	508.64	411.97
Spain	377.94	432.31	602.74	493.45	528.01
United States of America	251.77	250.06	306.38	307.59	307.46
Canada	156.21	135.39	152.14	189.07	192.46
South Africa	106.49	125.14	152.80	150.73	164.59

Note. Data taken from [International Trade Center \(2024\)](#).

In Table 5, the number of destination countries had an average growth rate of 6.21% with a standard deviation of 18.23%, experiencing the highest growth in 2023 and the greatest decline in 2022. The number of companies involved grew at an average annual rate of 16.10%, with a standard deviation of 27.08%, showing the highest growth in 2023 and the greatest decline in 2021. The net weight of exports saw an average annual growth of 16.38% and a standard deviation of 27.80%, with 2022 marking the highest increase and 2023 the

largest decrease. The FOB value exhibited an average annual growth rate of 19.88% and a standard deviation of 6.56%, with the highest growth in 2023 and the greatest decline in 2022. In conclusion, the indicators show an overall growth in Peruvian blueberry exports, albeit with some variability, with 2023 standing out as a year of significant growth and 2022 experiencing notable declines, especially in the number of destination countries and FOB value.

Table 5. Basic indicators of Peruvian blueberry exports.

Years	2019	2020	2021	2022	2023
Destination countries	36	35	35	33	44
Number of companies	70	84	71	78	117
Net weight thousand MT	125.04	163.83	206.38	275.66	206.61
FOB value million USD	814.56	995.67	1185.50	1319.66	1674.82

Note. Data taken from the DAM registered in [SUNAT \(2023\)](#).

In Table 6, the index had an average growth rate of 0.18% with a standard deviation of 0.34%. The highest growth was observed in 2020, while the greatest decline occurred in 2021. This suggests that while the comparative advantage of Peruvian blueberries has been relatively stable, there was a slight increase in 2020 followed by a minor decline in 2021. This suggests an improvement in the country's competitive standing in the global blueberry market, showcasing increased efficiency and effectiveness in blueberry production and export compared to other nations.

Table 6. Index of absolute revealed comparative advantage in blueberries.

Year	2019	2020	2021	2022	2023
Index	0.979	0.983	0.980	0.984	0.986

Table 7 presents global avocado exports. Mexico stands out with the highest annual percentage growth, achieving an average annual growth rate of 2.53%, accompanied by a standard deviation of 9.32, indicating moderate variability. The Netherlands shows significant growth with an average annual growth rate of 13.93% and a standard deviation of 29.11, reflecting considerable variability in its exports. Peru, on the other hand, experiences moderate growth with an average annual growth rate of 8.04% and a standard deviation of 22.14, indicating moderate variability in its increases. Spain presents an average annual growth rate of 3.49% with a standard deviation of 10.32, suggesting moderate fluctuations. The United States maintains relative stability with an average annual growth rate of −4.20% and a standard deviation of 8.52, indicating moderate variations. Chile records an average annual growth rate of −3.77% and a standard deviation of 17.36, reflecting moderate variability. Colombia shows substantial growth with an average annual growth rate of 25.94% and a standard deviation of 33.21, indicating significant variability. Finally, South Africa shows an average annual growth rate of 20.33% and a standard deviation of 17.00, indicating considerable growth with moderate annual variations.

In Table 8, the number of destination countries had an average growth rate of 16.10% with a standard deviation of 27.08%, experiencing the highest growth in 2023 and the greatest decline in 2021. The number of companies involved grew at an average annual rate of 16.39%, with a standard deviation of 27.81%, showing the highest growth in 2022 and the greatest decline in 2023. The net weight of exports saw an average annual growth of 19.88% and a standard deviation of 6.55%, with 2023 marking the highest increase and 2022 the largest decrease. The FOB value exhibited an average annual growth rate of 16.10% and a standard deviation of 27.08%, with the highest growth in 2023 and the greatest decline in 2021. In conclusion, the indicators show an overall growth in Peruvian avocado exports, albeit with some variability, with 2023 standing out as a year of significant growth and 2021

experiencing notable declines, especially in the number of destination countries and FOB value.

Table 7. Global avocado exports.

Exporters	2019	2020	2021	2022	2023
Mexico	2912.59	2665.85	3045.66	3143.31	3179.00
Netherlands	886.30	1059.18	1158.08	905.03	1345.91
Peru	751.33	759.05	1048.30	894.27	963.43
Spain	384.65	442.89	462.01	415.79	434.57
Chile	300.70	219.38	214.19	212.91	244.73
Colombia	89.05	146.03	204.59	179.26	200.90
United States of America	154.26	164.46	156.71	149.71	128.42
South Africa	70.76	76.87	110.49	118.14	144.17

Note. Data taken from [International Trade Center \(2024\)](#).

Table 8. Basic indicators of Peruvian avocado exports.

Years	2019	2020	2021	2022	2023
Destination countries	70	84	71	78	117
Number of companies	125.0	163.8	206.4	275.7	206.6
Net weight thousand MT	814.6	995.7	1185.5	1319.7	1674.8
FOB value million USD	70	84	71	78	117

Note. Data taken from the DAM registered in [SUNAT \(2023\)](#).

In Table 9, the index had an average growth rate of 0.16% with a standard deviation of 0.32%. The highest growth was observed in 2023, while the greatest decline occurred in 2022. This indicates that the comparative advantage of Peruvian avocados has shown a slight but consistent increase over the years, with a notable peak in 2023 and a minor setback in 2022. This trend suggests an improving competitive position in the global avocado market, reflecting increased efficiency and performance in avocado production and export relative to other countries.

Table 9. Index of absolute revealed comparative advantage in avocado.

Year	2019	2020	2021	2022	2023
Index	0.960	0.963	0.965	0.962	0.966

Table 10 presents global asparagus exports in million USD. Peru shows marginal growth with an average annual growth rate of 0.05% and a standard deviation of 7.71, indicating moderate variability. Mexico experiences a decline with an average annual growth rate of −4.09% and a standard deviation of 14.58, reflecting considerable variability. The United States maintains relative stability with an average annual growth rate of −1.93% and a standard deviation of 11.29, indicating moderate variations. Spain presents a robust growth rate with an average annual growth rate of 7.49% and a standard deviation of 22.68, suggesting significant fluctuations. The Netherlands shows minimal growth with an average annual growth rate of 0.59% and a standard deviation of 23.08, indicating high variability. Italy demonstrates substantial growth with an average annual growth rate of 21.98% and a standard deviation of 40.42, reflecting significant variability. France also shows significant growth with an average annual growth rate of 7.49% and a standard deviation of 32.34, indicating high variability. Finally, Greece exhibits a strong growth rate with an average annual growth rate of 19.29% and a standard deviation of 35.23, indicating considerable variability.

Table 10. Global asparagus exports in million USD.

Exporters	2019	2020	2021	2022	2023
Peru	394.01	377.10	400.97	366.43	391.23
Mexico	449.19	386.36	416.26	336.54	367.00
United States of America	163.57	144.45	156.27	137.98	148.34
Spain	78.84	88.54	120.26	98.33	98.40
Netherlands	83.01	75.80	97.86	73.34	78.48
Italy	31.16	41.41	60.00	37.28	55.17
France	25.78	26.15	40.20	31.58	30.39
Greece	13.69	20.09	28.75	20.22	23.65

Note. Data taken from [International Trade Center \(2024\)](#).

In Table 11, the number of destination countries had an average decline of -1.15% with a standard deviation of 5.71% , experiencing the highest growth in 2021 and the greatest decline in 2023. The number of companies involved showed an average annual decline of -1.26% and a standard deviation of 6.99% , with the highest growth in 2023 and the greatest decline in 2022. The net weight of exports saw an average annual decline of -6.84% and a standard deviation of 12.83% , with 2021 marking the highest increase and 2023 the largest decrease. The FOB value exhibited an average annual decline of -0.40% and a standard deviation of 6.10% , with the highest growth in 2023 and the greatest decline in 2022. In conclusion, the indicators show a general decline in Peruvian asparagus exports over the period, with some variability, highlighting 2023 as a year of recovery in some aspects and 2022 as a year of notable declines.

Table 11. Basic indicators of Peruvian asparagus exports.

Years	2019	2020	2021	2022	2023
Destination countries	40	40	41	42	38
Number of companies	89	86	82	77	84
Net weight thousand MT	133.97	128.02	135.98	129.69	97.90
FOB value million USD	400.19	387.07	399.38	369.56	391.62

Note. Data taken from the DAM registered in [SUNAT \(2023\)](#).

In Table 12, the index had an average growth rate of 0.10% with a standard deviation of 0.24% . The highest growth was observed in 2023, while the greatest decline occurred in 2022. This indicates a stable but slightly increasing comparative advantage of Peruvian asparagus over the years, with a significant rise in 2023 following a minor decline in 2022.

Table 12. Index of absolute revealed comparative advantage in asparagus.

Year	2021	2022	2022	2022	2023
Index	0.985	0.982	0.985	0.986	0.987

4. Discussion and Conclusions

This study has evaluated the competitiveness and export development of Peru's main agro-export products: grapes, blueberries, avocados, and asparagus, revealing several key points that contrast with the existing literature.

The results show significant growth in grape exports, which aligns with previous studies highlighting the potential of Peruvian grapes in the international market due to favorable climatic conditions and improvements in cultivation techniques ([Juarez Malaver 2022](#)). However, the high variability in exports reflects challenges in stability, indicating the need for more efficient logistics infrastructure and reduced transportation costs to maintain competitiveness ([Juarez Malaver 2022](#); [Ramos et al. 2019](#)). This finding is consistent with observations by authors emphasizing the importance of infrastructure improvements to ensure products reach international markets in optimal conditions ([Nonalaya et al. 2021](#)).

Peru has also shown notable growth in blueberry exports, consistent with the increasing demand in international markets reported in the literature (Bossio Valdivia et al. 2017). However, significant fluctuations in the number of destination countries and exporting companies suggest challenges in market diversification and exporter sustainability. This variability indicates that despite growth, there are obstacles that need to be addressed to ensure more stable and continuous development (Carbonell Santillán 2023). This reinforces the need to diversify both the markets and the base of exporting companies to reduce dependency and improve resilience (Roja and Sánchez 2023; Urcia Armas and Vivanco Caceres 2022).

In the case of avocados, the moderate growth in exports contrasts with expectations of more robust development due to Peru's comparative advantages in avocado production (Coayla and Jiménez 2022; Mills-Novoa 2020; Salmoral et al. 2020). The observed variability suggests that factors such as market access and logistics infrastructure remain significant challenges (Nonalaya et al. 2021). Furthermore, although the revealed comparative advantage index shows a positive trend, the lower consistency compared to other products highlights the need for specific strategies to strengthen the competitiveness of avocados in the global market (Larrea-Gallegos et al. 2019; Parco Espinoza and Mallqui Cunurana 2022). This aligns with arguments by authors advocating for improvements in technology access and capital to enhance productivity and product quality (Leyva Morales 2023).

For asparagus, the results indicate marginal growth in exports, contrasting with expectations of more solid development as suggested by the literature (Esterhuizen and van Rooyen 2006; Ramos et al. 2019). The significant variability in indicators suggests that Peru faces substantial challenges in the sustainability of asparagus exports (Lan and Kien 2021). This underscores the need to improve agricultural practices and supporting infrastructure to maintain competitiveness in this sector (Bossio Valdivia et al. 2017). The literature emphasizes that adopting sustainable practices and investing in technology are crucial to overcoming these challenges (Juarez Malaver 2022). The revealed comparative advantage index shows a positive trend for grapes, blueberries, and avocados, indicating improved efficiency and performance compared to other countries (Montes Ninaquispe et al. 2021). However, asparagus presents a less consistent comparative advantage, with variations reflecting challenges in maintaining solid and continuous competitiveness (Saki et al. 2019). These findings suggest the need for adaptive and resilient strategies focused on the continuous improvement of logistics infrastructure, technology access, and market diversification to ensure sustained growth (Larrea-Gallegos et al. 2019).

The results of this study on the competitiveness and export development of Peru's main agro-export products highlight several key areas that need to be addressed to improve the sector's efficiency and sustainability.

Firstly, Peru has shown remarkable growth in grape exports, significantly increasing export volumes between 2019 and 2023. However, this growth is accompanied by high annual variability, indicating significant fluctuations in exports. Despite the growth, this variability underscores the need to improve the stability of exports through investments in logistics infrastructure and greater transportation efficiency. Modernizing roads, ports, and internal transportation systems is essential to reduce costs and ensure that products reach international markets in optimal conditions.

Conversely, blueberry exports have also shown impressive growth, with a high annual growth rate. However, variability in export destinations and the number of exporting companies suggests challenges in market diversification. Although blueberry exports are on the rise, it is crucial to address market stability and diversification to ensure sustained growth. This involves exploring new international markets and supporting more producers and companies to integrate into the export chain, thereby reducing dependency on a few markets and exporters.

Regarding avocados, exports have grown moderately, reflecting positive performance but with significant variability. This trend indicates that while Peru is improving its competitive position in the global avocado market, it still faces challenges in terms of

efficiency and consistency in production and export. Adopting advanced technologies and providing technical training are fundamental to improving productivity and product quality, enabling Peruvian farmers to better meet global market demands.

In contrast to other products, asparagus exports have shown marginal growth and high variability. The revealed comparative advantage index suggests slight stability but with challenges in achieving sustained growth. The decline in the number of destination countries and exporting companies in certain years underscores the need for specific strategies to enhance the competitiveness and sustainability of asparagus exports. Adopting sustainable and efficient agricultural practices is crucial to ensure the sector's long-term viability, especially considering international pressure and the effects of climate change.

5. Recommendations

The results show a high variability in the exports of products such as grapes, which have grown significantly but exhibited large annual fluctuations. This underscores the urgent need to improve logistical infrastructure. It is essential to invest in the modernization of roads, ports, and internal transportation systems to reduce transportation costs and ensure that products reach international markets in optimal conditions. This improvement will not only increase logistical efficiency but also stabilize the observed fluctuations in exports, as seen in the export data for grapes and blueberries.

The data reveal significant fluctuations in the number of destination countries and exporting companies, especially in products such as blueberries and avocados. Although there has been notable growth in exports, these fluctuations suggest a vulnerability due to reliance on a few markets and exporting actors. It is crucial to diversify both export markets and the base of exporting companies. This involves exploring new international markets and supporting more producers and companies to integrate into the export chain, thereby reducing market fluctuation vulnerabilities and improving the stability and sustainability of Peruvian exports.

The variability in the competitiveness of products such as avocados and asparagus, which show less consistent growth, indicates the need for greater investment in agricultural technology and training for producers. The adoption of advanced technologies and technical training can significantly improve productivity and product quality, enabling Peruvian farmers to better adapt to the demands and standards of the global market. This investment in technology and training is essential to close the competitiveness gap and enhance productive efficiency, which will result in greater consistency and growth in exports.

MINAGRI must implement policies that encourage investment in infrastructure and agricultural technology, as well as training programs for farmers, focusing on improving logistical efficiency and the adoption of sustainable practices. PROMPERÚ should develop export promotion strategies that include market diversification and the enhancement of the image of Peruvian products abroad, promoting international fairs and trade missions to explore new markets and strengthen existing ones. ADEX should facilitate access to financing and technology for small and medium-sized producers, offering training and technical assistance programs to strengthen the export base and improve the competitiveness of Peruvian products. INIA should promote research and development in sustainable agricultural practices and innovative technologies, collaborating with educational institutions and the private sector to transfer advanced knowledge and technologies to farmers.

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