



Research Article

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Received: 17 December 2023 / Accepted: 27 February 2024 / Published: 5 March 2024

Diversification of Fresh Asparagus Exports from Perú

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DOI: <https://doi.org/10.36941/jesr-2024-0041>

Abstract

This quantitative descriptive study examined the diversification of asparagus exports in Peru using the Herfindahl-Hirschman Index (HHI). The results show a clear dominance of the United States as the main export destination, although there was an annual decrease of 6.7% in 2022. The HHI revealed a growing trend towards greater market concentration in Peruvian asparagus exports. At the company level, despite a general decrease in the number of exporting companies, significant growth was observed in some of them, such as Agrícola Cerro Prieto and Agrovisión. Based on these results, it is recommended that Peruvian companies seek further diversification of their export markets to minimize dependence on a single market and develop adaptable and resilient business strategies to cope with a constantly evolving market.

Keywords: International Trade, Exports, HHI, Peru Exports, Asparagus

1. Introduction

International trade, a fundamental pillar of the global economy, is based on the theory of comparative advantage, which argues that countries benefit from specializing in the production and export of goods and services in which they have a relative advantage (Casanova & Zuaznabar, 2018). This principle, first formulated by David Ricardo in the 19th century, remains a cornerstone of contemporary international economics. Exports, as a major component of international trade, play a crucial role in economic growth and the development of countries (Walter, 2022). They enable countries to leverage their comparative advantages, generate employment, increase productivity, improve the trade balance, and even establish trade agreements (Ando et al., 2022; Kwark & Lim, 2020; Yoshimatsu, 2020).

In light of countries' concern to maintain their export hegemony, the alternative of diversifying their exports emerges, which entails expanding the range of exported goods and services, as well as diversifying export markets and even diversifying exporting companies (Canh & Thanh, 2022).

According to the product life cycle theory, diversifying exports can be an effective strategy for countries, as it allows them to advance their economic development and reduce their dependence on a limited number of products or markets (Swathi & Sridharan, 2022). Consequently, diversifying exports has multiple benefits, including reducing vulnerability to price fluctuations and market volatility, improving competitiveness, and promoting innovation and technological development (Gnangnon, 2022). However, it also represents challenges, such as the need to invest in new production capabilities, adapt to the norms and regulations of new markets, and manage the risks associated with entering unknown markets (Nguyen et al., 2022).

The diversification of exports and export markets has proven to be a successful approach for several countries, especially in the context of fruit exports (LaFevor, 2022). This diversification process can be an effective strategy for developing countries to advance their economic development and reduce their dependence on a limited number of products or markets (Vázquez, 2016).

For example, Mexico has diversified its fruit exports to Asia and Europe, in addition to its traditional market in the United States (Agosin & Chancí, 2015). This process has involved a series of strategies (Cardoso, 2018). Firstly, the country has leveraged its comparative advantages such as its favorable climate for fruit and asparagus production and its proximity to the markets of the United States and Canada. Secondly, the mentioned country invested in improving its production and export infrastructure, such as modernizing processing and packaging facilities and enhancing logistics and transportation systems (Blanco et al., 2020). Thirdly, it established trade agreements with several countries in Asia and Europe, facilitating access to these markets (Maya et al., 2011).

On the other hand, Spain has expanded its asparagus exports to Middle Eastern and North African countries (International Trade Center, 2023). This expansion has been driven by a series of factors: the growing demand for asparagus in these markets, the adaptation of asparagus varieties to Spain's climatic and agricultural conditions, and the improvement of the country's production and export capabilities (Pérez et al., 2022). Through these strategies, Spain has managed to diversify its export markets, reducing its dependence on European markets and increasing its economic resilience (Rosal, 2019).

In other countries, it is evident how diversifying exports can open new market opportunities and improve the economy of companies (Alkhathlan et al., 2020). However, the complexity and challenges associated with this process are also highlighted (Quiñonez et al., 2021). Diversifying exports requires a deep understanding of international markets, consumers, and non-tariff entry barriers. It also requires significant investment in new production capabilities and the improvement of export infrastructure (Li et al., 2022).

These experiences help us understand that countries can advance their economy through export diversification. However, it is also suggested that this process is influenced by a series of contextual factors, including countries' comparative advantages, international market conditions, government and companies' policies and strategies (Markakkaran & Sridharan, 2022). Additionally, the

importance of Michael Porter's theory of competitive advantage is highlighted, as he states that companies and countries can enhance their competitiveness through innovation and improving their production and export capabilities (Vivoda, 2022).

The intricate architecture of international business dictates that corporations must navigate through multiple economic, political, and cultural environments, which implies a constant confrontation with diversity and uncertainty. Diversification of companies, this is, the strategic expansion of their product or service portfolio, is a crucial component to ensure sustainability and business resilience in this scenario of globalization (Uzundumlu et al., 2022). This tactic is used to mitigate the risks associated with excessive dependence on a single product line or specific market niche while leveraging opportunities for innovation and added value creation. Diversification involves conscious and systematic exploration of new business areas, vertical or horizontal integration, and capturing inter-company synergies (Swathi & Sridharan, 2022). All of this can be enhanced by aligning with the existing capabilities of the company, identifying market gaps, and orienting towards future industry trends.

On the other hand, market diversification, the act of introducing and promoting products or services in multiple geographic markets, is a strategic imperative that can drive a company's growth and global competitiveness (Zhou & Tong, 2022). This process involves careful assessment of market suitability, cultural adaptability, entry and exit barriers, competitive dynamics, regulatory trends, and partnership or acquisition opportunities. Similarly, it requires a well-articulated differentiation and positioning strategy that fits the specific characteristics of each market, resulting in product adaptation, pricing, placement, and promotion according to the local market environment (Siddiqui & Afzal, 2022). Finally, it is not only a measure to dissipate risks but also a way to access new consumers, leverage economies of scale, explore learning opportunities, and maximize competitive advantage in the international arena (Cervera & Compés, 2018).

Asparagus exports have experienced significant growth worldwide in recent years. According to the Food and Agriculture Organization of the United Nations, (2023), in 2022, the global trade of fresh asparagus exceeded 2.5 billion dollars. Countries such as Peru, Mexico, China, and Spain stand out as the main exporters, while the United States, Canada, and Germany are among the major importers.

In the highly competitive and globalized economy of the present, the diversification of Peru's important product exports becomes a crucial strategy to increase the competitiveness of the Peruvian agricultural sector (Montes, Pantaleón, et al., 2023). This diversification, understood as the process of expanding the sales of flagship products to a wider range of international markets (Montes, Pantaleon, et al., 2023), involves a meticulous evaluation of global demand, consumer preferences, health regulations, as well as tariff and non-tariff barriers that could affect the introduction of many Peruvian products into new markets (Yllescas-Rodríguez et al., 2021). In this context, it is vital to consider bilateral and multilateral trade agreements, such as free trade agreements, that can facilitate market access and reduce transaction costs (Barrientos-Felipa & Motta, 2020). Through export diversification, the goal is not only to mitigate risks associated with dependence on a limited number of markets but also to seize opportunities to increase profitability and value-added of Peruvian products, thus strengthening Peru's position as a relevant player in international trade (Escalante et al., 2022).

Based on the aforementioned, the aim is to conduct a study that describes the diversification of Peru's asparagus exports through the diversification of its markets and companies, as it is of vital importance to support sustainable growth in this agricultural industry. In this context, the proposal of a predictive model for asparagus export is added, becoming a crucial instrument to anticipate market trends, assess probabilities of success, and minimize risks associated with diversification.

2. Background

There is a study of the Mexican case in diversification of exports of mango, which depend highly on the American market. The authors of this investigation propose Japan as a new destination for the

fruit, and also the implementation of added value to the fruit, in order to have new presentations derived from the product, other than the raw extracted mango (Maya et al., 2011).

Another investigation was carried out to identify the relationship between the diversification of the exports and exports performance, basing in the case of Spain as an exporting country, analyzing its products on a broadly basis. The results of this paper conclude that there is a direct relationship between both variables (Pérez et al., 2022).

Saudi Arabia is also considered in a study where it is determined that the exports are mainly concentrated in the oil, product that also is matter of concentration within the country production. The authors also make a causalities analyses that involve the export concentration of this country (Rosal, 2019).

Ecuadorian mango also became a matter of investigation. A research about the geographical diversification of the exports of this product was made in the period 2016-2020. The results show that the most part of the shipments of mango are destined to United States. It is concluded that the public sector has a relationship with this high degree of dependency on the American market (Quiñonez et al., 2021).

A study that involved 101 countries was carried out, in which the product diversification was analyzed and its effect on the economic growth, basing on the gross domestic product per capita. The developed countries trend to diversify more their products, it is recommended that they focus on their more productive ones, whilst the developing countries show big efforts in diversifying their products to ameliorate their situation (Markakkaran & Sridharan, 2022).

The liquefied natural gas is another object of analysis in a study where the diversification of Australia, Qatar, United States, Russia and Malaysia (the main exporters of this product) is analyzed. The results demonstrate that all these countries have made efforts to diversify their markets. Another activity made in this study is that the researchers proposed different ways of diversification, from which the geographical realm and the price are relevant to analyze (Vivoda, 2022).

The asparagus industry in Peru stands as a foundational pillar within the country's agro-export sector, playing a pivotal role in the national economic dynamics through its significant contribution to foreign exchange earnings and job creation (Pairazaman, 2023). Historically, the cultivation of asparagus in Peru traces back several decades, but it was not until the implementation of economic liberalization policies and export promotion strategies in the 1990s that the industry witnessed exponential growth, elevating Peru to one of the world's foremost asparagus exporters (Quispe, 2023). This growth was underpinned by the adoption of innovative agricultural practices, investment in irrigation technology, and leveraging the favorable climatic conditions the country offers, enabling year-round harvesting (Mori & Castillo, 2023).

Key players in the industry range from small producers to large agro-exporters, including associations, governmental entities, and sector support organizations, collectively forging a robust and internationally competitive value chain (Avalos, 2023). However, the industry faces significant challenges in its endeavor to diversify export markets. These challenges encompass adapting to international quality and sustainability standards, the volatility of international prices, trade and tariff barriers, and the need for greater innovation and added value in the products offered (Lévano, 2023). Moreover, climate change emerges as a latent challenge, threatening the sustainability of the essential water resource for crop irrigation, thereby jeopardizing the sector's productive capacity.

Overcoming these obstacles necessitates integrated strategies that involve the continuous improvement of production processes, market diversification through the exploration of specific niches, and the promotion of sustainable agricultural practices (Chavez, 2023). Furthermore, the strengthening of strategic alliances between the public and private sectors is essential to enhance access to technologies, financing, and international markets. In this context, the Peruvian asparagus industry faces the imperative need to adapt and continually evolve to maintain its competitiveness on the global stage, thereby ensuring its long-term contribution to Peru's economic and social development. In the realm of exports, Peru has demonstrated remarkable progress characterized by sustainability and innovation (Montes, et al., 2023).

3. Theoretical Bases

It is known that the international trade is an important base of the economy. The commerce comprehends goods and services (Jerzy & Oleksandr, 2022). International trade is underpinned by the theory of the comparative advantage, which indicated that the nations will trade the goods in which they will be more efficient (Halkos et al., 2021).

Efficiency is not the only condition to make productive international business, because there has to be a guarantee of the continuity of the economic development. Following this idea, it is necessary to not to focus in a single market for exports. It is mandatory to adopt diversification and not only for markets, but for products. The agricultural sector, in this way, has a challenge in adopting added-value chains for their products, too (Canh & Thanh, 2022; Constantin et al., 2023).

The theory of the export-driven economic development vis-à-vis diversification bases on the premise that the diversification of products by the enterprises will reduce the degree of exposition of the company to economic fluctuations. In addition, product diversification endows a business with technology and opportunities of longer terms with their customers (Abdullahi et al., 2021; Damijan et al., 2020; Lemessa et al., 2018).

Although diversification has benefits for economy and business, there are countries that are limited in resources. In that case, there is a limitation to diversification and the primary produce is the option, alongside other sectors such as tourism. In these countries, there is also a high degree of vulnerability to outer factors (Amare et al., 2019; Ben et al., 2022; Brummitt et al., 2020; Hodey et al., 2015; McIntyre et al., 2018; Parteka & Tamberi, 2013; Tabash et al., 2022).

On diversification of exports, there are two currents: the market destination diversification theory and the exporting entity destination theory. The first one states that the more markets a country makes business with, the better this country deals with the risks associated to have only one destination and have a high degree of dependence on it (Fassio, 2018; Jaffee, 2023; Maertens & Swinnen, 2009; Quiñónez et al., 2021). Market diversification implies the adoption of business strategies, such as research and development [8, 32].

On the other hand, export entity diversification bases on the premise that a large number of export enterprises are more convenient than a small number of them, in the matter of facing risks linked to enterprise dependence in the economy of a country (Porter, 2008). Conditions to promote company diversification are policies for creating productive business, technology investments, creation of human capabilities to run and operate in these companies, efficiency in the production operations and the implementation of adequate infrastructures for these ends. Another benefit of relying in a plethora of enterprises is that the country resists better outer threats, such as the fluctuations of the price of the product (Barney, 1991; Karahan, 2017).

4. Materials and Methods

A quantitative, descriptive, and non-experimental research methodology was employed to examine the phenomenon of asparagus export diversification in Peru. This approach involved systematic collection of quantitative data that were used to describe observable characteristics, patterns, and trends in a specific context, without manipulating the variables of interest or creating controlled experimental conditions. Through this non-experimental study, authenticity and reliability of observations were ensured, providing an objective and rigorous snapshot of the state of asparagus trade without intervening or altering the natural conditions of this market, just as in other investigations related to agricultural products from Peru (Montes et al., 2023)

To determine the degree of asparagus export diversification, the Herfindahl-Hirschman Index (HHI) was used. This widely accepted measure in economics and international trade to quantify market, companies and goods concentration and, therefore, diversification. The index was calculated by summing the squares of the market shares of individual companies or countries in a specific market. The interpretation of the HHI is the following: if $1500 \leq \text{HHI} \leq 2500$, it indicated a moderate

concentration; and if $HHI \geq 2500$, the concentration is considered high (Department of Justice - The United States, 2018).

The national subheading analyzed was 0709200000, corresponding to fresh or refrigerated asparagus. This analysis was based on records from Peru's customs declarations in their web portal, which provided a comprehensive and up-to-date database of export operations. Thus, the study population consisted of all data recorded by exporting companies during the period starting in 2018 and finishing in 2022. Therefore, exhaustive coverage of relevant commercial transactions was ensured. Likewise, it allowed a detailed analysis of trends, volumes, destinations, and companies involved in asparagus exports.

5. Results

Data on world importations of asparagus can be seen in Table 1. Centering around the share of the import countries, Germany led the international purchases in 2018. Since 2019 and until 2022, the American market was at the top of the list, having 63.8% of share in 2022. The following countries of destination have smaller portions, but still relevant: they are Canada (5.3%), Germany (4.8%), Spain (3.2%), France (2.9%), United Kingdom (2.8%) and the Netherlands (2.7%).

About the average growth of the imports in the period of study, the only country that had a positive average rate was United States, with 1.5%. Other than this, the market with the smallest negative average rate was Belgium with -0.1% and the destination of the biggest average decrease was the Japanese one, with 9.8%.

The maximum annual growth rates are also important in this analysis. The Netherlands, Belgium and Spain have the largest annual growths, being 31.3%, 26.5% and 20% respectively, all rates given in 2021. Other information that is relevant is the minimum annual growth rate. Germany experienced the biggest annual decrease in 2022 (28.5%), whilst Belgium suffered a slowdown of 27.3% in the same year, in which France had a reduction of its imports in 23.8%. The smallest decrease came from the American market in 2022 (12.8%).

Table 1. World demand of asparagus (Imports in thousands of tons).

Country	2018	2019	2020	2021	2022
United States of America	0	256	266	302	263
Canada	24	23	25	27	22
Germany	25	24	23	27	20
Spain	14	13	11	13	13
France	14	16	15	16	12
United Kingdom	13	13	13	14	12
Netherlands	12	13	11	14	11
Switzerland	9	9	9	9	8
Japan	11	10	9	9	7
Belgium	6	7	6	8	6
Other countries	46	47	39	44	39
World ^a	174	431	426	484	412

^a Includes reporting and non-reporting countries, in addition to estimations obtained by the International Trade Center and the United Nations Statistics Division. Data extracted from Trademap.

In Table 2, the exports of asparagus by market can be analyzed. In 2022, the United States dominated as the main destination with a contribution of 65.9% of the total, despite an annual decrease of 6.7% compared to the 261.4 million USD in 2021. The higher point of the American market in the imports of this product was given in the year 2020, with 262.1 million USD and its lowest year was 2018, importing 227.1 million USD. It is also remarkable that the highest growth of the asparagus imports in the American market is in 2019, with 11.1%, opposite to the decrease of 6.7% this country had in 2022

regarding 2021. During the study period, the average annual growth rate of exports to the United States was 2%.

The average The Netherlands, the United Kingdom and Spain, contributing 35.4, 32.2 and 30.5 million USD respectively, represented 9.5%, 8.7% and 8.2% of the total exports in 2022, with a decreasing trend compared to the previous year. The average rise rates of these countries are -2.2% (Dutch market), -6% (British destination) and 2% in Spain, being this last country the only one among these three in having had a growth in its international purchases of Peruvian asparagus. Comparing Netherlands, United Kingdom and Spain, the market with the highest annual import value in the last five years was the British one, with 42.1 million USD in 2018; and the country with the lowest imported in a year the Spanish one, with 25.5 million USD in 2020.

Other information can be mentioned: on average growth rates, Canada has the highest one with 31% and Brazil is in the bottom with 10.9%. It is also important to focus on France as the market with the lowest positive ratio (0.2%) and Mexico with the highest negative percentage of growth (-0.6%). Just as the Canadian market is the top in average growth, it is also the one that is at the peak if analyzing the maximum growth rates of all countries (160.4% in 2019). Brazil, as it is the market at the bottom in average growth, is also the country with the lowest maximum growth rate (8.3% in 2021). The Brazilian destination is also the country with the lowest minimum shift rate (-51.4% in 2020). Belgium has the highest minimum variation percentage in a year (-3.7% in 2022).

Regarding total asparagus exports, there was a decrease of 7.3% in 2022 compared to 2021, with an average annual growth of -0.3% during the 2018-2022 period. The year with the biggest export value is 2019 (400.2 million USD), year in which the Peruvian asparagus had its highest growth rate (6%) and the littlest value can be found in 2022 (370.2 million USD), being this also the year with the least rate of variation of exports (-7.3%).

Table 2. Asparagus exports from Peru by destination market in FOB (Million USD)

Country	2018	2019	2020	2021	2022
United States	227.1	252.3	262.1	261.4	244.0
Netherlands	41.1	38.4	31.1	39.9	35.4
United Kingdom	42.1	38.8	35.3	38.5	32.2
Spain	29.1	31.7	25.5	28.6	30.5
Belgium	3.4	4.4	5.1	6.1	5.9
Canada	1.7	4.5	5.5	4.4	2.7
Brazil	4.7	4.7	2.3	2.5	2.5
France	2.7	2.6	1.6	2.5	2.2
Mexico	2.3	2.2	2.2	1.5	2.0
Chile	1.9	1.6	1.4	1.9	1.7
Others	27.4	18.9	15.0	12.1	11.1
Total	383.6	400.2	387.6	399.4	370.2

Note. Data taken from DAM (customs declarations) registered in SUNAT (2023).

The examination of the data of Table 3 reveals an increase in the HHI from 3929 in 2018 to 4584 in 2022, which indicates a growing trend towards greater market concentration in Peruvian asparagus exports. The peak market concentration occurred in 2020 with an HHI of 4920 (year with the highest growth rate of 16.4%), followed by a slight decrease of 7.8% to 4534 points of HHI in 2021, this before another increase to 4584 in 2022. The rise of 2022 meant the smallest positive ratio of variation of this index (1.1%). Analyzing the average growth, it was 4.3% in the years of study. The market concentration is high, and there is a trend towards a bigger concentration in few destinations of exports of the product of investigation.

Table 3. HHI of destination countries

Index	2018	2019	2020	2021	2022
IHH	3929	4228	4920	4534	4584

Note. Data taken from DAM (customs declarations) registered in SUNAT (2023).

The array of data about exports by enterprises is shown in Table 4. In 2022, Danper Trujillo led the sales abroad with an approximate representation of 10.8% of total exports, experiencing an annual growth of 34% since 2021. Complejo Agroindustrial Beta, although slightly decreased to 33.4 million USD in 2022 compared to the 33.9 million generated in 2021, maintained a 9% share in relation to the total exports of that year.

Companies such as Agrícola Cerro Prieto and Agrovisión Peru showed positive average growth during the study period, with average growth rates of 28.4% and 194.7% respectively. On the other hand, Sociedad Agrícola Drokasa, Kimsa Fresh, Floridablanca, Agro Paracas and Santa Sofía del Sur experienced a decrease in their exports in 2022 compared to the previous year, being Agro Paracas the enterprise which experienced the biggest decrease (24.7%) and Floridablanca the one that obtained the least aggressive slowdown (2.9%).

The conglomerate of other companies decreased its share from 218.3 million USD in 2021 to 179.9 million in 2022, a decrease of 17.6%. In total, exports decreased from 399.4 million USD in 2021 to 370.2 million USD in 2022, representing a decrease of 7.3%.

Danper Trujillo is a company that had its highest point of exports in 2018 (45.3 million USD). Its average growth rate is -1.3%, being unfavorable but not as the cases of Santa Sofía del Sur (-4.4%), Sociedad Agrícola Drokasa (-5.2%) and Complejo Agroindustrial Beta, which suffered the lowest growth in the period of study (-8.4%). Although the problem of the latter enterprise mentioned, it has been the leader in exports in the years from 2018 until 2021.

There are also companies that had a very healthy situation in the period of analysis. Looking at their average growth percentages, they are Agrovisión Peru (194.7%), Kimsa Fresh (161.8%), TWF S.A. (79.7%) and Agrícola Cerro Prieto (28.4%). These enterprises exported their biggest values in 2022, except for Kimsa Fresh, which did it in 2021. About the last company mentioned, it can be noted that it had no operations in 2018 and 2019, and it began its shippings in 2020. The year 2019 represented the biggest annual growth for Agrícola Cerro Prieto, Agrovisión Peru and TWF S.A., with 74.9%, 613.2% and 206.1% respectively.

Focusing on decreases, Kimsa Fresh had a very problematic year in 2020, with an annual rate of -30.6%, this being the lowest among all companies mentioned in Table 3. Besides this company, Agro Paracas (-24.7%) and Floridablanca (-23.9%) experienced considerable decreases in their exports in 2022 and 2020, respectively. The least decrease was the one obtained by Kimsa Fresh in 2022 (3.8%) and the highest positive minimum growth is the one of Agrícola Cerro Prieto, with a rate of 7.9%. It is necessary to add that this company hasn't had decreases in its exports during the period of study.

Table 4. Peru's asparagus exports by companies in FOB (Million USD)

Company	2018	2019	2020	2021	2022
Danper Trujillo	45.3	40.5	34.1	29.7	39.8
Complejo Agroindustrial Beta	48.1	44.5	35.5	33.9	33.4
Agrícola Cerro Prieto	7.2	12.6	14.9	16.1	18.2
Agrovisión Peru	0.8	6.0	15.5	13.8	16.1
Sociedad Agrícola Drokasa	19.6	23.1	16.1	15.7	14.8
Kimsa Fresh	0.0	0.0	3.5	15.1	14.5
Floridablanca	15.6	17.0	12.9	13.8	13.8
Twf, sucursal en el Perú	1.8	5.6	10.3	12.0	13.6
Agro Paracas	15.4	15.8	15.9	17.7	13.3
Santa Sofía del Sur	15.5	15.8	14.2	13.3	12.9
Other companies	214.1	219.2	214.2	218.3	179.9
Total	383.6	400.2	387.1	399.4	370.2

Note. Data taken from DAM (customs declarations) registered in SUNAT (2023).

The Herfindalh-Hirschman Index in concentration of asparagus exporting companies can be seen in Table 5. Overall, there is a decreasing trend in market concentration, from an HHI of 503 in 2018 to a minimum of 348 in 2021. However, the index experienced an increase of 17.7% to 410 in 2022, which means a higher concentration of exports in few companies. The average growth of this index is -4.2%. The general decrease in HHI suggests an increase in competition in Peru's asparagus export market during the period from 2018 to 2021.

Table 5. Exporting companies' HHI

Index	2018	2019	2020	2021	2022
IHH	503	426	376	348	410

Note. Data taken from DAM (customs declarations) registered in SUNAT (2023).

According to the information provided by Table 6, the biggest exporting region of asparagus in Peru in 2022 was La Libertad with 150 million USD and a share of 40.7%, but it has to be highlighted that Ica was at the top on the previous years (from 2018 to 2021), with an average share of 42.4% during these years. La Libertad has experienced an average growth of 4.7% between 2018 and 2022, with a maximum annual growth of 18.4% in 2019 and a minimum annual growth of -0.9% in 2021. On the other side, Ica had a different behavior on its exports, with an average growth of -8.7% in the period of analysis, being 1.4% its maximum annual growth in the year 2021 and -18.2% its minimum annual shift rate in 2022.

There is also a cluster of regions that can be mentioned, and these are Lambayeque, Lima and Ancash, gathering together an average share of 19.8% in the period of this study. Also Callao could be included in this cluster, but only between 2018 and 2020. In this group formed by three regions, Lambayeque has relevance with an average growth of 38%, being its annual maximum 132.6% in 2019 and its annual minimum -6.6% in 2022.

Focusing in other regions, Piura had a very notable change, with an average growth rate of 696.2%, its maximum annual shift rate occurred in 2021 (2048.4%). Meanwhile, the regions of Huancavelica, Amazonas and Cajamarca were very affected in their exports between 2018 and 2022, having average growth rates of -100%, -100% and -93.7% respectively.

Table 6. Exports by department of Peru in FOB (million USD)

Region	2018	2019	2020	2021	2022
La Libertad	127	150	150	149	150
Ica	185	173	152	155	127
Lambayeque	12	28	31	36	33
Lima	22	26	28	29	32
Ancash	18	16	18	29	26
Callao	19	7	6	1	1
Piura	0	0	0	1	0
Junin	0	0	0	0	0
Huancavelica	0	0	0	0	0
Amazonas	0	0	0	0	0
Arequipa	0	0	0	0	0
Cajamarca	0	0	1	0	0
Huanuco	1	0	0	0	0
Total	384	400	387	399	370

Note. Data taken from DAM (customs declarations) registered in SUNAT (2023).

Analyzing the Herfindahl-Hirshman indexes centered in the exporting regions of Peru (see Table 7), there is a clear concentration of exports in a few regions or one region, although there is also a slight decrease in this concentration. The average shift rate during the period of analysis was -3.5%, being

2020 the year with the lowest annual variation (-5.6%) and 2022 with the highest growth rate (-1.4%).

Table 7. Exporting regions' HHI

Index	2018	2019	2020	2021	2022
IHH	3503	3391	3201	3074	3032

Note. Data taken from DAM (customs declarations) registered in SUNAT (2023).

The data of the Table 8 shows an increase in the geographic diversification of asparagus export markets, with the number of recipient countries growing from 39 in 2018 to 42 in 2022, implying a cumulative growth of 7.5% and an average growth of 1.88% over the five-year period. On the other hand, a downward trend in diversification at the level of exporting companies was observed, with a decline from 92 companies in 2018 to 77 in 2022, representing a cumulative decrease of 17.38% and an average shortening of 4.35%. Other relevant data to be considered is the fluctuation of the exporting regions. The year with the biggest number of regions was 2021 (11 regions), and the bottom period was 2019 (9 regions). There was a cumulative change growth of 2.02% and an average growth of 0.51% between 2018 and 2022.

In export volumes, there was an inter-annual variation, with a peak of 136.0 million kg in 2021 and a minimum of 128.0 million kg in 2020. The fluctuation of the export quantity led to a cumulative growth rate of -2.03% and an average growth rate of -0.51%. The average export volume during the five-year period was 132.12 thousand tons. Regarding FOB value, a variation over time was detected, with a peak of 400.2 million USD in 2019 and a minimum of 370.2 million USD in 2022. The average FOB value during the five-year period was 388.1 million USD, fluctuating with a cumulative growth rate of -1.28% and an average growth rate of -0.32%.

Table 8. Peru's asparagus exports

Year	Countries	Companies	Regions	Net Weight Thousands of Metric Tons.	FOB Value Millions of USD
2022	42	77	10	129.7	370.2
2021	41	82	11	136.0	399.4
2020	40	86	10	128.0	387.1
2019	40	89	9	134.0	400.2
2018	39	92	10	132.9	383.6

Note. Data taken from Customs Declarations (DAM) registered in SUNAT (2023).

6. Discussion

The decrease in Peru's asparagus exports in 2022 compared to the previous year reflects common fluctuations in international agricultural markets, where factors such as weather, pests, and global economic conditions can affect production and demand (Karahan, 2017). However, the downward trend observed in several key markets, especially the United States, the Netherlands, and the United Kingdom, may also suggest specific challenges in those destinations.

Regarding the high dependence on the US market, it is relevant to note that several studies Fassio (2018) and Jaffee (2023) have shown that market diversification can help mitigate the risks associated with over-dependence on a single market.

The increasing trend of market concentration, indicated by the rise in HHI, may also imply risks. Maertens & Swinnen (2009) suggests that greater market concentration can lead to higher vulnerability to demand fluctuations in those markets and changes in import policies.

At the business level, the increase in company diversification, suggested by the decrease in HHI, highlights the importance of competitive strategies. According to Elumalai & Kumar (2023), companies can gain sustainable competitive advantages through innovation and improving efficiency

in their operations.

In addition, the high degree of dependence on the American market in the Peruvian asparagus resembles the case of the Mexican mango, where a need of diversification of markets and added value to the products is highlighted (Maya et al., 2011). As this background study proposes Japan as an alternative to diversify destinations for Mexico, in Peru there are also promising countries to consider as importers, such as Belgium and Canada, that have had considerable growth rates in their imports.

In Spain, it was determined that there is a direct relationship between export diversification and export performance (Rosal, 2019). Hence, it can be said that export concentration leads to a decrease in this export performance, reflected in Peruvian asparagus exports. In this case, it can be seen that the HHI of the markets has increased between 2018 and 2022, and in the same time the exports have suffered a decrease, so this direct relationship can be confirmed.

Another case study was carried out in Ecuador with the mangoes; where, as in Peru, there is a big concentration in the American market (Quiñonez et al., 2021). In the Ecuadorian case, this high level of market concentration is due to public sector limitation, but in the case of Peru, there is a task consisting in researching which could be the possible drivers that lead to the concentration of asparagus exports in United States as a major destination.

It was also demonstrated that developing countries trend more to diversify their products for export (Markakkaran & Sridharan, 2022). Taking this study into account, the product diversification could be a favorable starting point for Peru in asparagus, adding value to this good and not limiting in the raw, primary produce. This study agrees with the Mexican one that suggests product transformation to be more competitive in destinations such as Japan (Maya et al., 2011).

It is necessary to remember that the market diversification theory states that the more clients the business relies on, the less exposed the country is to the risks of having few markets (Fassio, 2018; Maertens & Swinnen, 2009; Quiñonez et al., 2021). Although the number of importing countries has grown between 2018 and 2022, the concentration of the exports volume – although moderate – has also grown, so there is no harmony between both aspects. Also, it can be underscored that market diversification reduces the risks of depending in only one country of destination. In this case, Peru has a very high degree of dependence in the American market, and its risk is high if there are market crises associated to the United States, being this the only destination it relies on. It is also said that R&D leads to a healthier market diversification (Gnangnon, 2022; Yllescas-Rodríguez et al., 2021), so that is something Peruvian companies could do and something Peruvian government could impulse.

About export entity diversification theory, it is known that the more companies a country is endowed with, the better situation it has in front of risks of depending in only one enterprise and the market risks, such as price fluctuations (Barney, 1991; Karahan, 2017; Li et al., 2022; Porter, 2008). Peru has a low concentration of enterprises for asparagus exports, and this concentration has even decreased, so this is a very convenient situation. What is not consistent with this information is the fact that the number of export companies has increased from 92 in 2018 to 77 in 2022, but this not means that the share of the enterprises is more spread in the last years. It is also important to remark that the diversification of exporting companies involves a series of conditions: export business creation policies, technology, efficiency in production and infrastructure (Li et al., 2022). The decrease of HHI means that these conditions have been complied in the period of analysis, and this is a factor that benefits the exports and decreases the risks of Peru on relying in just one exporting company and also it reduces Peru's vulnerability to external threats in the international market.

The decline in the number of exporting companies may reflect barriers to entry in the international market. According to Rugman & Verbeke (2008), companies may face various challenges in internationalizing: lack of knowledge about foreign markets, tariff and non-tariff barriers, and difficulty in adapting to cultural and regulatory differences.

Finally, the topic of the exporting regions has to be addressed. The number of regions fluctuated in the years of analysis, but the slight trend to diversification of these regions has also merit, based on the HHI. It does not mean that there is not region concentration at all; in fact, La Libertad and Ica are the zones where the exports of asparagus are very focused, having an average of 78.2% of the share of

exports between 2018 and 2022. It has to be remembered that the less dependence of few exporting or importing markets, the less risks the company is exposed to Gnanon (2022). Also, this situation reflects the need of endowing the country with efficient business in other regions to promote this kind of diversification (Li et al., 2022)

7. Conclusions

The dynamics of Peru's asparagus export market show a clear dominance of the United States as the main destination for Peruvian exports during the 2018-2022 period. Despite a decrease in exports in 2022, the United States continues to represent the largest proportion of total asparagus exports. However, the decline in exports to this country and the negative average annual growth during this period suggest the need for further diversification of export markets to minimize reliance on a single market.

The increase in the Herfindahl-Hirschman Index (HHI) from 3929 in 2018 to 4584 in 2022 indicates a growing concentration in the destination market for asparagus exports. This increase in market concentration may be a sign of decreased competition in the target markets, which can have implications for the stability and sustainability of Peru's asparagus exports.

At the company level, Danper Trujillo and Complejo Agroindustrial Beta lead Peruvian asparagus exports, but notable growth has also been observed in companies like Agrícola Cerro Prieto and Agrovisión Perú. However, the overall downward trend of HHI from 503 in 2018 to 410 in 2022 suggests increased competition among asparagus exporting companies. This, combined with the decrease in the number of exporting companies from 92 in 2018 to 77 in 2022, indicates a constantly evolving market and the need for adaptable and resilient business strategies.

The topic of the regions is also relevant in this study. La Libertad and Ica concentrate the exports of asparagus in Peru between 2018 and 2022, and though this concentration has been less in time, with an HHI of 3503 in the first year of analysis and 3032 points in the last year.

Finally, a fundamental limitation lies in the reliance on data from customs declarations and public records, which, although providing an extensive and up-to-date database, may be subject to inherent biases or reporting errors. Furthermore, the use of the HHI index to assess market concentration and diversification, while widely accepted and used in economic and international trade analyses, is based on assumptions that may not capture the full complexity of the global asparagus market, especially regarding competition dynamics, the entry of new competitors, and the fluctuation of market shares. This methodological approach may not fully reflect market and company diversification strategies nor the effects of emerging trade and economic policies. These limitations underscore the need to interpret results with caution and consider the incorporation of additional qualitative methodologies in future research to gain a more holistic and nuanced understanding of diversification in Peru's asparagus exports.

8. Recommendations

Given the dependence on the US market, it is recommended to diversify export destinations. In this regard, exploring emerging markets or markets with growing demand for asparagus, such as Canada, Belgium and countries in East Asia or the Middle East, could be beneficial. Additionally, marketing strategies in existing markets could be redesigned to increase market share in countries like the United Kingdom or the Netherlands, which are already significant destinations but experiencing a decrease in demand.

Due to the increasing market concentration, as indicated by the rise in HHI, it could be advantageous to develop strategies for product diversification. This could involve expanding into related products, such as processed or value-added foods that utilize asparagus, allowing for a broader reach in the market.

At the company level, the increase in competition highlights the importance of innovation and

efficiency in operations. Companies could benefit from implementing advanced production technologies, improving logistics and supply chain processes, and investing in employee training, development, and infrastructure.

Finally, given the decrease in the number of exporting companies, it would be beneficial for Peruvian authorities to provide support and resources to emerging enterprises. This could involve initiatives for financing, export counseling, and training in international business. Additionally, promoting collaborations and partnerships among companies could lead to greater resilience and adaptability in Peru's asparagus export sector.

In the regions factor, it is recommended to develop business in other regions than La Libertad and Ica to not to depend in those two and generate exposure to market risks. Lambayeque, Lima, and Ancash were demonstrated to be potential regions to grow.

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