

Challenges for Sustainability and Entrepreneurship in Peruvian Squid Exports: An Analysis of Market and Regional Concentration (2019-2023)

Castillo Coronado, Yazmin del Milagro¹; Alcoser Valdez, Estrella Brilli¹; Santisteban De La Cruz, Delia Lisett¹
Morán Santamaría, Rogger Orlando ¹

¹Universidad César Vallejo, Perú, ycastilloco01@ucvvirtual.edu.pe, ealcoserva21@ucvvirtual.edu.pe,
dsantisteban11@ucvvirtual.edu.pe, msantaro@ucvvirtual.edu.pe

Resumen– *The article analyses the sustainability of frozen squid exports from Peru between 2019 and 2023, evaluating the diversification of markets and exporting companies using the Herfindahl-Hirschman Index (HHI). Globally, there was a trend towards diversification, with a reduction in the Herfindahl-Hirschman Index (HHI) from 1379 to 957. In Peru, exports showed a significant recovery after the Coronavirus disease 2019 (Covid-19) pandemic, albeit with a high concentration in the Chinese market, which represented a growth of 361.5% between 2020 and 2023. The research under discussion highlights challenges related to dependence on specific markets and companies, as well as the need to diversify destinations and promote sustainable practices to reduce economic vulnerability. In methodological terms, a descriptive analysis was carried out based on VERITRADE export data, showing that Piura leads national exports, while other regions such as Ica and Lambayeque face significant declines. The study concludes that, although initial diversification is positive, recent concentration represents a risk, and recommends strategies to promote market diversification, support for new export companies, and the strengthening of the sector's environmental and economic sustainability.*

Keywords– *Exports, market diversification, fisheries sustainability, international markets, commercial competitiveness.*

I. INTRODUCTION

The sustainability of frozen squid exports, also known as giant squid, is of global importance due to its relevance as a fishery and economic resource [1]. On a global scale, this species is subject to high levels of fishing, particularly in the Pacific Ocean, where its biomass is a key component of various industrial fisheries [2]. Nevertheless, the sustainability of this species is confronted with challenges pertaining to overfishing, climate change, and illegal, unreported, and unregulated (IUU) fishing practices [3].

Squid is a key resource for many countries, and high demand in Asian, European and American markets has led to an increase in catches, raising concerns about the sustainability of current exploitation levels [4]. Seto (2023) asserts that, whilst global catches of giant squid have exhibited sustained growth in recent decades, this growth has not been accompanied by effective measures to ensure the regeneration of stocks in some cases.⁵

Furthermore, IUU fishing represents a significant impediment to the sustainable management of squid [6].

Numerous countries, especially those operating substantial fishing fleets, have been accused of engaging in fishing activities without adhering to the established international regulations [7]. This phenomenon not only undermines the sustainability of the resource, but also distorts market dynamics by engendering inequitable competition and diminishing international prices for the product [8]. Moreover, the utilisation of non-selective fishing gear and destructive practices endangers the marine ecosystems inhabiting fishing areas [9].

China is a notable participant in the global squid fishing and marketing sectors, both in terms of catches and exports [10]. Nevertheless, there is ample evidence to suggest that Chinese fishing fleets have been repeatedly accused of IUU fishing practices in international waters and the exclusive economic zones of third countries, thereby exacerbating the overexploitation of the resource [11].

Japan, another significant participant in the frozen squid trade, has adopted a more stringent approach to regulating and managing its fisheries [12]. Strict controls on catches have been implemented, and the use of advanced technologies has been promoted to minimise the environmental impact of fishing [13]. However, the reliance of Japan on squid imports from countries such as Peru and Ecuador introduces further challenges, as the sustainability of the resource in these exporting countries directly impacts Japanese food security [14].

In the context of Latin America, Ecuador has distinguished itself as a prominent exporter of frozen squid [15]. The management policies implemented by this nation include temporary closures and catch quotas, measures that have contributed to the sustainability of the resource [16]. Nevertheless, IUU fishing in waters adjacent to its exclusive economic zone remains problematic, as it impacts the shared squid biomass and generates international tensions with foreign fleets [17].

Peru is the world's leading exporter of frozen squid, which represents a significant source of income and employment, particularly for coastal communities [18]. Nevertheless, the sustainability of this activity is confronted with significant challenges, including overfishing, the absence of effective regulation, and disputes over access to the resource [19].

A significant challenge confronting Peru is the inadequacy of the regulatory framework governing squid fishing [19]. Despite the existence of regulations designed to impose limits on catches and to ensure their protection, the capacity for effective monitoring and control remains constrained [20]. Artisanal fishing, which accounts for a significant proportion of catches, frequently operates without adequate supervision, thereby making it difficult to collect accurate data on catches [21].

Furthermore, access to the resource in question has been demonstrated to engender conflict between artisanal and industrial fleets [22]. While the former depend on squid as their main source of livelihood, the latter are oriented towards large-scale export [23]. This competition for the resource has led to intensified catches in certain seasons, increasing the risk of overexploitation and reducing regenerative capacity [24].

In view of this problematic reality, the following research question is posited: The present study sets out to examine the development of the sustainability of frozen squid exports from Peru during the period 2019-2023.

II. THEORETICAL FRAMEWORK

The theoretical underpinnings of this approach emphasise the imperative to comprehend the potential for enhancing sustainability through the augmentation of exports, precipitated by the emergence of new markets or enterprises. Moreover, from a pragmatic standpoint, the diagnosis will furnish companies with pivotal insights regarding the markets that exhibit demand for these products, thereby fostering diversification towards these destinations.

The overarching objective of this study is to analyse the development of the sustainability of Peruvian frozen squid exports during the period 2019-2023. In order to achieve the aforementioned overall objective, four specific objectives were established. Firstly, the global exports of frozen squid during the period 2019 to 2023 were to be described. Secondly, the global imports of frozen squid during the same period were to be described. Thirdly, the destination markets for Peruvian exports of frozen squid during the period 2019 to 2023 were to be described. Finally, the Herfindahl-Hirschman Index (HHI) of Peruvian frozen squid exporting companies during the period 2019 to 2023 was to be determined.

A study undertaken in Peru [25] sought to analyse the variation in markets and exporting companies in the Peruvian fishing sector during the period from 2000 to 2022, with a view to understanding their behaviour. The methodology employed was of a basic, quantitative and descriptive nature, characterised by a non-experimental and cross-sectional design. The data collection instrument utilised was a documentary review of fishery exports recorded by the National Customs and Tax Administration Service (SUNAT), encompassing a period of 22 years. In order to assess diversification, the Herfindahl-Hirschman Index (HHI), a widely utilised metric in the study of market concentration, was employed to evaluate the diversification of Peruvian fishing sector exports in terms of

destination markets and exporting companies. The study concludes that, despite the Peruvian fishing sector's demonstrated capacity for diversification, with exports exhibiting a certain degree of breadth, the sector remains heavily concentrated in a small number of markets, particularly China. This finding underscores the imperative for the promotion of diversification strategies, with the aim of reducing reliance on a single destination and ensuring long-term economic stability.

In this regard, another study carried out in Peru [26] analysed the impact of fishing as a fundamental pillar of the Peruvian economy, highlighting its relevance to the country's economic development. In particular, it highlighted the importance of fishmeal, a by-product of the livestock and aquaculture industries, which has made this product Peru's main marine export, contributing significantly to foreign exchange earnings. Nevertheless, the sector is confronted with critical challenges pertaining to sustainability, largely attributable to overexploitation and inadequate management of fishery resources. In response, the Peruvian government, in collaboration with regulatory agencies, has implemented a range of measures. These include closed seasons, minimum size regulations and the promotion of selective fishing gear, seeking responsible management of marine resources. It was determined that fishing accounts for 1.5% of the national GDP and 7% of exports, supporting more than 250,000 people and generating revenues of 3.2 billion dollars annually. Nevertheless, concerns regarding global stability persist, as 33.1% of commercial species are overexploited, and the number of affected populations has increased by 20%. This scenario underlines the necessity to reinforce regulatory efforts and to encourage sustainable practices in order to guarantee the continuity of the economic and environmental benefits associated with fishing in Peru.

A further study[^] ([27]) was identified that sought to analyse how Peru can ensure the sustainability of its exports through market diversification and the enhancement of its competitiveness. The methodology employed is quantitative in nature, utilising the Herfindahl-Hirschman Index and the Balassa Index as measures of market concentration and revealed competitive advantage, respectively. The study evaluated the growth of Peru's exports to key markets, including the United States, the Netherlands and the United Kingdom, as well as the concentration in specific markets and the risks associated with such concentration. The conclusion drawn was that, despite Peru's noteworthy surge in blueberry exports, particularly to the United States, further analysis is required to ascertain the full implications of this development.

In a similar vein, another study [28] sought to ascertain the diversification and comparative advantage of cocoa bean exports in Peru during the period 2013-2023. The methodology employed was quantitative, basic and descriptive in nature, utilising a non-experimental design. A documentary review of cocoa bean exports in Peru during the period 2013-2023 was utilised as a data collection instrument. Data on exports was

recorded by entities such as Trademap and SUNAT. The Herfindahl-Hirschman index of cocoa bean exporting companies in Peru during this same period was utilised to evaluate diversification and comparative advantage. The diversification of Peruvian cocoa exports was evaluated in terms of destination markets and exporting companies. It was concluded that cocoa exports in Peru have demonstrated sustained growth, thus consolidating their position as a pivotal product in the export sector, exhibiting an average annual increase of 13% in FOB value, following a seasonal pattern.

Furthermore, an additional study [29] was identified that examined the breadth of fresh asparagus exports in Peru between 2018 and 2022. The utilisation of the Herfindahl-Hirschman Index (HHI) as a metric for the evaluation of market concentration yielded findings that indicated a significant reliance on the US market, accounting for 65.9% of exports in 2022. It was concluded that diversification into new international markets is necessary to reduce risks associated with dependence and promote economic resilience.

A further study[^]([30]) was identified that sought to analyse the impact of Chinese foreign direct investment (FDI) in the Peruvian fishing sector following the signing of the Free Trade Agreement (FTA) between Peru and China during the period 2009-2021, with a view to understanding its economic influence. The methodology adopted was descriptive and quantitative in nature, employing a non-experimental and longitudinal design. The data collection tool that was utilised was a documentary review of records of landings, production plants and exports, obtained from official sources such as the INEI and the Ministry of Production. The analysis of fishery landings and the distribution of investments was conducted through the utilisation of line trends and statistical graphs. The research concludes that, although the FTA has boosted Peruvian exports, especially fishmeal to China, and has increased Chinese investment in infrastructure and company acquisitions, there is no evidence of significant improvements in employment or sustainable economic development. This highlights the need for strategies that prioritise technology transfer and economic diversification.

The theory of comparative advantage, as proposed by David Ricardo, can serve as a conceptual basis for a product's export strategy, whether a company focuses on a few destination markets or decides to diversify its portfolio of buyer countries [31]. In accordance with this theory, a nation (or a corporation within it) ought to specialise in the production and export of those goods in which it possesses a relative efficiency advantage over other markets, thus reducing opportunity costs and maximising overall profit [32].

In the context of market concentration, the principle of comparative advantage can serve as a heuristic device, guiding decisions towards specific destinations characterised by enhanced product acceptance, reduced logistics costs, or more favourable trading conditions [33]. A company that focuses on countries where the product is consumed more intensively or where preferential trade agreements exist can obtain higher

returns [34]. Specialisation in specific markets also allows for a deeper understanding of consumer preferences, regulations and competitive dynamics, optimising the production structure and efficiency [35].

Conversely, the diversification of target markets can be interpreted as the flexible application of comparative advantage, thereby extending the product's presence to wherever profitable niches are identified [36]. By expanding the geographical scope of its buyer countries, the company mitigates its reliance on a single market [37]. In summary, the theory of comparative advantage not only underlies international trade, but also provides a conceptual framework for choosing between market concentration and diversification [33]. Consequently, exporting companies can achieve a balance between the pursuit of efficiency and cost reduction, and the imperative of risk management. This enables them to maintain a strategy that enhances their global competitiveness [38].

III. METHODOLOGY

The research was of a basic nature, with the objective of generating knowledge about the development of the study variable. The programme's emphasis on theoretical knowledge expansion, devoid of any immediate practical application, is pivotal for fostering scientific progress [39].

The present study employed a non-experimental, descriptive research design, in which the variable was observed in its natural context, without manipulation [40]. The approach entailed the collection and analysis of numerical data to identify patterns and relationships [41].

The research population comprised all the data contained in the customs declarations for exports of frozen squid in Peru under heading 0307.43.00.00 during the period from 2019 to 2023, obtained from the commercial tools VERITRADE and TRADE MAP. The sample coincided with the population, as all available records for the specified period were analysed, thus ensuring the representativeness and breadth of the analysis.

In order to ensure a representative analysis, all available information was used, allowing for a rigorous and accurate approach to market diversification in frozen squid exports. The Herfindahl-Hirschman Index (HHI) was utilised as a metric to assess the diversification of exports [25]. This analytical instrument is extensively employed in economic and business studies to evaluate concentration and diversification in diverse contexts, including trade, market competition, and industrial structure. The HHI is calculated by adding the squares of the market shares of each entity (in this case, the countries receiving exports and the exporting companies) [42]. The resulting index value ranges from 0 to 10,000, where a value close to 0 indicates high diversification and a value close to 10,000 reflects a greater impact on a small number of entities; similarly, when the value is 1800, there is moderate variety. In the context of export diversification, a low HDI is indicative of the dispersion of exports to a greater number of markets, thereby reducing a country's dependence on specific markets

and decreasing the risks associated with fluctuations and changes in those markets [43] [44].

The data collection process involved the utilisation of a document review guide, which was employed as an instrument in accordance with the methodology outlined by Montes [45]. This particular guide was utilised to facilitate the organisation and systematisation of the secondary information collected from the documentary sources, in this case, VERITRADE and TRADE MAP. The guide facilitated the identification, selection, and recording of relevant data from customs declarations for frozen squid exports, such as the volume, value, and destination of the products, thus providing a comprehensive overview of the behaviour of these exports.

The data analysis technique that was applied consisted of organising the data into dynamic tables and performing statistical calculations such as variation, percentage share, trends, and growth rate.

The research was conducted in accordance with the stringent ethical principles established by César Vallejo University, thereby ensuring transparency, integrity, and respect for intellectual property. All information utilised was derived from commercial tools such as VERITRADE and TRADE MAP, databases and market analyses, and was correctly cited, acknowledging the original authors and sources. Furthermore, statistical data has been handled objectively, without alterations or manipulations that could modify the results for personal gain. Reliable figures have been used, respecting the integrity of the data and reflecting the opinions and analyses as they appear in the consulted sources.

IV. RESULTS

As illustrated in Table I, global exports of frozen squid exhibited significant fluctuations, attributable to shifts in supply, demand and external factors, including the pandemic. Morocco has demonstrated a leadership position in terms of cumulative growth (71.43%) and average annual growth (15.87%), while Argentina has recorded the most substantial annual increase in 2020 (86.97%). In contrast, China suffered the largest decline in 2023 (-32.61%) and Vietnam accumulated a decrease of -5.13%. Thailand was distinguished by its stability, characterised by the lowest standard deviation (22.59), in contrast to China's high variability (287.93%).

TABLE I
WORLD EXPORTERS

Exporters	2019	2020	2021	2022	2023
China	2007	1885	2091	2314	1559
India	605	468	600	727	664
Indonesia	433	425	492	587	627
Peru	577	411	423	443	610
Spain	395	346	493	570	543
Morocco	273	312	405	313	468
Islas (Malvinas) Falkland	251	244	292	341	303
Argentina	208	389	247	293	288
Thailand	249	195	208	238	222
Vietnam	156	149	152	211	148

Others	1118	949	1269	1437	1420
Total	6,272	5,772	6673	7,474	6853

Note. Registration of SUNAT data obtained through the trade intelligence tool VERITRADE

According to Table II, the Herfindahl-Hirschman Index (HHI) shows a downward trend, falling from 1,379 to 957, reflecting greater market diversification. Although there was a slight increase of 1.5% between 2019 and 2020, the index declined progressively, with a notable reduction of 26.4% between 2022 and 2023. With a standard deviation of 179.7, there is evidence of moderate variability, accompanied by lower concentration and a more balanced distribution among exporters.

TABLE II
DIVERSIFICATION OF WORLD EXPORTS

Years	2019	2020	2021	2022	2023
IHH	1379	1400	1319	1300	957

As illustrated in Table III, global imports of frozen squid exhibited fluctuations, with a 13% decrease in 2020, followed by recoveries in 2021 (+22.5%) and 2022 (+15%), prior to a slight decrease of 0.9% in 2023. Spain was the primary importer, exhibiting substantial variations, while China was notable for its high volatility, oscillating between declines and sharp increases. The standard deviation of \$750 million reflects moderate variability in the global market, showing a recovery after 2020 and a trend towards stabilisation in recent years.

TABLE III
WORLD IMPORTS

Importers	2019	2020	2021	2022	2023
Spain	1126	990	1104	1270	1218
China	861	663	987	892	1175
Italy	657	552	750	810	770
Japan	585	534	489	582	564
Thailand	391	386	382	465	463
Republic of Korea	308	350	259	274	340
Vietnam	132	124	163	309	299
United States of America	194	149	286	353	255
Portugal	151	113	129	158	137
Malaysia	55	69	116	150	135
Others	991	813	1143	1414	1264
Total	5451	4742	5807	6679	6621

Note. Registration of SUNAT data obtained through the trade intelligence tool VERITRADE

As demonstrated in Table IV, the Herfindahl-Hirschman Index (HHI) for imports exhibited a tendency towards increased diversification until 2022, with a cumulative decline of 14.8% in concentration (from 1,068 to 910). However, in 2023, the index increased to 997 (+9.6%), indicating a slight reversal towards greater concentration. The most significant annual decline was observed between 2021 and 2022 (-10%), indicative of a more equitable distribution among importers. With a standard deviation of 61.7, fluctuations were moderate, and in 2023, concentration may have been influenced by changes in global trade dynamics.

TABLE IV
DIVERSIFICATION OF WORLD IMPORTS

Years	2019	2020	2021	2022	2023
IHH	1068	1058	1011	910	997

As illustrated in Table V, between 2019 and 2023, Peruvian exports of frozen squid exhibited growth of 3.6%, with values increasing from \$584 million to \$605 million. This growth is noteworthy given the significant decline experienced in 2020 (-36%) due to the pandemic. From 2021 onwards, a steady recovery was observed, with a notable increase of 34.8% in 2023. China demonstrated notable resilience, with a recovery from a 72.1% decrease in 2020 to a cumulative growth of 361.5% in 2023, reaching £180 million. In contrast, Spain reduced its imports by 29.3%, while Thailand and Mexico demonstrated increases of 13.8% and 42.1%, respectively. Finland emerged as a new market with 13 million in 2023. The standard deviation for the period, 101.3 million, reflects moderate variability in total exports.

TABLE V
PERU'S EXPORTS OF FROZEN COD IN MILLIONS OF DOLLARS

Countries	2019	2020	2021	2022	2023
China	140	39	99	44	180
Spain	167	116	100	125	118
Thailand	58	56	53	58	66
South Korea	78	53	35	46	64
Mexico	19	18	20	23	27
Japan	24	20	20	33	24
Italy	24	22	20	24	24
Finland	0	0	0	4	13
Brazil	11	6	7	7	12
United States	7	4	13	19	11
Others	57	39	61	67	67
Total	584	374	428	449	605

Note. Registration of SUNAT data obtained through the trade intelligence tool VERITRADE

As demonstrated in Table VI, the Herfindahl-Hirschman Index (HHI) for Peruvian frozen squid exports exhibited a tendency towards diversification until 2022, with a 25.1% decrease in the index (from 1,731 to 1,297). However, in 2023, the HHI increased by 21% (to 1,569), indicating greater concentration in fewer markets. The variability of the HHI, with a standard deviation of 170.9, reflects moderate fluctuations, influenced by changes in global demand, domestic production and trade policies.

TABLE VI
DIVERSIFICATION OF PERU'S FROZEN SQUID EXPORTS

Years	2019	2020	2021	2022	2023
IHH	1731	1603	1405	1297	1569

As demonstrated in Table VII, Peruvian exports of frozen squid, predominantly via the customs offices of Paíta and Marítima del Callao, constituted the majority of trade. Paíta

exhibited a 12.8% increase in value, ascending from \$443.8 million in 2019 to \$500.7 million in 2023, subsequent to a substantial recovery of 51.9% between 2022 and 2023. Marítima del Callao, in second place, experienced a 3.7% decrease in exports during the period, indicating recent volatility. Other customs offices, including Tumbes, Tacna, Ilo and Pisco, experienced lower volumes, with Tumbes growing to £1.4 million in 2023 and Tacna experiencing a significant decrease of 93.5%.

TABLE VII
PERU'S EXPORTS OF FROZEN SQUID BY CUSTOMS

Customs	2019	2020	2021	2022	2023
Paíta	443,797	271,642	328,717	329,524	500708
Maritime of Callao	105,554	86630	94100	113806	101709
Tumbes	0	278	754	2087	1412
Tacna	11,660	4920	3473	2816	755
Ilo	10,423	2729	849	90	423
Callao Airport	1	0	0	2	2
Pisco	10224	6927	58	50	0
Talara	0	0	0	0	0
Chimbote	293	462	0	0	0
Mollendo - Matarani	1602	415	133	317	0

Note. Registration of SUNAT data obtained through the trade intelligence tool VERITRADE

Table VIII shows that growth in total exports is led by key players such as Despachos Aduaneros Chavimochic, which increased its exports by 95.4% between 2019 and 2023, and Js Perú Agencia de Aduana, with a remarkable increase of 433.3%. While some agents, such as San Miguel Servicios Logísticos, reduced their exports (-21.3%), others such as Scharff Logística (7.8%), Adm Aduanas (12.1%) and Agencia de Aduana Macromar (20.6%) showed moderate growth. The general trend points to greater concentration in a smaller number of larger agents.

TABLE VIII
PERU'S EXPORTS OF FROZEN SQUID BY CUSTOMS AGENT

Customs Agent	2019	2020	2021	2022	2023
Chavimochic Customs Clearance	87	82	128	130	170
San Miguel Logistics Services	108	60	49	58	85
Scharff Integrated Logistics	51	50	69	48	55
Customs Administration	33	14	35	22	37
Js Perú Customs Agency	3	2	0	21	16
Macromar Customs Agency	34	28	21	21	41
Dogana Sa Bonded Customs Agents	11	1	1	18	22
Customs Advice and Management	0	0	2	12	16
Adualink	9	11	7	12	7
Macromar Customs	8	4	5	10	15

Others	239	123	110	96	142
--------	-----	-----	-----	----	-----

Note. Registration of SUNAT data obtained through the trade intelligence tool VERITRADE

As illustrated in Table IX, Piura was the leading exporter of frozen squid in Peru between 2019 and 2023. In 2019, Piura accounted for 74.9% of the national total, and this figure increased to 82.4% in 2023. This represents a cumulative growth of 14.1% compared to 2019, as well as a significant increase of 50.5% between 2022 and 2023. Lima, in second place, demonstrated consistent growth, reaching \$61.3 million in 2023 (+19.3% since 2019). Ancash demonstrated a significant increase of 40% between 2019 and 2023, with a substantial doubling of exports between 2022 and 2023 (+124.5%). Conversely, regions such as Ica, Lambayeque and Moquegua experienced significant declines, with exports becoming increasingly concentrated in a smaller number of regions. The moderate variability, reflected in a standard deviation of \$101.3 million, was primarily influenced by Piura, which consolidated its position as the country's primary export centre.

TABLE IX
PERU'S EXPORTS OF FROZEN SQUID BY REGION

Region	2019	2020	2021	2022	2023
Piura	437.1	266.2	328.0	331.2	498.6
Lima	51.4	45.8	49.4	61.8	61.3
Constitutional Province of Callao	33.9	24.8	19.8	28.4	22.9
Ancash	8.5	6.2	5.2	5.3	11.9
Ica	17.2	15.6	15.3	14.3	4.4
Lambayeque	5.7	4.1	2.7	0.7	2.6
Arequipa	6.9	2.6	1.9	1.8	1.5
Tacna	11.9	5.0	3.5	3.3	1.2
Moquegua	10.6	3.0	2.0	1.6	0.7
Others	0.5	0.6	0.2	0.2	0.0

Note. Registration of SUNAT data obtained through the trade intelligence tool VERITRADE

As demonstrated in Table X, Peruvian exports of frozen squid exhibited a moderate growth of 3.9%, escalating from \$583 million to \$606 million, propelled by the performance of prominent companies and the emergence of new market entrants. It is noteworthy that Peruvian Sea Food (89.3%), Proveedora de Productos Marinos, and Pescados y Cefalópodos del Perú, which entered the market with considerable force, have experienced significant increases. It is evident that companies such as Productora Andina de Congelados and Seafrost have demonstrated a consistent pattern of growth, while Altamar Foods Perú has exhibited a high degree of volatility. Conversely, the 'Others' category witnessed a 26.1% decline in its market share, indicative of a consolidation of market share among the leading companies. The post-2020 recovery was characterised by volatility, attributable to fluctuations in global demand, logistical challenges and consolidation within the sector.

TABLE X

PERU'S EXPORTS OF FROZEN SQUID BY COMPANY

Companies	2019	2020	2021	2022	2023
Andean Frozen Food Producer	58	42	48	52	65
Altamar Foods Peru	57	39	57	34	57
Peruvian Sea Food S.A.	28	13	25	28	53
Seafood Supplier	0	22	27	39	37
Seafrost	30	20	26	27	37
Mira Coast	18	11	11	23	23
Santa Monica Fishing Industry	12	9	16	14	19
Novaperu S.A.C.	16	10	14	15	19
Marfrio Peru S.A.	11	8	9	14	18
Fish and Cephalopods of Peru	0	5	11	17	17
Others	353	196	186	187	261

Note. Registration of SUNAT data obtained through the trade intelligence tool VERITRADE

IV. DISCUSIÓN

The findings of this research on frozen squid exports during the period 2019–2023 reveal trends and challenges that can be contrasted and analysed in light of previous studies. Of particular note are the fluctuations in global markets, the focus on specific destinations, and the significance of diversification as a strategy for ensuring long-term economic stability.

This finding aligns with the observations made by Falla and Heredia [25], who reported that the Peruvian fishing sector continues to exhibit a high degree of market concentration, particularly in major global markets such as China. The subsequent analysis of Peruvian frozen squid exports corroborates this conclusion. Despite the recovery witnessed in certain key markets, the high degree of reliance on specific destinations, such as China and Spain, exposes exporters to considerable risks in the event of fluctuations in global demand or unfavourable political and economic conditions. This concentration is reflected by the increase in the Herfindahl-Hirschman Index in 2023, suggesting a reversal of the diversification achieved in previous years.

The significance of diversifying markets has been emphasised in research, including that of Estela [29], who noted the substantial reliance on the US market for fresh asparagus exports. In a similar vein, this study underscores the imperative to diversify frozen squid exports to novel destinations, a strategy that would serve to mitigate risks associated with reliance and foster enhanced economic resilience.

Conversely, Ticse and Maldonado-Cueva underscore the sustainability challenges in the Peruvian fishing sector, which are equally pertinent to frozen squid. Despite indications of recovery and growth in exports, concerns remain regarding the long-term sustainability of such endeavours, primarily due to factors such as overexploitation of resources and inadequate management. This observation underscores the necessity for policies that not only promote diversification but also incorporate sustainable resource management practices.

Competitiveness emerges as a central element in Peruvian exports, which highlight that maintaining a competitive advantage in international markets requires improvements in logistics infrastructure and sustainable practices. These aspects are of fundamental importance for frozen squid, given that fluctuations in production and exports are influenced by external factors such as the pandemic and logistical constraints.

It is evident from the extant literature that significant products such as cocoa have achieved sustained growth as a result of diversification strategies and the exploitation of comparative advantages. This approach could be replicated in the case of frozen squid, integrating tools such as the Balassa Index to identify opportunities for competitive advantage in emerging markets.

IV. CONCLUSIONS

A study of global exports of frozen squid during the period 2019 to 2023 revealed a trend towards diversification in the global market. The Herfindahl-Hirschman Index, a measure of market concentration, decreased from 1,379 in 2019 to 957 in 2023, indicating a reduction in the concentration of exports among exporting countries. Despite the fluctuations caused by factors such as the pandemic of the Coronavirus (SARS-CoV-2), countries such as the Kingdom of Morocco and the Argentine Republic have shown significant increases in their exports, contributing to this diversification. This suggests that the global market for frozen squid has become more competitive and less dominated by a small number of exporters, which may favour the stability and sustainability of international trade in this product.

It was identified that, although there was an initial trend towards diversification in imports until 2022, in 2023 there was a slight increase in concentration, with the HHI increasing from 910 to 997. This finding suggests that, despite an increase in the number of countries participating as importers, a few countries continue to exert a significant influence on the market. The phenomenon may be attributed to a number of factors, including variations in demand and changes in the trade policies of major importers. This concentration may pose a risk to the sustainability of the global market, as reliance on a small number of major importers can create vulnerability to economic or political fluctuations in those countries.

It is evident that China has consolidated its position as the primary destination, exhibiting a substantial growth rate of 361.5% during the period spanning from 2020 to 2023. Nevertheless, the elevated degree of reliance on the Chinese market engenders heightened vulnerability of Peruvian exports to potential fluctuations in demand, trade policies or regulations in China. Conversely, the establishment of new markets, such as Finland, which transitioned from zero imports to purchasing \$13 million in 2023, demonstrates avenues for diversifying export destinations. Market diversification is imperative in order to mitigate risk and ensure the long-term sustainability of Peruvian frozen squid exports.

When determining the HHI of Peruvian exporting companies, an initial trend towards greater diversification was observed until 2022, with the HHI decreasing from 1.731 to 1.297. However, in 2023, the HHI increased to 1.569, indicating a greater concentration in a small number of exporting companies. This suggests that Peruvian frozen squid exports are dominated by a small number of key companies, which could limit competitiveness and innovation in the sector. A focus on business concentration has the potential to result in dependency and an increased susceptibility to operational or financial challenges within these prominent corporations. It is therefore essential to promote the participation of a greater number of companies in the export market in order to strengthen the resilience and sustainability of the sector.

It is concluded that, although there has been a significant recovery and growth after the decline in 2020, there are important challenges related to market and company concentration. The high degree of reliance on markets such as China, in conjunction with the concentration of exports in a small number of companies and regions, has the potential to compromise long-term sustainability and increase vulnerability to external changes. It is imperative to implement strategies that promote market diversification, support the development of new exporting companies and producing regions, and encourage sustainable fishing practices. These actions will contribute to ensuring the economic and environmental sustainability of the sector, aligning with Sustainable Development Goal 8, which seeks to promote inclusive and sustainable economic growth, employment and decent work for all.

IV. RECOMMENDATIONS

Peruvian trade authorities and frozen squid exporters are advised to continue monitoring global market trends and take advantage of growing diversification to expand their presence in new markets. Given the decline in the concentration of exporters worldwide, it is essential to strengthen competitiveness through innovation, improved product quality and the adoption of sustainable practices that differentiate Peru in the international market.

Government agencies and the export sector are advised to implement strategies to diversify the destination markets for Peruvian frozen squid. Given the slight increase in the concentration of global imports in 2023, it is crucial to identify and develop trade relationships with new importing countries, reducing dependence on traditional markets and minimising risks associated with economic or political changes in those countries.

Peruvian exporting companies are advised to diversify their destination markets to reduce their high dependence on China. This involves exploring opportunities in emerging markets and strengthening their presence in countries where trade relations already exist, such as Finland and other European markets. In addition, it is suggested that marketing and negotiation strategies be adapted to meet the specific needs

of each market, promoting the sustainability and stability of exports.

Economic authorities and the business sector are advised to encourage more companies to participate in the export of frozen squid, thereby promoting diversification and competitiveness in the sector. This can be achieved through support programmes for small and medium-sized enterprises, facilitating access to financing, training in international trade and compliance with quality and sustainability standards. Greater business diversity will help reduce concentration and strengthen the resilience of the Peruvian export sector.

REFERENCIAS

- [1] A. Thais, «Pesquería de pota: Desafíos y avances en el camino hacia su sostenibilidad», Inforegion. Accedido: 14 de noviembre de 2024. [En línea]. Disponible en: <https://inforegion.pe/pesqueria-de-pota-desafios-y-avances-en-el-camino-hacia-su-sostenibilidad/>
- [2] FAO, «La situación de los recursos pesqueros», *Organización de las Naciones Unidas para la Alimentación y la Agricultura*, 2022. Accedido: 14 de noviembre de 2024. [En línea]. Disponible en: <https://openknowledge.fao.org/server/api/core/bitstreams/ae439370-d5a7-4552-9968-46ab8dd13b58/content/sofia/2022/status-of-fishery-resources.html>
- [3] D. Ecim y W. Maroun, «Biodiversity considerations in the marine aquaculture and fisheries industries», 2024, pp. 83-110. doi: 10.19103/AS.2023.0128.24.
- [4] I. Sabolić, M. Baltazar, y A. Štambuk, «Incorporating evolutionary based tools in cephalopod fisheries management», *Rev Fish Biol Fish*, vol. 31, n.º 3, pp. 485-503, sep. 2021, doi: 10.1007/s11160-021-09652-0.
- [5] K. Seto *et al.*, «Fishing through the cracks: The unregulated nature of global squid fisheries», *Sci Adv*, vol. 9, n.º 10, mar. 2023, doi: 10.1126/sciadv.add8125.
- [6] Y. Gou y C. Yang, «Dilemmas and paths of international cooperation in China's fight against IUU fishing analysis», *Mar Policy*, vol. 155, p. 105789, sep. 2023, doi: 10.1016/j.marpol.2023.105789.
- [7] M. Cornelis, T. Doortje, y I. Sheriman, «The Quandary of Resolving Illegal, Unreported, and Unregulated (IUU) Fishing Cases: Navigating the Crossroads of Judicial Processes and Maritime Diplomacy», *Pakistan Journal of Criminology*, n.º 16.3, pp. 1143-1154, may 2024, doi: 10.62271/pjc.16.3.1143.1154.
- [8] M. Samy-Kamal, «Insights on Illegal, Unreported and Unregulated (IUU) Fishing Activities by Egyptian Vessels in Neighbouring Countries», *Fishes*, vol. 7, n.º 5, p. 288, oct. 2022, doi: 10.3390/fishes7050288.
- [9] L. Du, «Understanding and Enhancing Fishing Practices for A Sustainable Future», *Highlights in Science, Engineering and Technology*, vol. 99, pp. 227-231, jun. 2024, doi: 10.54097/bg3zfm15.
- [10] B. Yang, J. Anderson, y F. Asche, «Determinants of China's Seafood Trade Patterns», *Marine Resource Economics*, vol. 35, n.º 2, pp. 97-112, abr. 2020, doi: 10.1086/708617.
- [11] N. Jenne, J. Rehner, y L. Quispe, «Las embarcaciones chinas y la pesca ilegal, no declarada y no reglamentada frente a la costa pacífica de Sudamérica», *ICLAC*, 2024, Accedido: 14 de noviembre de 2024. [En línea]. Disponible en: <https://zenodo.org/records/14004234>
- [12] H. Okamura, M. Ichinokawa, y R. Hilborn, «Evaluating a harvest control rule to improve the sustainability of Japanese fisheries», 17 de julio de 2020. doi: 10.1101/2020.07.16.207282.
- [13] M. Makino, «Institutional and Economic Analysis of Japanese Fisheries Management and Its Expansion into Marine Ecosystem Conservation», *AGRI-Bioscience Monographs*, vol. 7, n.º 1, pp. 1-24, feb. 2017, doi: 10.5047/agbm.2017.00701.0001.
- [14] W. Tsutsui, «Modern Japanese Fisheries and the Global Seafood Market», en *Oxford Research Encyclopedia of Asian History*, Oxford University Press, 2023. doi: 10.1093/acrefore/9780190277727.013.572.
- [15] S. Mantilla y G. Loo, «La Exportación de Camarón y su Efecto en las Exportaciones Tradicionales de Ecuador», *593 Digital Publisher CEIT*, vol. 9, n.º 1, pp. 716-733, ene. 2024, doi: 10.33386/593dp.2024.1.2228.
- [16] M. A. Emam, M. Leibrecht, y T. Chen, «The Impact of a “National Green Export Review” on Competitiveness: Empirical Evidence for Ecuador's Fish Exports», *Agriculture*, vol. 13, n.º 1, p. 62, dic. 2022, doi: 10.3390/agriculture13010062.
- [17] M. Barragán, M. Schoon, W. D'Escury, y R. Chuenpagdee, «Managing Fish or Governing Fisheries? An Historical Recount of Marine Resources Governance in the Context of Latin America – The Ecuadorian Case», 2023, pp. 47-71. doi: 10.1007/978-3-031-20740-2_3.
- [18] M. García, «Coastal Lives: Nature, Capital, and the Struggle for Artisanal Fisheries in Peru. Maximilian Viatori and Héctor Bombiella. Tucson: The University of Arizona Press, 2019. 232 pp.», *J Lat Am Caribb Anthropol*, vol. 27, n.º 1-2, pp. 170-172, jun. 2022, doi: 10.1111/jlca.12598.
- [19] A. Lozano, J. Shibata, J. Jeri, y J. Kittinger, «Elevating labor concerns in small-scale fisheries: challenges to decent work in Peru's jumbo flying squid fishery», *Maritime Studies*, vol. 23, n.º 2, p. 28, jun. 2024, doi: 10.1007/s40152-024-00368-y.
- [20] J. Mantari *et al.*, «Investigating Fishing Vessel Casualties in Peru: A Technical and Scientific Review to Support New Regulations», *J Mar Sci Eng*, vol. 11, n.º 12, p. 2224, nov. 2023, doi: 10.3390/jmse11122224.
- [21] M. James, R. Gozzer-Wuest, T. Mendo, I. Gomez, J. Grillo-Núñez, y J. Mendo, «To ignore or mitigate – Economic implications of an illegal artisanal trawl fishery in northern Peru», *Mar Policy*, vol. 158, p. 105865, dic. 2023, doi: 10.1016/j.marpol.2023.105865.
- [22] S. Puente y R. Lama, «Industrial fisheries in Latin America», en *Marine and Fisheries Policies in Latin America*, Routledge, 2019, pp. 15-32. doi: 10.4324/9780429426520-3.
- [23] M. Gutiérrez, J. Castillo, L. Naranjo, y M. Akester, «Current state of goods, services and governance of the Humboldt Current Large Marine Ecosystem in the context of climate change», *Environ Dev*, vol. 22, pp. 175-190, jun. 2017, doi: 10.1016/J.ENVDEV.2017.02.006.
- [24] N. Rajab, «Rethinking Marine Resource Management and the Livelihoods of Artisanal Fishers», *Tanzania Journal of Sociology*, vol. 9, n.º 1, pp. 137-155, jun. 2023, doi: 10.56279/tajoso.v9i1.123.
- [25] R. Falla y F. Heredia, «Analysis of the Diversification of Exports in Peru's Fishing Sector 2000 – 2022», en *22nd LACCEI International Multi-Conference for Engineering, Education and Technology (LACCEI 2024): “Sustainable Engineering for a Diverse, Equitable, and Inclusive Future at the Service of Education, Research, and Industry for a Society 5.0.”*, Latin American and Caribbean Consortium of Engineering Institutions, 2024. doi: 10.18687/LACCEI2024.1.1.492.
- [26] E. Ticsé *et al.*, «“Importancia de la Industria Pesquera en el Perú, un enfoque hacia el desarrollo sostenible de la misma”», en *The 1st LACCEI International Multi-Conference on Entrepreneurship, Innovation, and Regional Development: “Ideas to Overcome and Emerge from the Pandemic Crisis”*, Latin American and Caribbean Consortium of Engineering Institutions, 2021. doi: 10.18687/LEIRD2021.1.1.24.
- [27] J. Montes *et al.*, «A Strategy for the Sustainability of Peru's Blueberry Exports: Diversification and Competitiveness», *Sustainability*, vol. 16, n.º 15, p. 6606, ago. 2024, doi: 10.3390/su16156606.
- [28] S. Galvez y C. Lopez, «Diversificación y ventaja comparativa revelada de las exportaciones de cacao en grano en el Perú 2013-2023», Tesis de pregrado, Universidad de San Martín de Porres, 2024. Accedido: 20 de diciembre de 2024. [En línea]. Disponible en: <https://repositorio.usmp.edu.pe/handle/20.500.12727/15727>
- [29] M. Estela *et al.*, «Diversificación de las exportaciones de Espárragos en conserva, del Perú 2013-2022», en *Proceedings of the 3rd LACCEI International Multiconference on Entrepreneurship, Innovation and*

Regional Development (LEIRD 2023): “Igniting the Spark of Innovation: Emerging Trends, Disruptive Technologies, and Innovative Models for Business Success”, Latin American and Caribbean Consortium of Engineering Institutions, 2023. doi: 10.18687/LEIRD2023.1.1.255.

- [30] P. Maldonado-Cueva, Y. Criado-Dávila, y V. Fernandez-Bedoya, «Foreign investment in the fishing sector after the Free Trade Agreement between Peru and China, 2009-2021», en *LACCEI*, Latin American and Caribbean Consortium of Engineering Institutions, 2024. doi: 10.18687/LACCEI2024.1.1.1606.
- [31] Alfonso. Casanova y Ismael. Zuaznabar, *El Comercio Internacional: teorías y políticas*, 2018.^a ed. Editorial: «Universo Sur», 2018.
- [32] P. Krugman y M. Obstfeld, *Economía internacional: teoría y política*, SÉPTIMA EDICIÓN. PEARSON EDUCACIÓN, 2006. Accedido: 23 de septiembre de 2023. [En línea]. Disponible en: <https://fad.unsa.edu.pe/bancayseguros/wp-content/uploads/sites/4/2019/03/Krugman-y-Obstfeld-2006-Economia-Internacional.pdf>
- [33] N. Coniglio, D. Vurchio, N. Cantore, y M. Clara, «On the Evolution of Comparative Advantage: Path-Dependent Versus Path-Defying Changes», *SSRN Electronic Journal*, 2018, doi: 10.2139/ssrn.3136471.
- [34] U. Whang, «Comparative advantage, product quality, and the competitiveness of firms», *Journal of Korea Trade*, vol. 21, n.º 3, pp. 174-190, sep. 2017, doi: 10.1108/JKT-06-2017-0061.
- [35] F. Palmieri, «Repensando las teorías del comercio internacional. Argentina: Cámara de exportadores de la República de Argentina», 2019. <https://www.studocu.com/latam/document/universidad-nacional-autonoma-de-honduras/cooperacion-internacional-e-integracion-economica/teorias-del-ci-palmieri/46411253>
- [36] R. Forslid y I. Wooton, «Comparative Advantage and the Location of Production», *Rev Int Econ*, vol. 11, n.º 4, pp. 588-603, sep. 2003, doi: 10.1111/1467-9396.00405.
- [37] OECD, *Globalisation, Comparative Advantage and the Changing Dynamics of Trade*. OECD, 2011. doi: 10.1787/9789264113084-en.
- [38] S. Kanaka y M. Chinadurai, «A study of comparative advantage of indian agricultural exports», *Journal of Management and Science*, vol. 1, n.º 3, pp. 175-183, dic. 2012, doi: 10.26524/jms.2012.19.
- [39] M. McHugh *et al.*, «What is it good for? Basic versus applied research », *Science in School*, nov. 2021, Accedido: 11 de noviembre de 2024. [En línea]. Disponible en: <https://www.scienceinschool.org/es/article/2021/basic-versus-applied-research/>
- [40] C. Thompson y E. Panacek, «Research study designs: Non-experimental», *Air Med J*, vol. 26, n.º 1, pp. 18-22, ene. 2007, doi: 10.1016/j.amj.2006.10.003.
- [41] T. Cueva, O. Jara, J. Arias, F. Flores, y C. Balmaceda, *Métodos mixtos de investigación para principiantes*. Instituto Universitario de Innovación Ciencia y Tecnología Inudi Perú, 2023. doi: 10.35622/inudi.b.106.
- [42] P. Yllescas-Rodríguez, R. Espinoza-Casco, y R. Macha-Huamán, «Diversificación de la oferta exportable y las exportaciones peruanas», *Revista Arbitrada Interdisciplinaria Koinonía*, vol. 6, n.º 1, p. 322, dic. 2021, doi: 10.35381/r.k.v6i1.1510.
- [43] S. Gnanon y S. Priyadarshi, «Export Product Diversification, Services Production and Exports in Least Developed Countries», *Journal of International Commerce, Economics and Policy*, vol. 07, n.º 03, p. 1650013, oct. 2016, doi: 10.1142/S1793993316500137.
- [44] J. Montes *et al.*, «Diversification of Peruvian Ginger exports 2012 – 2021», Latin American and Caribbean Consortium of Engineering Institutions, 2023. doi: 10.18687/LACCEI2023.1.1.1053.
- [45] J. Montes *et al.*, «Peruvian Agro-Exports’ Competitiveness: An Assessment of the Export Development of Its Main Products», *Economies*, vol. 12, n.º 6, p. 156, jun. 2024, doi: 10.3390/economies12060156.