Distribution and export logistics: Commercial development of the millenary product Chenopodium Quinoa

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Abstracts: The objective of this article was the commercial development of the millenary product Chenopodium Quinoa from a perspective of distribution and export logistics. Methodologically, it was a documentary research that used content analysis as a strategy for the review of the texts, which were retrieved through the following databases: a) Scopus, b) Scielo, c) Web of Science - WoS and, d) Google Scholar, and selected based on the criteria: (a) original or review scientific articles, (b) published in Spanish or English language, (c) temporal delimitation to the last eight years (2015-2022), (d) citable documents, resulting in a total of fourteen reviewed articles (n=14). The bibliographic analysis allowed discriminating from an analytical point of view the supply chain from the quinoa production source, markets and logistic corridors to its export point. This literature review demonstrated that the creation of a more efficient supply chain (distribution logistics) would be beneficial for all parties involved, as it would expedite the circulation of the product, improve responsiveness to customer needs and encourage creative problem solving in the service of distribution and export, validating it from a documentary and bibliographic perspective.

Keywords: Distribution logistics, Supply chain, Export, Business development, Quinoa product.

1. INTRODUCTION

Today's agricultural market faces difficult challenges in meeting the needs of a growing world population in a way that does not compromise environmental sustainability. In addition, the nutritional quality of the food produced and supplied is of utmost importance in the fight against global malnutrition (Campos et al., 2017). Therefore, new functional, healthy and nutritionally dense products have become fashionable. For this reason, the development of the agricultural sector, including the export of its derived products, requires the establishment of a logistic distribution system capable of responding to the benefits obtained both nationally and internationally through export (Feito, 2020).

Peru is a country rich in natural resources and one of the pioneers of large industrial sectors that promote the country's development, among them is the agricultural sector, from which various products have established themselves in the world market. One of these is quinoa, whose production and market value have increased significantly since 2010-especially in 2013 and 2014-making the country the world's leading exporter of this product (Orellana & Lalvay, 2018).

The native Peruvian quinoa crop showed a significant rebound in agricultural production in 2014, which in turn boosted Peru's quinoa supply for export. This was good news for the country's economy as a whole, and boosted quinoa cultivation in the countryside displacing other emerging crops and opening new markets (Mendoza et al., 2021). However, the boom of the 1990s may have been built on unsustainable foundations, leading to overproduction, price volatility, poor logistics management and, in certain cases, a decline in quality that tarnished the product's reputation abroad. Thus, there was no commercially viable and productive support system that would set the agroexport trend for this crop and obtain benefits for the producer (Del Barco et al., 2020; Vargas et al., 2015).

In addition, improving industrial processes that are optimal, simple and easy to use is crucial for the development of products that can utilize agricultural labor to meet mass market demand for processed goods and ultimately help the Colombian farmer improve his standard of living and financial situation.

By virtue of this, and maintaining the premise of economic sustainability, the distribution logistics of this product plays an elemental role, since it is the set of activities related to the management of goods, since they leave the planting (land preparation, crop installation, grain harvesting, among others), selection and classification, temporary storage with the appropriate predisposition in terms of environmental characteristics for their conservation, reception of cargo directly from the assembly line, until they are delivered to the customer who has ordered them (Pinedo et al., 2020).

The objective of this study is to analyze the commercial development of the millenary product *Chenopodium* Quinoa from the perspective of distribution and export logistics, as well as, through this objective, to demonstrate the procedures and logistics involved in the shipment of this product abroad. As a crop with important export potential and geographical representation along Peru's key trade routes, quinoa was chosen as a representative example. As such, this outline constitutes a contribution to the study of the analysis of composite supply chains for the comprehensive analysis of logistics services in Peru. From the source of quinoa production to the point of export, the distribution network, its markets and the transportation routes that link them are traced and described.

2. METHODOLOGY

The present literature review study allows, as Codina (2020) states, to unveil the relevance of a given topic and the underlying previously published documents, compiling all the evidence that met the eligibility standards established to guide the scientific research topic (Sobrido & Rumbo-Prieto, 2018). This study also uses the application of the content analysis methodology to the study, which, according to Berelson (1952), is a modality used to describe objectively, systematically and quantitatively, in which it seeks to analyze the commercial development of Quinoa from a perspective of distribution and export logistics. Likewise, this approach revealed the logistics management, supply chain and exports of quinoa; in addition, this study concluded with evidence of the commercial development of this millenary product.

The information was initially selected by identifying relevant key terms, which are crucial for finding relevant articles in databases (Granda et al., 2003). In the case of this study, the search terms were produced from the incorporation of the following keywords: a) distribution logistics, b) supply chain, c) export, d) commercial development, e) quinoa product, the use of the Boolean "AND", this accompanied the search for the papers considered, discovering studies that addressed each of the categories and that were within the range of publications classified as studies of relevance for being recent and original in the treatment of the topic of interest.

The keywords previously described were processed through the following search engines: a) Scopus, b) Scielo, c) Web of Science - WoS and, d) Google Scholar, which allowed identifying a total of one hundred and seventy seven (n= 177), being necessary a selection of texts from criteria (Flick, 2012; Herbas & Rocha, 2018) that delimited the search in the databases, establishing the following: (a) original or review scientific articles, (b) published in Spanish or English language, (c) temporal delimitation to the last eight years (2015-2022), (d) citable documents, and those for exclusion were: a) degree, master's or doctoral theses, (b) opinion articles, (c) in a language other than Spanish or English (d) outside the established time range, all of which led to the selection of twenty (n= 20) publications to be reviewed.

Table 1. Selected Research by Search Engines Used.

Search Engine	Quantity
Scopus	9
Scielo	5
WoS	3
Google Scholar	3
Total	20

2.1. Information Processing

To gather and standardize the necessary information inherent to the texts, the bibliographic record technique was applied to the selected texts, following Casasola's approaches (2014). Next, the records were examined in search of any relevant information for the definition of units of analysis, for this, they were processed in an artisanal way, using the Detector tool, available at http://www.repetition-detector.com/?p=onlin, after the identification, the categorization procedure described by Chávez & Martínez (2021) was used, this method was based on the elaboration of units of meaning and analytical categories, which played an essential role in the realization of this research.

Finally, the results were synthesized and presented using the triangulation method suggested by Okuda & Gómez-Restrepo (2005) to compare and contrast the author's analysis, the information available in the literature and the support of other studies that support the analytical horizon.

3. RESULTS

The results made it possible to select 14 publications out of the 20 selected, all of them detailed in Table 2, which is organized according to: a) year of publication, b) author and c) title, and which presents the documents that were the object of analysis for this review.

Table 2. Matrix of Articles Considered for the Review.

N°	Año	Autor	Título
1	2019	Durán Olivares Tania	Quinua export. Producto milenario, mercado e instituciones en el altiplano boliviano.
2	2019	Guardián José & Trujillo Indira	Cadena de suministros para la exportación de granos andinos a Estados Unidos.
3	2018	Mercado Waldemar	Economía institucional de la cadena productiva de la quinua en Junín, Perú.
4	2019	Basantes-Morales Emilio, Alconada Margarita & Pantoja José	Quinua (Chenopodium quinoa Willd) Production in the Andean Region: Challenges and Potentials
5	2015	Cely Torres Lucy & Ducón Salas Julio	Posibilidades en el comercio internacional de la quinua: un análisis desde la perspectiva de la competitividad.
7	2017	Mercado Waldemar & Ubillus Karina	Characterization of producers and quinoa supply chains in the Peruvian regions of Puno and Junín
8	2021	Mardaneh Elham, Loxton Ryan, Meka Shiv & Gamble Luke	A decision support system for grain harvesting, storage, and distribution logistics
9	2018	Macheno-Saá Marcelo, Villaba-Miranda Raúl, Gamboa-Salinas Jenny & Mancheco-Saá Juan	Logística comercial. Revisión Literaria
10	2021	Sánchez Yasniel, Pérez Castaneira Jessie, Sangroni Laguardia Naylet, Cruz Blanco Cesar & Medina Nogueira Yuly	Retos actuales de la logística y la cadena de suministro.
11	2019	Mogale Naoufel & Manoj Kumar	Modelling of sustainable food grain supply chain distribution system: a bi-objective approach.
12	2021	Szentesi Szabolcs, Illés Béla, Cservenák Ákos, Skapinyecz Róbert & Tamás Péter	Multi-Level Optimization Process for Rationalizing the Distribution Logistics Process of Companies Selling Dietary Supplements.
13	2019	Gurnak Vitalii, Volynets Lyudmila & Khalatska Illona	Intellectualization of logistic supply chains on the basis of forecasting volumes of cargo transportation.
14	2016	Nourbakhsh Seyed, Bai Yun, Maia Guilherme, Ouyang Yanfeng & Rodríguez Luis	Grain supply chain network design and logistics planning for reducing post-harvest loss.
15	2019	Kingwell Ross, Loxton Ryan & Mardaneg Elham	Factors and scenarios affecting a farmer's grain harvest logistics.
16	2017	Khan Yury, Taipov Timur, Kantarbayeva Shyryn, Zamanbekova Altynshash & Khan Valery	Kazakhstan: Transport and Logistical Risks in Grain Export.
17	2020	Kolodiichuk, V., Cherevko, H., Kolodiichuk , I. & Popivniak,	Efficiency of logistics chain management in the grain product subcomplex of the agro-industrial complex of Ukraine.
18	2020	Mesterházy Ákos, Oláh Judit & Popp József	Losses in the Grain Supply Chain: Causes and Solutions.
19	2021	Iryna Ihorivna Polishchuk, Yuriy Vasylovych Dovhan, Iryna Valentynivna Korol	Logistics and marketing support improvement in the export supply chain.
20	2018	Bvepfepfe, Benjamin	Supply chain network and logistics management.

Now, the analysis of the documents in general allows verifying that the studies since 2015 have been developed continuously, so it can be deduced that it is an updated research problem and of interest in the distribution logistics area. It is evident that the years with the highest trend in these studies are concentrated between 2018, 2019 and 2021. Therefore, we proceed to establish the theoretical discrimination of the condensed clusters in the table above.

4. DISCUSSION

The logistics process is a vital cog in the supply chain management circle, as the momentum of the chain can be maintained even if some links in the chain are temporarily disabled (Mancheco-Saá et al., 2018; Mogale, 2019). In other words, logistics is responsible for minimizing overhead, ensuring product quality, and making the most efficient use of available time and materials, all while maintaining a working relationship with the company's suppliers (Casttaneita et al., 2021; Mesterházy et al., 2020).

The value chain in production is highly relevant to the growth of highly competitive factors of production, as it necessitates an appreciation of how the complexity of markets requires a cooperative approach to manufacturing (Nourbakhsh et al., 2016; Guardián & Trujillo, 2019).

4.1. Quinoa Supply Chain

Starting from the growing regions of Apurímac, Puno, Cusco, Junín and Ayacucho, the quinoa supply chain finally reaches the port of Callao for export (Figure 1). Currently, more than 3,400 hectares of quinoa are cultivated nationally using an organic method, making it an important variety in this chain (Durán, 2019; Mercado, 2018). However, a series of steps must be taken, such as switching to organic inputs within two years and obtaining organic certification by the corresponding institutions BCS OKO Garantie or organizations such as SENASA.

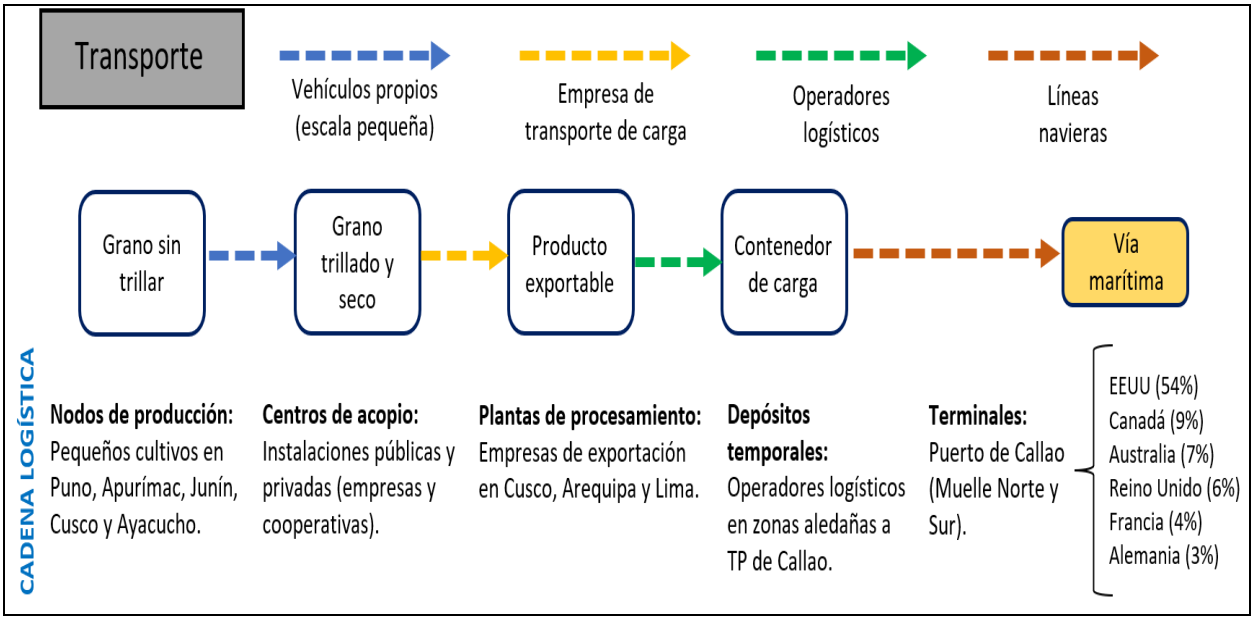

Figure 1. Quinoa Supply Chain.

Cultivated mostly in the dry climates of the puna in the south, quinoa is transported from production nodes to the collection center. Also, the Puno region is the first national production center, responsible for almost 60% of all national production (Mercado & Ubillus, 2017; Mercado, 2018). In addition, almost half of Peru's total production comes from this region alone, with San Román, Puno, Huancané, El Collao and Azángaro accounting for the largest share.

On the other hand, the smallest production centers are located in the provinces of Arequipa and Caylloma, in the highlands of Arequipa, the city of Ayacucho and Huamanga in the province of Ayacucho, the surrounding countryside and Jauja in Junín, the province of Quispicanchi in the highlands of Cusco and the province of Apurímac in the highlands of Apurímac (in the Andahuaylas region).

In contrast, from the collection points to the places where quinoa is processed, smallholder farmers who grow quinoa often cannot do more than harvest the grain at the production sites and transport it to another location, where it does not undergo any further processing (Mercado & Ubillus, 2017; Mercado, 2018). To be more precise, quinoa is unique in the sense that the storage link is crucial to its success. This is because it is the only way for farmers to sell their products to consumers. Currently, only large export organizations such as Alisur S.A.C, Exportadora Agrícola Orgánica S.A.C and Grupo Orgánico Nacional S.A. maintain direct communication between farmers and traders. In addition, the merchandise receives a value increase at the collection centers, where the grain is prepared for further processing by being cleaned, rinsed and dried, threshed and undergoes quality control to ensure a consistent final product (Kingwell, 2019).

On the other hand, most of Peru's processing factories oriented to export or supplying international buyers are located in Arequipa, Lima and Cusco, to a lesser extent (Mercado & Ubillus, 2017; Mercado, 2018). The main agroexporting companies have facilities in Lima (Ate and Lurín), among these companies are Grupo Orgánico Nacional S. A., Exportadora Agrícola Orgánica S.A.C., Interamsa Agroindustrial S. A. C and Alisur S.A.C.

In these facilities, the product goes through the various processing stages, such as washing, grading, de-stoning, packing or packaging and storage. Furthermore, in the processing factories, the grain goes through an additional process, depending on the final result, the quinoa may undergo further processing, such as milling to export flour or flakes (Romero-Carazas et al.,2023).

The production and distribution process (logistic chain) of quinoa involves:

- The cultivation of the product is the responsibility of the producers. There are two types of producers: those who are too small to form groups or cooperatives, who sell their goods directly to consumers, and those who are large enough to sell to marketing companies or exporters.

- The rescuers: they arrive by buying the goods from low-income producers and reselling them at higher prices at wholesale markets or community events.

- Sellers or associations, cooperatives, processors, traders and export companies do not grow the crop themselves, but store and sell it. It is important to note that cooperatives, in some places, are actually government-operated collection and processing centers.

- Those who transform quinoa into exportable forms are called "processors". Their only responsibility is the final packaging of the product or its transformation into flakes or flour.

- Traders; those who buy and sell quinoa in its various processed forms (such as flour and flakes).

- Foreign market buyers, often referred to as exporters, are companies that purchase quinoa grains for export.

Therefore, in order to achieve production levels that improve the company's position in world markets, it initially requires the creation of an enabling environment for its production, in which producers can access financial, technological, economic, political, etc., elements that help the development of synergies that facilitate the entry and continued success of producers in the markets.

4.2. Logistics Corridors

In this project, quinoa was located along three of the logistics routes considered: in the Peruvian region of Puno-Arequipa-Callao (along the entire corridor), subsections of Satipo-Callao, Puno-Zarumilla and Puno-Callao can be found.

Moreover, the difference between the latter two corridors is due to the fact that one of them focuses on the logistics of quinoa grown in Puno and Arequipa that is processed in Arequipa or Lima, while the other focuses on quinoa grown in Apurímac, Puno, Ayacucho and Cusco that is processed in Cusco or Lima. In some situations, such as the Satipo-Callao corridor, due to the proximity of production nodes and collection centers, these routes are relatively comparable to those for other commodities; however, in other cases, a different analysis is needed.

Consequently, supply chain corridors consist of three stages:

- The first stage is transportation from the factory to the warehouse. This stage covers all costs from the time the quinoa is harvested until it arrives at the collection facility.

- The second phase of transportation occurs on the journey from the collection facility to the processing facility. This includes all costs from the time the quinoa is delivered to the collection facility until it is processed.

- The third phase of transportation occurs on the route between the manufacturing plant and the port of departure. This covers the costs incurred at the plant up to the time of shipment to the port of departure.

Storage and lead time for consolidation of export cargo entail significant logistical costs that must be taken into account from the beginning of the supply chain (Mardaneh, 2021; Khan, 2017). In some regions, such as Ayacucho, production is dispersed, making it difficult to combine goods into a single shipment for export.

4.3. Quinoa Exports

As for the main nations to which quinoa is exported, the United States tops the list with US$ 49.3 million in FOB value, followed by countries such as Canada and France, among others, with US$ 9.5 million and US$ 7.1 million, respectively. While Brazil (74.2%), France (30.0%) and Chile (28.7%) saw the largest year-on-year changes from 2018 to 2019.

According to discussions with suppliers, white quinoa is the most demanded variety, with the other shades serving as complementary orders. Therefore, in 2019, white quinoa accounted for US$94.6 million (70.3%) of all quinoa exports, followed by red quinoa with US$23.2 million (17.3%) and tricolor quinoa with US$11.4 million (8.4%).

Exports, measured in kilograms, show an even more dramatic change from 2015 to 2019, rising from 41.8 thousand tn to 48.9 thousand tn. Consequently, Spain, Belgium and France, along with Brazil and Chile, have some of the highest sustained economic growth rates in the world. In that sense, due to rising incomes and, by extension, health awareness, quinoa presents a significant opportunity in developing countries.

Last but not least, it is crucial that, through a collaborative effort throughout the production chain, the advantages, applications and qualities of quinoa begin to be more actively developed and promoted (Cely & Ducón, 2015). This will awaken the interest of national and international markets in a crop that, while not a recent discovery, is still relatively unknown to a large segment of the world's population and can offer a solution to urgent problems famine and other public health problems (Mercado, 2018).

5. CONCLUSIONS

In the bibliographic review of the articles analyzed, it became evident that, in only the last four years, quinoa has matured to become a competitive export. An increase in the volume of exports was highlighted, as well as the increase in the total gross value of the agricultural sector that exports represent. It is also important to mention that the United States and Canada occupy the first two positions, followed by Australia and the United Kingdom.

It was also found that the three most important logistical corridors in the quinoa supply chain for exporting the product are: Puno-Zarumilla (Puno section), Satipo-Callao (Jauja-Callao section) and Puno-Callao (Ayacucho-Callao section). The routes end at the port of Callao, which has handled an average of 70% of the world's quinoa exports in recent years.

Importantly, the separate aspects of supply chain management should not be examined in isolation, as doing so could lead to problems that could hinder performance. This is why it is so significant to include all links in the supply chain in national development projects to address these issues. When the supply chain works well, everyone involved in the production process, from farmers to distributors to retailers to consumers, benefits.

Consequently, quinoa producing countries must commit to forms of association, production and marketing that allow them to create differentiating factors through research, innovation and the creation of products in which quinoa plays a key role. Understanding the importance of food security today and the environmental conditions of the planet in general, requires a production framework that is supported and generated by the State from which public policies can be derived.

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