Statistical Analysis of Manufacturing, Trade and Service in the Textile Industry in Ecuador, 2000-2020

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Abstract

The aim of this scientific contribution is to show a statistical analysis of the manufacturing, trade and services of the textile industry in Ecuador, between the years 2000 and 2020. To achieve this objective, an exhaustive study of the Scopus international database and of the Ecuadorian government database called the National Institute of Statistics and Censuses (by its acronym in Spanish INEC). This research provided the following lines of results: 1) Bibliometric study of the textile industry in Ecuador; 2) Statistical study of the textile industry in Ecuador; 3) Preferences of the Ecuadorian textile market. The fundamental conclusion of this study is that: Manufacturing activities have 11,006 establishments, of which 74.2% correspond to the manufacture of clothing, except leather clothing. Total employed personnel in activities related to the textile sector amounts to 115,937 people, of which 68,215 are women and 47,722 men. In the last 11 years, the textile industry has maintained an average share of between 1% and 2% in total GDP, according to data from the Central Bank of Ecuador.

Keywords

Manufacturing, Industrial Economy, Productive, Business Economy, Competitiveness

1. Introduction

Some studies in the business literature indicate the relationship that exists between technology, capital, labor and productivity, and even, going a little further, determine the correlation that exists between the technological stock, capital human and technical efficiency expected in industries. According to an investi-

gation carried out on technical efficiency in the manufacturing industry in Mexico, evidence was found that despite investment and changes in technology, industries do not tend to approach the best practice production level (Bravo, 2022).

Another reference to consider for this study is that the government of Ecuador, through the National Secretariat of Planning and Development of Ecuador, has determined as a public policy the change of the productive matrix, understood as the transformation of the primary export and extractivist industry, to one that focuses on diversified, eco-efficient production with higher added value, as well as services based on the economy of knowledge and biodiversity (Fuentes Garcés, 2019).

The authors' publication (Villacís & Pazmiño, 2018) establishes that in Ecuador there are three large groups of activities that make up the textile sector, a classification that was obtained from the results of the 2019 National Economic Census; these are: Manufacturing, Commerce and Services, with a participation in the textile sector of 23%, 68% and 9%, respectively. Additionally, Pichincha (27%), Guayas (17%), Tungurahua (8.1%), Azuay (7.5%) and Imbabura (4.5%) are the provinces where the largest number of establishments is located. Textile sector totals 47,043 establishments nationwide.

The investigation (Moreno, 2017), indicates that the textile sector generated a total of 107,000 jobs in 2017; additionally, the sector represented 603 million of GDP, and production, between 2007 and 2013, was 8.16%. The manufacturing industrial sector, of which the textile sector is a part, grew by 4.03% between the years 2010-2013. On the other hand, the annual cost of the textile industries that operate in Ecuador is 18% lower than the average of competing countries in the region, such as Chile, Argentina, Colombia and Costa Rica. To this advantage of the companies in the sector are added others, such as: incentives in the payment of income tax, reduction of taxes on foreign currency outflows, reduction of tariffs on imported capital goods and customs facilities.

The diversification of the textile sector in Ecuador with the elaboration of multiple textile products has a great classification of products. Spinning and weaving are the main activities, with the largest volume of production. However, the manufacture of textile garments, such as clothing and household items, is increasing its production level (Ak, Yucesan, & Gul, 2022).

According to the Association of Textile Industries of Ecuador (for its acronym in Spanish AITE), in its 2016 report, Ecuadorian textile companies generate direct and indirect employment and are the second manufacturing industry to offer more employment to Ecuadorians. 72.5% of working people are women, 30% of workers are between 18 and 30 years old, while 65% are between 31 and 65 years old. In addition, according to the AITE itself, this industry is the third largest in the entire manufacturing sector and contributes more than 1040 million dollars to Ecuador's GDP (AITE, 2016).

The contribution of the authors (Villacís & Pazmiño, 2018) shows that from

the results obtained from analyzing the SMEs belonging to the International Standard Industrial Classification (ISIC C13) of Ecuador throughout the period of time between 2000 and 2014, it is evident that Productivity is most influenced by the use of technology, followed by capital and labor, in that order. However, it should be clarified that the model found in this research, as well as the variables used, present decreasing returns to scale, which means that if factors such as capital, labor and technology are increased, the product will increase, but in smaller proportion. The importance of the technology and capital variables is due to the fact that in recent years the textile industry has invested in the incorporation of new machinery and technology with the aim of raising the level of efficiency in production processes. However, according to the model obtained, the positive impacts of their aggregation on the productivity of SMEs in the textile sector are not yet evident (Karanikas & Hasan, 2022).

The hypothesis regarding the effect of the use of technology on productivity in textile SMEs was verified, since if investment is made in technological inputs and machinery and equipment are modernized and increased, these actions will result in an increase in productivity. productivity, a situation that could be strengthened if there is a legal framework that promotes the industrial development of Ecuadorian SMEs (Jiménez, 2016).

Although it is too early to evaluate the effect of the policies related to the change of the productive matrix in Ecuador, which basically aim to strengthen the productive system based on efficiency and innovation, the results obtained still do not allow us to affirm that there is evidence that the SMEs are playing an important role in this process, since they barely report a small business and economic growth, or what is the same, their productivity growth results are still far from government expectations (Tauriz, 2015).

This research has the purpose of showing a statistical analysis of the manufacturing, trade and services of the textile industry in Ecuador, from the years 2000 to 2020. This document focuses on the following points: 1) Bibliometric study of the textile industry in Ecuador. 2) Statistical study of the textile industry in Ecuador. 3) Preferences of the Ecuadorian textile market.

2. Materials and Methods

To achieve this research, the Scopus database was used. This is a bibliographic database started in 2004, of abstracts and citations of articles from scientific journals. It contains, apart from articles, more than 3700 Gold Open Access indexed journals, more than 210,000 books and more than 8 million conference proceedings, more than 8 million documents in open Access, it also includes "Articles in Press" of more than 5500 titles, and covers 40 languages (Bravo-Hidalgo, 2018). It covers areas of: science, technology, medicine and social sciences (including arts and humanities). It covers more than 35,000 titles from all areas. Apart from journals, it has monographic series, conference proceedings, books (emptied at the book and chapter level) or patents (more than 39

million, emptied from five official offices: WIPO, EPO, United States, Japan and United Kingdom). Its temporary coverage is from 1996, although sometimes it reaches up to 1970. It is updated daily (Hidalgo & Hernández, 2021).

In some cases, it gives access to the full text of the documents it includes. It also offers bibliometric tools to evaluate the performance of publications and authors, according to the citations received by each article. These tools are based on the metrics developed by different experts, such as the Spanish research group Scimago, or the CWTS (Center for Science and Technology Studies), of the University of Leiden (The Netherlands). This database allowed:

- Search for documents and access the full text if the library has a subscription.
- One of the search options available in Scopus is by funding agency. It also allows you to limit the results of a search to showing patents.
- Evaluate the performance of the research through the SJR, CiteScore and SNIP impact indices or the altmetrics offered by PlumX (following the PlumX link, the list of documents that cite the article in question is retrieved). Apart from the basic metrics of an author and his publications, Scopus Preview gives us metrics of a specific article.

The other database used in this research is the National Institute of Statistics and Censuses (by its acronym in Spanish INEC), it is an Ecuadorian institution, responsible for official statistics, it is the entity in charge of planning, regulating and certifying the production of National Statistical System, in addition to producing relevant, timely, reliable and quality statistical information; and, innovate in methodologies, metrics and analysis of statistical information necessary for the design, implementation and evaluation of national planning.

- Operate as a general official center with information on the country's statistical data.
- Coordinate and supervise the execution of programs and work plans to be carried out by the institutions of the National Statistical System (for its acronym in Spanish SEN).
- Carry out statistical inventories and maintain a centralized archive of the research methodologies and instruments used by the SEN.
- Prepare and update the statistical cartography necessary for the execution of the investigations carried out by the dependencies that make up the SEN.
- Carry out population and housing, agricultural, economic and other censuses, publish and distribute their results.
- Disseminate statistical information in a timely manner, through printed and magnetic media to people or public and private entities at the national or international level.

The information detected in these databases was extracted in different formats and analyzed in computational tools for calculation and statistical analysis such as Microsoft Excel.

The information is found in the Scopus database, under the search criteria "Textile industry in Ecuador" in the title, abstract and keywords of the ar-

ticle-type documents. They showed a total of 563 results. This information was exported from the Scopus database in (RIS) format and was processed in the VOS viewer science bibliometric analysis tool.

3. Results and Discussion

Before you begin to format your paper, first write and save the content as a separate text file. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads—the template will do that for you.

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar:

3.1. Bibliometric Study of the Textile Industry in Ecuador

As a bibliographic review, a list of the main scientific contributions published in the Scopus database is shown. These are publications directly related to the context of services, businesses and manufacturing of the Ecuadorian textile industry.

(Aguilera, Mila, Batallas, & Torres, 2018) This research aims to determine if the technical training policies proposed by the Ecuadorian government after the adoption of the methodological model of productivity and systematic competition (which originated in the German Institute of Development), were correctly distributed and implemented in one of the prioritized industries: the textile and clothing industry.

(Corr, 2018) In the 1600s, Marcos Cunamasi, an indigenous man in Pelileo, Ecuador, hid his child from him to protect him from officials who would put the boy to work in the textile mill. Cunamasi was forced to turn him over. Because his young son deél could n't keep up with spinning his quota of wool per day, Cunamasi helped so the child would n't be whipped. After working a year, Cunamasi was paid a shirt and a hat. Interwoven is the untold story of indigenous people's historical experience in colonial Ecuador's textile economy. It focuses on the lives of Native Andean families in Pelileo, a town dominated by one of Quito's largest and longest-lasting textile mills. Quito's textile industry developed as a secondary market to supply cloth to mining centers in the Andes; thus, the experience of indigenous people in Pelileo is linked to the history of mining in Bolivia and Peru. Although much has been written about colonial Quito's textile economy, Rachel Corr provides a unique perspective by putting indigenous voices at the center of that history. Telling the stories of Andean families of Pelileo, she traces their varied responses to historical pressures over three hundred years; the responses range from everyday acts to the historical transformation of culture through ethnogenesis. These stories of ordinary Andean men and women provide insight into the lived experience of the people who formed the backbone of Quito's textile industry (Kim et al., 2022).

(Doyon-Bernard, 1993) Details are presented of the textile remains recovered from the shaft tombs of La Florida, near Quito in Ecuador, which provide an opportunity to evaluate the weaving tradition of pre-Hispanic Ecuador. These date back to AD 340 and consist of nearly 250 fragments and lengths of cordage, representing the oldest existing textiles known to have survived the moist climate of this Andean nation. Cotton and camelid hair yarns have been identified. Spinning and dyeing are examined. Plain-weave and twill-weave fabrics and braids have been discovered.

(Gaibor, Mesias, & Vásquez, 2021) The objective of this chapter is to propose a methodology for the measurement of value chain relational coordination of SMEs. For this purpose, the case of the measurement of relational coordination of the value chain of a small safety footwear company of Ambato, Ecuador is analyzed. The results of the analysis show that the measurement of relational coordination in the value chain of SMEs presents several challenges. Some of the challenges are the result of some characteristics of SMEs such as the lack of strategy, processes, and functions formalization. Other challenges are derived from the size and power asymmetry of chain members and the geographical distance between them (Louhichi, Gaied, Mansouri, & Jeday, 2022). Five steps are proposed for the measurement of relational coordination of the value chain of SMEs.

(Víctor, Ronald, Ester, Cintia, & Carolina, 2021) In recent decades, China has conquered the different markets of the world, especially in developing countries. Ecuador is one of the countries where products from the Chinese textile industry are commercialized on a large scale, being a strong competition for the local industry. However, one of the most important characteristics that differentiate these products is quality. For this reason, the present study seeks to determine if there are differences in the perception of quality of consumers compared to both industries. In addition, this study identifies the relevant attributes that differentiate garments. To achieve this, two surveys were prepared, one aimed at consumers of Chinese clothing and another at consumers of Ecuadorian clothing, both were conducted in Guayaquil (Tseng, Bui, Lim, Fujii, & Mishra, 2022). Then, with the data obtained from the survey, an exploratory analysis was carried out to understand the context of each demand. Likewise, different statistical tests were applied prior to the application of structural equations that allow us to recognize the differentiating attributes. It is concluded that there are indeed differences in the perception of quality of Guayaquil consumers and that they value Chinese clothing more for aesthetic reasons.

(Villacís & Pazmiño, 2018) Technology currently has an important role in global business management, and has become a key tool for companies to become more effective, efficient and competitive. This paper studies how the use of technology relates to the productivity of small and medium-sized enterprises (SMEs) in the textile industry in Ecuador. This industrial sector has been prioritized in Ecuadorian industry, and the SMEs that are the purpose of this study is

within the International Standard Industrial Classification of all Economic Activities (ISIC) C13, "Textile manufacturing" distributed throughout the country. In order to determine the relationship between technology and productivity, Solow's economic model was applied, using the variables: production, capital, workforce, and technology, which are found in production procedures of these business organisations. The results of the study, in general, show the scope that the previously mentioned variables contribute to the productivity of companies of the textile industry, and in particular, the influence of the use of the technology in the increase or decrease of the productivity (Zhou, Zhou, Chen, Zhao, & Zhang, 2022).

(Altamirano, Espinoza, & Parra, 2020) The city of Cuenca-Ecuador, characterized by being an industrial city, specifically those in the textile sector, where its market has proven to be very competitive, predominating tastes and preferences of customers with alternative prices of products or services. The problem of research is presented by the limited supply of designs or models in the garments that are manufactured within this sector. The aim of the study is to develop an intelligent tool for the design and innovation of a men's garment (jacket), called STIM7, this cutting-edge tool allows companies to reduce uncertainty through expert opinion. Methodologically, this research is of an explanatory nature, connecting on a quantitative level by putting into practice instruments of fuzzy logic. The results achieved are a new jacket design, with qualities of innovation and creativity trying to meet the expectations of the potential client. It is concluded that with this contribution, the textile sector will try to position its product in a competitive market, overcoming the constant changes that occur within it, the model represents an essential factor for the success of an organization through better management business.

(Sablón-Cossío, Crespo, Pulido-Rojano, Acevedo-Urquiaga, & Ruiz Cedeño, 2021) At present, the integration in the supply chain facilitates the achievement of the competitiveness of its actors. It is an important factor when trying to reach common goals and high degree of interaction within each link of the chain. In this study, a diagnosis of the shirt supply chain in the northern area of Ecuador was developed and a set of strategies and joint objectives were proposed to improve the competitiveness of the actors involved. For this purpose, a verification instrument was designed, consisting of the dimensions of Strategy, Information, Planning, Purchases, Collaborative Inventory, Transport and Collaborative Performance, to evaluate the integration of 96 actors. The construct validity of the instrument was carried out and the information was processed using descriptive and inferential statistics. Results of this research reflect the low level of integration of the supply chain under study. Where the weakest variables focus on: strategy, information, purchases and collaborative inventory. The contributions of this research are evidenced in its practical value, since the results obtained are used for the diagnosis, analysis and proposal of strategies or actions to improve the performance of the textile industry in Ecuador.

(Torres et al., 2016) Fenton and photo-Fenton processes were tested for the

treatment of wastewater from a local textile industry in Ecuador. The goal of this research was to obtain an efficient, easy-toapply method for the removal of colour, organic compounds, biodegradability, resistant pollutants, and toxicity according to the Vibrio fischeri bioluminescence test. The best results for Fenton were obtained with 100 mM H_2O_2 and 0.36 mM Fe^{2+}. Toxicity was reduced by 84%, biodegradability was increased from 0.21 to 0.6, and the resulting COD and BOD5 concentrations met the Ecuadorian legislation. Both temperature and UV radiation improved Fenton degradation. Detoxification was accomplished with a combination of sand filter with Fenton.

(Verdugo, 2016) The Pachamama Plateau (Azuay, Ecuador) is an area of great archaeological interest, as it contains evidence regarding the specific activities of pre-Hispanic cultures in the region. This article is an initial approach to the characterization of textile-making activity in the area based on artifacts such as spindle whorls, camelid mandibles, and corrals, in order to provide new historical knowledge about southern Ecuador. The study area is a favorable environment for the development of flora and fauna, as it contains permanent water resources across the extent of plateau. This environmental scenario was similar during periods of past occupations of the Pachamama Plateau, where terraces and roads were built to connect different areas, constituting a road network.

Figure 1 shows the percentage distribution of socialized scientific publications
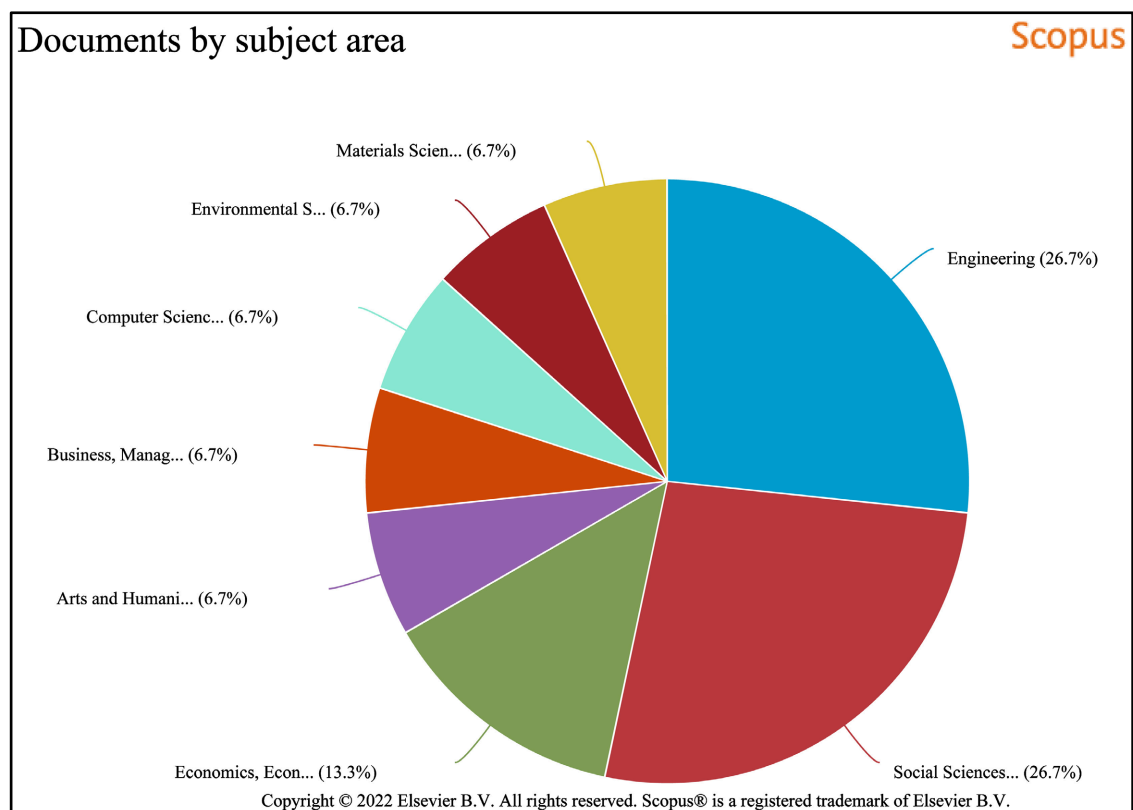

Figure 1. Percentage of documents published in the Scopus database, related to the textile industry in Ecuador; by line of research. Source: Scopus database.

in the Scopus database; related to this research topic. It can be seen that the highest percentages of publication are concentrated in the following subjects: Social Sciences, Engineering, Economics, Arts and Humanities, and Business.

Figure 2 shows the percentage distribution of the types of documents related to this topic, which have been published in the aforementioned Scopus database. 60% of the scientific contributions are of the scientific article type, 20% of conference type documents, and the rest is due equally between books and book chapters.

3.2. Statistical Studies of the Textile Industry in Ecuador

In Ecuador there are three large groups of activities that make up the textile sector, according to data from the 2010 National Economic Census: Manufacturing, Commerce and Services. See Figure 3.

In the activities of Commerce there are 31,983 economic establishments, of which 80% are dedicated to the retail sale of clothing, footwear and leather goods in specialized stores; 13% to the retail sale of textiles, clothing and footwear in stalls and markets; and 7% to other similar businesses.

Manufacturing activities have 11,006 establishments, of which 74.2% correspond to the manufacture of garments, except leather garments; 8.2% to manufacture of articles made of textile materials, except clothing; 8.2% to footwear
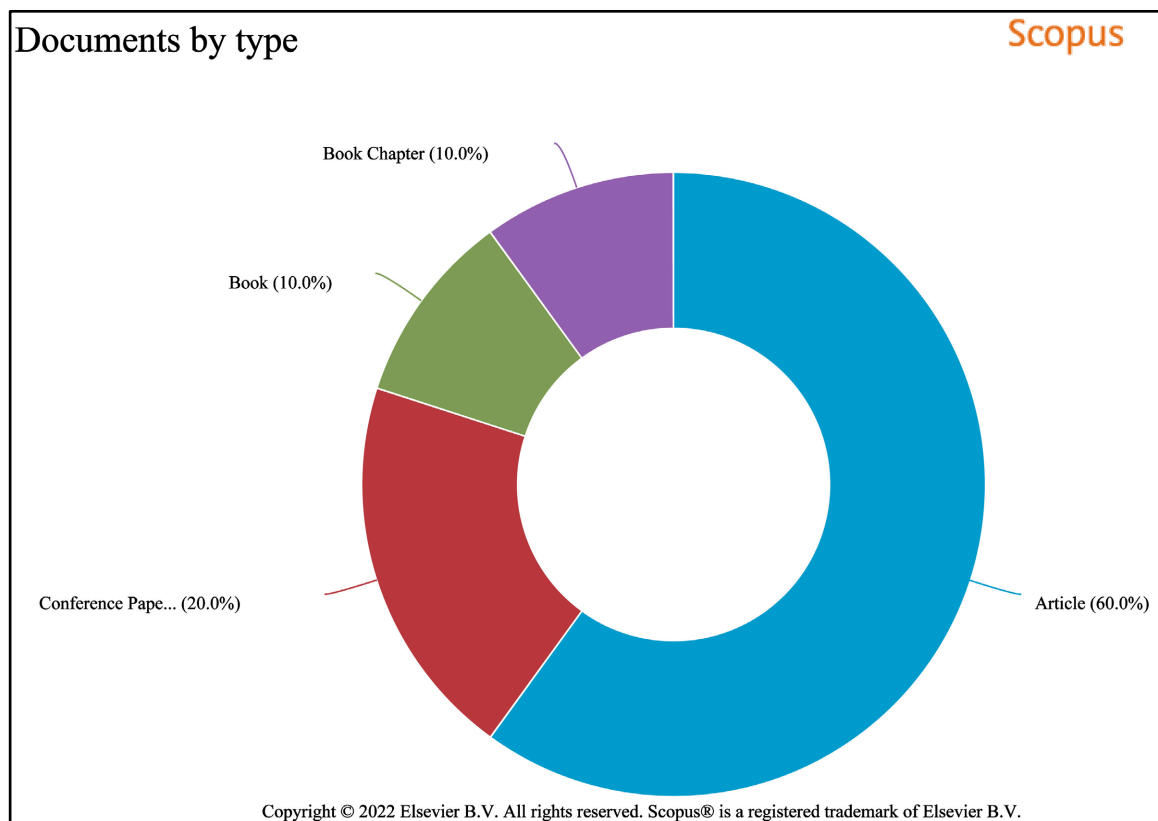
Figure 2. Percentage of documents published in the Scopus database, related to the textile industry in Ecuador; by type of document. Source: Scopus database.
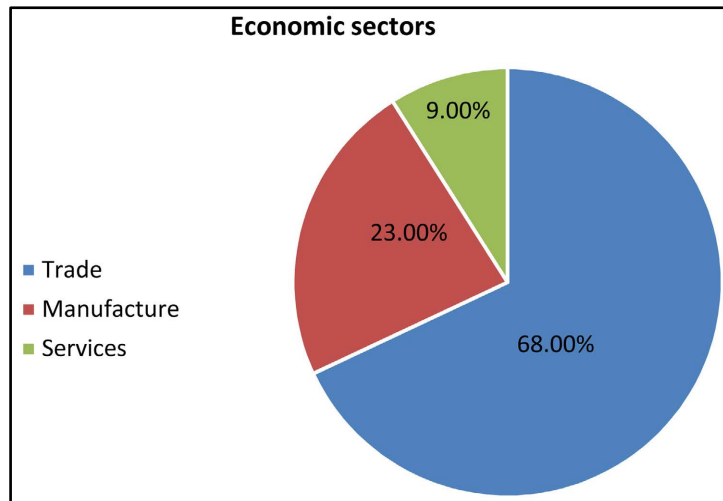
Figure 3. Percentages of the groups of activities that make up the ecua-dorian textile sector. Source: National institute of statistics and censuses (by its acronym in Spanish INEC) in Ecuador.

manufacturing and the remaining 9.5% to other manufacturing activities. While in the Services activities, 4054 establishments are registered, of which 56% are dedicated to the Repair of footwear and leather goods, and the remaining 44% are dedicated to the Washing and cleaning of textile and leather products.

Total employed personnel in activities related to the textile sector amounts to 115,937 people, of which 68,215 are women and 47,722 men. 62,352 people are employed in Commerce establishments, 46,562 in Manufacturing and 7023 in Services. See Figure 4.

In Ecuador, the geographical distribution of the percentage of establishments related to the textile industry is as follows: Pichincha with 27%, Guayas with 17%, Tungurahua with 8.1%, Azuay with 7.5% and Imbabura with 4.5%. These are the provinces where the largest number of establishments in the textile sector comes together. Figure 5 shows the number of establishments in the textile sector for each province of the Ecuadorian nation. In total, there are 47,043 establishments in the textile sector throughout the country.

On the other hand, it is important to note that the manufacture of textiles and clothing are part of the country's Manufacturing Industry. In the last 11 years, this sector has maintained an average share of between 1% and 2% in total GDP, according to data from the Central Bank of Ecuador. In contrast, within the manufacturing industry, its average share is around 15.87% with respect to GDP. The average share of textiles, clothing and leather products in exports by product for the period 2010 to 2020 is 1.4%. Figure 6 shows the main textile exports in Ecuador.

There are many statistical parameters related to the performance of trade, manufacturing and services of the Ecuadorian textile industry. Table 1 shows a summary of the most important parameters considered in this scientific contribution.
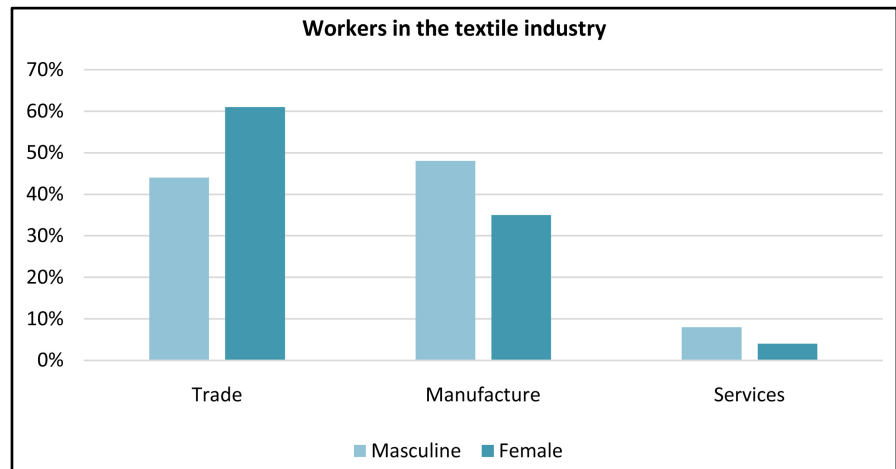
Figure 4. Percentage of personnel employed in activities related to the Ecuadorian textile sector. Source: National institute of statistics and censuses (by its acronym in Spanish INEC) in Ecuador.
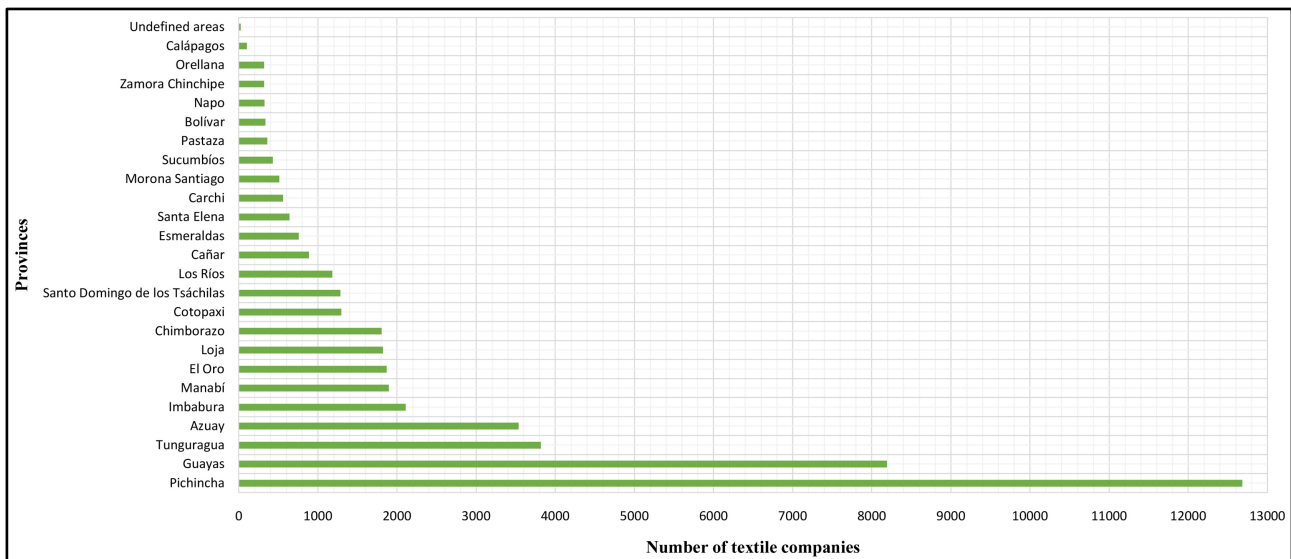

Figure 5. Number of establishments in the textile sector for each province of Ecuador. Source: National institute of statistics and censuses (by its acronym in Spanish INEC) in Ecuador.

3.3. Preferences of the Ecuadorian Textile Market

Consumer perception is a subjective concept focused on the preferences and experiences obtained by the consumer through different contexts over time. Sometimes, the preferences and tastes of consumers are enough for them to have an inclination for certain types of products. On the other hand, consumer purchasing decisions are supported by the good or bad experiences they have had when acquiring a garment and the opinions of friends and relatives around them (Amin, Amanullah, & Akbar, 2016).

One of the frequent filter factors, in the purchase decision process, of clothing users is quality. This factor is different for each person, because a certain group may consider the texture of the fabric, the sewing and the finish of the garment
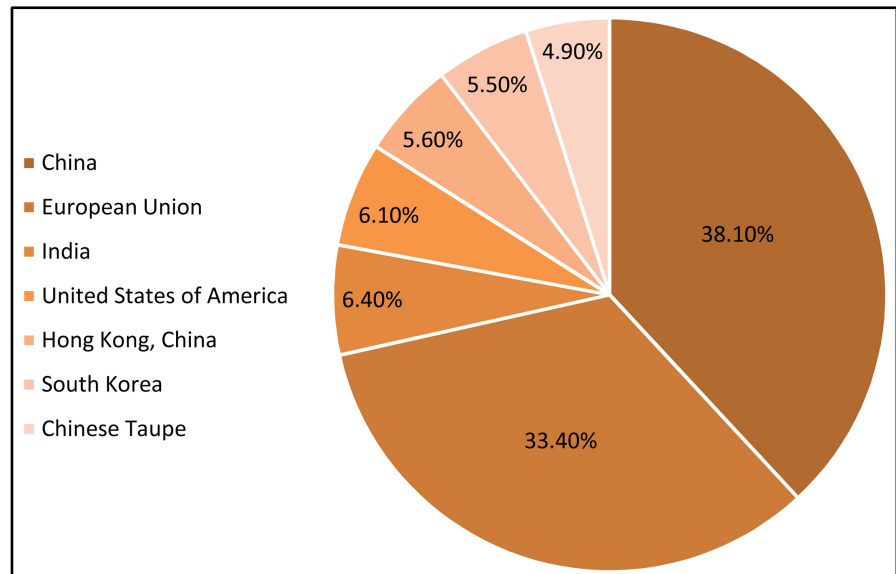
Figure 6. Main textile exporters of Ecuador. Source: National institute of statistics and censuses (by its acronym in Spanish INEC) in Ecuador.

Table 1. Statistical parameters of manufacturing, trade and service in the textile industry in Ecuador, 2000-2020. Source: National institute of statistics and census (INEC) in Ecuador.

	Manufacture	Trade	Services	Total
Number of sales premises	11,006	31,983	4054	47,043
Staff	46,562	62,352	7023	115,937
Men	22,750	21,004	3968	47,722
Women	23,812	41,348	3055	68,215
Total Income (Thousands USD)	1,279,597	2,027,023	49,589	3,356,210
Average Income (Thousands USD)	116	63	12	192
Investment in Fixed Assets (Thousands of USD)	407,722	316,708	25,405	749,835
Expenditure on Investment and Development (USD)	613,732	398,775	1625	1,014,132

to be quality, while another group of people considers the good reputation of the product or its modern appearance to be a factor. adequate indicator for quality. On the other hand, the origin of clothing can have a considerable influence on the consumer's perception of quality. Currently, there are still prejudices in the minds of people who describe Ecuadorian clothing as poor quality, which is why there is a preference in acquiring clothing of foreign origin, including Chinese, American or European clothing (Amsden, 1994).

In 2017, there was an increase in clothing imports as a result of the total eli-

mination of safeguards. These impositions affected 32% of imports, which represented 2800 items entering the country, the most affected being luxury products, such as clothing, where China is one of the main suppliers (Abel, Lauter, Gries, & Troester, 2015). This new entry of foreign textile products generated a negative effect on the national textile sector and created the assumption in the consumer about the preference for clothing of Chinese origin, instead of clothing of Ecuadorian origin (Antonelli, Petit, & Tahar, 1989).

The issue of quality perception for Ecuadorian consumers of clothing according to origin is a topic of interest for the decision-making process of Ecuadorian clothing manufacturers, since it provides guidance to know the different price factors that the national consumer considers more relevant when choosing a garment and consequently prioritize what it should offer in the garment manufacturing process (Asibey, Agyeman, & Yeboah, 2017).

Consumers at the time of choosing clothing express their preferences based on characteristics of textile products, including: comfort, fit, brand and country of origin. However, most consumers prioritize quality. At the time of purchase or acquisition, users evaluate whether or not the product, in this case the garment, satisfies their need and the duration (Abbas, Chiang Hsieh, & Techato, 2021).

Additionally, through the literature review, it has been identified that consumers have other determinants of consumption, generally related to the quality of the product such as 1) the price in the acquisition of clothing and 2) the sources of information by which they form their perceptions. These additional factors have been shown to influence the evaluation of the quality of the clothing and the fulfillment of the expectations of the product.

4. Conclusion

This research focused on the statistical analysis of the manufacturing, trade and services of the textile industry in Ecuador, between the years 2000 and 2020. For this purpose, a study of the Scopus international database and the database of the Ecuadorian government called the National Institute of Statistics and Censuses (by its acronym in Spanish INEC). This research concludes that:

- The main scientific contributions published on the subject addressed in this research are related to the policies, economy and services of the textile industry in Ecuador.
- Most of the publications detected in the Scopus database belong to the category of social sciences and engineering.
- 60% of the scientific contributions published in Scopus are scientific articles.
- Manufacturing activities have 11,006 establishments, of which 74.2% correspond to the manufacture of garments, except leather garments.
- Total employed personnel in activities related to the textile sector amounts to 115,937 people, of which 68,215 are women and 47,722 men.
- In the last 11 years, the textile industry has maintained an average share of

between 1% and 2% in total GDP, according to data from the Central Bank of Ecuador.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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