

CHAPTER 1: WHAT IS KNOWN ABOUT THE AGRICULTURAL VALUE CHAIN? PERSPECTIVES OF THE BIBLIOMETRIC ANALYSIS

1.1. Introduction

Globalization increases and strengthens communication between people and places, and brings them closer to the whole world. The social, economic, environmental, political, and other contexts are changing rapidly in the world, which requires us to take new approaches to multiple stakeholders in performance, articulation within society, and economic activities. The development of the research shows how developed countries consume a large number of goods and services from the markets (Yang et al., 2013), and agro-export processors transform the marketing channels of small economies and their income (Barrett et al. al., 2011; Hodges, Buzbi and Bennett, 2011; Trapala et al., 2020).

To face the challenges of the sustainability of agricultural systems, the reduction of dependency links has become a central issue within food chains and agronomic practices at different spatio-temporal and trophic levels (Larsen and Marx, 2013). Highlighting that the potentially negative impacts of Covid-19 on agriculture and agricultural trade for developing countries exceeded the IMF's economic growth forecasts for 2020-2021 (Morton, 2020; Elleby et al., 2020; Bolwing et al., 2010).

About agricultural value chains, studies should be carried out on their different stages or product transformation routes (Beretta et al., 2012; Lixian et al., 2011; Ramírez Molina et al., 2021). While Govindan & Soleimani (2017) mention the process of implementing and controlling the efficient and profitable flow of raw materials, in-process inventory, finished products and related information from the point of consumption to the point of origin. The different links from the production cycle to the consumer, passing through the processes of handling, transformation, sale and access to homes, have a common problem in their sector. Thus, for example, in the last decade, research has been related to the concentrations of the metal component or nanomaterials in grains or fruits and their impact on the various trophic levels (Gardea et al., 2014; Martinho & Mourão, 2020).

Bibliometrics and its scientific development are based on the search for typical statistical behaviours over time and the production of scientific information consumption (Ardanuy, 2009; Akinlolu et al., 2020; Baranauskas et al., 2020), allowing changes to be evaluated.

Qualitative and quantitative (De Las Heras, 2018). The Thomson Reuters Web of Science database is currently the primary reference for scientific research worldwide (Llorent-Bedmar & Sianes - Bautista, 2018). Mapping and clustering are often used in bibliometric research to visualise structural aspects (Lei et al., 2018). The mapping technique is based on directly applying an occurrence data matrix with multidimensional scale words (Peters & van Raan, 1993; Barrios Guzman et al., 2017).

VOSviewer is a tool that allows building and visualizing bibliometric networks. Using the "distance-based" technique, the nodes are positioned in such a way that the distance between them indicates a proximity relationship (Van Eck & Waltman, 2020; Zhao et al., 2020). The bibliometric analysis allows highlighting information from the organized literature and identifying the bibliometric dimensions related to co-authorship, citation, bibliographic coupling and co-citation (Martinho & Mourão, 2020; Vergara-Romero et al., 2021).

The unsupervised clustering technique and pattern recognition are susceptible. The input parameters for the algorithm validation based on clustering (Kovács & Iváncsy, 2006; Guadalupe & León, 2019; Pascual et al., 2008) are frequently used in exploratory data analysis to extract the natural structure of the data (Lange et al. 2019; Baya & Granitto, 2013). Network visualizations can help to reveal complex and hidden patterns in textual sources (Düring, 2020.) Our attention is focused on colours and patterns (Tableu, 2020), while for the construction of bibliometric maps, we distinguish between maps and the representation of such maps (Van Eck & Waltman, 2010).

The usefulness of the Thesaurus model in the global use of records with keywords and added to improve search retrieval in databases (Elsevier, 2020) translates into improvements in the methodology of fractional counting of citations and grouping of the variable level with a maximum limit of the group size (Guadalupe & León, 2019; Small & Sweeney, 1985; Bollen et al. 2009). For example, the number of authors, citations or references of a publication (Perianes et al., 2016). Likewise, the h index proposed to characterize the scientific production of a researcher (Estrada-Cuzcano & Alhuay-Quispe, 2020) is the balance between the number of publications and their citations (Souto-Anido et al., 2020).

This work's objective focuses on analysing bibliometric indicators between the years 2010 and 2020 based on the theme of agricultural value chains. In addition, as a specific aim, it is proposed to obtain the research source and search criteria in order to obtain a database

that allows analyzing the information from the research source and interpreting the collected data in order to analyze the literary production generated worldwide by countries, organizations, and authors.

This study used publications and data retrieved from Web of Science (WOS), and subsequently using VOSviewer to map the data graphically for the co-occurrence of bibliographic connections. It is a sections structure document. The following section describes the methodology and the data used. Then, in the next section, the bibliometric analysis shows the general trend of the topic before discussing collaborative networks. And finally, the last section of discussion and conclusions regarding other research areas.

1.2. Materials and methods

This study aims to identify the main actors in research on agricultural value chains, taking into account that various links are formed and grouped around the world around agricultural activity. The different activities associated with the living conditions of farmers, producers, and consumers contribute to the study of value chains. In order to understand the trends and perspectives of research in this scientific field, it was essential to know the main features and structure of the current trend (Jimber del Río et al., 2020; Pérez González & Lutsak Yaroslava, 2017). The analysis of the results of the investigations was obtained from “WOS”. The software tool VOSviewer version 1.6.15 was chosen since it is free, functional, and updated software for processing the networks and obtaining the behaviour of the bibliometric indicators in the study period. Networks can include, for example, journals, research, and individual publications and build co-occurrences in keywords or co-authorship relationships from citations. The problem and motivation for this work are summarized in the following problem question: What is the information trend of the agricultural value chain worldwide?

In the preparation and visualization of the map of everyday expressions, the following must be distinguished: the identification of the keywords later, we use a filter of nominal phrases, which are called terms (Van Eck & Waltman, 2016; Ferasso et al., 2020; Hernández-Rojas et al., 2021).

For information analysis and results generation, aspects related to qualitative and quantitative analysis are considered. Thus, in the initial stage, information from records is considered, such as author, addresses, times cited, number of references cited, language, keywords, access number, open access, and research area, among others, and the

database obtained is downloaded. Subsequently, the data is migrated to the VOSviewer software, where the processing of the scientific information, analysis, and visualization of the indicators is finally achieved by obtaining the graphs that show the results of the proposed objectives.

1.3. Analysis and Results

The present study The research is presented in a general way according to the documents related to agricultural value chains entered in the WOS database in the Main Collection of Web of Science, with the terms " agriculture value chain". A systematic review was carried out. Obtaining a total of 1,669 records from the date and year of publication according to the analysis period. It should be mentioned that all documents in the sample maintain a Digital Object Identifier DOI or unique identifier of electronic publications. Most of the documents are journal articles or are part of book chapters 1660, in review 6, editorial material 3. Published scientific articles indicate the primary mode of scientific communication involving agricultural value chains. The works were written mainly in English with 94.85%.

The results were generated by searching for an "agriculture value chain" in WOS. It was observed that during the analysis period of 1,669 records, these were cited 21,979 times in different indexed elements within the WOS Main Collection, having an average number of citations for each element of 14.27 and reaching an h-index of 63.

Within WOS, this work has 111 visualization categories or research areas. The ten predominant categories in publications are environmental sciences with 359, agricultural economics policy with 211, economic sciences with 194, multidisciplinary agriculture with 148, green and sustainable science technology with 145, environmental studies with 140, food science technology with 134, agronomy with 101, environmental engineering 95, administration 79.

Regarding the research areas related to the present work, WOS groups 60 research areas, of which agriculture represents 31%, ecology of environmental sciences with 26%, economic business with 17%, science technology and other topics. 11%, engineering 10%, and 5% the remaining areas.

According to the information collected, the annual production of research between 2010 and 2020. Since 2010, 62 publications have been registered, increasing progressively until 2013 with 100 publications, suffering a slight drop in 2014 with 88 records, managing to recover and reaching 2020 with 273 records, increasing considerably.

The high-impact authors within the WOS registries, as shown in Table 1, the author with the highest number of registries is Klerkx, who published nine articles and represented a value of 0.54%. The following four authors were Hellin, Bijman, Bonney, and Poole, with many records of 7-6-6 and 6 for each of the authors, respectively.

Table 1.

High Impact Authors (Top 15)

	Authors	Number of records	% of 1,669
1	Klerkx L.	9	0.54%
2	Hellin J.	7	0.42%
3	Bijman J.	6	0.36%
4	Bonney L.	6	0.36%
5	Poole N.	6	0.36%
6	Swinnen J.	6	0.36%
7	Wang J.	6	0.36%
8	Yan B.	6	0.36%
9	Bellemare M.F.	5	0.30%
10	Dentoni D.	5	0.30%
11	Durr J.	5	0.30%
12	Phase A.	5	0.30%

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13	Glasbergen P.	5	0.30%
14	Graef F.	5	0.30%
15	Lambin E.	5	0.30%

Organization-based distribution of research results can help understand research capacity and activities around organizations worldwide, thereby identifying leadership in agricultural value chain research. An essential feature in bibliometric networks is evaluating citations by analysing the most influential and cited organizations or universities. The analysis reveals the organisations' affinity level based on the number of registrations. Consequently, the twenty most-cited organizations in the agricultural value chain research domain are presented in table 2. Organizational production is headed by Wageningen University, which found 55 records. The following four organizations were: the Chinese Academy of Sciences, International Food Policy Research Institute, University Ghent, and Cornell University.

Table 2.

Leading Organizations (Top 20)

	Field: Organizations	number of records	% of 1,669
1	Wageningen University	55	3.30%
2	Chinese Akkad science	26	1.56%
3	Int Food Policy Res Inst	24	1.44%
4	University Ghent	18	1.08%
5	Cornell University	17	1.02%
6	University Hohenheim	17	1.02%
7	Int Livestock Res Inst	16	0.96%
8	Michigan State University	16	0.96%

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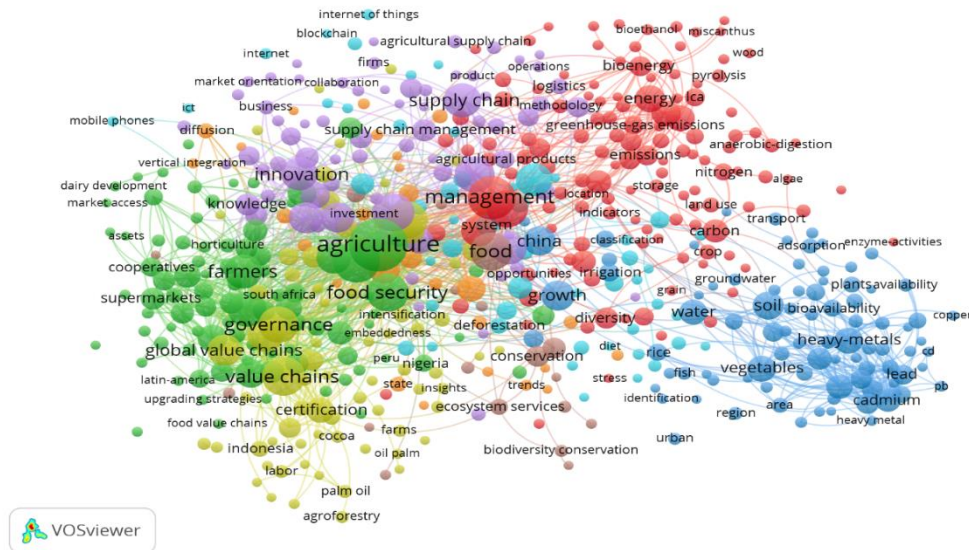
9	University Copenhagen	16	0.96%
10	Wageningen Univ Res	16	0.96%
11	Humboldt University	15	0.90%
12	University of Bonn	15	0.90%
13	University of Queensland	15	0.90%
14	Swedish Univ Agr Sci	14	0.84%
15	Cirad	13	0.78%
16	Penn State university	11	0.66%
17	University Calif Davis	11	0.66%
18	University of New England	11	0.66%
19	Zhejiang University	11	0.66%
20	University of Illinois	10	0.60%

For generating visual information through graphs of results, the keywords were considered, and their origin by country, considering the highest frequency in the records of the documents of the analyzed database. The graphic representations or visual maps found in the records aim to show the subject's exciting results based on the keywords' co-occurrence.

The distance between nodes can be observed, which reflects the relationship between them; the closer the distance, the greater the relationship. Network connections show the keywords that appear together most often in posts. The higher the presence frequency, the larger the circle will be. Finally, the node's colour indicates the relationship between research areas and those associated with a political or geographic area. The relevant trends can be extracted in the analysis with the nomenclature in terms of the territorial positioning of the research: Europe, Asia, North America and China show their interest in agricultural value chains

Figure 1.

Visualization of keywords in WOS publications.



To generate the relationship graph and identify the most used keywords in research focused on value chains using VOSviewer. Figure 1 shows the most used keywords are “agriculture”, followed by “management”, “value chains”, “impact”, and “governance”, based on the number of times they are used in the records of the analyzed database. It can be seen that among the 20 main keywords, some are related to food and business, such as nutrition, quality, consumption, energy systems, growth, model, and poverty. There are also keywords related to the social sphere, such as “gender”, “farmers”, and smallholder farmer. In addition, the graph shows the formation of five conglomerates or clusters of the words with the most significant impact.

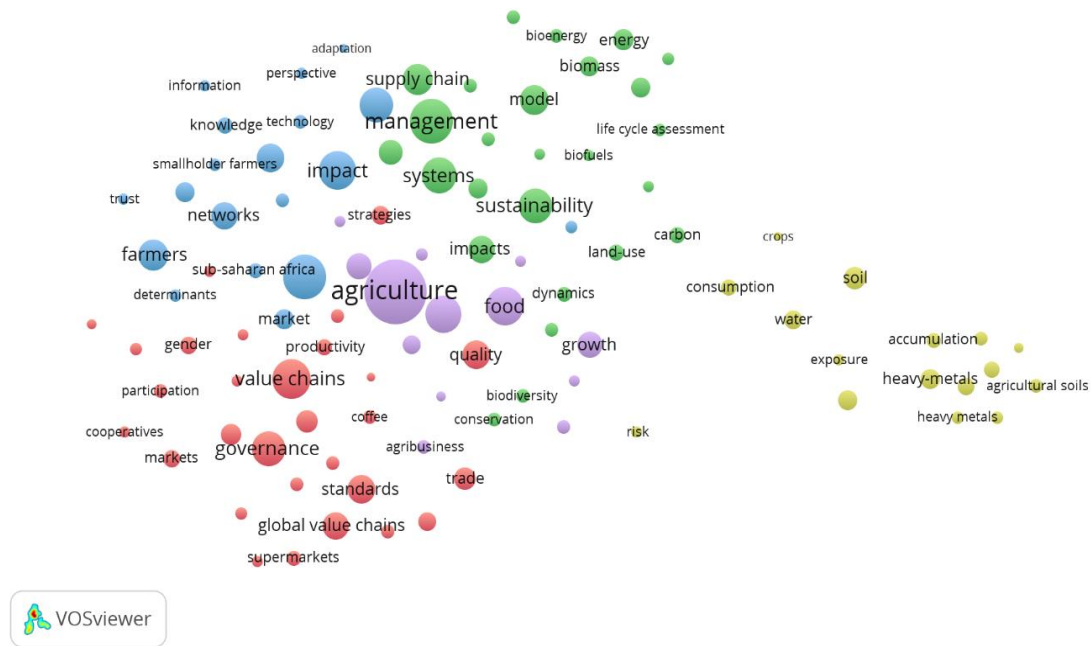
The term occurrence analysis, after the normalization process and the frequency threshold ($n > 1$), was reduced to 101 keywords in the records, which were represented by colours in five clusters as shown in figure 2. keywords to identify the topics in the publication show the weight of appearance in the count through the size of each term. Thus, the first cluster in purple, made up of 13 items, shows the five most frequent: agriculture, food, growth, integration and nutrition. In the red cluster comprised of 29 items, five toponyms are seen as predominant: value chains, governance, global value chain, standards and gender. The third group in green comprises 24 items, highlighting: management, systems, supply chain, and sustainability model.

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The stellar cluster comprises 18 items, the most common: farmers, impact, networks, smallholder farmers and sub-Saharan Africa. And finally, the yellow cluster with the five most frequent items: agricultural soils, consumption, heavy metal, soil and water.

Figure 2.

Network of the keywords in publications on agricultural value chains.



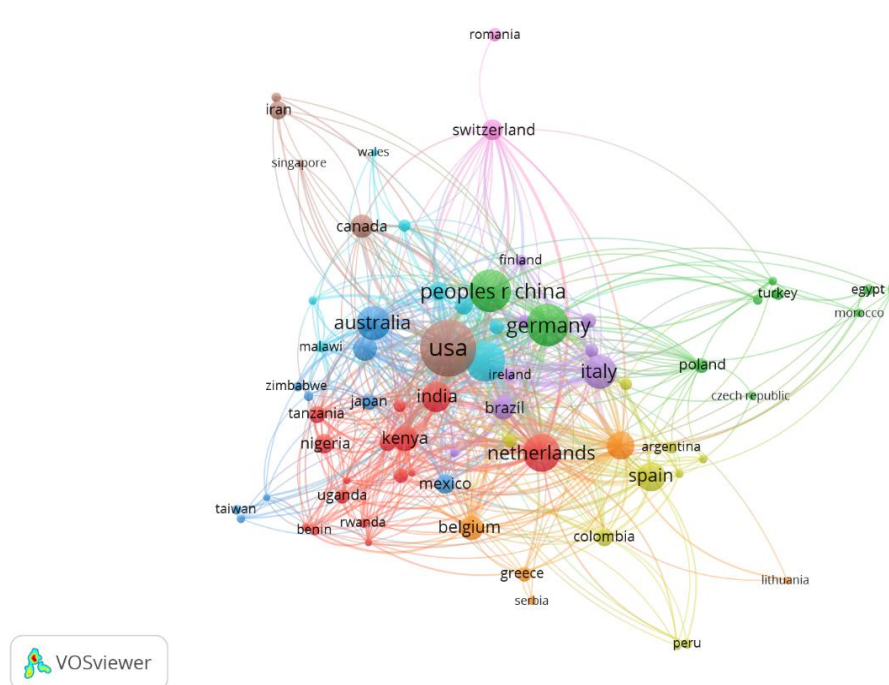
The elements involved in the development of the investigations demonstrate the number of elements involved in the different agricultural production links, the effect it can cause on the environment, and the social, economic, environmental, ecological, and political aspects framed in social development, and the populations where food is produced to supply the world population. Finally, it can be seen that the agricultural products that attract attention and are related to the theme are: coffee, corn and some unspecified vegetable products.

The analysis of records by country related to agricultural value chains can help us understand the capacity of a country for scientific production, as shown in figure 3. A total of 126 countries contributed to the scientific and academic production of the processes of agricultural value chains.

As shown in Figure 3, the size of the circles is proportional to the number of items. Thus we see that the countries that contribute the most concerning the subject are: the United States, England, Denmark, Germany, and France, leading scientific productivity in this area. In addition, countries such as the United States, the People's Republic of China, Ireland, Australia and Germany have more significant influence.

Figure 3.

Countries researching agricultural value chains.



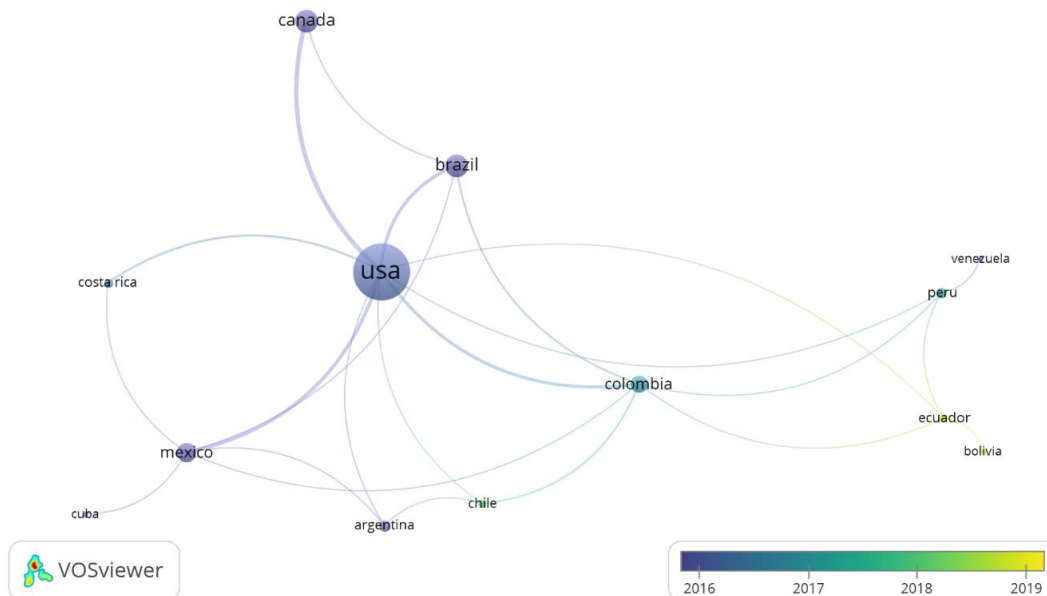
The closeness between these three countries is observed; although there is a scientific closeness between the countries mentioned, the United States are distant politically and geographically, but they are intellectually related; this contrasts with the geographical closeness between Germany and Italy, which is a show on the graph. Aiming at improving efficiency in the quality of agricultural value chains.

As can be seen in figure 4, the size of the nodes and the investigative work correspond to the weights of the nodes; that is, the larger the node and the word, the greater the weight. The distance between the nodes reflects the relationship that exists between them. The thicker the line, the greater the occurrence; as can be seen in the previous figure, the frequency and solidity of the countries with the greatest representativeness in investigations

of agricultural value chains in the American continent, according to the WOS report are: the United States, Canada, Brazil and Mexico. Thus, according to the curves' colour, the countries' annual contribution can also be appreciated. Furthermore, the initial contribution of countries such as Ecuador, Bolivia, Argentina and Peru in 2019 begin the articulation of research on this topic.

Figure 4.

Network of articles on agricultural value chains in terms of countries of the American continent.



1.4. Discussion

The research has a broad focus and relationship with different research areas; 111 categories are denoted, primarily related to the agricultural, environmental and economic parts. Compared to a bibliometric study of Covid-19 using a Scopus database, the documents were classified into four different areas: health sciences, physical sciences, life sciences, social sciences, and humanities (Aristovnik et al., 2020); this is possibly due to the relevance of the topic related to the pandemic and the search for solutions for the vaccine and its effects on health.

In the parametric analysis of the bibliometric data for the keywords and the citation analysis used in evaluating the quality of publications in scientific, technological and social science journals, a total of 15,400 keywords were obtained in the investigation of intelligent cities (Yi-Ming et al., 2019). In the present study, 8,375 keywords were obtained that have a relationship and impact related to agricultural value chains.

According to Medina-Mijangos & Seguí-Amórtegui (2020), the study on municipal solid waste management using WOS mentions the importance of the types of waste and the keywords "packaging waste" and its environmental and economic impact as way management of university social responsibility. Similarly, in our study, the research theme predominates words related to "agriculture" and agricultural, simple, supply and global "value chains" focused on different environmental, economic and agricultural areas.

The growing interest of the academy in search of problems related to networks identifies 1,863 records for the phrase "sustainable supply chain" in Scopus, and 1,182 in WOS, which served to map the scientific landscape of this topic (Andrzej et al., 2020). Values similar to those obtained in this investigation with 1,669 records. However, when collecting the information from WOS, Scopus and Google Scholar Metrics on Circular Economy (Enric Camón & Celma, 2020), record values of 3,391, 1,901 and 36,300 records, respectively, to compare the metrics based on bibliographic reference managers, obtaining considerable differences possibly due to the subject matter and the evaluation period.

Concerning the affiliation of researchers by countries in the theme of sustainable tourism worldwide (Pacherres Nolivos et al., 2020), there are 122, with the United States being the country that contributes 10.10% of a total of 415 records; this fact suggests a global theme that attracts the attention of authors from many countries (Niñerola et al., 2019; Pozo-Estupiñan et al., 2021a). Regarding the research, a global result of 126 countries was obtained, the trend being the United States with 268 records, England 204, Denmark 189, Germany 160, France 113, the countries with the most outstanding contribution at the level of connections on the subject, probably Because they are the most significant agricultural producers, something similar happens with the contribution of scientific articles related to agricultural value chains.

The delimitation of a sample can be defined by the selected publication period, geographical location of the authors, research area, magazine sample or keywords, among others; thus, from the Collection of WOS, from 2005 to 2014, a sample of 453 papers with a total of 9,207

citations distributed in the period of analysis on bioeconomy (Bugge et al., 2016). Meanwhile, in the present study, a sample of 1,669 publications with 21,979 citations was obtained within a more extended period, possibly in the exact geographic location.

Regarding publications by country, the bibliometric analysis study of Islamic economics and finance articles by Indonesian authors has a sample of 559 articles published in Indonesia; almost half were published in 24 magazines, the most popular magazine being Talent Developments and Excellence with 35 articles related to Scimago classification (Handoko, 2020; Ramos-Leal et al., 2021). In the present study, Indonesia has a sample of 19 publications, values lower than those shown by South American countries such as Brazil with 49 publications, Colombia with 28, but higher than those shown by countries such as Argentina with 13 publications, Peru, 10 Chile with seven and Ecuador with six publications in a variety of scientific journals, possibly due to the research conditions on the subject and the economic conditions of the study.

Reyes-Belmonte 2020, in a study, carried out on integrated solar combined cycles based on data analysis, obtained a total average of 15 citations per publication from 2000 to 2018. When comparing in the present study, there is a value mean of 14.27, with no significant variation between the research areas despite the current relevance of the study and the similarity of the analysis periods.

Using the InOrdinatio equation to rank articles in order of relevance based on Journal impact factor Citations Reports (JCR) and the criteria for choosing the most relevant articles, a sample of 39 articles was obtained for the bibliographic portfolio on intelligent cities (De Souza et al. 2019). Likewise, in the present study, the organizations that report a more significant number of citations are Wageningen University with 984 citations, far behind Cornell University with 455, Columbia University with 376 and Chinese Academic Science with 274 citations. Despite being the second in publications with 25 records, the latter is surpassed in citations by Columbia University, which has six publications. Its network of citations includes the World Bank and the international maize and wheat improvement research organization (Int maize & Wheat improvement).

1.5. Conclusions

From the analysis of bibliometric indicators of the publications in WOS applied to the investigation of agricultural value chains, the document shows the trends from a general perspective through the articles that analyze aspects of the subject; the importance of the document lies in the fact that until to date, no bibliometric studies have been carried out that analyze aspects related to agricultural value chains. Another point to consider is the methodology to analyze the external impact. What is evidenced as a result of the bibliometric analysis on the subject and in general, the increase in research related to the agricultural value chain since 2014, a trend that leads to the sustainable development of agriculture, becomes a potential research area in each country, in addition to the relevance for improving the quality of life of the actors and their environment, as a measure to mitigate the pollution of natural resources.

Since the livelihood of the world population depends on the production of agricultural products and by-products, it is expected that research will continue to increase mainly in countries identified in this study and improve publications in underdeveloped countries. In addition, the theme is related to the sustainable development goals and objectives set by the United Nations Organization for 2030.

The importance of the theme serves as a guide for decision-makers that the results will help them find samples of the economic, social, and ecological systems and evaluation methodology of the process, thus improving their decisions. Another aspect to consider in local governments is to develop agricultural policies and regulations based on socioeconomic results to increase or decrease the use of external technologies and improve management systems. The research visualized a series of networks of organizations that describe the relationships between various scientific domains that contribute to the connection between the natural, agricultural, environmental, social, economic, and political sciences. It is essential to evaluate bibliometric techniques not only for research fields but for the specific field of agricultural value chains.

In the political-administrative sphere, there is an urgent need to increase the commitment to agricultural value chains and the economy of South American producers to replicate and promote public policies. Promote the search for information on elements to promote the consumption of non-traditional agricultural products in consumers, in addition to knowing what they consume. Encourage companies that are competitive and make a profit in activities for the benefit of the community.

The dataset used for the visualizations requires context awareness to be meaningful; data coding and domain knowledge will make sense of the charts. For the future, it is recommended that the search for records be expanded through other databases, the comparative analysis of the number of results in pillars such as agricultural sustainability and agricultural economy.