Agricultural Commodities' Research Associated with Economic Activities in the Past 20 Years : A Bibliometric Analysis

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Abstract

Background : Research has been conducted on agricultural commodities for many years. Studies on agri-commodities are numerous. While many academics link their studies to global commodities exchanges, many others concentrated on the unpredictable prices of agricultural commodities. A few scholars examined the connections among energy, oil, and agricultural products. Conversely, other scholars investigated the effectiveness and hazards of futures markets, global trade regulations, food securities, and so on.

Purpose : This review analysis aimed to investigate the trends in the research domain of agri-commodities, which have been associated with economic activities in the past 20 years.

Methodology : Bibliometric analysis helped us to identify those trends. We used the Web of Science core collection for the data collection and Vosviwer software for bibliographic data analysis.

Findings : The research findings suggested that agricultural commodities can be a good research area for researchers associated with economics, commerce, and management, as agri-commodities have added many new dimensions to their domain in the past decades.

Practical Implications : The study's findings would benefit future researchers in finding the research gap in the Indian agricultural commodity derivatives market. They could discover the research areas they want to study about Indian agricultural commodities.

Originality : We attest that this research paper's intellectual substance is entirely our creation and that all sources and help used in its preparation have been appropriately cited.

Keywords : **agricultural commodities, bibliometrics, commodity exchanges, citations analysis, futures markets, Web of Science**

JEL Classification Codes : G13, Q020, Q02

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Agriculture is the base on which this world survives as it provides food for living and employment to millions of people. Agricultural activities have seen tremendous growth in the past century, so research on different agricultural areas has also increased in the past decades. As it makes the world a more interconnected place, globalization has had a significant impact on agricultural practices worldwide (Lencucha et al., 2020). Nonetheless, agricultural commodity imports and exports are nothing new; globalization has only made them more prevalent. Better production, marketing, and distribution of the goods those farmers worked so

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hard to acquire are necessary in the new world. This brings us to the idea of agricultural commodities, which has been the subject of extensive research in recent decades. One must comprehend the notion of agricultural commodities before delving into the depth of research on agricultural commodities connected to economic activity.

Agricultural Commodities

Farmers trade agricultural commodities on commodity exchanges and in local marketplaces to enable the trading of agri-commodities. It involves more than just growing crops and putting them on the market. Nowadays, agri-commodities are primarily traded on exchanges worldwide. Agricultural commodities are classified into six categories: oilseeds, cereal grains, meat as a food source, dairy products, soft commodities, and miscellaneous agri-commodities. As they integrate into a structured trading system, farmers that trade agricommodities make greater money. Farmers and farmer-produced corporations (FPCs) or farmer-produced organizations (FPOs) may participate in futures or options contracts on these markets. Agri-commodity futures are instruments that help in the market's price discovery, and with these instruments' help, farmers can hedge their risk. So, in other words, farmers can use these as price insurance.

Internationally, Agri-commodity futures are well-recognized and utilized instruments. Agriculture and related products have long been traded internationally. In recent times, organized and sophisticated agri-commodities exchanges have replaced the barter system that our ancestors used to trade their agricultural products (Birthal et al., 2007). Many commodities exchanges dealing in agri-commodities are present worldwide. Different prices are present in these commodities markets because Agri-commodity prices vary between nations (Rosegrant et al., 2012). Global trends indicate that trading in Agri commodities is growing rapidly (Hong Kong Exchanges and Clearing Limited, 2020). These markets manage stakeholder risks effectively, particularly the price risk that farmers confront.

One important exchange for agricultural commodities is the Chicago Board of Trade (CBOT) (Chen, 2022). The creation of this exchange modifies the public perception of Agri-commodities. Even farmers began to view product marketing from a different perspective, which made them more cautious when selling their goods in the market and interested in getting into futures contracts. Agricultural commodities derivatives contracts in the US market are currently limited in terms of both volume and contracts (APEDA, 2021). Since its founding in 1848, the Chicago Board of Trade has served as the primary exchange market for agri-derivatives globally (Algieri, 2018). Although numerous other exchanges deal in agricultural commodities throughout the world, "the Chicago Mercantile Exchange and CBOT are the benchmarks for several commodities such as wheat, maize, and livestock" (Algieri, 2018; Berg et al., 2014). Although there are fewer sales of agricultural commodities in the EU, trading activity has increased recently (Algieri, 2018). The most well-known commodities exchanges in Europe are Euronext in London, which trades cocoa, coffee, sugar, and feed wheat, and Euronext in Paris, which is the primary Agri-commodities contracting site for milling grain, rapeseed, and maize commodities (Algieri, 2018). The Dojima rice exchange from Japan was the world's first organized exchange, established in 1730 (Algieri, 2018). In Asia, the leading commodity exchanges are the Dalian and Zhengzhou Commodity Exchanges in China; edible oil contracts and soybean meal futures are the best contracts on these exchanges (Algieri, 2018).

The better Management of Agri-commodities is crucial for growing every part of these economies, primarily for the better future of small and marginal farmers. And so, industrialized economies such as the United States, Germany, and Russia have long engaged in the trading of agricultural goods. Nevertheless, with the greatest number of global agri-futures contracts, China remains the leading nation in the trading of agri-commodities worldwide (Gulati et al., 2017).

Even though everyone has engaged in farm commodities since ancient times, the concept of agricultural commodities for researchers and farmers is relatively new. Researchers started gaining more and more interest in

this field in the last three decades, and millions of farmers are still unaware of the modern mechanisms of agricultural marketing agricultural commodities exchanges. These farmers participate in conventional agrarian marketing, make little money, and end up trapped in a never-ending cycle of debt. Small and marginal farmers are primarily indebted to emerging nations such as Bangladesh, India, Nepal, and Sri Lanka. Many studies have focused on the significance of these exchanges (Kar, 2021). Her study demonstrates how the shift to agricultural futures markets has improved risk management and price discovery. The price discovery function of the Indian commodity derivative markets is the subject of studies by Irfan and Hooda (2017), Lethesh and Viswanatha Reddy (2023), and Narsimhulu and Satyanarayana (2016), while Gutierrez (2013) focused on whether speculative bubbles exist in agricultural commodities markets. Thus, the body of knowledge regarding agricultural commodities keeps growing over time as more scholars become interested in this field.

Literature Review

Contrary to other businesses, agriculture is known to experience ongoing price variations due to external variables such as output, weather predictions, trade, and domestic consumption (Ferreira & Junior, 2019). Among these changes, protection is required, and related goods are easily accessible (Ferreira & Junior, 2019). The goal of derivative markets' evolution has been to find practical measures to reduce the risk of price volatility. One of the important subcategories is agricultural commodities derivatives; their agricultural products include maize, soybeans, and coffee (Ferreira & Junior, 2019).

The Indian commodity market, in particular the agricultural commodity market, has experienced multiple shifts over the long history of commodity trading and related derivatives between two extreme scenarios: government intervention to protect the vital commodity market and opening the sector to obtain the necessary protection through market-based instruments like commodity futures contracts. However, there has always been skepticism about the utility and applicability of futures contracts in growing the underlying market for agricultural commodities, particularly in agriculturally dependent economies like India (Shanmugam & Mohammad Irshad, 2017).

Additionally, there is a dramatic theory that dates back decades that claims agricultural commodities play a major role in the inflation of food costs. According to a number of studies, trading in agricultural commodities has very little impact on inflation (Babshetti & Basanna, 2019). Thus, since the turn of the century, certain prohibitions have been imposed on the derivative trading of Indian agricultural commodities. Despite this, the size and network of India's commodity futures market have expanded significantly over time; this is particularly true when it comes to agricultural commodities (Gogoi, 2018).

The authors have discovered that a large number of research (Chatrath et al., 2002; Rosegrant et al., 2012) address the pricing and volatility in the agri-commodity markets in the body of existing literature. According to a study by Chatrath et al. (2002), seasonality affects the price of agricultural commodities. According to multiple articles approved by (Mensi et al., 2014), there is a dynamic volatility spillover between oil and agricultural commodities.

Objectives of the Research

(1) To determine the trends in agricultural commodities research related to economic activities in the past 20 years.

(2) To understand the depth of literature on agricultural commodities related to economic activities.

Research Methodology

The authors have adopted bibliometric analysis. This study will provide a citation analysis, bibliographic coupling, co-occurrence, and network analysis. The best database to use for gathering bibliographic information and the best analysis program must be chosen before beginning bibliometrics analysis. Databases are selected using predetermined standards. The definition of bibliometrics analysis must first be understood. Therefore, a brief overview of bibliometric analysis is given.

Bibliometrics Analysis

Alan Pritchard is the originator of bibliometrics analysis. He coined this term in 1969 in his article "Statistical Bibliography or Bibliometrics," which was published in the journal *Journal of Documentation* (Pritchard, 1969). Utilizing bibliographic data analysis, bibliometrics analysis is a tool for mapping a certain research area. The comprehensive body of bibliographic information gathered for a certain area, domain, journal, etc., is described in detail by the bibliometrics analysis. The bibliometrics tool is popular among researchers for many reasons, such as simplifying large volumes of data for easy understanding, finding emerging research trends in specific subject domains, determining the intellectual depth of existing literature on different subjects or journals, etc. (Donthu et al., 2021). Bibliometrics analysis investigates the contribution of authors, countries, and organizations in the research domain.

Data Collection and Search Criteria

The authors have considered the Web of Science (WOS) Core Collection for data collection. The WOS from "The Thomson Reuters Institute of Scientific Information" is the world's oldest and most authorized database (Birkle et al., 2020). When Eugene Garfield established the Web of Science in 1960, the Science Citation Index (SCI) was the original name of the citation index. Nevertheless, it eventually added a number of other indexes, including the Arts and Humanities Citation Index (AHCI) and the Social Science Citation Index (SSCI) (Singh et al., 2021). In 1997, all three indexes combined and launched as the WOS. The WOS Core Collection has 21,100 thousand high-quality scholarly journals in various disciplines. WOS Core Collection has around 79 million documents in different fields, such as science, social sciences, arts, and humanities, and the WOS Platform covers almost 171 million records. Many studies compared Thomson Reuters's WOS and Elsevier's Scopus database as the primary data sources for bibliometrics analysis (Bakkalbasi et al., 2006; Chadegani et al., 2013; Gavel & Iselid, 2008; Liu et al., 2013; Martín-Martín et al., 2018; Singh et al., 2021). After analyzing those past studies, the authors have found that Scopus has a more comprehensive range of coverage in journals. Although it is the oldest, the WOS nevertheless has the most selective journal database and the benefit of having a larger variety of citations from before 1900 (Chadegani et al., 2013; Singh et al., 2021). Both contain millions of journal articles, conference proceedings, book reviews, and other editorial data. However, after further analysis, it is concluded that the WOS is more user-friendly and easier to use. So, it was chosen for data collection for this review.

After selecting a database, the authors found articles on agricultural commodities. For that, a search was done on the WOS by typing agricultural commodities; in that search, 7,231 documents came up, including articles, review papers, proceedings papers, editorial notes, etc. These papers mainly have all the documents that mention the word agriculture or commodities. Specifically, we have chosen our keyword, "agricultural commodities." The selected keyword was searched, and 1,415 documents were found after the investigation. After that, for a more refined result. Additionally, the authors used many criteria, which are listed in Tables 1 and 2. The results were narrowed down to 309 articles using these criteria, which the authors then personally improved.

Table 1. ***Inclusion Criteria for Data Collection***

Inclusion Criteria	Reason of Inclusion
Papers that were found in the WOS categories for "business, management, agricultural economic policy, finance, and economics" after being searched for using the term "agricultural commodities."	The authors considered all papers related to business and economics to know the importance of agricultural commodities in different economic activities.
Paper published in journals indexed on the WOS database.	WOS Core Collection has many scholarly journals of high quality and peer-reviewed.
Selected document type - Articles, conference proceedings, and book reviews.	Articles, conference proceedings, and book reviews contain the most crucial information about the research domains and discuss where research is heading in the future.

Table 2. ***Exclusion Criteria for Data Collection***

Exclusion Criteria	Reason of Exclusion
Falling outside the timespan of review.	The timespan selected for the research is from 2002 to 2021. So, the papers published in 2022 were excluded.
Papers that belong in WOS categories other than the six that were selected (economics, business finance, management, agriculture, and economic policy).	The focus is on agricultural commodities research related to management and economics. So, the other 125 WOS categories were not considered during data collection.
Documents - Early access paper of 2022, editorials, etc.	Many papers from 2022 were present in the 2021 year as early access, and they are manually excluded. Documents like editorials, commentary, letters, etc., do not contain complete bibliographic data, so they are excluded.

Table 1 shows the inclusion criteria adopted for the data collection with a reason. Generally, research on agri-commodities includes agronomy, entomology, biotechnology, applied microbiology, plant sciences, ecology, and other disciplines. Nonetheless, this analysis provides an overview of the type of published research on agri-commodities related to different types of economic activity.

Table 2 displays the criteria for exclusion. The significance of exclusion criteria lies in their ability to assist writers in precisely locating the facts they require while weeding out superfluous and unimportant information. Unwanted information is noise, and noise takes a lot longer to understand. The exclusion criteria provide clear, concise data that eliminates noise. The final sample size for analysis is limited to 304 papers based on the inclusion and exclusion criteria as well as manual document exclusion. The features of the acquired data are explained in Table 3.

Table 3. ***Characteristics of the Data on the Keyword "Agricultural Commodities"***

Descriptions	Results
Main keyword	"Agricultural Commodities"
Period of analysis	20 Years (2002–2021)
Database	Web of Science Core Collection
Sources	Scholarly Journals

No. of sources	99
Types of documents	Articles, proceedings papers, and book chapters
Total no. of publications (TP)	304
No. of Authors	731
Average authors per article	2.4
Total no. of citations (TC)	6,155
Average citations per paper (AC)	20.24
Total no. of Cited References (TR)	13,246
Average references per paper	43.6
Number of keywords	1,502
Number of author's keywords	901
Number of keywords plus	726

Data Analysis and Visualization

Data Statistics

Data has been analyzed with the help of a bibliometric analysis using VOSviewer software, where VOS stands for visualization of similarities. VOSviewer is a program developed for constructing and viewing bibliographic maps. Moreover, "the program is freely available to the bibliometrics research community" (van Eck & Waltman, 2010). In VOSviewer, users can construct different maps based on citation, co-citation, co-authorship, bibliographic coupling, co-occurrence, etc. VOSviewer is the most user-friendly software for data analysis among the software for analyzing bibliographic data.

Descriptive analysis was also utilized in the study of the data. The authors could analyze the data more precisely in subsequent analyses thanks to the descriptive analysis. Following exploratory analysis, descriptive research is organized and preplanned to meet the specific requirements of the study. More quantitative research is descriptive (Malhotra, 2020). We used Microsoft Excel to complete this.

Descriptive Analysis Results

Figure 1 shows the distribution of publications on agricultural commodities per year. The pattern suggests that during the year, the number of publications climbed progressively. There have been a lot more publications on agricultural commodities related to economic activity within the past ten years (2011–2021). There were not many papers there prior to that year. A peak of 37 papers in this field was reached in 2020. Following 2011, scholars in the fields of management and commerce began to look into agricultural commodities as a potentially more fruitful topic of study.

The citation analysis of these documents is equally vital in understanding their relevance in the agricultural commodities research literature. Figure 2 demonstrates the number of citations received by the papers over the years and the average citations. The number of citations to past articles is more critical when researchers' interest grows. Total citations in 2011 are the second highest, so it is a turning point in the context of no. of papers and the number of citations. The increasing number of citations from 2011 to 2015 indicates a positive impact on researchers associated with commerce and management discussing agricultural commodities in their research. The standard used by all to evaluate a document's quality is its citation count; higher citation counts indicate that more researchers believe the study to be valuable enough to incorporate into their next work. It is evident from the rise in citations that agri-commodity research is heading on the correct path.

Figure 1. ***Year-wise Distributions of the Publications***

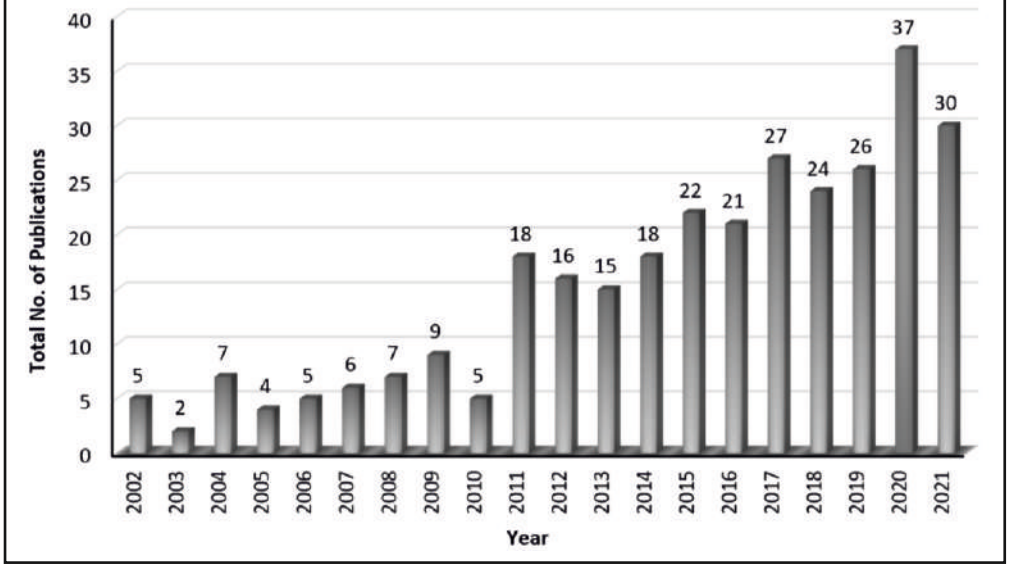
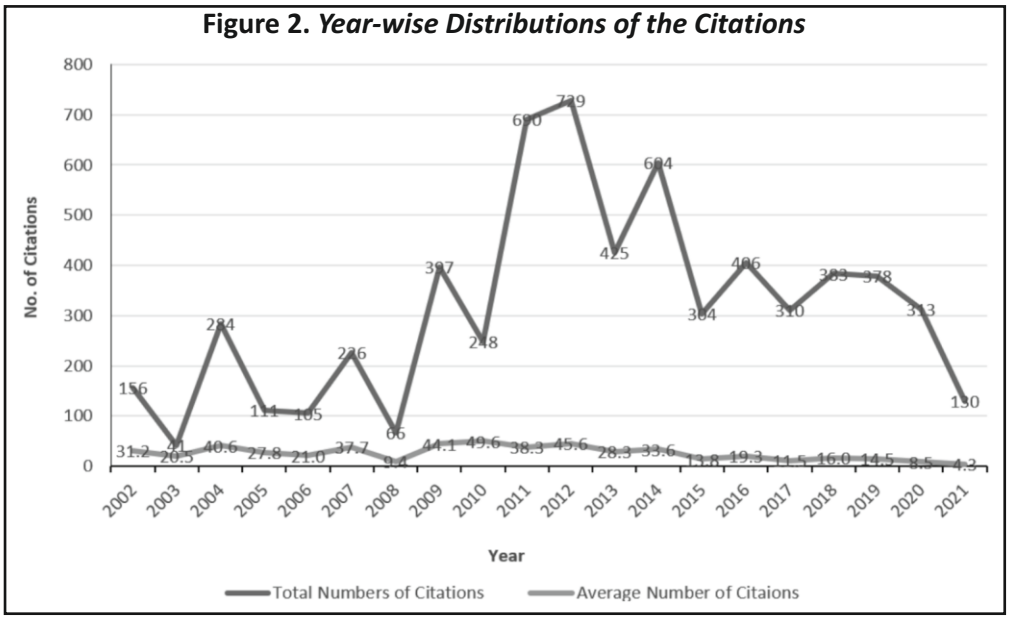
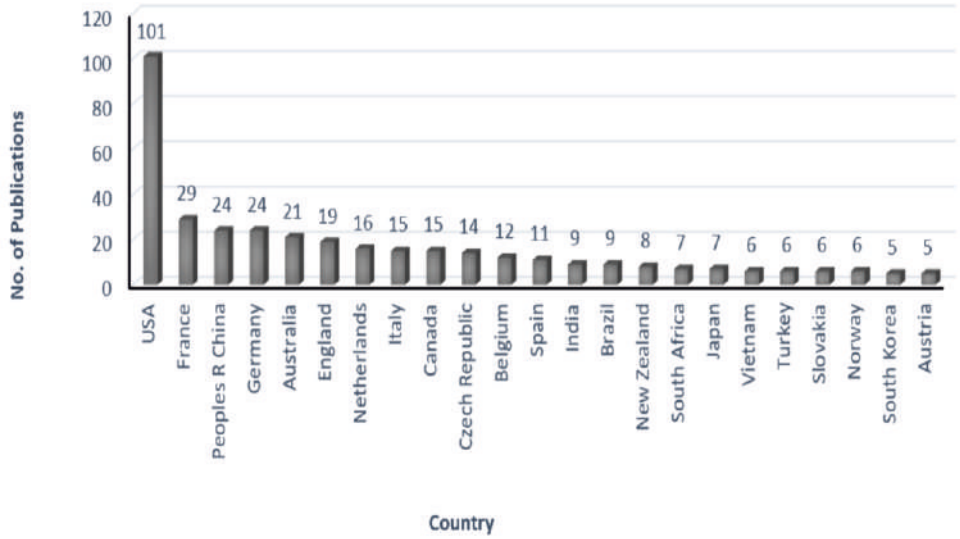


Figure 2. ***Year-wise Distributions of the Citations***



The expansion of the field is not only assessed based on the years but also has to determine the evolution of the research area based on the geographical locations. Figure 3 demonstrates the contributions of different countries in the publications related to agricultural commodities. Although there are 63 countries in the data publishing literature about agricultural commodities, only 23 meet the threshold criteria of publishing five or more papers in the research domain. So, Figure 3 contains a descriptive statistical analysis of 23 top countries only. The United States has published 101 documents on agricultural commodities, which is the maximum, followed by France and Germany. China and India are also on the list, publishing 24 and 9 papers, respectively. The chart shows that developed countries engage more in research on agricultural commodities, although agriculture is an integral part of every economy. Developing countries depend on the agriculture sector, but these countries are not spending much on agricultural commodities research, leading to low publications in those countries.

Figure 3. ***Top - Countries in No. of Publications***



Note. Threshold criteria: minimum five publications per country.

Figure 4. ***Top Countries in No. of Citations***

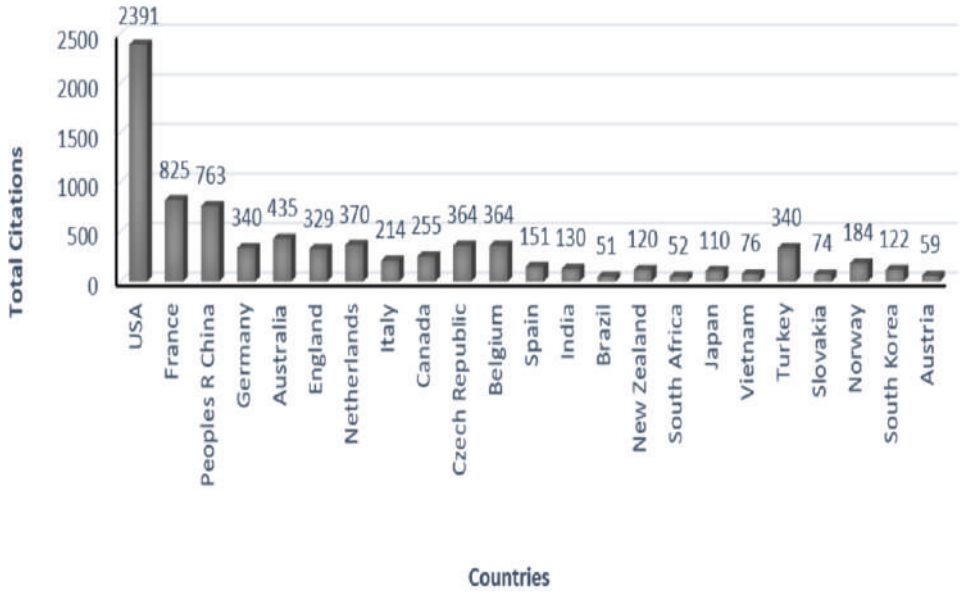


Figure 4 presents the top countries regarding the number of citations they received in their literature on agri-commodities. The United States gets 2,391 citations out of 6,304 citations, the maximum number of citations in their publications, clearly showing their superiority in agricultural commodities research. France follows the USA by getting 823 citations, less than half of the USA's, but still much better than the remaining countries publishing articles on agricultural commodities.

Bibliometric Analysis Results

Bibliometrics analysis contains techniques like citation, co-authorship, co-citation, bibliographic coupling, and co-occurrence analyses. These methods are used for different purposes and depend on the study's needs. Here, authors have applied citation analysis, co-authorship analysis, bibliographic coupling, and network analysis to analyze trends of agri-commodities research analogous to economic activities.

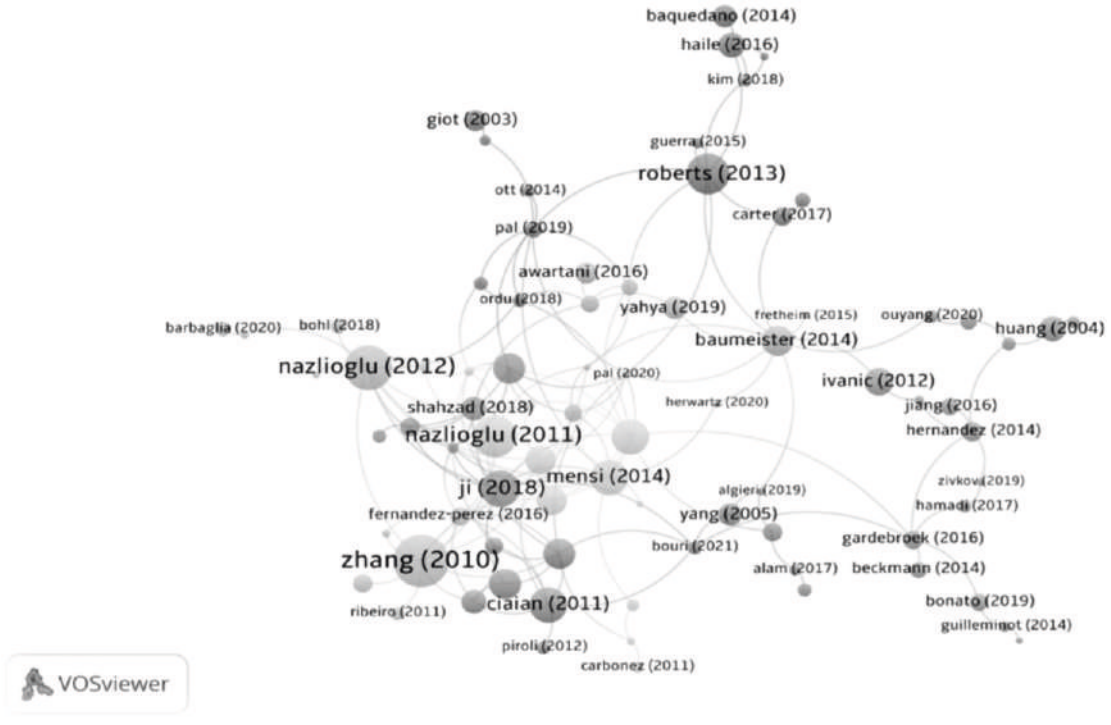
Citation Analysis

Citation analysis provides the base for determining the effect of a certain publication, author, journal, etc. (Donthu et al., 2021). Everyone assesses a research document's quality according to its citations. Here, Citation analysis helped authors recognize the most profound documents of the subject area analyzed based on no. of citations. It discusses the importance of a particular research article published in the research area. More citations mean more matter to the research work.

Figure 5 shows the citation analysis of the most cited publications. Out of the 304 papers, 210 satisfy the minimal number of citations requirement of five, but only 80 articles are linked together in the Scientific mapping. The examination of the 80 linked documents is presented here. The top ten most cited papers are shown in Table 4, which is based on this analysis.

Table 4 presents the details of the Top 10 most cited papers selected based on the total number of citations. After data analysis, it was found that out of 304 publications, only 12 have more than 100 citations. This table shows that documents on agri-commodities research related to energy markets have gained maximum citations.

Figure 5. ***Most-Cited Documents***



Note. Threshold criteria: Minimum five citations per document.

Table 4. ***Top – Ten Most Cited Publications on Agricultural Commodities***

R	Title of the Paper	Author(s)	Source	Year	WC	TC
1	Food Versus Fuel: What do Prices Tell us?	Zhang et al. (2010)	*Energy Policy*	2010	229	231
2	The Impact of Mobile Phone Coverage Expansion on Market Participation: Panel Data Evidence from Uganda	Muto & Yamano (2009)	*World Development*	2009	208	208
3	Oil Price, Agricultural Commodity Prices, and the Dollar: A Panel Cointegration and Causality Analysis	Nalioglu & Soytas (2012)	*Energy Economics*	2012	168	170
4	World oil and Agricultural Commodity Prices: Evidence from nonlinear causality.	Nazlioglu (2011)	*Energy Policy*	2011	149	151
5	Swimming Upstream: Local Indonesian Production Networks in Globalized Palm Oil Production	McCarthy et al. (2012)	*World Development*	2012	147	151
6	Identifying Supply and Demand Elasticities of Agricultural Commodities: Implications for the US Ethanol Mandate	Roberts & Schlenker (2013)	*American Economic Review*	2013	139	142
7	"Risk spillover between energy and agricultural commodity markets: A dependence-switching CoVaR-copula model"	Ji et al. (2018)	*Energy Economics*	2018	115	116
8	"Sustainability of biofuels in Latin America: Risks and opportunities."	Janssen & Rutz (2011)	*Energy Policy*	2011	110	112
9	"Interdependencies in the energy-bioenergy-food price systems: A cointegration analysis."	Ciaian & Kancs (2011)	*Resource and Energy Economics*	2011	110	110
10	"Is there co-movement of agricultural commodities futures prices and crude oil?"	(Natanelov et al., 2011)	*Energy Policy*	2011	109	111

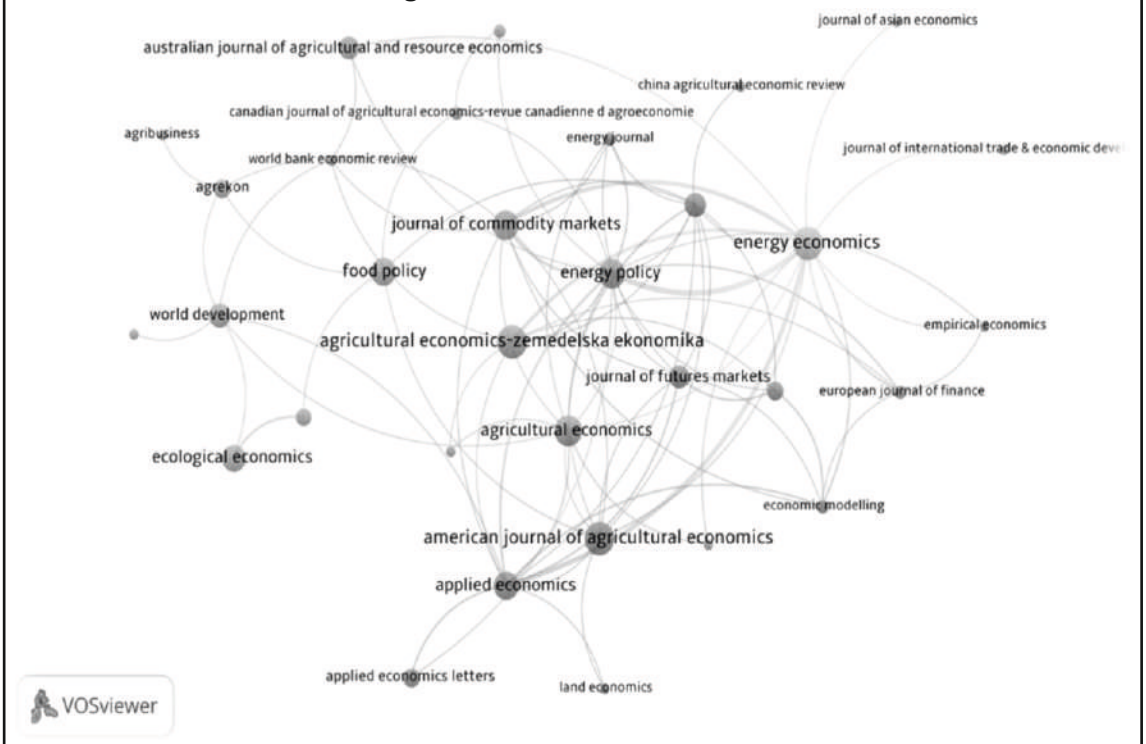
Note. R-Rank, WC = Web of Science citations, TC = Total citations.

The sources of these most cited articles are indexed on the world's most reliable and used databases, namely Web of Science and Scopus. So, one can say that articles from those sources are of high quality and published in peer-reviewed journals, having significant impact factors.

Figure 6 presents the citation analysis of the different journals publishing articles on agricultural commodities. This analysis shows the impact of journals in posting high-quality content, and it doesn't depend on the number of papers. Citation analysis shows how relevant a journal is for the researchers. Out of 99 journals, only 44 have met the threshold criteria of having more than two articles published on agri-commodities in various disciplines selected for the study. But 34 journals connect in scientific mapping. So, citation analyses demonstrate 34 connected journals. It also observed that top journals publishing on agri-commodities have a good impact factor, which is more than one. The data on impact factors, SJR, and SNIP of different journals presented below have been taken from the website of Journal Searches (Journal Searches, 2022).

Table 5 supports the argument that the number of papers does not conclude a journal's worth. It can be seen that even though it published only nine articles, the "World Development" journal is the most relevant journal for the researchers as the journal's average citation is the maximum. The impact score of this journal is also the highest. The impact score shows the importance of these journals in the researcher's community as they selected journals to which they want to send their research articles based on the impact factors and cite scores.

Figure 6. ***Most - Cited Journals***



Note. Threshold criteria: Minimum two documents per journal.

Table 5. ***Top-Ten Most Relevant Journals***

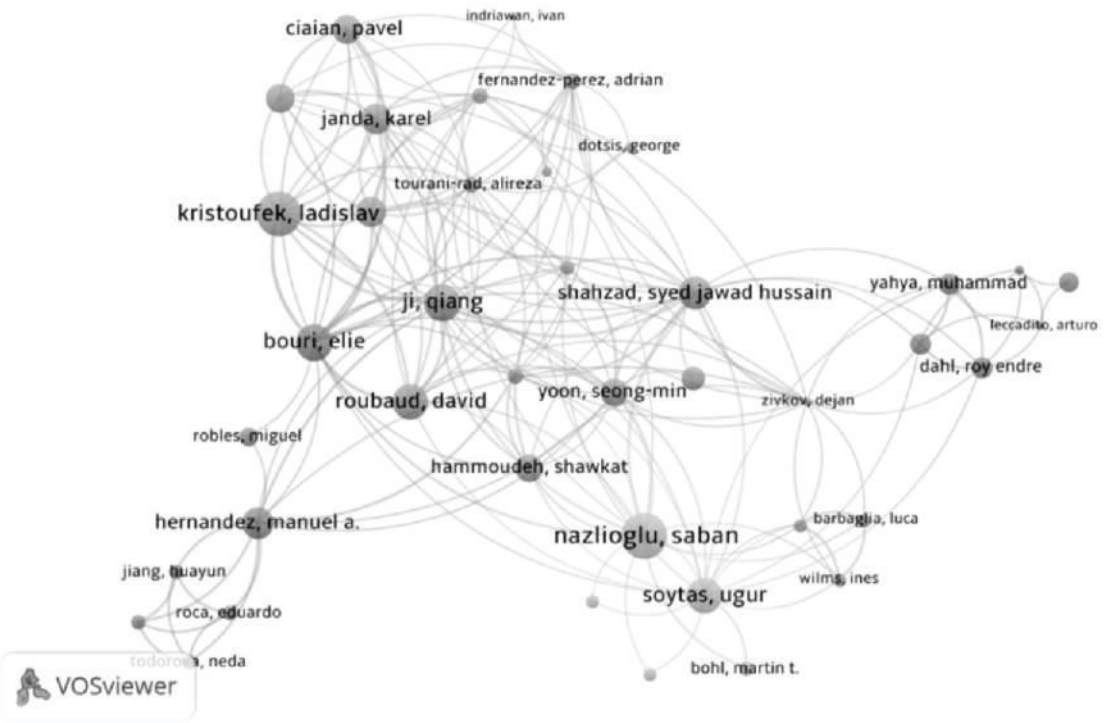
S. No.	Title	TC.	TP.	AC.	Impact factor	SJR	SINP	Cite Score
1	*Energy Economics*	969	18	53.8	7.042	2.5	2.238	10
2	*Energy Policy*	809	13	62.2	6.142	2.093	1.941	10.2
3	*World Development*	582	9	64.7	5.278	2.386	3.097	8.4
4	*Ecological Economics*	418	11	38	5.389	1.917	1.92	9.1
5	*Food Policy*	311	12	25.9	4.552	2.092	2.401	7.7
6	*European Review of Agricultural Economics*	225	9	25	3.386	1.4	1.756	4.3
7	*American Journal of Agricultural Economics*	210	17	12.4	4.082	1.949	2.345	5.5
8	*Agricultural Economics*	191	15	12.7	2.585	1.29	1.442	3.6
9	*Journal of Commodity Markets*	151	13	11.6	2.721	0.727	1.893	4.4
10	*Agricultural Economics-Zemedelska Ekonomika*	136	17	8	1.711	0.531	NA	2.3

Note. NA is unavailable, TC is total citations, AC is average citations, SJR is Scimago Journal Rank, and SNIP is Source-Normalized Impact per Paper.

Figure 7 demonstrates the citation analysis of authors publishing on agricultural commodities. Out of 731, only 57 authors meet the threshold criteria of having at least two documents and five citations, but only 41 are connected in the scientific mapping. So, only related items are present in Figure 7. Based on this analysis, a table of top-ten authors has been presented.

The top ten most influential authors, according to total citations, are shown in Table 6. Every year, Google Scholar uses the published papers and citations on those publications to determine the authors' h-index and I-10

Figure 7. ***Authors' Citation Analysis***



Note. The threshold criteria are at least two documents per author and five citations per author.

Table 6. ***Top-Ten Authors by their No. of Citations***

S. No.	Authors	TP	TC	AC	H	I-10	TLS
1	Saban Nazlioglu	3	317	105.7	26	37	18
2	Ladislav Kristoufek	4	289	72.3	38	69	23
3	Elie Bouri	3	206	68.7	50	142	25
4	Qiang Ji	3	202	67.3	70	244	27
5	Syed Jawad Hussain Shahzad	3	164	54.7	37	NA	23
6	Manuel A. Hernandez	3	144	48	24	46	5
7	David Zilberman	4	139	34.8	90	413	20
8	Karel Janda	3	131	43.7	24	42	20
9	Pavel Ciaian	3	128	42.7	37	88	14
10	Seong-min Yoon	3	109	36.3	34	75	12

Note. TP: Total publication, TC: Total citation, AC: Average citation, H: h-index, I-10: I-10 index, TLS: Total link strength, NA.- Not available.

index (Google Scholar). The data for the H-index and I-10 index were gathered from Google Scholar. Saban Nazlioglu from Pamukkale University Turkey is the most profound author, with only three documents but more than 100 average citations on his papers. His H-index is also 26, which is too good in the research community. His two articles are on the list of the top ten most cited articles, and he is the only author having this achievement. Ladislav Kristoufek from Charles University in Prague is the second most profound author researching agricultural commodities. David Zilberman, Professor Of Agricultural And Resource Economics University of

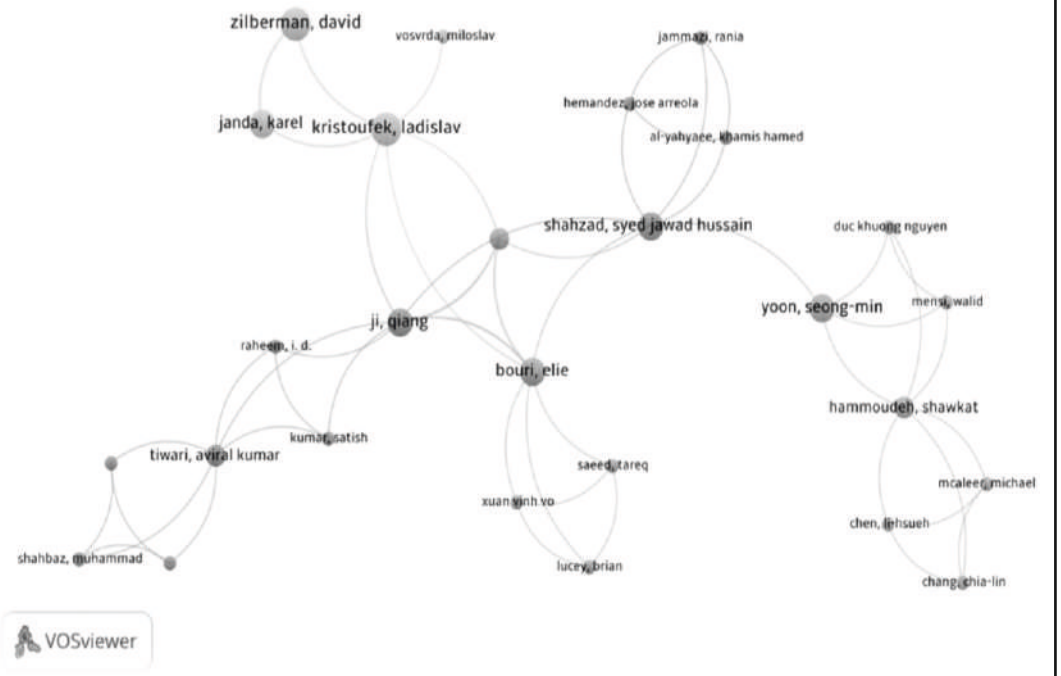
California Berkeley, even when he does not have maximum citations on his articles in this domain, his h-index is 90, which is leading and shows his contribution to the existing literature.

Co-Authorship Analysis

Co-authorship analysis facilitates comprehension of the relationships among writers in a certain field of study (Donthu et al., 2021). Different authors associate with other authors on various projects. This association can be between authors from the same area, organization, country, or field, organizations, and countries. Here, the analysis of authors researching agri-commodities connected with economic activities has been presented. Co-authorized investigations examine the changing cooperation between authors and the impact of that change. Here, the authors have investigated the association between different authors with the help of co-authorship analysis.

Figure 8 illustrates the co-authorship analysis of the referenced authors. Only 27 of the 731 writers are linked in scientific mapping, even though 365 of them satisfy the requirement of 10 citations per piece written by two or more associated authors. Therefore, the figure in this case only shows the 27 documents that had two or more related writers co-author. Though numerous authors co-authored different publications, each author has a distinct number of citations.

Figure 8. ***Co-Authorship Analysis***

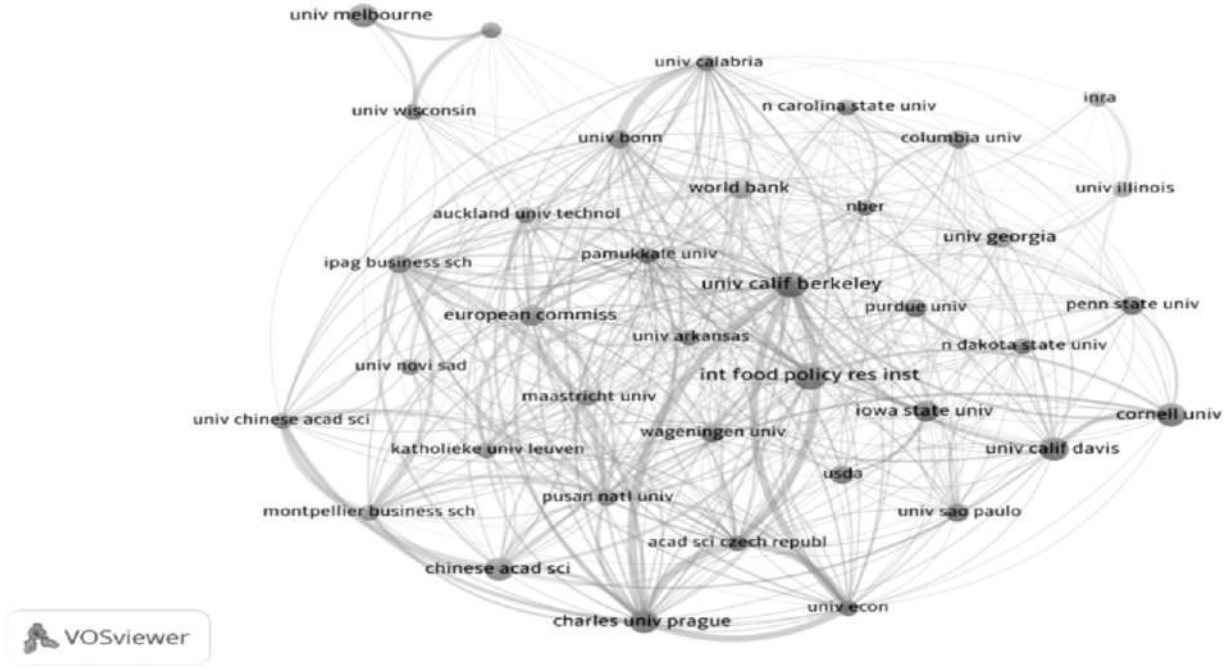


Note. Threshold criteria: minimum of ten citations per document.

Bibliographic Coupling

Bibliographic coupling is a technique for science mapping that operates on the assumption that two publications sharing common references are also similar in their content. (Donthu et al., 2021). Here, the authors have examined the research area of agri-commodities based on prominent organizations publishing in the area. This analysis can help one understand the contribution and similarities of research processes in different organizations in agri-commodities research.

Figure 9. ***Most Prominent Organizations' Bibliographic Coupling***



Note. Threshold criteria: minimum of three documents per organization and minimum of ten citations per organization.

Figure 9 demonstrates the bibliographic coupling of the most prominent organizations publishing on agricultural commodities. This coupling is for the enhancement of knowledge about the organizations. With three papers published and ten citations per organization, out of 451, 37 organizations satisfy the qualifying requirements. According to scientific mapping, all 37 organizations are connected. The relationship between these organizations and the most well-known organizations demonstrates how these organizations serve as the foundation for upcoming scholars studying the literature on agri-commodities.

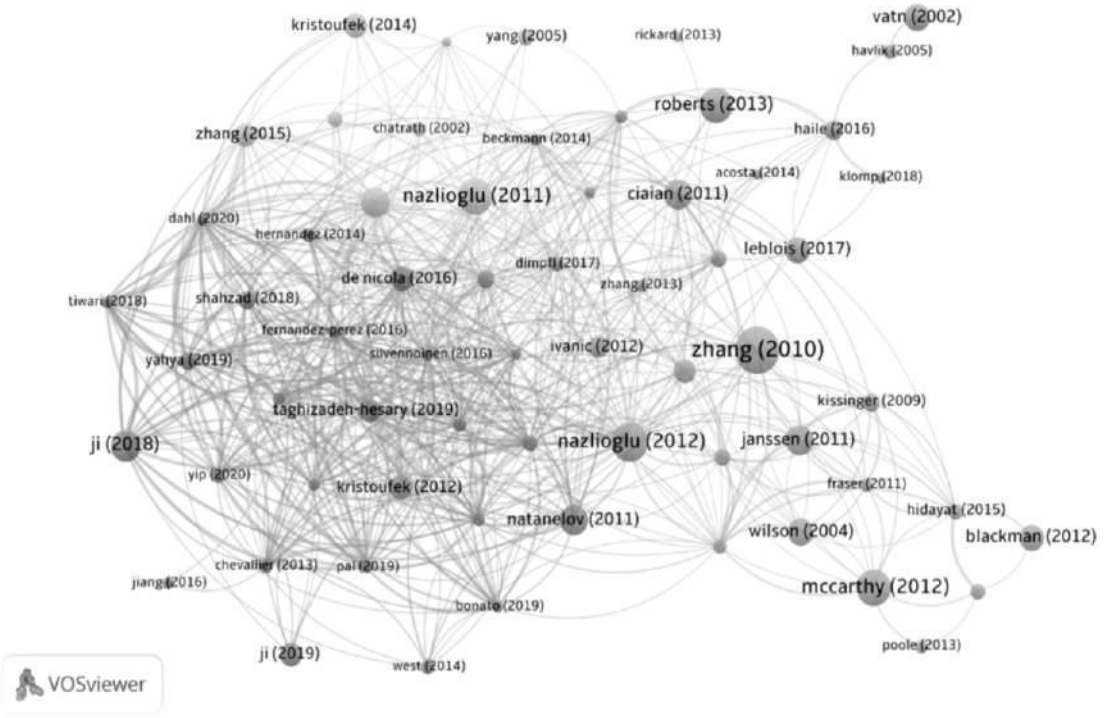
Table 7 shows the top 10 organizations publishing in this research domain. The IFPRI is the most prominent

Table 7. ***Most Prominent Organizations***

S. No.	Organization	Founded	Location	TP	TC	AC
1	The International Food Policy Research Institute (IFPRI)	1957	Washington DC, USA	8	205	25.6
2	University of California Berkeley	1868	Berkeley, California, USA	7	187	26.7
3	Charles University Prague (one of the world's oldest universities)	1348	Prague, Czech Republic	6	292	48.7
4	Chinese Academy of Science	1949	Nationwide, China	6	295	49.2
5	Cornell University	1865	Ithaca, New York, USA	6	100	16.7
6	University of California Davis	1905	Davis, California, USA	6	178	29.7
7	University of Melbourne	1853	Melbourne, Victoria, Australia	6	50	8.3
8	European Commission	1958	Brussels, Belgium	5	121	24.2
9	Iowa State University	1858	Ames, Iowa, USA	5	44	8.8
10	University of Georgia	1758	Athens, Georgia, USA	5	240	48

Note. TP- Total Publication, TC- Total Citations, and AC- Average Citations.

Figure 10. ***Bibliographic Coupling of Documents***



Note. The threshold criteria are a minimum of 20 citations per article.

organization as it publishes eight articles and has a maximum of 205 citations related to agricultural commodities in its publications. The University of California Berkeley is the second most prominent organization, having seven research papers that received 187 citations, followed by Charles University Prague (one of the world's oldest universities), with six papers and 292 citations.

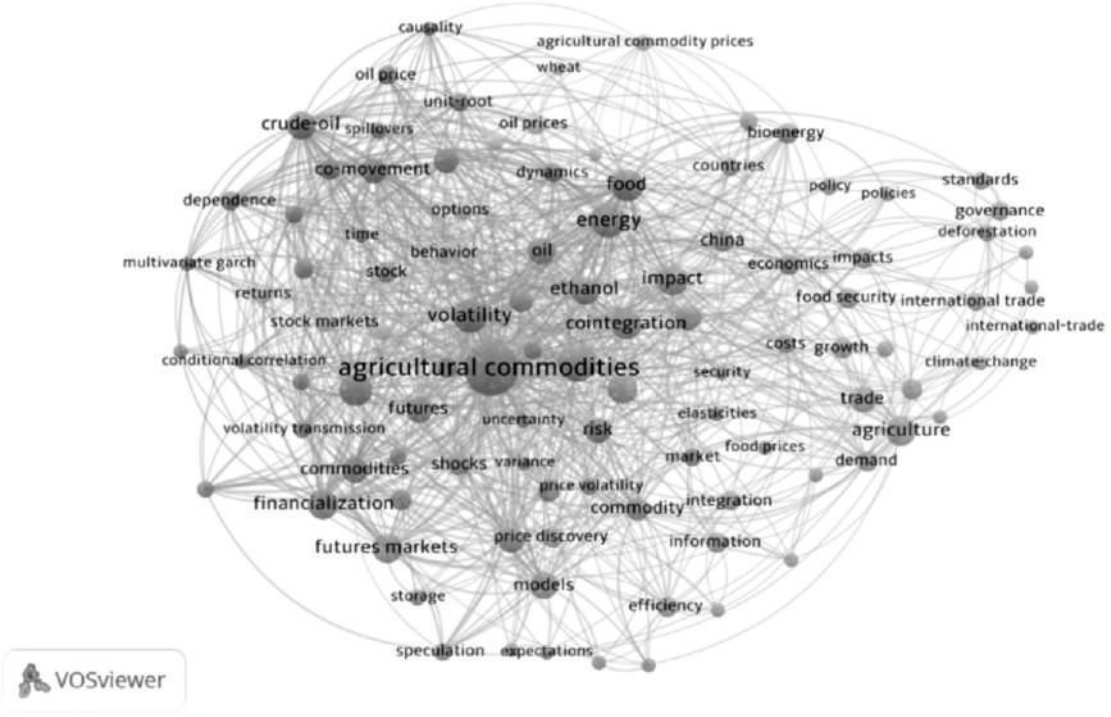
Figure 10 presents a study of the publications' bibliographic coupling. Only 83 out of 304 articles satisfy the requirement that each article has at least 20 citations; of these 83, only 64 documents are linked in the scientific mapping, meaning that only 64 papers' analysis is available here. The bibliographic coupling of documents explains past research's relevance as new researchers use some papers as references in their publications. What do prices tell us about food versus fuel? According to researchers, the most referenced publication is (Zhang et al., 2010). This study serves as a foundation for additional research for many researchers.

Co-occurrence Analysis (Network Analysis)

Co-occurrence analysis, also known as co-word analysis, helped authors detect the critical keywords researchers use while researching agricultural commodities, mainly in research associated with economics, commerce, and management. This analysis determines the trends in the research area as the most frequently used keywords influence upcoming researchers, and new trends can be seen in the research area.

Figure 11 demonstrates the most frequently picked keywords by the researchers in this research domain. Instead of using an author-only keyword analysis, the writers used an all-keyword analysis to determine the breadth of the literature in the agri-commodities study domain. Through the application of threshold criteria, the authors have determined that, of the 1,501 keywords, only 102 match the requirement of having at least five appearances as a keyword. “Agricultural commodities” is the most frequent keyword, with a maximum

Figure 11. ***The Network Analysis of all Keywords***



Note. The threshold criteria are a minimum of five occurrences of a keyword.

occurrence of 62 times. "Price" comes in second with an event of 33 times, reflecting the relationship between agricultural commodities and price, followed by "energy" with 26 occurrences. Table 8 of the top 20 terms, together with their occurrence times, is shown below, based on Figure 11.

Table 8. ***Top 20 Keywords with Maximum Occurrence***

Rank	Keyword	Occurrence	Cluster	TLS
1	Agricultural Commodities	62	2	250
2	Prices	33	3	136
3	Energy	26	3	151
4	Volatility	25	2	119
5	Food	22	2	121
6	Markets	22	2	106
7	Impact	21	2	77
8	Agriculture	20	1	54
9	Futures Markets	20	6	102
10	Financialization	19	2	99
11	Model	19	3	77
12	Cointegration	19	6	84
13	Crude-Oil	18	2	120
14	Ethanol	17	3	107

15	Commodity Prices	16	3	58
16	Models	16	6	60
17	Oil	16	6	75
18	Trade	15	1	33
19	Co-Movement	15	2	90
20	Futures	15	2	61

Note. TLS- Total Link Strength.

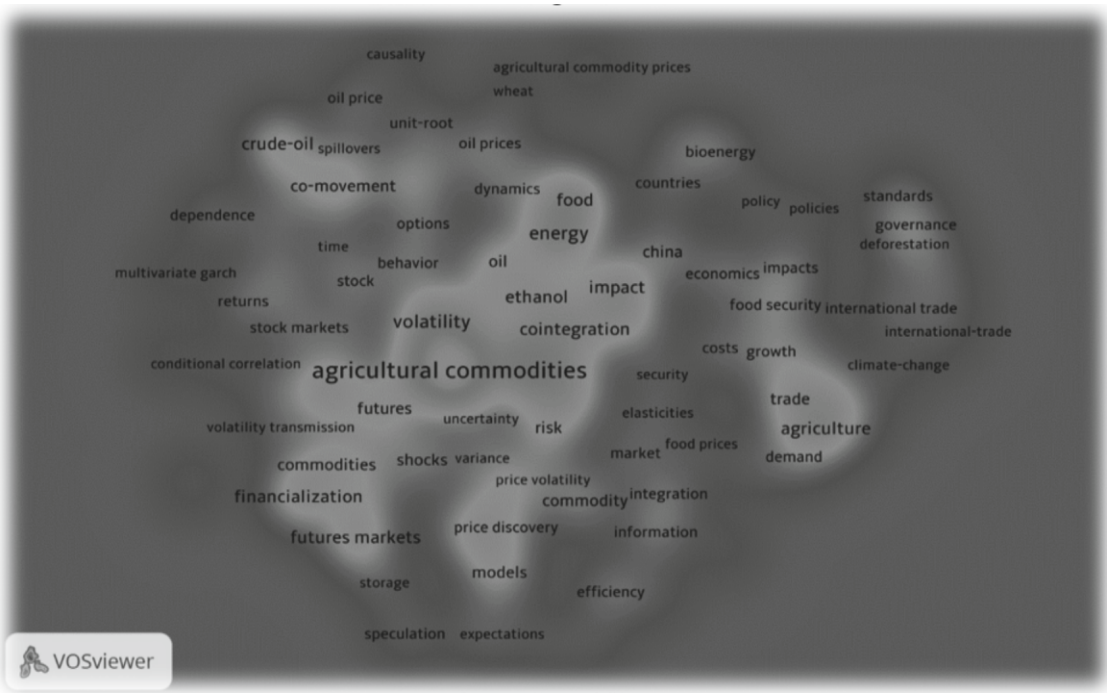
Table 8 presents the occurrence of the most recurring keywords. These keywords determine the scope for future research in the area. When one sees energy as one of the most occurring keywords, a prediction about the association between energy and agri-commodities can be made for an excellent title to research by upcoming researchers. These words can be found, giving researchers the maximum idea of which direction they must move. So here, Agricultural commodities are the most common keyword in the existing literature. All other keywords are related to the futures markets where these commodities trade. Prices are the second most used keyword, followed by energy. Energy commodities are deeply associated with agri-commodities from the start of their trading.

Density Visualization

The similarity between the various elements that make up a cluster is displayed through density visualization; the greater the weight and similarity of items within a set, the higher the density. Density visualization suggests that items are strongly related to one another inside a cluster, highlighting the significance of that specific cluster within the investigation.

Figure 12 represents the density of the keywords in agri-commodities research connected to commerce and

Figure 12. ***Density Visualization of the Keywords***



management. This figure implied that cluster 2 contains the maximum weightage of most occurring keywords in the literature of agri-commodities research as the keyword agricultural commodities fall in this cluster along with volatility, food, markets, impact, finalization, etc., which are present in the table of most occurring keywords.

Conclusion

The scientific mapping of documents shows that Agricultural commodities have been a remarkable research area in the last two decades, particularly in economics, commerce, and management. Many influential documents have been published in the previous decade. The top-cited paper published in 2010 (Zhang et al., 2010) concluded that food for all should be the priority in the short run, and fuel prices are not directly impacting food inflation. The second most cited paper concluded that the participation of farmers in systematic markets increases the standard of living and can be enhanced with the use of mobile phones in remote areas (Muto & Yamano, 2009). An increasing amount of study is being conducted on various aspects of agricultural commodities. Research on agri-commodities is increasing with time, and new trends related to this area are emerging. Research publications on agricultural commodities are moving in the direction of discussing the impact of energy commodities on agricultural commodities, price volatility in agricultural commodity markets, international trade agreements, futures trading activities, etc.

In the past decade, commodity exchanges and various aspects related to agri-commodity trading have been the highlight of the research in agri-commodities. Increased globalization has reduced the border effect (Furtan et al., 2004). In their research article, Furtan and Van Melle concluded the same with the example of the US and Canada. Apart from the growing impact of globalization on agricultural commodities trading, the relationship between energy commodities and agri-commodities is the most talked-about research area related to agri-commodities. Numerous published articles on energy and agri-commodities include those by Ji et al. (2018), Nazlioglu (2011), Natanelov et al. (2011), Nazlioglu and Soytas (2012), and Zhang et al. (2010). Research on agri commodities is also related to food security, biofuels, risk, and returns. A growing area of research is the idea that price volatility in agricultural commodities is caused by speculative bubbles in agri-derivative markets (Gutierrez, 2013; Zhang et al., 2019). "Sustainability of biofuels in Latin America: Risks and opportunities" is one of the most cited articles discussing the positive impact of biofuels on the environment and economy and also originates a new dimension in agri-commodity research (Janssen & Rutz, 2011).

Based on the above analysis, the authors concluded that many aspects of agricultural commodities research in commerce and management are still open for further study. The past decade has seen remarkable growth in the publication of articles in the area. The increase in the literature shows good progress in agri-commodity Research conducted by researchers in different parts of the world.

Authors' Contribution

Pallavi Rani and Dr. Sanjay Kumar created the concept for this research article. Under Dr. Sanjay Kumar's supervision, Pallavi Rani conceptualized this review study. Using keywords that were important in this review paper, Pallavi Rani found high-quality research articles. Pallavi Rani completed the formal analysis and manuscript writing for this review study, while Dr. Sanjay Kumar completed the final drafting and manuscript review.

Conflict of Interest

The authors attest that they are not associated with or actively involved in any group or entity with a financial or non-financial stake in the topics or resources covered in this paper.

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