

Scientific Production on Clusters in South America

Paulo Cassanego Jr*, Cristiane Ferreira de Souza Araújo

Universidade Federal do Pampa, Maria Anunciação Gomes Godoy, Bagé, BRAZIL.

ABSTRACT

The theme that deals with clusters have been discussed incessantly by the academic community. However, despite not being a new issue, it is an issue that needs a broad engagement for its full development. In this context, the general objective of this research is to analyze the state of the art of scientific production on clusters in countries that make up South America, according to the Scopus platform. Based on the principles of social network analysis, the textual corpus available in the context of the terms Cluster OR "Industrial District" OR NOT "Cluster Analysis" from the survey of 300 articles in databases and through the application of selection filters were explored. 150 articles we extracted for the corpus of this research. To data compile, the following softwares we used: HistCiteTM, VOSviewer, Gephi and Iramuteq. The textual analysis modality of the research corpus associated with metric studies was adopted to contextualize the indicators related to production. As a result of this study, a research elite in South America composed of 19 authors, 5 thematic communities called Performance, Cooperation, Innovation, Market and Resources, 31 bibliographic couplings, Brazil as the country that publishes the most articles in the area with 101 documents.

Keywords: Clusters, Scientific production, Graph Theory

Correspondence

Paulo Cassanego Jr.

Universidade Federal do Pampa, Maria Anunciação Gomes Godoy, 1650-Bagé, BRAZIL.

Email id: paulo.cass@gmail.com

ORCID ID: 0000-0002-8035-9448

Received: 03-06-2022

Revised: 28-09-2022

Accepted: 10-11-2022

DOI: 10.5530/jscires.11.3.43

INTRODUCTION

Clusters have unique characteristics that lead to competitive advantages for organizations that participate in them.^[1] These advantages occur because organizations have geographic proximity, being classified in positive externalities,^[2] increased export intensity,^[3] marketing externalities,^[4] more efficient collaboration,^[5-7] among others. Clusters of organizations maintain a competitive and competitive relationship with each other,^[8] creating a favorable environment to generate innovations, facilitating the perception of customer needs and the possibilities of new technologies,^[9] in addition to having a trend towards the creation of new ventures.

In the relationship between the entities of a cluster, innovative efforts we related to companies or sectors that cooperate in the process of diffusion of innovations such as new technologies or products and clusters based on production links that refer to companies or sectors that form a production chain or of value.^[10,11]

An organizational environment has multiple dimensions and that the different types of associated information can affect the management processes underlying strategic decision making.^[12] Thus, the study of a cluster involves a deep analysis

of numerous dimensions to take specific and appropriate decisions.

Different researches we carried out to understand business agglomerations in different areas and contexts;^[13] however, the discussion on the development and maintenance of the phenomenon remains to provoke greater attention from researchers.^[14] Thus, considering the subject's relevance, the following research problem was elaborated: What is the state of the art of scientific production on clusters in the countries that make up South America?

It is considered a justification of this research, in particular, the choice for the region of South America which show how much the clusters of African and Latin American countries were consolidated in these countries,^[15,16] making industrial sectors more varied and competitive.^[17-19] Furthermore, the authors show that clusters are quite heterogeneous in terms of origin, structure, and principles of organization, as well as in terms of trajectories and growth prospects.^[20]

The diversity in terms of the development models adopted by different countries, as well as the history and political and economic situation of each of them. According to the author, the concept of industrial district begins to be used as an instrument for analyzing industrial structures, insofar as the territory starts to be considered an important dimension of industrial dynamics. In this way, the territory is no longer seen as passive support, but as an active agent that is capable of stimulating its development.^[20]

Copyright

© The Author(s). 2022 This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

Therefore, this study assumes the need to highlight and understand the position of schools of thought formed on the subject of recent clusters and with a low level of industrialization, analyzing their evolution, main fields studied, and directions given to research, to understand their specificities.

In this research, the expressions Industrial District and Cluster were considered synonymous.^[21-23] and the expressions agglomeration, co-location were used to refer to geographic co-location.^[24]

In addition, this introduction, section 2, presented the theoretical framework, the methodological procedures in section 3 and the discussion in section 4, followed by the final considerations.

Clusters

The term cluster is recognized for its capacity for external reproduction and generation of efficiency for the collective, for example, in the case of specialized labor, in the mutual support that occurs between companies in the same sectors, in the sharing of infrastructure, in the availability of suppliers locations and also in the sharing of information, skills and knowledge shared from between company.^[1,25] In this sense, the cluster term is a geographic grouping in companies and institutions that are similar by common or complementary elements. However, it has been a formalized cluster if there are competitive advantages between the companies caused by mutual relationships; otherwise, it has not been a cluster.^[25,26]

The classified variety of clusters along two dimensions: The level of analysis and the relationship between the entities of a cluster.^[10,11] Table 1 summarizes the classification that results in six types of the cluster:

The co-location literature argues that, as firms cluster, some externalities, which only exist when firms are close, come to

play a role that affects firms both positively and negatively. The final result depends on industry specificities and regional and country factors.^[27,28]

A cluster in the region, state or sector makes the government assume a different role; because macroeconomic policies are necessary conditions, they are still insufficient to foster competitiveness between sectors.^[25]

With this, the government starts to exercise a microeconomic function to remove obstacles to growth and improve the existing groups. It is noteworthy that the presence of a cluster means that part of the located competitive advantages outside the company or sector, through business units or industrial geographic concentrations.^[25,46]

METHODOLOGY

This study is quantitative, descriptive research, with the primary objective of detailing the particularities of the universe or recognizing aspects to define the nature of this connection. Data for analysis we imported from the SCOPUS portal on January 24th. The search strings used were: Cluster OR "Industrial District" OR NOT "Cluster Analysis". The addition of the negative string we gave contributes to the problem mentioned by Lazzarotti, Sedita and Caloffi (2013). The use of the expressions Industrial district and cluster as synonyms was a choice based on McEvily, Zaheer (1999), to exhaust the search for the terms, Returning 700,786. Afterward, the results were filtered to represent only articles in journals, leaving 583,168 articles.

As a choice criterion, the Business, Management and Accounting area we defined 7,724 articles remained. Afterward, the articles we filtered by the country of origin of their authors, from which 12 countries in South America we selected, namely: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay and Venezuela. French Guiana is an overseas territory and not a country, with 354 documents remaining.^[29]

Afterward, the data we processed in the Histcite Software generates chronological maps of bibliographic collections resulting from searches by subject, author, and institutional publication.^[30] This search step we used to adjust the article data. In addition to performing an analysis on the theme of the studies. Three independent researchers read all articles. They kept the database only those that fit the research objective, taking into account the established conceptual assumptions. After this phase, 150 articles formed the basis of the study.

The data analysis performs 150 articles resulting from the filtering process we inserted into the VosViewer Software^[31] to investigate the co-authorship relationships and the constitution of the publication networks. The analysis of social

Table 1: Annual distribution of the textual corpus.

Analysis level	Relationship between entities in a cluster	
	Innovative efforts	Production links
Micro-level (Company clusters)	Technologies dissemination and knowledge among firms, research institutions, etc.	Suppliers and buyers in an aggregated or productive value chain of firms.
Meso-level (Sector clusters)	Technology diffusion and knowledge across sectors.	Back and forward links between sectors; partial analyses.
Macro-level (Sector clusters)	A division of the economic system into sectors that spread knowledge or technologies.	A division of the economic system into sectors that form value-added or production chains.

Source: ^[10]

networks of co-authorship allows identifying researchers in a particular field of work. These networks explain and draw the extent of the researchers' collaboration and its impact on the scientific community.^[32]

To measure the productivity of researchers, used Lotka's Law-Inverse Squares,^[33] which allows verifying the distribution of authors who publish the most.^[34] However, to operationalize this step of the analysis, the improvement made to Lotka's Law known as Price's Law of Elitism was chosen, which considers formed that the elite of researchers by the square root of the total number of researchers.^[35]

We used social network analysis to know the characteristics of the co-authorship network.^[36,37] In this analysis, represented researchers by nodes (vertices) of a network and collaboration relationships are the edges (connections).^[38] We imported the data into the Gephi 0.9.2 Software.^[39] In the analysis of social networks, two sets evaluated indicators, the network level and the node level metrics.

The calculation of metrics at the network level began with detecting research communities, using the Blondell algorithm, a heuristic method based on modularity optimization.^[40] Afterward, the calculation of the density of the network we performed. The network density defines the ratio between edges number in the graph and the square of the total nodes number.^[41]

The elaboration of the word network and the word cloud we carried out with the help of 2 (two) software, VOSviewer and Iramuteq, respectively. The VOSviewer software is a software specifically designed for the construction and visualization of bibliometric maps, with particular attention to the graphical representation of such maps,^[42] while Iramuteq allows different forms of statistical analysis of texts, produced from interviews, documents, among others.^[43]

The last step is to carry out an in-depth analysis of the textual corpus, built by identifying clusters or analysis categories representing similar research themes found in the 150 articles.

The categories emerge from the analysis of the textual corpus and are constituted based on different groups. The carried-out analysis of potential variables can carry out future research on the investigated topic at this stage.

DISCUSSION

In this section, we seek to highlight the results obtained by analyzing the textual corpus of this research. The three classical laws of bibliometrics support the analyzes carried out: a) Lotka's Law (1926), which assesses the productivity of authors; b) Bradford's Law (1953), which measures the productivity of journals; c) Zipf's Law (1949), which measures

the frequency of occurrence and co-occurrence of certain words in a text.

The descriptive analysis of the corpus deals with indicators related to citation and content indicators reported in the work methodology; thus, the number of articles published over time, the geographic distribution of authors and co-authors, the composition of authorship in the works, in addition to the estimate of the research elite of the textual corpus we evaluated.

Then, the presented analyzes referring to the bibliographic cocitation and coupling of authors. In this case, this evaluation seeks to identify and, at the same time, deepen knowledge about a particular group of researchers and social scientists over time, which contribute to scientific production, in cooperation through jointly signed articles, following the development of areas of knowledge and authorship and publication standards.^[44]

Regarding the reputation of journals, it is noteworthy that we evaluated to know the quality of journals. Scientific articles were published in the sampled period, based on citation indicators, to provide the reader with an outline situation.

The word analysis consists of verifying the co-occurrence through the construction of the word cloud and similarity tree and the evolution analysis of the terms used over time, from the year 1996, using for this is the summaries of the articles that make up the textual corpus.

Annual Distribution of the Research Corpus

The articles that make up the sample textual corpus (150 articles) cover 60 journals and 348 authors and co-authors registered in the Scopus database. In Figure 1, it is possible to see how these published articles over the years, in quantity and trend terms. The interval between 1996 and 2019 comprises the registration of articles published in the area. There is a gradual increase in publications, with 2012 and 2017 being

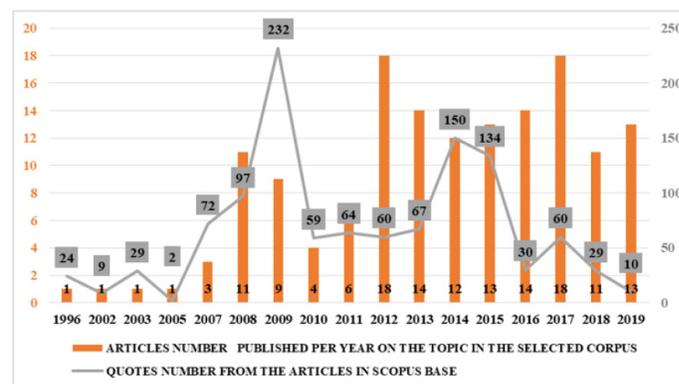


Figure 1: Number of articles published per year and number of citations in Scopus database

Source: elaborated by the authors in the Histcite software (2021).

the years with the highest publications number, 18 articles per year, and 24% of the textual corpus. Regarding the number of citations, in 2009, 09 articles were published, reaching 232 citations.

Among these, the article published in 2009 deserves to be highlighted, which had the highest peak of the entire time series, presenting 107 global citations in the Scopus database, with the work developed by Elisa Giuliani and Valeria Arza (2009), entitled *What drives the formation of 'valuable' university-industry linkages?. Insights from the wine industry. Research Policy*, 38(6), 906–921, which deals with the factors that drive the formation of “valuable UI links”, conceived as those links between universities and companies that have the most significant potential to spread knowledge to other companies in their regional economy.

By following the number of articles published, it is clear that from 2012 to 2019, the number of publications remained stable, with minor fluctuations, however, always with more than 10 articles published per year, corresponding to 75.3% of the analyzed textual corpus.

Composition of Periodicals and Authorship

By analyzing the journals that make up the selected textual corpus, we identified that the journal “Espacios” from Venezuela brought the most significant number of publications on the subject, with a total of 43 articles; however, we noted that

there is no record of this newspaper in the InCites Journal Cited Reports (JCR).

Noteworthy are the journals “*Journal of Cleaner Production*” and “*Journal of Business Research*”, both from the United States, published by Elsevier and have the highest JCR index, as shown in Table 2.

Bradford’s Law states that decreasing the ordering of articles in scientific journals enables exponentially divided groupings. The number of journals in each group has been proportional to 1: n: n². Thus, by measuring the productivity of journals, it is possible to establish the core and areas of dispersion about a given subject in the same set of journals.

In this context, they placed 60 journals in descending order of productivity and distributed them into three zones, each with at most a third of the total number of articles (150/3 results in approximately 50 articles per zone). The first zone contains a small number of highly productive journals (2 journals), the second zone, considered intermediate, contains a more significant number of less productive journals (16 journals). At the same time, the third includes an even larger volume of journals with reduced productivity on the subject (42 periodicals). We emphasize that not presented the journals referring to Zone 3 in the table, with only two or one published article in each.

Table 2: Number of publications on the subject per journal.

	Journals	JCR	h-index	Articles number	Quotes number	Countries	Published
ZONE 1	Espacios	0	0	43	17	Venezuela	0
	Gestao E Producao	0	0	10	41	Brazil	UFSCAR
ZONE 2	Journal of Technology Management and Innovation	0	0	7	17	Chile	0
	Entrepreneurship and Regional Development	2.885	0.720	5	65	USA	Taylor and Francis
	Journal of Business Research	4.874	1.358	5	105	USA	Elsevier
	Revista Brasileira De Gestao De Negocios	0.875	0.188	5	7	Brazil	FECAP
	Competitiveness Review	0	0	3	1	UK	Emerald
	International Journal of Entrepreneurship and Small Business	0	0	3	13	UK	Inderscience
	Journal of Business and Industrial Marketing	2.497	0.576	3	72	USA	Emerald
	Journal of Cleaner Production	7.246	1.904	3	71	USA	Elsevier
	Bar - Brazilian Administration Review	0	0	2	12	Brazil	BAR
	European Business Review	0	0	2	13	UK	Emerald
	International Journal of Business and Globalisation	0	0	2	5	Switzerland	Inderscience
	International Journal of Business Excellence	0	0	2	33	UK	Inderscience
	International Journal of Emerging Markets	1.022	.0183	2	11	England	Emerald
	International Journal of Productivity and Performance Management	0	0	2	38	UK	Emerald
	International Journal of Wine Business Research	0	0	2	54	Australia	Emerald
	Latin American Business Review	0	0	2	24	UK	Taylor and Francis

Source: elaborated by the authors in the Histcite software (2021).

We considered that this analysis brings essential revelations regarding the quality of the scientific productions in this textual corpus since the journals that comprise 35.4% of the articles published on the JCR index are not classified.

The information above complies with Bradford's Law (1953), as it indicates the degree of relevance of journals, providing the reader with an indication of critical formal channels in scientific communication in the area.

Regarding the 19 authors selected as the most representative, Christian Felzensztein of the Universidad Adolfo Ibáñez in Chile is worth mentioning. It presents 263 global citations, corresponding to 23.3% of the total citations in the database, as the author most cited in the textual corpus. of the 13 articles written by the author, the most cited was Felzensztein, C., Gimmon, E., and Carter, S. (2010). *Geographical co-location, social networks and inter-firm marketing cooperation: the case of the salmon industry. Long Range Planning*, 43(5-6), 675-690, with 54 global citations.

Based on the research by Price (1976), a calculation based on the square root of the number of authors and co-authors responsible for the articles that make up the corpus of this research was estimated as a criterion to establish the research elite. Thus, when extracting the square root of the 255 authors and co-authors, the value obtained was 18.65, which is approximately equal to 19 authors, characterized as the elite of this research, as shown in Figure 3.

In Figure 2, there are 348 authors and co-authors directly involved in the study; 19 authors are the most fruitful or the research elite, proportionally equivalent to 57.5% of the textual corpus, which accounts for the more excellent production in the studied domain.

From these results, we evidenced Lotka's Law (1926), which we considered presupposes a group of more prolific

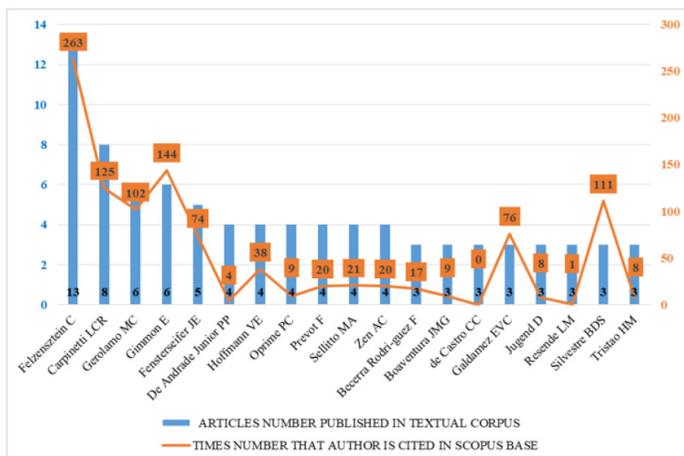


Figure 2: Number of articles and citations by research elite author
Source: Prepared by the authors based on the Histcite software (2021).

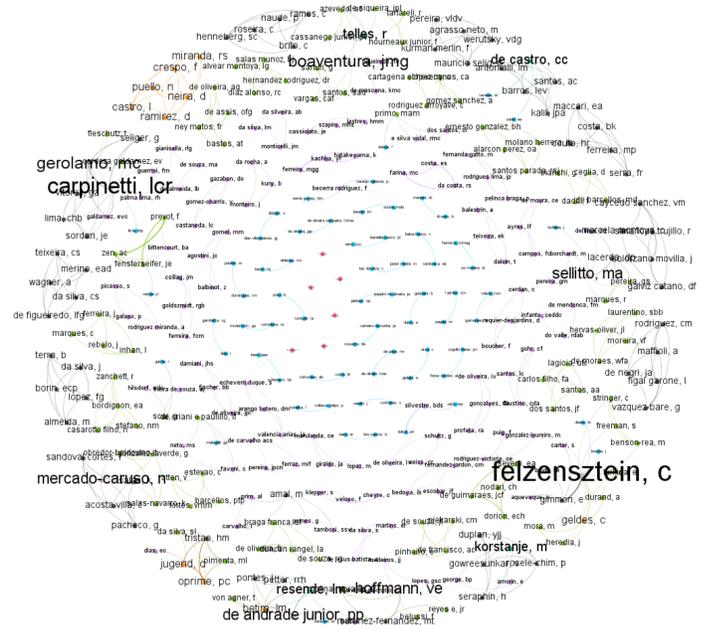


Figure 3: Network formed by 348 authors and co-authors of articles in the textual corpus.
Source: Prepared by the authors with the aid of the Gephi 0.9.2 Software.

researchers, the elite of scientific production in the area, while a large part has few publications that arouse little less interest from the academic community.

Furthermore, we used the social network analysis with the aid of the Software Gephi 0.9.2 to explore the co-authorship relationships, as shown in Figure 4. The network is composed of 348 nodes and 461 edges. Modularity identified 96 communities, characterizing a 0.8% dense network; thus, we understood that the network constitutes a heterogeneous set about scientific production, reflecting the presence of structural holes in the network that is when several groups keep sharing the same information due to the absence of connections with other isolated groups. Although the authors work on the same theme, we noticed that many of them work in isolation.

However, we noticed strong agglomerations around the authors Christian Felzensztein (Universidad Adolfo Ibáñez in Chile), Luiz Carpinetti (Universidade de São Paulo in Brazil), Miguel Sellitto (Universidade do Vale do Rio dos Sinos in Brazil), João Maurício Gama Boaventura (Universidade de São Paulo in Brazil), Valmir Emil Hoffman (Universidade de Brasília in Brazil).

Since the network built among researchers is sparse, we tried to get to know the communities to go beyond the co-authorship network. Thus, we detected communities by bibliographic coupling. This type of analysis measures the similarities between two articles buying their references.

These Bibliographic Coupling communities help to define fields or disciplines^[45].

For this analysis, with the help of the VOSviewer software, the defined parameters were “bibliographic coupling” for the type of analysis, “documents” for the analysis unit and “full counting” for the counting method attributing the same weight to each link between documents. The data comprised 150 articles, with a minimum of 10 citations, extracted from the textual corpus, resulting in 31 coupled items, as shown in Figure 4.

Through the Figure 4, we identified 5 different communities. After reading these articles, named the communities, as follows: A) PERFORMANCE (in yellow), which concentrates articles that aim to discuss the performance of organizations in clusters; B) COOPERATION (in purple), brings articles that talk about integrated cooperation actions between organizations in the cluster; C) INNOVATION (in green), consisting of articles dealing with actions that enable organizations to more innovate; D) MARKET (in blue), formed by studies dealing with market strategies of companies in clusters; and E) RESOURCES (in red), which study the interrelationships between the use of resources from the agglomeration to achieve goals.

Geographical distribution of the textual corpus

Regarding the analysis of the geographical distribution (Figure 5) of the articles that make up the textual corpus, about institutional affiliation, 348 authors and co-authors are distributed in 22 countries, as illustrated in Figure 6. It is possible to verify that Brazil has the most significant number of articles published in the selected textual corpus, 101 articles, corresponding to 67.3% of publications. It was followed by Colombia, with 18 articles, which correspond to 12% of the total publications in the selected textual corpus.

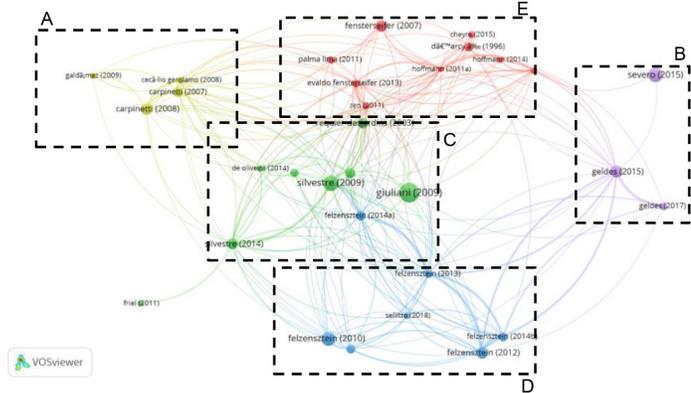


Figure 4: Communities identified through bibliographic coupling (sharing of research sources)
Source: Prepared by the authors with the help of the VOSviewer Software (2021).



COUNTRIES	ARTICLES NUMBER	COUNTRIES	ARTICLES NUMBER	COUNTRIES	ARTICLES NUMBER	COUNTRIES	ARTICLES NUMBER	COUNTRIES	ARTICLES NUMBER	COUNTRIES	ARTICLES NUMBER
Brazil	101	Argentina	8	France	5	Germany	3	Peru	3	Israel	1
Colombia	18	Portugal	7	United States	5	Italy	3	Australia	2	Japan	1
Chile	16	Spain	6	Canada	4	New Zealand	3	UK	2	Mexico	1
										Uruguay	1
										Venezuela	1

Figure 5: Number of articles per country [distortion of Indian map should be removed]
Source: Prepared by the authors on the Mapchart website.

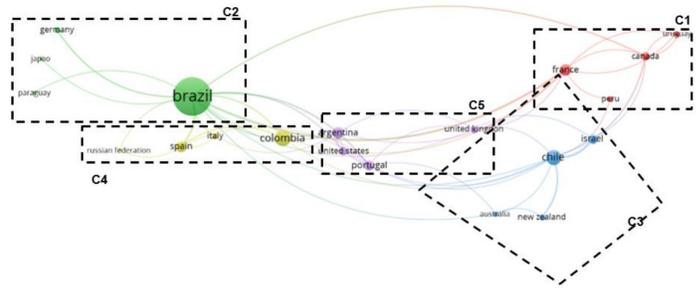


Figure 6: Network of coupled countries according to established co-authorship relationships.
Source: elaborated by the authors in the Vosviewer software (2021).

Mexico and the United States are responsible for producing 27 and 19 articles, respectively, which accounted for 21.19% of the articles published in the selected textual corpus.

It is important to note that the sum of the articles number distributed by country is 193, and the articles that make up the textual corpus are 150. This difference of 43 articles or more is explained by the country’s collaboration, with the counted articles two or three times, depending on the countries number contributing to each article. The collaborative relationship between authors from different countries is explained in Figure 6, which shows the collaboration relationship between countries by forming clusters calculated from the co-authorship relationships.

We observed the existence of 05 clusters that establish a collaborative relationship with each other in research. We identified the clusters from the composition of the colors in Figure 6. The yellow cluster – C2, is composed of Brazil, Germany, Japan and Uruguay, where Brazil stands out due to the number of articles it produced, either acting as a coordinating country for the research, either through the participation of Brazilian researchers in research coordinated in other countries, such as the study by Puppim de Oliveira,

JA, and de Oliveira Cerqueira Fortes, PJ (2014). *Global value chains and social upgrading of clusters: Lessons from two fair trade cases in the Brazilian northeast. Competition and Change*, 18(4), 365-381, which analyzes how the integration of clusters in global value chains affects social updating processes in two local industrial districts in the agro-industrial sector (cosmetic oil and organic honey) Brazil northeast.

We observed that relations are not interconnected between countries through the cluster but still establish less frequent exchange relations, as in Brazil and Spain in the article by Hoffmann, VE, Bandeira-de-Mello, R., and Molina-Morales, FX (2011). *Innovation and knowledge transfer in clustered inter-organizational networks in Brazil. Latin American Business Review*, 12(3), 143-163, analyzes whether it influenced business innovation by transferring knowledge between firms in the cluster. It directly estimates the measurement and parameters they defined as the structural model in which cooperation, workforce mobility, and institutions are knowledge transfer indicators.

Cloud, Abstract Similarity Tree and Author Keyword Network

To item analyze, it is necessary to observe that the larger and more centralized a given the word is, the greater its degree of occurrence. When the opposite happens, its size has been smaller, and its degree of occurrence in the textual corpus has been minor.

In this context, it can be seen from Figure 7(a) that, out of a total of two thousand four hundred and thirty-five (2435) words/terms from the analyzed abstracts, identified by the Iramuteq software, one hundred and thirty (130) words/terms that presented an occurrence greater than 20. Among these, eighth (8) words presented an occurrence from 100 repetitions, namely: cluster, study, firm, innovation, company, research, development, result, configuring the core of the researches that make up the corpus.

Regarding the similitude tree, seen in Figure 7(b), the connection between the words of the textual corpus is possible to infer the structures of the text construction and themes of the analyzed abstracts and how they relate to them each other. We evidenced twelve main groups, all related to the primary term, “cluster”.

In the orange grouping, for example, the highlighted word “study” can be seen, this grouping covers the words that most occurred related to the highlighted word, namely: case, quantitative, focus, tuna, theory, among others, that is, this grouping represents the way the methodological procedures, in general, were conducted.

Regarding the grouping of words in blue, it is perceived as the highlighted word “develop”; thus, it is possible to infer that the studies developed with this focus considered aspects such as efficiency, involve, report, importance, contribute, environmental. The same analysis applies to the other groupings.

In this context, there is an analysis of the author’s keyword network, in which, according to the graph theory, it is possible to verify the connection between the main words in the network. Based on the constitution of the edges between the terms.

We noted that the main words found on the network are similar to the words highlighted in Figure 7; however, the origin of the words belongs to different items in the article, the first in the abstracts and the second in the author’s keywords.

At this point in the analysis, Zipf’s Law strongly identifies the clustering of themes and types of studies/focus applied to the

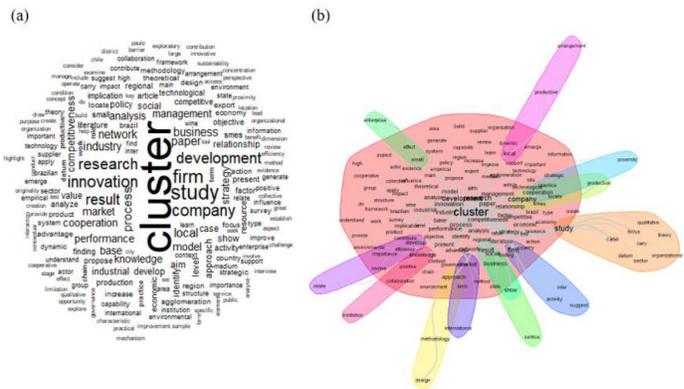


Figure 7: Cloud(a) and similarity tree (b) of the most used words in the abstracts of the articles. Source: elaborated by the authors in the Iramuteq software (2021).

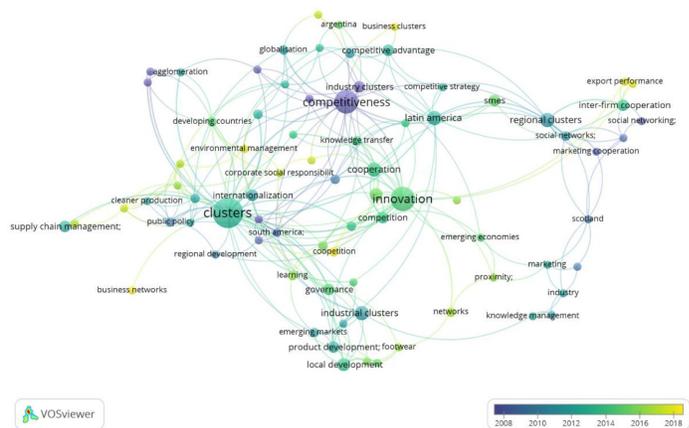


Figure 8: Author’s keyword network with temporal evolution. Source: elaborated by the authors in the Vosviewer software (2021).

theme of clusters. Thus, in Figure 8, studies on clusters in the database began their efforts to understand how globalization affected emerging markets and their relationship with clusters, companies' internationalization, and public policies—mainly concerning industrial clusters. Afterward, the texts discussed strategy, cooperation, competition and technology transfer. The newest texts talk about achieving competitiveness through cooperation, learning, governance and innovation. We developed this finding indicates that these are the current topics on which research on agglomerations.

Furthermore, the comparison between the Figures that some words connected to the nuclei coincide with those found with greater expression in the word cloud and the similitude tree.

CONCLUSION

The present works aimed to establish the state of the art in scientific production on clusters in the countries that make up South America, according to the Scopus platform. For that, the social networks formed between the authors, countries and most representative words, the temporal evolution and the most widespread journals in the South American scientific production on clusters were analyzed. As a theoretical contribution, the article demonstrated the main schools of thought in South America on clusters. It also made apparent the networks of relationships and the main groups of researchers on the subject. Another contribution concerns the most researched subjects today. The main limitation of the article concerns the choice of only one database for collection. The use of more bases would bring a more robust result. It is suggested that the same methodology be used in other continents so that their results can be compared.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES

- Porter ME. Como as forças competitivas moldam a estratégia. *Estratégia: a busca da vantagem competitiva*. Rio de Janeiro: Campus. 1998;7:11-27.
- Marshall A. *Principles of economics: Unabridged eighth edition*. Cosimo, Inc. 2009.
- Becchetti L, Rossi SP. The positive effect of industrial district on the export performance of Italian firms. *Review of Industrial Organization*. 2000;16(1):53-68.
- Felzensztein C, Brodt S E, and Gimmon E. Do strategic marketing and social capital really matter in regional clusters? Lessons from an emerging economy of Latin America. *Journal of Business Research*. 2014;67(4):498-507.
- Wollner C. Saxenian Annalee, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. (Book Review). *Business History Review*. 1994;68(3):429.
- Kasabov E, Sundaram U. Conceptualizing clusters as dynamic and path-dependent pools of skills. *Regional Studies*. 2016;50(9):1520-36.
- Schmidt VK. Resiliência de cluster: Um estudo no cluster vinícola da Serra Gaúcha. *Dissertação de Mestrado em Administração*. Universidade Federal do Rio Grande do Sul. 2020.
- Porter ME. Location, competition, and economic development: Local clusters in a global economy. *Economic Development Quarterly*, 2000;14(1):15-34.
- Porter ME. Location, competition, and economic development: Local clusters in

- a global economy. *Economic development quarterly*, 2000;14(1):15-34.
- Hoen A. Three variations on identifying clusters. In *National Innovation Systems: Workshops and Meetings of the Focus Group on Clusters*. Utrecht: OCDE. 2000:8-9
- Bernardes T C, Batista L, Paines P A, Ceballos M H, Casarotto N. Os fabricantes de veículos de duas rodas da zona franca de Manaus podem ser vistos como pertencentes a um cluster?. *Latin American Journal of Business Management*. 2020;11(2).
- Alexiev AS, Volberda HW, Van den Bosch FA. Interorganizational collaboration and firm innovativeness: Unpacking the role of the organizational environment. *Journal of Business Research*, 2016;69(2):974-84.
- Ellison G, Glaeser EL, Kerr WR. What causes industry agglomeration? Evidence from coagglomeration patterns. *American Economic Review*. 2010; 100(3):1195-213.
- Lazzeretti L, Capone F, Caloffi A, Sedita SR. Rethinking clusters. Towards a new research agenda for cluster research. *European Planning Studies*. 2019;27(10):1879-903.
- Nadvi K, Schmitz H. Industrial clusters in less developed countries: Review of experiences and research agenda. Brighton: Institute of Development Studies.
- Schmitz H, Nadvi K. Industrial clusters in developing countries—clustering and industrialization: Introduction. *World Development*. 1999;27(9):1503-14.
- Humphrey J, Schmitz H. How does insertion in global value chains affect upgrading in industrial clusters?. *Regional studies*. 2002;36(9):1017-27.
- Kaplinsky R, Readman J. *Integrating SMEs in global value chains: Towards partnership for development*. Vienna: UNIDO. 2001.
- Zaccarelli SB. *Estratégia e sucesso nas empresas*. Saraiva; 2003.
- Azevedo B. Clusters. Os distritos industriais dos países em desenvolvimento. *Desenvolvimento em Questão*. 2003;1(2):99-121.
- Porter ME, Ketels C. Clusters and industrial districts: Common roots, different perspectives. *A handbook of industrial districts*. 2009;172-83.
- McEvily B, Zaheer A. Bridging ties: A source of firm heterogeneity in competitive capabilities. *Strategic Management Journal*. 1999;20(12):1133-56.
- Lazzeretti L, Sedita SR, Caloffi A. Founders and disseminators of cluster research. *Journal of Economic Geography*. 2014;14(1):21-43.
- Felzensztein C., Brodt S. E., Gimmon E. Do strategic marketing and social capital really matter in regional clusters? Lessons from an emerging economy of Latin America. *Journal of Business Research*. 2014;67(4):498-507.
- Porter ME. *Competição: estratégias competitivas essenciais*. Gulf Professional Publishing. 1999.
- Donaire D, Boaventura J, Siqueira J, Telles R, Zaccarelli S. *Clusters e redes de negócios: Uma nova visão para a gestão de negócios*. São Paulo, Atlas. 2008.
- Nicholson J, Gimmon E, Felzensztein C. Economic geography and business networks: creating a dialogue between disciplines: An introduction to the special issue. *Industrial Marketing Management*. 2017;61:4-9.
- Brache J, Felzensztein C. Geographical co-location on Chilean SME's export performance. *Journal of Business Research*. 2019;105:310-21.
- The Editors of *Encyclopedia Britannica*. List of countries in Latin America. In *Encyclopædia Britannica*. 2017. <https://www.britannica.com/topic/list-of-countries-in-Latin-America-2061416>
- Bornmann L, Marx W. HistCite analysis of papers constituting the *h*_{index} research front. *Journal of Informetrics*. 2012;6(2):285-8.
- Van Eck N J, Waltman L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*. 2010;84(2):523-38.
- Salamati P, Soheili F. Social network analysis of Iranian researchers in the field of violence. *Chinese Journal of Traumatology*. 2016;19(5):264-70.
- Lotka AJ. The frequency distribution of scientific productivity. *Journal of the Washington Academy of Sciences*. 1926;16(12):317-23.
- Rowlands I. Emerald authorship data, Lotka's law and research productivity. In *Aslib Proceedings*. Emerald Group Publishing Limited. 2005.
- Price DJ. Some remarks on elitism in information and the invisible college phenomenon in science. *Journal of the American Society for Information Science*. 1971;22(2):74.
- Scott J. Social network analysis. *Sociology*. 1988;22(1):109-27.
- Tabassum S, Pereira FS, Fernandes S, Gama J. Social network analysis: An overview. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*. 2018;8(5):e1256.
- Fan W, Li G, Law R. Analyzing co-authoring communities of tourism research collaboration. *Tourism Management Perspectives*. 2020;33:100607.
- Bastian M, Heymann S, Jacomy M. Gephi: An open source software for exploring and manipulating networks. In *Proceedings of the International AAAI Conference on web and Social Media*. 2009;3(1):361-2.
- Blondel VD, Guillaume JL, Lambiotte R, Lefebvre E. Fast unfolding of communities in large networks. *Journal of Statistical Mechanics: Theory and Experiment*. 2008(10):P10008.

41. Börner K, Sanyal S, Vespignani A. Network science. *Annual Review of Information Science and Technology*. 2007;41(1):537-607.
42. Jeyasekar JJ, Saravanan P. Impact of Collaboration on Indian Forensic Science Research: A Scientometric Mapping from 1975 to 2012. *J Sci Res*. 2015;4(3):135-42.
43. Camargo BV, Justo AM. IRAMUTEQ: Um software gratuito para análise de dados textuais. *Temas em psicologia*. 2013;21(2):513-8.
44. Hou H, Liu Z, Kretschmer H, Qu T, Lu C. International collaboration networks of chinese Scientometrics. *COLLNET Journal of Scientometrics and Information Management*. 2009;3(1):61-70.
45. Lucas EO, Garcia-Zorita JC. Produção Científica sobre Capital Social: Estudo por acoplamento bibliográfico. *Em Questão*. 2014;20(3):27-42.
46. Cassanego Júnior PV, Boaventura JM, Azevedo AC, Telles R. Governance in business clusters: Proposal for an application of an analytical model. *Entrepreneurship and Regional Development*. 2019;31(9-10):984-1010.