



Brazilian scientific publications in Information Science indexed in the Web of Science

João Paulo Pastana Neves

Master Degree in Information Science from Universidade Federal do Pará (UFPA)

Duly assigned librarian at Universidade Federal do Pará (UFPA), Pará, Brazil

<http://lattes.cnpq.br/6105948858806831>



Roberto Lopes dos Santos Júnior

PhD in Information Science from Ibict/UFRJ

Associate Professor in Archival Science at the Postgraduate Program in Information Science at Universidade Federal do Pará (UFPA), Pará, Brazil

<http://lattes.cnpq.br/3355963647616547>

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ABSTRACT

In the 50 years of Information Science history at Brazil, a lot of research has been carried out in the field of scientific information being the genesis of CI, contributing to scientific advancement is its journey in the hall of science. The objective of the article was to analyze the scientific production of CI in Brazil in the 50 years of history in the Web of Science (WoS), through a quantitative and qualitative approach, using bibliometric analysis as a method. After data collection, this analysis took place using the VOSviewer and Gephi software, 207 scientific publications were retrieved from the year 1971 to the year 2021, including scientific articles (original, review and annals). The publications involved 416 authors, 23 countries, 142 institutions, 46 journals and 708 keywords, with 87.27% of the publications concentrated in the last 11 years. The periodical *Informação Sociedade Estudos* was the scientific journal that most published scientific documents, with 39 of the total. In addition, researchers Bufrem (UNESP) and Martinez-Ávila (ULE-ESP/UNESP) and the institutions UNESP and UFMG were the largest producers of scientific publications. Regarding international collaboration, 12.72% of the works were produced in partnership with various institutions around the world, with Europe being the highlight with 71.46%.

Keywords: scientific production; information science; bibliometry; Web of Science; Brazil.

INTRODUCTION

Information Science, in its 50 years of history in Brazil, has provided perspectives in the field of scientific information both in how to organize it and how to mediate it. With regard to the organization of knowledge information, according to Guimarães (2015), it consists of differentiating knowledge from the individual, subjective or objective process, from a fact, or state in which there is no transfer, and it is only acquired through reflection; its object is its registered and disclosed form, such as, for example, in the occurrence of registered documents, allowing easy access and retrieval.

For Araújo Júnior and Souza (2018), it establishes the relationship between the organization and retrieval of information, which is directly linked to the relationship between the arrangement of collections in the physical description and their informational content and, then, to locating the document and the informational items stored in the knowledge base.

Understood as systems for organizing knowledge, they include the variety of schemes that organize, manage and retrieve information, since ancient times, and which are currently present in all areas of human knowledge, from the simplest to the most complex. They cover classification, thesaurus and ontology, as well as our well-known glossaries and dictionaries, specific to each area and linked to libraries and other information management organizations, with a view to organizing, retrieving and disseminating information (Tristão; Fachin; Alarcon, 2004).

Concerning the type of system described above, we present *Web of Science* – multidisciplinary scientific knowledge base, sponsored by *Clarivate Analytics*, which has *Journal Impact Factor* (JIF) as a journal-level metric, calculated from data indexed in the *WoS Core Collection* –, which aggregates IS journals in its category.

From this contextualization, we intend to discover: how has research related to IS been conducted in Brazil during its 50 years of history in WoS?

Therefore, this article intends to analyze the scientific production of IS in Brazil in WoS, based on a quantitative and qualitative survey by means of a bibliometric analysis between 1971 and 2021. This research is justified by the quality of scientific production related to the topic in question.

The research initially provided a brief overview of the main characteristics linked to the organization of scientific knowledge information and the information system for this knowledge, WoS. Subsequently, the research methods used and the results obtained in this research were discussed, indicating the main trends in scientific collaboration and analysis on the topic.

Communication system in Information Science

The first steps to have been reported regarding the scientific communication system in IS may have taken place with the birth of modern science, around the 16th century, in meetings of scientific societies, the communication of which was carried out by means of

letters disseminating studies and discoveries. This means of communication was a next step towards the creation of journals, around the 17th century, which consolidated the process of scientific communication and information (Pinheiro, 2002a). At that time, two remarkable journals appeared, in the year 1665, the *Journal des Sçavans*, from France, and *Philosophical Transactions*, from England, thus beginning the process of scientific communication and information, considering that both are pioneering scientific journals today (Meadows, 1999).

Regarding scientific communication systems in IS, the following events are milestones of this historic achievement, as Pinheiro (2002b) notes:

- a) the creation of the International Institute of Bibliography (IIB), in 1895, during the 1st International Bibliography Conference, in Brussels, Belgium; and
- b) the transformation of IIB into the International Institute for Documentation (IID), in 1931, at the suggestion of Paul Otlet and Henri de La Fontaine, during the 10th International Bibliography Conference, in Brussels, Belgium.

Other events contributed to the emergence of IS, as mentioned by Queiroz and Moura (2015a):

- a) the Scientific Information Conference, of the *Royal Society*, in 1948, in the city of London, United Kingdom;
- b) the Conference of the International *Union on Pure and Applied Chemistry* (IUPAC), in London, United Kingdom, in 1955; and
- c) the International Conference on Scientific Information, of the National Academy of Sciences, in Washington, D.C., United States of America, in 1958.

In Brazil, the first research activities in IS possibly date back to 1968, and are more specific in the scope of Scientific Documentation, as this is its field of application. Within the scope of the activities, research and development (R&D), in particular, can be considered, on account of its concentration on technologies linked to automation. Around the 1970s, the first graduate courses in IS emerged, which may have solidified research activities in the field (Gomes, 1981), with the emergence of communications at conferences across the country, such as:

- a) the Brazilian Information Science Meetings (REBRACI), in 1975 and 1979, of great repercussion, which allowed time for ideas to mature and, at the end of the following decade, the implementation of the National Association for Research in Information Science (ANCIB) (Pinheiro, 2007a);
- b) the National Meeting of Research in Information Science (ENANCIB), which stood out as the largest and most significant research event in IS in Brazil, starting in 1989;
- c) the National Meeting of Information Teaching and Research (CINFORM), previously named the National Meeting of Information Science, promoted by the Information Science Institute (ICI) of Universidade Federal da Bahia (UFBA), in 1998;

- d) the National Meeting of Education in Information Science (ENECIN), created in 2004 by the Brazilian Association of Education in Information Science (ABECIN), which aimed to discuss emerging issues related to education and teaching didactics in the field; and
- e) the Regional Meeting on Education in Information Science (ERECIN), which focused on the particularities of each region of the country, the Regional Workshops and Pedagogical Seminars, where guiding documents for teaching practice in the field were produced (Araújo; Valentim, 2019).

Scientific journals

In Brazil, the reported emergence of journals took place around the 19th century, by means of the Portuguese Court, which allowed the press in the country and created numerous scientific institutions, beginning science practice and studies in Brazilian territory. Therefore, printed journal *Gazeta do Rio de Janeiro* emerged with the role of publicizing scientific matters in the country (Freitas, 2007).

In general, in the field of IS, the emergence of the first journals took place with the publication of *American Documentation*, in the United States of America, and *Nachrichten für Dokumentation*, in Germany, both in 1950, which continue to be relevant journals in this field.

In the Union of Soviet Socialist Republics (USSR), the first journal was created in 1952, the *Vserossiisky Institut Nauchnoi i Tekhnicheskoi Informatsii* (VINITI), or, in English, *All-Union Institute for Scientific and Technical Information*, linked to the Russian Academy of Sciences, the function of which was to provide information to scientists and specialists in technical and natural sciences (Silva; Freire, 2012a).

Returning to the national scenario, the first IS journal published was *Information Science*, created in 1972 by the then Brazilian Institute of Bibliography and Documentation (IBBD), currently called the Brazilian Institute of Information in Science and Technology (Ibict), responsible for its publishing and for contributing to the development of the field in the country (Queiroz; Moura, 2015b).

Another aspect of IS consolidation in Brazil was the promotion of research from the 1990s onwards by the National Council for Scientific and Technological Development (CNPq) and the Coordination for the Improvement of Higher Education Personnel (CAPES), which now include IS amongst the supported areas and recognize its national institutionalization (Pineiro, 2007b).

In the following section, a brief historical fact is discussed, characteristic of IS at the national and international level.

Information Science: history and characteristics

Information Science began with the technical-scientific revolution and entered the Second World War period. This emergency state culminated in the emergence of new areas or the replacement of interdisciplinary relationships in already known areas of knowledge, having this transition been witnessed in recent decades by cognitive science. Thus, IS, like other areas of scientific knowledge, has followed the same evolutionary processes in science (Saracevic, 2008a).

The origin of IS is marked by two basic foundations, such as the connection with social and scientific ancestors who contributed to the principle of IS in its form of phenomenon manifestation, cause, motive and origin and milestones of institutional, technical and scientific occurrences to promote its journey in beginning and ascendancy (Silva; Freire, 2012b).

In Brazil, IS was introduced in the 1970s with the Master's program in Information Science, implemented by the IBBD, which is currently named Ibict (Russo, 2010; Queiroz; Moura, 2015c).

Regarding the ascendancy of IS, three general characteristics constitute the rationality of its existence and its evolution, shared by other areas of knowledge (Saracevic, 2008b):

1. IS is, by nature, interdisciplinary, although its relationships with other disciplines are changing. The interdisciplinary evolution is far from complete;
2. IS is inexorably linked to information technology. The technological imperative determines IS, as it does in other fields. In a broad sense, the technological imperative is imposing the transformation of modern society into information society, information age or post-industrial society; and
3. IS is, along with many other disciplines, an active and deliberate participant in the evolution of the information society. IS did and does have an important role to play due to its strong social and human dimension, which goes beyond technology.

These three characteristics (or rationality of IS) pointed out by the author make up a standard for understanding its past, present and future, and the means and problems and issues it faces.

Bibliometrics

Bibliometrics, also known as multidisciplinary practice, began by identifying behaviors in scientific literature and evolved in a defined context and time. It was first determined by Otlet, in 1934, as an integration of bibliography as a measure or quantity applied to books. Therefore, bibliometrics has the quantifiable method for recording scientific knowledge (Bufrem; Prates, 2006).

With this understanding, bibliometrics applies mathematical and statistical methods to books and other subjects related to scientific production (Pritchard, 1969). It is associated with measurement and aimed at any type of document, it is related to the study of quantitative

processes of production, dissemination and use of information, as well as advanced online search processes and mechanisms and information retrieval techniques, such as, for example, the Boolean operators (*AND*, *OR* and *NOT*).

In Brazil, it emerged around 1970, under the influence of metric studies, by means of discipline Data Processing in Documentation, taught in the Master's program in Information Science at IBBD, currently Ibict (Alvarado, 1984). This historic achievement made Ibict the first nationwide disseminator of bibliometrics, which came to be used in various fields of scientific knowledge.

The three bibliometric laws

IS presents, prominently, the three laws that aim to understand a certain phenomenon described, observed and verified by means of a prediction (Pinheiro, 1997a). According to Pinheiro, the most commonly used bibliometric laws related to scientific productivity are:

1. Lotka's Law (1926), which focuses on the productivity of authors;
2. Zipf's Law (1929), which addresses the frequent use of words in a text; and
3. Bradford's Law (1934), which was formulated for the distribution of journals in a certain area of knowledge.

These laws play an important role in the measurement of Science and highlight, in advance, “[...] o marco definatório da Ciência da Informação (1962) e de Bibliometria (1969)” (Pinheiro, 1997b, p. 10)¹.

METHODS

The research was conducted on March 23, 2022, based on the scientific productions in IS in Brazil indexed in WoS in the last 50 years, between 1971 and 2021. This article, by means of bibliometric studies and the help of *software VOSviewer* and *Gephi*, had a quantitative and qualitative approach, and publications were surveyed in the WoS scientific knowledge base. The search strategy consisted of using descriptors “*Information Science*” and “*Brazil*”.

The exact match search was conducted using quotation marks (“”) in both terms and the filter used was Boolean operator AND between the descriptors. When retrieving information on topic “scientific publications in IS indexed in WoS”, the “topic” field was used, which allowed search for more qualitative information. Furthermore, when searching for both terms, fields “titles”, “abstracts” and “keywords” were used, and when excluding items, Boolean operator “NOT” was used to discard editorial materials, allowing articles only. The organization of data consisted of titles, year, indexed journals, conferences, and type of documents. The results and discussion on the topic are presented below.

¹ Translation: “[...] the defining framework of Information Science (1962) and Bibliometrics (1969)” (Pinheiro, 1997b, p. 10, editorial translation).

RESULTS AND DISCUSSION

In the WoS scientific knowledge base, 220 scientific productions were recovered, 13 of which were discarded because they were not scientific articles, totaling 207 documents collected, among which: 191 articles, 11 conference articles and 5 review articles, as shown in **TABLE 1** below.

TABLE 1 – Scientific knowledge base and data analysis.

Scientific knowledge base	Search expression	Title	Journals/ Conferences	Document types	Analysis period
Web of Science	Topic: "Information Science" AND Tópico: "Brazil"	207	46 journals 11 conferences	191 articles 11 submissions 5 review articles	1971 to 2021

Source: Prepared by the authors based on research data (2022).

In identifying the 207 documents, of which 196 are articles (originals and reviews), and both indexed in 46 scientific journals, 11 are conference communications. These works were produced by 416 authors, linked to 142 institutions in 23 countries. There were also 708 keywords, data presented in **TABLE 1**.

TABLE 1 – Bibliographic information of the research

Bibliographic information	Frequency
Publications	207
Journals	46
Annals	11
Authors	416
Institutions	142
Countries	23
Keywords	708

Source: Prepared by the authors based on research data (2022).

Regarding the main sources of publications that addressed topic "scientific productions in IS in Brazil indexed in WoS", **TABLE 2** presents the ten most cited publications, in addition to year of publication, journals, average citation per year and Impact Factor (IF) of the journal.

TABLE 2 – Most cited publications first, average citation per year and journal IF in WoS

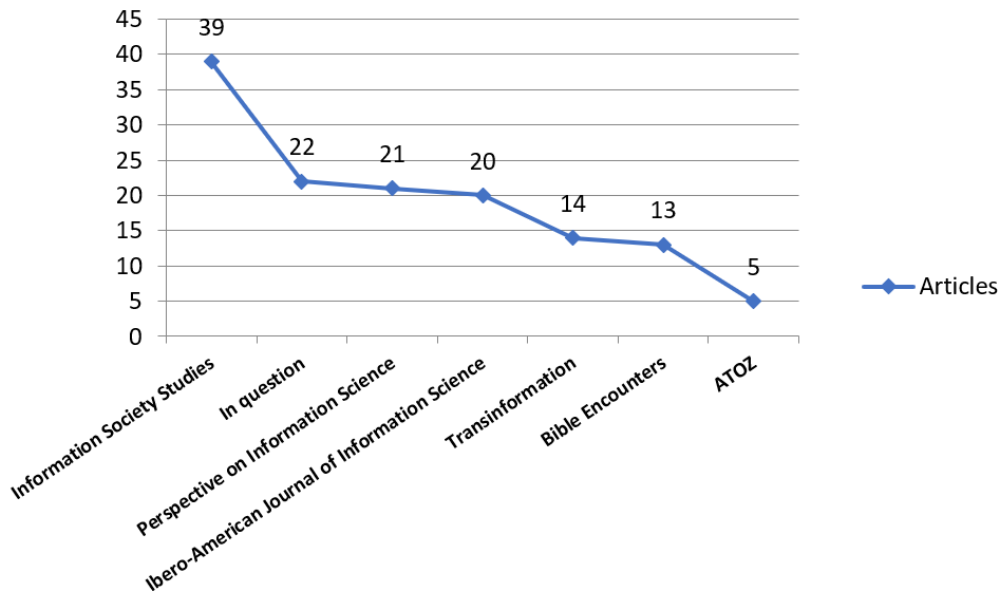
Ranking of IS publications in Brazil most cited first in WoS	Year of publication	Journals	Average citation per year	Impact factor (IF)
Information Science Research in Brazil: institutional milestones, scenarios and perspectives	2009	Perspectivas em Ciência da Informação	0.71	0.106
Information science as area of knowledge: viewed through research and Postgraduate studies in Brazil	2009	Perspectivas em Ciência da Informação	0.64	0.106
Articles from Brazilian scientific journals in information areas: evolution of production and multiple authorship	2008	Perspectivas em Ciência da Informação	0.6	0.106
The theory and practice of interdisciplinarity in Information Science	2011	Perspectivas em Ciência da Informação	0.67	0.106
Thematic characterization of research on Information Science in Brazil from 2000-2009	2013	Transinformação	0.7	0.648
Scientific production about competitive intelligence of the School of Science Information of Brasilia University	2012	Perspectivas em Ciência da Informação	0.64	0.106
Scenario and perspectives of scientific literature on information literacy in BRAZIL: study of production within the ANCIB	2016	Informação Sociedade Estudos	0.86	0.311
The production of scientific research in national events in the field of information science	2011	Trasinformação	0.5	0.648
Appearance and consolidation of Documentation: subsidies for the understanding of the history of Information Science in Brazil	2009	Perspectivas em Ciência da Informação	0.43	0.106
Visibility of studies in social network analysis in South America: Its evolution and metrics from 1990 to 2013	2014	Transinformação	0.56	0.648

Source: Prepared by the authors based on research data (2022).

It can be seen from the table above that the journals with the most citations of publications in the WoS scientific knowledge base are: *Perspectivas em Ciência da Informação*, with 6 articles, *Transinformação*, with 3 productions, and *Informação Sociedade Estudos*, with one article.

As for the journals that produced the most scientific articles in the period analyzed, the Brazilian IS journals are showed in **CHART 1**.

CHART 1 – Journals with the most publications.

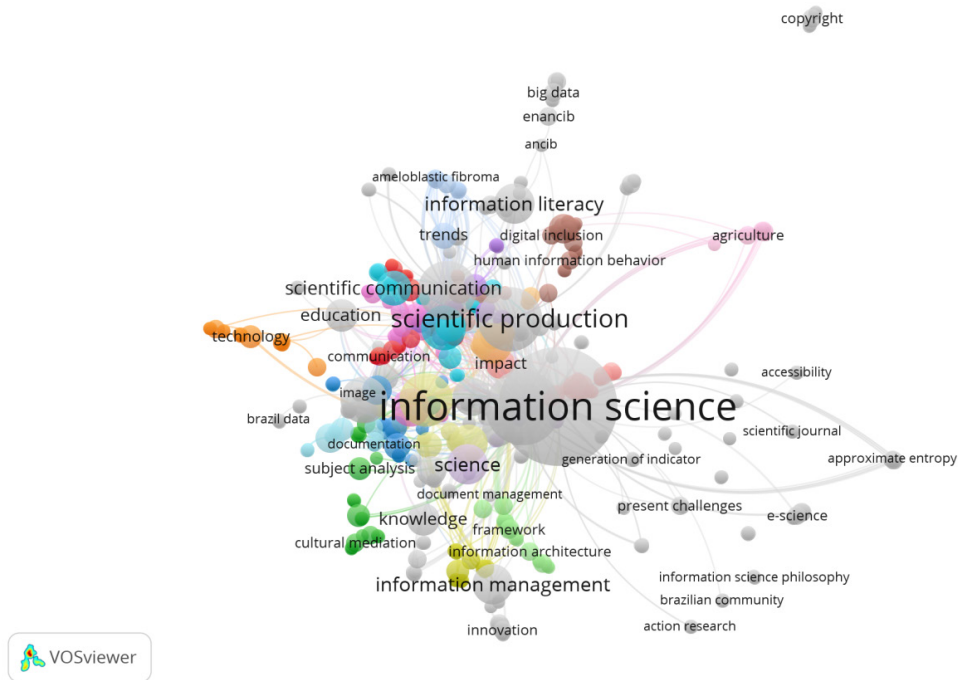


Source: Prepared by the authors based on research data (2022).

It can be seen, in the chart above, that the productivity contribution of scientific articles in IS by Brazilian journals in WoS is segregated as follows: *Informação Sociedade Estudos*, with 39 articles, representing 18.84%; *Em questão*, with 22 (10.62%); *Perspectiva em Ciência da Informação*, with 21 (10.14%); *Revista Ibero Americana de Ciência da Informação*, with 20 (9.66%); *Transinformação*, with 14 (6.76%); *Encontros Bibli*, with 13 (6.28%); and *ATOZ Novas Práticas em Informação e Conhecimento*, with 5 (2.41%).

FIGURE 1 below shows the thematic approaches in scientific publications in IS in Brazil indexed in WoS. The associative and correlated dynamics of the 708 keywords are observed as of the creation of the network of terms in software *VOSviewer*.

FIGURE 1 – Analysis network of the topics covered

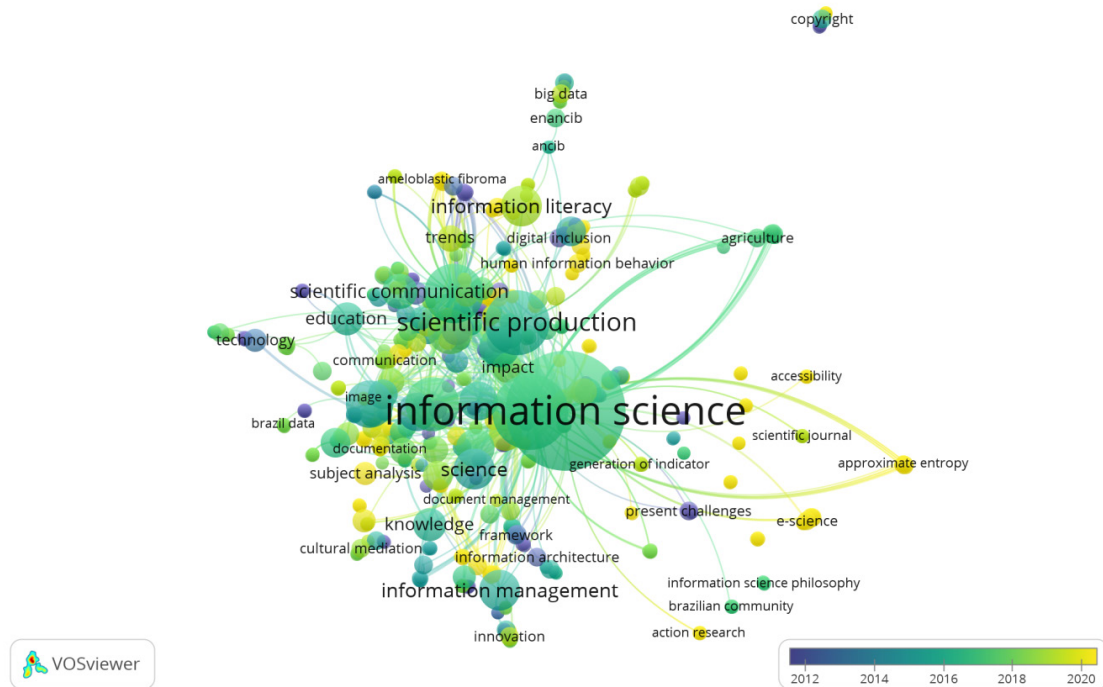


Source: Prepared by the authors based on research data (2022).

In identifying the network above, the topics with the highest occurrences, in addition to Information Science, within the period analyzed, are: scientific production, with 23 occurrences; bibliometrics (19); knowledge organization (16); information management (9); information literature and scientific communication, both with 6 occurrences.

FIGURE 2 shows the thematic trends analyzed during the period.

FIGURE 2 – Thematic trend analysis network

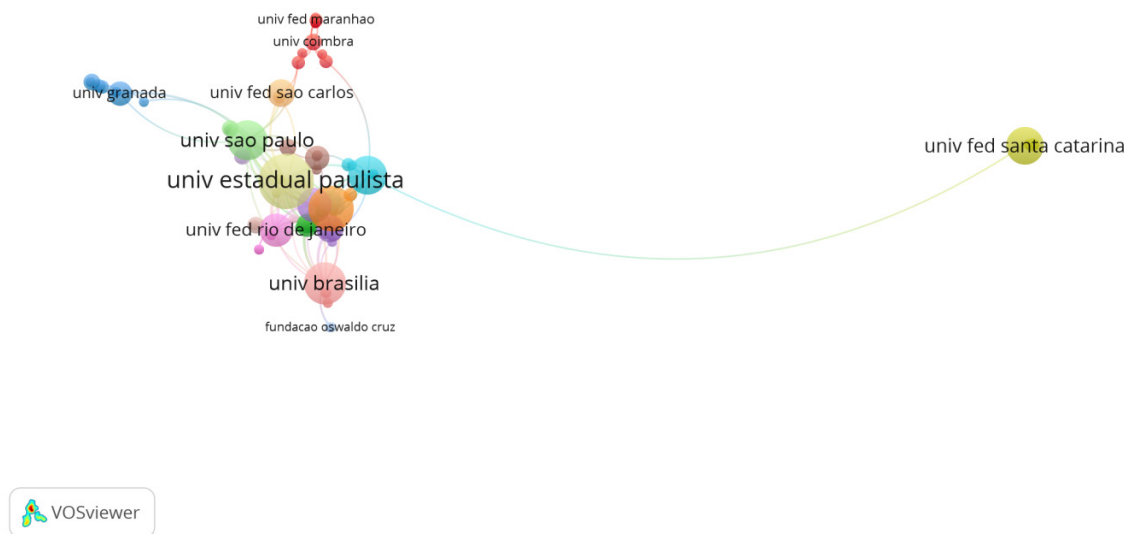


Source: Prepared by the authors based on research data (2022).

The themes that have been addressed in IS research in Brazil were identified among the topics distributed in the network above. In a yellow circle, the representation of these trends observed in the period between 2018 and 2021 stands out in topics such as *libraries*, in 2019; *subject analysis*; *digital citizenship*; *information policy*; *covid-19*; *ethics* and *accessibility*, in 2020; and *human information behavior* in 2021.

The network analysis of the 142 productive institutions is seen in **FIGURE 3**.

FIGURE 3 – Analysis network of productive institutions



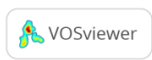
Source: Prepared by the authors based on research data (2022).

It can be seen that the most productive institutions are located in southeastern Brazil, such as Universidade Estadual Paulista (UNESP), with 42 occurrences (20.29%); Universidade Federal de Minas Gerais (UFMG), with 21 (10.14%); Universidade de São Paulo (USP), with 16 (9.17%); Universidade Federal do Rio de Janeiro (UFRJ), with 13 (6.28%); Universidade Federal de São Carlos (UFSCar), with 8 (4.34%); Universidade Federal do Paraná (UFPR), with 7 (3.38%); and Universidade Federal Fluminense (UFF), with 5 (2.41%).

However, the following associations have also been noted: in the northeast, Universidade Federal de Pernambuco (UFPE), with 17 occurrences (8.21%); Universidade Federal da Paraíba (UFPB), with (12) (5.79%); Universidade Federal do Ceará (UFC), with 8 (3.86%) and Universidade Federal do Rio Grande do Norte (UFRN), with 2 (0.96%); and in the midwest, Universidade de Brasília (UnB), with 19 works (9.17%). On the other hand, the institution from the southern region that appears furthest away in the chart is Universidade Federal de Santa Catarina (UFSC), with 15 occurrences (7.24%), at the same time that it has strong association and correlation with UFPE, from the northeast, as found in the analysis.

The most productive authors in the period are presented on the network, as shown in **FIGURE 4** below.

FIGURE 4 – Network of most productive authors and collaboration

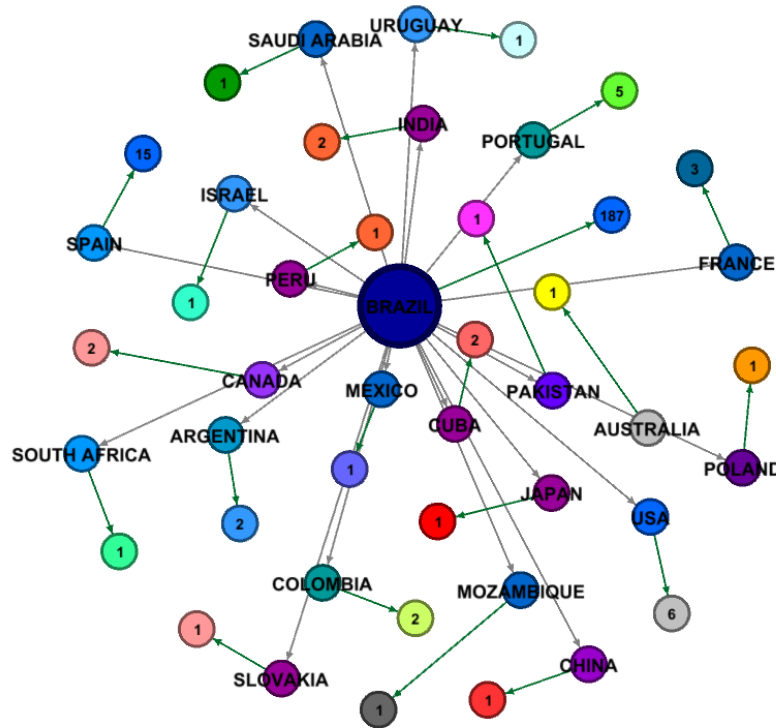


Source: Prepared by the authors based on research data (2022).

In the analysis of the most productive authors and collaboration, Bufrem appears with 13 scientific articles, including one work in which she was the only author and twelve works in collaboration with 19 national and 1 international authors. Second is Martinez-Ávila with 8 productions, including the collaboration of 17 national and 2 foreign authors. And finally, there is Guimarães with 7 productions, in partnership with 10 national authors and 2 international authors in different works. One point noted in the analysis: author Martinez-Ávila is Spanish and an assistant professor doctor at Universidad de León, in Spain. Moreover, he has been a full professor in the Graduate Program in Information Science (PPGCI) at Universidade Estadual Paulista (UNESP) since 2014.

Scientific collaboration can be described as two or more research groups in a graph analysis network (Bastian; Heymann; Jacomy, 2009). The collaboration between Brazil and foreign countries on the research topic of this paper is presented in the graph network below using software *Gephi*, as seen in **FIGURE 5**.

FIGURE 5 – Scientific collaboration network between foreign countries and Brazil



Source: Prepared by the authors based on research data (2022).

Regarding scientific collaboration between foreign countries and Brazil, the graph network shows the countries that collaborated the most, within the scope of IS, in the following order: Spain, with 15 publications; followed by the United States of America, with 6; Portugal, with 5; and France, with 3.

FINAL CONSIDERATIONS

The quantitative and qualitative survey on the topic – Information Science publications in Brazil indexed in the WoS scientific knowledge base – made it possible to observe the growing number of material published in the period analyzed.

Among the factors that contributed to the increased number of publications from 2011 onwards, one can point out the expansion of research related to the growing trend in the number of IS-related courses, such as, for example, Library Science, Archival Science, Museology and Management and its aspect of interdisciplinarity on a large scale with other fields of knowledge, as well as in studies of social relations.

The research, based on the 207 works identified, by focusing on the three most productive researchers and the topics covered, indicates the existence of a variety of multidisciplinary and interdisciplinary subjects in the production of scientific articles, such as scientific collaboration, productivity of authors, organization of knowledge, discourse analysis,

information representation, Access to Information Law, copyright, gender and ethics, and showed, through keywords, the expansion of other topics such as digital citizenship, *covid-19*, accessibility and human information behavior.

In this study, it is identified, at a theoretical level, that scientific productions on IS in Brazil are extremely important for scientific advancement in the country, favoring its recognition abroad, as indicated by scientific collaborations with other countries. Thus, in the quantitative and qualitative survey, the participation of these elements showed the advancement that IS has perpetuated in the scientific community both at a national and international level.

It is also noted that there is a considerable interdisciplinary trend in research, as different areas of knowledge have been working together with IS, in addition to Social Sciences such as Computer Science, Health Science, Engineering, Environmental Science, Agricultural Sciences, and Linguistics.

The data obtained in this research showed that IS in Brazil has been increasingly evolving over the last fifty years of studies in the country, both in institutional, interdisciplinary aspects, which is its essence, and in scientific collaboration, that is, in groups of national and international authors, also taking into account foreign countries.

Therefore, future investigations into Brazilian scientific publications in IS are recommended, that is, research into other scientific knowledge databases. Therefore, studies like this allow one to see that Information Science is in constant social, economic and political construction, based on information, which is its vocation.

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