

# Production and impact of Brazilian papers in Library and Information Science journals (1986-2015)

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Data de submissão: 20/09/2018 Data de aceite: 31/05/2019 Data de publicação:

## **ABSTRACT**

This paper aims to carry out a diachronic analysis of Brazilian scientific productivity in the Library and Information Science field as indexed by the Scopus database for the period 1986-2015. We also analyze the main journals that publish Brazilian contributions, compare the impact of Brazilian production between papers published in Latin language journals and those in English, and identify the primary language of Brazilian papers and the main collaborating countries. We carried out a search on Brazilian scientific productivity in the analyzed field in the Scopus database for the studied period. Then, through a manual filter, we identified a corpus of 1,195 papers. Of the 90 journals identified, 26 journals were considered the main venues for Brazilian Library and Information Science research. These were grouped using multivariate cluster analysis. The main collaborating countries were grouped based on normalized values of co-authorship using Salton's cosine measure. Since 2006, Brazilian scientific production has experienced a similar growth tendency as the rest of the world. We observed that Brazilian journals, publishing in Portuguese, formed a cluster, while English and Spanish language journals clustered separately. We observed that papers published in English received on average more citations than those papers published in other languages.

**Keywords:** Brazilian paper production in Library and Information Science. Library and Information Science research journals. Collaborating countries of the Brazilian scientific production in Librarianship and Information Science.

## ***Produção e impacto dos artigos brasileiros em periódicos científicos da biblioteconomia e ciência da informação (1986-2015)***

### **RESUMO**

*Este artigo tem como objetivo realizar uma análise diacrônica da produção científica brasileira na área da ciência da informação e biblioteconomia indexada na base de dados Scopus, no período 1986-2015, bem como analisar os principais periódicos que a disseminar, comparar o impacto da produção brasileira entre artigos publicados em revistas em língua latina e em revistas em língua inglesa, identificar o idioma dos artigos e os principais países colaboradores dessa produção. Realizou-se a busca na base de dados Scopus. A seguir, por meio de um filtro manual, obteve-se o corpus de 1.195 artigos. Dos 90 periódicos, 26 foram considerados os principais disseminadores da produção brasileira na área, que foram agrupados utilizando análise multivariada de cluster. Os principais países colaboradores foram reunidos em função dos valores normalizados de coautoria pelo Cosseno de Salton. Como resultado, a partir de 2006, a produção científica brasileira atingiu tendência de crescimento semelhante à mundial. Os periódicos brasileiros formaram um cluster, enquanto os periódicos em idioma inglês e espanhol se agrupavam separadamente. Observou-se que os artigos publicados em inglês receberam em média mais citações do que os artigos publicados nos outros idiomas.*

**Palavras-chave:** *Produção brasileira de artigos em biblioteconomia e ciência da informação. Periódicos científicos em biblioteconomia e ciência da informação. Países colaboradores da produção científica brasileira em biblioteconomia e ciência da informação.*

## ***Producción e impacto de artículos brasileños en revistas en Biblioteconomía y Ciencia de la Información (1986-2015)***

### **RESUMEN**

*Este artículo tiene como objetivo realizar un análisis diacrónico de la producción científica brasileña en el área de la Ciencia de la Información y Biblioteconomía indexada en la base de datos Scopus en el período 1986-2015, así como analizar las principales revistas que están diseminando esa producción, comparar el impacto de la producción entre artículos publicados en revistas en lengua latina y en revistas en lengua inglesa, identificar el idioma de los artículos y los principales países colaboradores de esta producción. Realizamos la búsqueda de la producción científica brasileña en el área analizada en la base de datos Scopus. A continuación, utilizando un filtro manual, el corpus de artículos quedó en 1.195 artículos. De las 90 revistas, 26 fueron consideradas las principales diseminadoras de la producción brasileña en el área, las cuales fueron agrupados, utilizando análisis multivariante de cluster. Los principales países colaboradores fueron agrupados en función de los valores normalizados de coautoría por el coseno de Salton. Como resultado, a partir de 2006, la producción científica brasileña alcanzó una tendencia de crecimiento similar a la mundial. Las revistas brasileñas formaron un cluster, mientras que las revistas en lengua inglés y española se agruparon por separado. Observamos que los artículos publicados en inglés recibieron en media más citas que los artículos publicados en los otros idiomas.*

**Palabras clave:** *Producción brasileña de artículos en Biblioteconomía y Ciencia de la Información. Revistas científicas en Biblioteconomía y Ciencia de la Información. Países colaboradores de la producción científica brasileña en Biblioteconomía y Ciencia de la Información.*

## INTRODUCTION AND LITERATURE REVIEW

In Brazil, Information Science is closely related to Librarianship, which began in 1911 with the creation of the first Librarianship program at the National Library in Rio de Janeiro, under the influence of the *École Nationanale de Chartes*. Its curriculum predominantly covered subjects focused on general culture and the humanities, including paleography and diplomacy, iconography, numismatics and bibliography, into which technical content was included.

The French and humanistic influence in the formation of Brazilian librarianship continued until the mid-twentieth century, when we observe the adoption of the current American model for Librarianship and for professional library organizations (ODONNE, 2004).

In this context, in 1929, the second Brazilian Librarianship program was developed at the American orientation institute, *Makenzie Institute*, with a markedly technical tendency and topical coverage oriented to the organization of libraries, such as cataloging, classification, reference and organization. The transition to American-style librarianship began at this time, gradually moving away from the French influence (OLIVEIRA, 1995).

During the 1930's, there was an expansion in education in all areas and levels in Brazil arising from an increase in educational demand. In this context, librarianship courses began to increase in Brazil. During the following decade, the Public Service Administrative Department determined the preparation of the Librarian at two levels: Librarian and Auxiliary Librarian, both employing a technical and American orientation.

In the early 1950's, with the creation of three new programs, there were eight Librarianship programs in the country, with curricula reflecting the imported American model, centered in technical disciplines.

In 1954, the Brazilian Institute of Bibliography and Documentation (IBBD) was created, with an informational approach to bibliographical work, whose activities reflected a hybrid field of knowledge, situated between Documentation and Librarianship, for which there was no defined denomination.

In 1962, the first minimum compulsory curriculum for the Librarianship undergraduate course was approved, which had a strong American influence and emphasis on technical disciplines. There was an absence of disciplines focused on scientific research in this curriculum. Research did not yet exist in this area in Brazil at this time.

In the 1970s, the Brazilian Institute of Information in Science and Technology-IBICT (former IBBB) created the first master's degree in the area, called a Master in Information Science. This denomination marks the beginning of Information Science in Brazil, which was aligned with the transformation that occurred in other countries. The program followed the European and American approach, aimed at training professionals dedicated to dealing with the increasing production of scientific and technological information. It brought together professionals from several knowledge areas, who produced research applied to other knowledge areas, and broadened the debates and reflections on the problems and issues of Information Science (IS) in Brazil. Furthermore, in 1972, IBICT created the journal *Ciência da Informação*, closely related to the academic activities of its master's program (SOUZA; RIBEIRO, 2009). In the 1980s and 1990s, undergraduate and postgraduate programs multiplied, leveraging Brazilian scientific research in IS.

At the beginning of the 2000s, studies were carried out in Brazil on the institutionalization of Library and Information Science (LIS), similar to those carried out in Europe. Among them, the studies by Kobashi and Santos (2006), Bazi and Silveira (2008), and Eliel (2008) stand out.

From these authors' works, we observe the tendency towards the use of information metric studies and the establishment of scientific indicators, understood from the viewpoint of knowledge social theory. All of these studies were concerned with evaluating Information Science's institutionalization stage in Brazil, a concern that was aligned with foreign researchers, who were also concerned with IS institutionalization in their countries (ARBOIT; BUFREM; MOREIRO GONZALEZ, 2011).

In this way, Brazilian Information Science was born under foreign influences. However, through the action of its researchers and the importance of their scientific outcomes in the national context, funding for scientific and technological information increased. IS has strengthened as a field of knowledge, through the training of researchers, the emergence of postgraduate programs, and the establishment of its own means of academic communication, such as journals and scientific events, which favored its theoretical-methodological construction and its national and international recognition.

In this context, today's relationship between IS and Librarianship is seen in the coexistence of undergraduate Librarianship programs and postgraduate Information Science programs within the same units in Brazilian universities (NUNES; COUZINET, 2015).

Herrero Solana and Ríos-Gómez (2006) analyzed scientific production in the IS field in Latin America indexed in the international database Social Science Citation Index (SSCI), from 1966 to 2003. They verified a steady growth from the years 1990, highlighting Brazil's role in this scenario and its better academic and scientific infrastructure in relation to the other countries in the region.

This perspective of analysis of the scientific field's dynamics is emphasized in Callon, Courtial and Penan (1993), who highlight the significant contribution of bibliometric studies to the evaluation and visualization of a scientific field's behavior, development, and transformations.

Bibliometric studies are consistent and objective methods based on detailed analyses of the connections between papers, journals and authors, which, when combined with qualitative approaches (e.g., epistemological, historical, or other) provides a broader context and consolidation for the visualization of a scientific domain. Among these studies, we highlight the citation analyses that are dependent on the scientific literature and constitute a methodological approach that is characterized by its social, historical and dynamic nature (HJØRLAND, 2002, 2013). These analyses also contribute to the identity of author clusters that define the growth of science (MEIRELES; CÉNDON; ALMEIDA, 2014).

In this context, the citation analysis contributes to a consistent and in-depth understanding of a field's intellectual structure, its theoretical and methodological currents, as defined by the scientific community. In this way, citations show the dominant scientific paradigm from the citers' perspective, expanding the scope of scientific analysis (CRONIN, SHAW, 2002). Moreover, citation analysis from the citers' perspective provides recognition of the published work (LU; WOLFRAM, 2010). Therefore, of the number of citations received by scientific literature are believed to provide evidence of its impact on the community.

In view of the above, this paper aims to analyze the production and impact of Brazilian scientific papers in the LIS field indexed in Scopus, an international citation database for the period 1986-2015. More specifically, this study aim to:

- Carry out a diachronic analysis of Brazilian scientific productivity in the LIS field to reveal its characteristics and evolution, compared with global scientific production in the study area;
- Identify and analyze the main journals (country, Open Access or not, thematic focus) that disseminate Brazilian LIS research, and assess its scientific impact;

- Identify the primary language of analyzed Brazilian papers and their impact;
- Analyze diachronically the impact of scientific publications based on the publication language;
- Identify the main countries that contribute to Brazilian productivity in LIS.

## METHODOLOGY

For achieving the objectives it was used the journal assessment portal SCImagoJr (<https://www.scimagojr.com/>), where we searched the journal set indexed in the sub-area “Library and Information Science”, in which identified 193 journals. Next, using the “advanced search” tool, we carried out a search on the Scopus database, inserting the names of the 193 journals using the “exactsrcitle” field code, including the Brazilian journal *Informação & Sociedade* and the different names that some of 193 journals have adopted during the period analyzed. We note that although the *Journal of Informetrics* and the Brazilian journal *Informação & Sociedade* are not indexed in the Library and Information Science (LIS) subarea, they are devoted to the Information Science area, and so they were also included in the journal set. We limited the search to: scientific publications with a Brazilian affiliation among the authors (AFFILCOUNTRY), paper as document type (DOCTYPE), Social Science as the subject area (SUBJAREA), journal as source type (SRCTYPE), for the period 1986 to 2015.

From this search, we identified 1,342 papers. It is noteworthy that even though we limited the search the 193 journals from the LIS subarea, the search retrieved papers from four indexed journals in the Social Science area that are not indexed as part of the LIS sub-area. This way, through a manual filter, we excluded papers that were not part of the LIS area. More specifically, papers from the following journals were excluded: *Archives of Gerontology and Geriatrics*, *Education Policy Analysis Archives*, *Economic Notes*, *Evaluation and Program Planning*. Our resulting paper corpus contained 1,178 papers.

The *Journal of the Association for Information Science and Technology* has had three titles during the analyzed period, namely: *Journal of the American Society for Information Science* (1st), *Journal of the American Society for Information Science and Technology* (2nd) and *Journal of the Association for Information Science and Technology* (3rd). However, it is noteworthy that the second title is not indexed in the Social Science area and therefore neither in the LIS sub-area, focus of this research. At Scopus, this second title is indexed under the subject areas: Artificial Intelligence, Computer Networks and Communications, Human-Computer Interaction, Information Systems; Software. It was, therefore, necessary to conduct an additional search for this second title, from which 18 additional papers were retrieved.

Therefore, the total research corpus was composed for 1,195 papers.

This set of 1,195 papers was exported from Scopus in CSV format (Excel) with the following fields: year, journal title, abstract, received citations, and paper language. From this archive, we constructed tables for the indicator set and graphs providing a diachronic analysis for the Brazilian research production, average citations, and the Brazilian and world scientific production growth rate for the period 2007-2015. This temporal cut is justified because Brazilian scientific production in the LIS area was low until 2005 (fewer than 10 papers) offering a sparse view that could result in biased and inflated rates.

Concerning the diachronic study of Brazilian productivity in LIS in Scopus, we also downloaded data for world scientific production in LIS for the same journal set and time period to contextualize the evolution of Brazilian productivity in relation to the rest of the world. Brazilian scientific productivity was excluded from the retrieved world papers. The resulting world scientific production corpus without Brazilian papers consisted of 91,716 papers.



The annual growth rates were calculated both for the world production (91,716) and for the total Brazilian scientific production as well as for Brazilian production separated by Brazilian and non-Brazilian journals in Scopus. Formally, the annual growth rate (AGR) was calculated by the equation:

$$AGR_{year} = \frac{P_{year} - P_{year-1}}{P_{year-1}} \times 100$$

where:  $P_{year}$  = total of papers published in the year, for  $P_{year-1} > 0$ .

The 1,195 papers were published in 90 (46.7%) of the 195 journals present in the search. The main journal set that has published Brazilian LIS research consists of 26 journals, corresponding to ~90% of the total papers found. Each of these journals has published at least 6 Brazilian papers during the analyzed period. These 26 journals were grouped using multivariate cluster analysis based on the total number of papers, average citations, language, minimum number of citations, maximum number of citations, total papers with no citations, percentage of papers with no citations, year of first published paper, year of last published paper. We used SPSS's cluster analysis with Ward's method and Euclidian distance.

For the relevance analysis of the journals that published Brazilian papers during the analyzed period, we used the journal set highlighted by

White and McCain (1998), composed of 8 Information Science (IS) journals and 4 journals from Library Automation, which the authors considered those that define the core journals in the LIS area. In addition, in August 2016, from this list, we consulted 5 prominent Brazilian researchers in the area who have been granted level 1 (PQ1) fellowship by the National Council for Scientific and Technological Development (CNPq) in the Information Science area. We asked these researchers to indicate from the list of 12 journals present in White and McCain (1998), which journals they considered relevant to Information Science. In addition, they were asked which other international scientific journals they consider significant to define mainstream Information Science. Finally, the researchers were also asked which Brazilian journals (Perspectivas em Ciência da Informação, Ciência da Informação, and Transinformação) indexed by Scopus, they considered significant to Information Science. From this expert input, we obtained a set of 24 scientific journals, consisting of the 8 journals from Information Science highlighted by White and McCain (1998) and 17 additional journals identified by the consulted researchers, including contemporary English-language journals, Spanish-language journals and Portuguese-language journals. We compared the journal set in which the Brazilian scientific production was disseminated with this journal list to visualize the relevance of journals in which Brazilian researchers have shared their constructed knowledge. This list is presented at Table 1.

Table 1 – List of 24 scientific journals pointed as relevance for the LIS definition

Annual Rev Information Science and Technology	BID
Ciência da Informação	D – LIB
Documentaliste	El profesional de la information
Informação & Sociedade	Information Processing and Management
Information Research	Int Journal of Information & Library Research
Investigación Bibliotecológica	Journal American Society for Information Science
Journal of Documentation	Journal of Information Science

(Continua)

Table 1 – List of 24 scientific journals pointed as relevance for the LIS definition

(Conclusão)

Annual Rev Information Science and Technology	BID
Knowledge Organization	Library & Information Science Research
LIBRI	Library Trends
Proc. Amer Soc for Information Science	Perspectivas em Ciência da Informação
Revista Interamericana de Bibliotecologia	Revista Española de Documentación Científica
Scientometrics	Transinformação

Thirty-three countries were identified as collaborating countries with Brazilian researchers in LIS, based on co-author affiliations. Of these collaborating countries, 20 countries contributed at least 2 published papers with Brazilian researchers in the LIS field. The 20 countries were grouped by applying Cluster Analysis using Ward's method, Euclidean distance and values normalized by z statistics for the variables: number of papers co-authored with Brazilian researchers, and Salton's cosine measure between Brazil and the respective collaborating country. To calculate Salton's cosine measure values, the total number of papers published by each of the 20 collaborating countries was identified in the Scopus database using the same search terms used for Brazil and present in the AFFILCOUNTRY field the name of each collaborating country in English, Portuguese and Spanish language as it was for Brazil.

## ANALYSIS OF RESULTS AND DISCUSSION

Table 2 shows the global and Brazilian scientific productivity frequency, and their respective annual growth rates from 1986 to 2015. From the table analysis, for the first 20 years of the analyzed period (1986-2005), the Brazilian scientific production in LIS totaled only 97 papers, corresponding to 8.1% of its total production. This shows that the Brazilian presence in international LIS research is relatively recent, dating largely from the last 10 years.

It is worth mentioning the large number of papers published in Scientometrics during first 20 years of the analyzed period, corresponding to 25% of the published Brazilian papers during this time.

This indicates that Brazilian contributions to bibliometrics and its allied areas were already internationally significant during the early years of the studied period, given their presence in the main journal devoted to this area of information science, which began publication in 1978.

The more recent growth may be associated with: i) the increase in the number of information science graduate programs in Brazil during this decade; ii) the high value attributed to articles as part of the scientific evaluation system, during this decade, corresponding to 40% of the final weight received by the programs during the triennial evaluations; iii) the journal classification established by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) that encouraging publication in international journals for the dissemination of the Brazilian scientific production; iv) the increase in the number of Brazilian journals indexed in SCOPUS, as a consequence of the evaluation rules mentioned above (GRÁCIO et al, 2013).

It should be noted that CAPES, the main Brazilian government agency responsible for funding and coordinating efforts to improve the quality, expansion, and consolidation of Brazil's graduate education at universities and research centers, has increased its financial resources by about 473%. Funds are reserved for scholarship grants and subvention to graduate programs (masters and doctoral) during the period from 2002 to 2012<sup>1</sup>.

<sup>1</sup> Data extracted from GEOCAPES-Georeferenced Information System. Available at: [http://geocapes.capes.gov.br/geocapes2/#tab\\_18](http://geocapes.capes.gov.br/geocapes2/#tab_18). Accessed on: February 8th, 2017.

Table 2 – World and Brazilian scientific production and growth rates in LIS (1986- 2015)

Year	World scientific production excluding Brazil	World Annual growth rate excluding Brazil	Brazilian scientific production	Brazilian annual growth rate	Brazilian scientific production in Brazilian journals	Annual Brazilian contribution to world scientific production	Annual Brazilian growth rate in Brazilian journals	Brazilian papers in Brazilian journals in relation to Brazilian papers
1986	1,208		4	-	-	0.33%	-	-
1987	1,479	22%	1	-75%	-	0.07%	-	-
1988	1,705	15%	2	100%	-	0.12%	-	-
1989	1,626	-5%	4	100%	-	0.25%	-	-
1990	1,899	17%	-	-400%	-	0.00%	-	-
1991	2,031	7%	2	200%	-	0.10%	-	-
1992	1,759	-13%	2	0%	-	0.11%	-	-
1993	2,032	16%	7	250%	-	0.34%	-	-
1994	1,955	-4%	7	0%	-	0.36%	-	-
1995	1,978	1%	6	-14%	-	0.30%	-	-
1996	1,445	-27%	7	17%	-	0.48%	-	-
1997	1,498	4%	4	-43%	-	0.27%	-	-
1998	1,478	-1%	6	50%	-	0.40%	-	-
1999	1,638	11%	7	17%	-	0.43%	-	-
2000	1,872	14%	5	-29%	-	0.27%	-	-
2001	2,192	17%	10	100%	-	0.45%	-	-
2002	1,790	-18%	3	-70%	-	0.17%	-	-
2003	1,656	-7%	6	100%	-	0.36%	-	-
2004	1,715	4%	9	50%	-	0.52%	-	-
2005	2,068	21%	5	-44%	-	0.24%	-	-
2006	2,994	45%	34	580%	14	1.12%	-	41%
2007	3,566	19%	33	-3%	17	0.92%	12%	52%
2008	4,421	24%	72	118%	49	1.60%	-16%	68%
2009	5,457	23%	83	15%	55	1.50%	148%	66%
2010	5,858	7%	82	-1%	46	1.38%	-20%	56%
2011	6,378	9%	143	74%	114	2.19%	5%	80%
2012	6,672	5%	140	-2%	91	2.06%	5%	65%
2013	6,940	4%	155	11%	96	2.18%	-5%	62%
2014	7,539	9%	191	23%	101	2.47%	12%	53%
2015	6,867	-9%	165	-14%	96	2.35%	-16%	58%
Total	91,716		1195		679	1.29%		57%



Also, among the factors for this growth, it is worth noting the financial increase specifically for the Applied Social Sciences area (where LIS is classified), by other Brazilian funding agencies. Since 2001, CNPq has been continuously increasing funding for this area, through research grants in the country and abroad, and funding research projects, with an increase of 454% from 2001 to 2015. In particular, the scholarship funding in Brazil for this area grew by 402% during this period, with an even greater growth from 2010 onward. Funding for international scholarships during the same period also experienced a significant increase, of around 1,256%, especially since 2012. The increase in funding for research projects was also noted during this period (2001-2015), growing 253% from 2012 onward.

Concerning, specifically, the funding of research projects by CNPq, we highlight the role of the Brazilian Public Call Announcements specific to the Human, Social and Applied Social Sciences, with the first of these announcements dating back to 2004. Since then they have continued annually. We believe they have greatly contributed to the significant increase in the Brazilian production of Information Science research since 2006.

In this context, we also note that, between 2000 and 2002, the Human and Social Sciences were among the four knowledge areas for which CNPq directed the greatest resources to São Paulo State, which has the highest scientific productivity in Brazil. Also, at FAPESP (São Paulo Research Foundation), a public foundation that has provided significant funding to São Paulo State's scientific research, the area of social sciences was among the main recipients of its resources during the period 1998-2002 (HOLLANDA et al, 2005).

The increase of Brazilian scientific production that occurred in 2006 can be partly explained by the inclusion of the Brazilian journal *Ciência da Informação*, which contributed 14 papers, but also by the increase of Brazilian publications in foreign

journals, since the other 20 papers (most of the production in this year) were disseminated in non-Brazilian journals with a large dispersion of distinct authorships.

In 2008, we observed the second big increase in Brazilian scientific productivity, equivalent to 125%, which is well above the 24% global growth rate at the time. In this year, Brazilian growth was influenced mainly by the inclusion of the Brazilian journal *Perspectivas em Ciência da Informação* in Scopus, with 39 of the 72 (54%) Brazilian articles published that year. It is also worth noting that in 2008 another 10 published articles were also disseminated in other Brazilian journals. From these developments in 2008 we observed the majority (68%) of Brazilian productivity is due to the greater inclusion of Brazilian Library and Information Science journals in Scopus.

In 2011, there was another significant increase (75%) in Brazilian productivity, above the world growth of 9%. In part, the Brazilian growth was due to the inclusion of the Brazilian journal *Informação & Sociedade* in Scopus, which added 31 Brazilian papers. When combined with the other Brazilian journals previously indexed in Scopus, the total number of Brazilian papers in Brazilian Library and Information Science journals was 114 papers of a total of 142 papers published that year, corresponding to 80.3% of Brazilian Library and Information Science papers published in 2011. This outcome does not represent so much a greater contribution by Brazilian researchers in international Library and Information Science, but rather a greater visibility of the Brazilian LIS literature in international databases.

Table 3 presents the 26 journals that account for ~90% of the Brazilian Library and Information Science productivity, grouped into five clusters.

Table 3 – Journals in which Brazilian LIS production has been disseminated, with respective citation indicators

Group	Source title (Publisher country, Quartil, OA)	Language	Papers	Citation Average	Citation Min	Citation Max	Citation SD	% papers no cit	Year first paper	Year last paper
G1	Perspec Ciencia da Informacao (BR, Q3, Yes)	PORT	296	0,7	0	18	1,6	68%	2008	2015
G2	Transinformacao (BR, Q4, Yes)	PORT	79	0,3	0	3	0,6	73%	2010	2015
	Informacao e Sociedade (BR, Q4, Yes)	PORT	149	0,3	0	4	0,6	79%	2011	2015
	Ciencia da Informacao (BR, Q4, Yes)	PORT	155	1,1	0	15	2,4	61%	2006	2015
G3	Scientometrics (NL, Q1, No)	ENGL	85	9,8	0	87	13,3	9%	1986	2015
	IEEE Transac on Information Theory (USA, Q1, No)	ENGL	34	9,4	0	51	14,3	29%	1986	2015
	Information Process and Management (UK, Q1, No)	ENGL	18	14,7	0	59	14,9	6%	1989	2015
	J Chemical Information and Modeling (USA, Q1, No)	ENGL	21	19,3	0	60	16,7	5%	2008	2015
	JASIST (USA, Q1, No)	ENGL	31	11,8	0	58	16,5	11%	2001	2015
	Int J Information Management (UK, Q1, No)	ENGL	9	28,6	3	141	44,4	0%	1998	2015
	Int J Geographical Information Science (UK, Q1, No)	ENGL	10	34,0	1	99	32,6	0%	2000	2015
G4	Social Science Information (UK, Q3, No)	ENGL	15	3,1	0	12	3,8	13%	1989	2015
	Int J Digital Libraries (DE, Q2, No)	ENGL	7	8,6	2	23	8,3	0%	1998	2015
	Journal of Informetrics (NL, Q1, No)	ENGL	8	9,0	2	19	6,0	0%	2007	2014
	Knowledge Manag Research and Pract (UK, Q2, No)	ENGL	6	3,2	1	9	3,1	0%	2012	2014
	World Patent Information (UK, Q2, No)	ENGL	7	2,2	0	4	1,5	17%	2009	2014
	J Information and Knowledge Manag (USA, Q4, No)	ENGL	6	0,5	0	1	0,5	50%	2006	2015
	Research Evaluation (UK, Q1, No)	ENGL	11	2,5	0	7	2,7	36%	1996	2015
	Int J Metadata, Semantics and Ontol (UK, Q3, No)	ENGL	11	1,7	0	10	3,0	45%	2008	2015
G5	Knowledge Organization (DE, Q2, No)	ENGL	16	1,6	0	8	2,1	38%	2006	2015
	Scire (SPAIN, Q3, Yes)	SPAIN	31	0,4	0	3	0,7	71%	2011	2015
	Ibersid (SPAIN, Q4, Yes)	PORT	16	0,0	0	0	0,0	100%	2012	2015
	Biblios (PERU, Q4, Yes)	SPAIN	22	0,0	0	0	0,0	100%	2013	2015
	Information Development (UK, Q2, No)	ENGL	12	0,5	0	6	1,7	92%	1988	2014
	Cuadernos.info(CHILE, Q4, Yes)	PORT/ENG	7	0,1	0	1	0,4	86%	2013	2014
	Investigacion Bibliotecologica (MEX, Q4, Yes)	PORT	10	0,1	0	1	0,3	90%	2008	2015

The first cluster (G1) consists of only one Brazilian journal that accounts for almost 25% of the published papers. Since 2008, this journal has been indexed in the Communication area in addition to LIS. It is an Open Access (OA) journal and falls into the 3rd Quartile of LIS journals indexed in Scopus. Its main distinguishing characteristic is the journal's productivity. Perspectivas em Ciência da Informação published almost twice as many articles as the journal with the second greatest Brazilian productivity during the analyzed period. In addition, it has a low average citation count per paper, with more than half of its papers attracting no citations. For the analyzed time period, all papers published by this journal were authored by Brazilian researchers. Thus, although the journal is indexed in the Scopus database, the community that disseminates the knowledge generated by this journal is eminently Brazilian.

The second cluster (G2) is composed of three Brazilian journals that publish in Portuguese and accounts for 32% of the observed productivity. All of the journals are OA and belong to the 4th Quartile of LIS journals in Scopus. They are indexed in the Communication area in addition to LIS, except for the journal *Ciência da Informação*. Similar to cluster G1, journals in this cluster have high paper productivity and low citation averages per paper arising from the high percentage of papers without citations. This outcome can be partially explained by the fact that the journals have been only recently indexed. Also, the publication of papers in Portuguese could limit the audience for these papers.

Group 3 (G3) is composed of seven English-language journals, none of which are OA. All of them are ranked in the 1st Quartile. They are indexed in the area of Computer Science, in addition to LIS.

The main feature of the journals that belong to this group is the high average citations per paper and almost absence of papers with no citations. This group accounts for 17.4% of published papers.

The fourth group (G4) consists of nine English-language journals, none of which are OA. They belong to different quartiles in Scopus, predominately Q1 and Q2. In addition to LIS, journals in this group are indexed to different areas such as computing, chemical engineering and business. This group accounts for 7.3% of the analyzed productivity. It is the group that presents more varied indicators, especially those that are citation-based. The average citations per paper ranged between 0.5 and 9 citations and there was wide variation in the percentage of papers with no citations. There are three journals where all papers are cited, but this group also has journals with significant percentages of papers with no citations (between 36% and 50%).

The group G5 is composed of six journals, five of them published in a Spanish-speaking country. They are predominantly Open Access and are ranked anywhere from Q2 to Q4, but predominantly Q4. Of its six journals, three are indexed only under LIS. This group is responsible for 8.2% of publications. Its main characteristic is that journals in this group have the highest percentage of papers with no citations, ranging from 71% to 100%, which leads to the lowest citation averages per paper. It is noteworthy that in this group, although the journals are published in Spanish-speaking countries, some of the journals published papers by Brazilian authors in Portuguese.

Among the 26 journals that account for ~90% of the Brazilian Information Science productivity, only 9 (35%) belong to the set of 25 journals indicated by the consulted researchers as those that define LIS, namely: *Perspectivas em Ciência da Informação* (G1); *Transinformação, Informação & Sociedade*, and *Ciência da Informação* (G2); *Scientometrics*, *Information Process and Management*, and *JASIST* (G3); *Knowledge Organization* (G4); and *Investigación Bibliotecológica* (G5).

Together, these 9 journals were responsible for the publication of 839 papers, corresponding to 70% of the 1195 analyzed papers.

Also, it is worth noting that another 9 of the 25 journals highlighted by the Brazilian PQ scholarship researchers as those that define LIS appear in the Brazilian paper corpus, but with less significant dissemination of papers, namely: *El profesional de la información* (5); *Information Research* (4); *Journal of Documentation* (3); *Revista Espanola de Documentación Científica* (3); *Journal of Information Science* (2); *Proceedings of the American Society for Information Science* (and *Proceedings of the ASIS Annual Meeting*) (2); *LIBRI -International Journal of Libraries and Information Studies* (1); *Library Trends* (1); *BID: textos universitaris de biblioteconomia i documentació* (1), corresponding to 1,8% of Brazilian papers in LIS area at Scopus.

On the other hand, 6 of the 24 journals highlighted by the Brazilian PQ scholarship researchers do not appear in the Brazilian paper corpus, namely: *Annual Review of Information Science and Technology*; *Library & Information Science Research* (and *Library Research*); *I2D - Information, données & documents* (up to 2015 *Documentaliste*); *D – LIB*; *International Journal of Information & Library Research*; *Revista Interamericana de Bibliotecologia* (Colombia).

This behavior suggests that Brazilian research in the LIS area already contributes in a significant way the mainstream channels of socialization of scientific knowledge in LIS by Brazil's scientific elite in this area. However, we recognize that there are also many relevant channels of scientific communication that Brazilian researchers must engage with to broaden the dialogue with their international peers beyond the Brazilian scientific elite perspectives in the LIS area.

Table 4 shows the language in which the Brazilian scientific papers were published in LIS, with the production and citation indicators, to compare the Brazilian production impact between papers published in Latin language journals and English language journals. It shows that 97.5% of Brazilian papers were published in Portuguese and English, with a majority published in Portuguese (62.4%).

In relation to the productivity indicator (number of papers), the Brazilian scientific productivity is centered on papers written in the Portuguese language. Brazilian papers published in English

present the highest value trend in relation to the impact indicators. The paper with the largest number of citations (141) was published in 2006, in the International Journal of Information Management, belonging to cluster G3, and ranked in the first quartile of the LIS area. It was published as collaboration between a Brazilian and a Canadian researcher. The paper written in Portuguese with the highest number of citations (18) was published in 2008, in the Brazilian journal *Perspectivas em Ciência da Informação* that forms the cluster G1 on its own. It was published as collaboration between two Brazilian researchers.

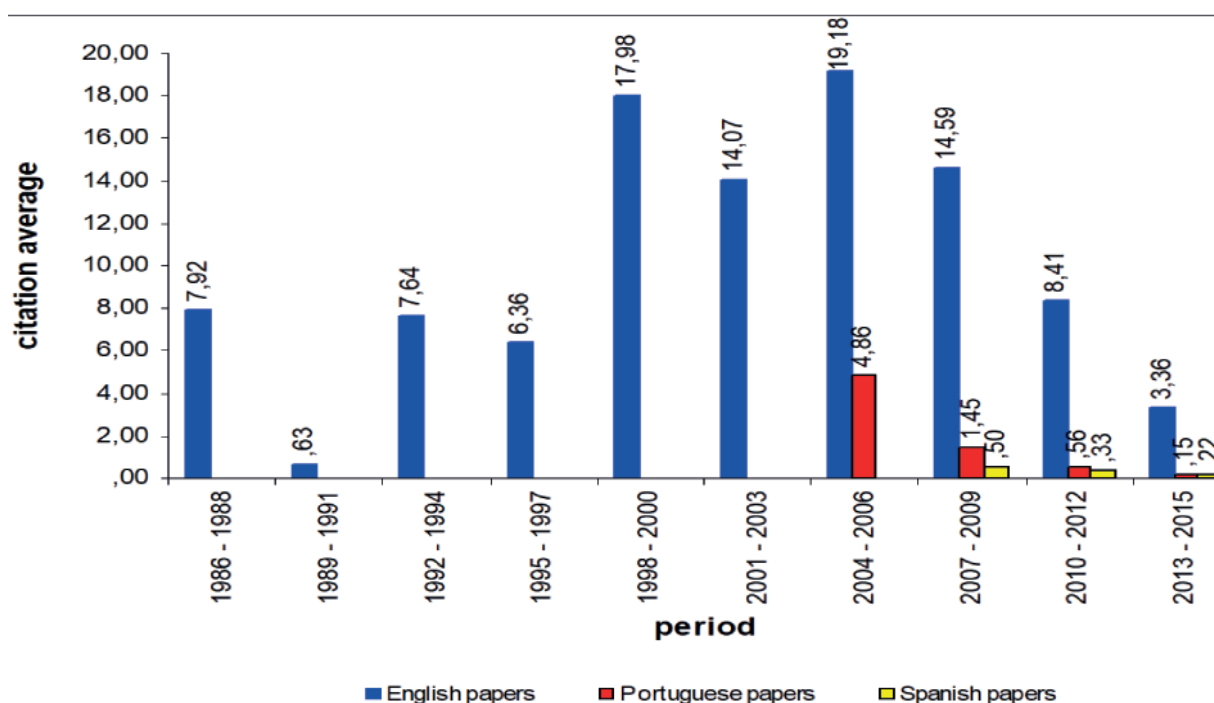
Table 4 – Descriptive statistics for the citation indicator, by Brazilian paper language

Paper Language	# papers	Citation Minimum	Citation Maximum	% papers with no citation	Mean citations	Std. Deviation
Portuguese	746	0	18	71.4	0.60	1.58
English	419	0	141	24.3	8.92	16.73
Spanish	18	0	4	77.8	0.39	0.98
French	8	0	11	37.5	2.13	3.68
Portuguese/English	2	0	0	100.0	0.00	0.00
Catalan	1	0	0	100.0	0.00	-
German	1	0	0	100.0	0.00	-

Also, in relation to percentage of papers with no citations, there is a substantial difference between those published in Portuguese and English. In general, the chance of a paper published in Portuguese not being cited is approximately three times higher than a paper published in English. We observe that the few papers published in Portuguese/English, Catalan and German were not cited, and among those published in Spanish, only 22% received between 1 and 4 citations. On the other hand, although papers in French were few, the majority (62.5%) of them were cited between 1 and 8 times.

Figure 1 presents a diachronic analysis of the average citations per paper and per publication year, comparing the languages: English, Portuguese and Spanish, which together account for 99% of the analyzed papers. We observed that before 1998-2000, papers published in English showed a stable tendency to receive, on average, between 6 and 8 citations, except those published in the period 1989-1991. It should be noted that during this period, we observed the lowest number of papers published (5) in relation to the corpus analyzed: 4 of them in 1989 and 1 in 1991. Most of the papers publishing during this time appeared in third and fourth quartile journals, with one published in a first quartile journal.

Figure 1 – Diachronic analysis of the average citation by the paper language



During the period between 1998 and 2009, papers received, on average, the highest citations observed: between 14 and 19 citations. One of the reasons for this increase is the official launch of the Capes' Journal Portal in November 2000, which enabled universities with post graduate courses to access a collection of 1,419 journals and nine reference databases in all knowledge area, including the Web of Science and Scopus, giving Brazilian researchers access to Brazilian science produced and disseminated in restricted access journals.

During the period from 2010 to 2015, we observed a drop in citations for English language papers. This is likely due to the fact that it takes time for papers to be found and cited. Papers published in Portuguese were more recent and showed the same citation behavior trend as those published in English, but with much lower values, despite being published in Open Access journals.

Regarding international scientific collaborations, we did not observe coauthors from foreign institutions in 988 of the 1195 papers analyzed, suggesting that Brazilian scientific productivity in the LIS area is mostly (82%) undertaken without international collaborations. This characteristic is observed consistently throughout the analyzed period. The publications without international collaborations were mainly published (64%) in Portuguese (628), although a significant proportion were also published in English (457), Spanish (57) and some in French (6) and German (1).

Table 5 shows the 20 main collaborating countries, grouped into four clusters by cluster multivariate analysis, using the variables: the total of co-authored articles, and their respective Salton's cosine values.



Table 5 – Main 20 collaborating countries with Brazilian LIS production at Scopus

Collaborating country		# co-authored papers	Salton's cosine
C1	United States	58	0,008
C2	Portugal	18	0,031
	Spain	40	0,021
	France	26	0,016
C3	Peru	3	0,015
	United Kingdom	24	0,008
	Canada	17	0,008
C4	Germany	10	0,006
	Argentina	3	0,006
	Italy	6	0,005
	Belgium	5	0,005
	Hungary	3	0,005
	Chile	2	0,005
	Colombia	2	0,005
	Netherlands	6	0,004
	Australia	4	0,002
	India	3	0,002
	Israel	2	0,002
	South Korea	2	0,002
	China	2	0,001

The first cluster (C1) is formed by the U.S.A. alone and has as its characteristic the largest number of co-authored papers with Brazilian authors. The Salton's cosine index is weighted value, in light of the great productivity potential of this country in all areas of knowledge. Thus, although the total number of papers published is the largest observed, this partnership does not prove to be so significant for the scientific development of both countries in the LIS area. It is noteworthy that scientific cooperation between authors in Brazil and the United States was present throughout the analyzed period, being initially more modest and increasing in the last two three-year periods.

Most (78%) of these papers were written in English, although we observed papers in Portuguese and Spanish as well.

The second cluster (C2) is composed of three Latin language countries. They produced the highest values for Salton's cosine index and significant absolute frequency values, indicating that this is Brazil's main collaborating country group for achieving a mutually beneficial development. Cooperation with authors from both Portugal and Spain started in 2007 and increased from 2010 and 2012, respectively. Scientific collaboration with France began in 1999. This is earlier than the collaboration with the other two countries of this group and increased in the last three years. It is worth mentioning that collaborations with authors from Portugal resulted in the highest Salton's cosine index and the lowest collaboration frequencies. Most (~50%) of these papers were written in Portuguese, although we observed papers in English (41%), Spanish (7%) and French (2%) as well.

The third cluster (C3) presents values with the greatest variations, both for the Salton's cosine index and for the absolute frequencies. Peru is highlighted, with the largest Salton's cosine value, although there have been only three co-authored papers with Brazilian authors during the study period, due to the modest presence of Peruvian research in the LIS area, as indexed in Scopus. All collaborative papers published with authors from the United Kingdom or Canada were written in English.

The fourth cluster (C4) is the largest group, with 13 of the 20 partner countries. It has low indicators, both in terms of co-authorship frequency and Salton's cosine indices, suggesting that these countries represent a more peripheral group that is less significant in relation to the contributions of these partnerships for Brazilian scientific development in the LIS area. Most papers from this cluster were written in English (~83%), but some were written in Portuguese or Spanish.

## CONCLUSIONS

From the results, we can observe that from 2006 onwards, Brazilian scientific productivity increased to more than 1% of the world production, with a growth tendency similar to the rest of the world, except for 2008 and 2011 when Brazil's growth rate exceeded the world's growth rate by approximately 400% and 700%, respectively.

It is important to note that the increase in the number of Brazilian journals indexed in Scopus on its own doesn't explain the annual growth in publications; simultaneously, there was an expressed increase in the number of Brazilian papers published in international and globally renowned journals.

In addition, we observed that Brazilian journals formed their own cluster, while the English language and Spanish language journals (some publish Portuguese papers as well) clustered separately, although several of the English language journals are published in countries where English isn't a primary language. Therefore, it seems that the language of the journals plays a bigger role than the publication location.

Concerning the paper language, papers published in English received on average approximately nine citations, corresponding to four times as many citations in relation to those papers published in French, the language that presented the second highest average citations per paper. Furthermore, there is a substantial difference between those papers published in Portuguese and English, since, in general, the likelihood of a paper published in Portuguese not being cited is approximately three times higher than for papers published in English.

We consider that authors from Portugal, Spain and France comprise the most consolidated group in relation to co-authorship with Brazilian authors in the LIS area, although it represents only 7% of Brazil's scientific production in the LIS area in the Scopus database. The Brazilian scientific collaboration behavior in the area is aligned with the global trend of cooperative scientific work that increased at the beginning of this century.

We must highlight two limitations regarding the results obtained in this research. The first limitation is that the results portray the scientific performance of Brazilian research only in Library and Information Science in the multidisciplinary database Scopus. The second limitation arises from the adoption of the understanding of the PQ1 researchers as a criterion to identify relevant journals in the LIS area. This criterion was adopted due to the consolidation and scientific maturity of this group of researchers in Brazil.

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