ARTICLE

Corporate governance
survey of scientific production in articles recovered from scopus

Marcelo Maia [1] iD https://orcid.org/0000-0002-2924-4426

Denise Fukumi Tsunoda [2] iD https://orcid.org/0000-0002-5663-4534

[1] Federal University of Parana, Curitiba, PR, Brazil / e-mail: maiamarcelomaia@hotmail.com
[2] Federal University of Parana, Curitiba, PR, Brazil / e-mail: dtsunoda@gmail.com

ABSTRACT

The research on corporate governance based on the pillars: transparency, equity, accountability and corporate responsibility, is based on the creation of a system for company management. In order to investigate the productivity of researchers in terms of temporality, number of authors, applying Lotka's Law (using the generalized reverse power model for direct and complete counting), the research is classified as descriptive, with a quantitative approach, the bibliographic analysis of national and international production was carried out in January 2020. The analysis on Scopus basis, with the search terms "corporate governance" OR "corporative governance" resulted in 23,167 publications, being the object of study only the articles (16,818). These data were retrieved in BibTeX format, program R (Bibliometrix package) and spreadsheet inserted to achieve the objective. The results show that the number of collaborators has grown continuously in recent years and that the configuration of two and three authors has become more frequent. The productivity of the researchers performed by direct counting ($n = 0.75$) is lower than the complete counting ($n = 1.12$), demonstrating a favorable effect for the collaboration regime.

KEYWORDS

Corporate governance. Bibliometrix. Bibliometry.

Governança corporativa
levantamento da produção científica em artigos recuperados da scopus

RESUMO

A pesquisa sobre governança corporativa apoiada nos pilares: transparência, equidade, prestação de contas e responsabilidade corporativa, baseia-se na criação de um sistema para direção da empresa. Afim de investigar a produtividade dos pesquisadores quanto a temporalidade, quantidade de autores, colaboração, aplicando a Lei de Lotka (utilizando o modelo do poder inverso generalizado para contagem direta e completa), a pesquisa é classificada como descritiva, com abordagem quantitativa, realizou-se a análise bibliográfica da produção nacional e internacional em janeiro de 2020. A análise na base Scopus, com os termos de busca "governança corporativa" OR "corporate governance" OR "corporative governance" resultou em 23.167 publicações, sendo objeto de estudo apenas os artigos (16.818). Esses dados foram recuperados no formato BibTeX, inseridos programa R (pacote Bibliometrix) e planilha eletrônica para a realização do objetivo. Os resultados apontam que o número de colaboradores cresceu continuamente nos últimos anos e que a configuração de dois e três autores vem tornando-se mais frequente. A produtividade dos pesquisadores realizada pela contagem direta ($n = 0,75$) é inferior a contagem completa ($n = 1,12$), demonstrando efeito favorável para o regime de colaboração.

PALAVRAS-CHAVE

Governança Corporativa. Bibliometrix. Bibliometria.

JITA: BB. Bibliometric methods.

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RDBCI: Rev. Dig. Bibliotec e Ci. Info. / RDBCI: Dig. J. of Lib. and Info. Sci. **|** Campinas, SP **|** v.18**|** e020019 **|** 2020

1 INTRODUCTION

With the oscillation of technological advances, communication, the process of globalization and economic evolution, there is an adaptation in the development of organizations in the search for standards and processes, in ensuring information to interested parties. Thus, the set of regulatory bodies, policies, laws and processes, for the relationship between partners, directors and employees, is necessary for the management of companies in adopting practices. In this context, Corporate Governance "aims to provide security for shareholders and creditors, with the aim that they are not expropriated by company executives" (CORREA, BORTOLUZZI, 2015, p. 1-2).

The implantation process, for Chrysostom; Girão (2019, p. 42) "[...] of a corporate governance system in the company comprising a set of good practices has been defended as capable of improving the company's management, its performance, and its relationship with the market". Thus, the main governance structures of organizations are "[...] board of directors, executive board, advisory committees to the board of directors and fiscal council" (CRISÓSTOMO; GIRÃO, 2019, p.43). The purpose of the present work is to investigate the researchers' productivity in terms of temporality and number of authors, colaboration applying Lotka's Law using the generalized inverse power model for direct and complete counting.

In order to achieve the objective, it is necessary to construct the theory resulting from bibliographic research, obtained by consulting scientific articles, newspapers reporting, magazines, consulting books, dissertations, theses, among others. At the end of the text, through the bibliographic list, the sources of materials used are informed. For Aquino et. al. (2019, p.217) "research in journals can point out indicators of the relevance that some themes in a given field have, [...] allowing (re)targeting for themes considered more urgent and relevant". Thus, the evaluation and analysis "[...] of the bibliographic survey allow reflections on the types and characteristics of the sources used in the knowledge construction process" (SANTOS; LIMA; MARTINS; 2009, p.1). Obtaining the indicators "enables an assessment of the maturity stage of scientific production in a certain area or research program" (SANTOS; LIMA; MARTINS; 2009, p.1).

The choice of the theme is justified, due to "an immense interest in the capital market and a prominent role in the press and also in academic production [...] they see it growing and evolving every day in the legal, accounting, economic and also financial environments" (CORREA, BORTOLUZZI, 2015, p.2), in which "it received little attention, [...], in a short time, it became an object of discussion in organizations, in academic events, as well as in regulation policies" (KREUZBERG; VICENTE, 2019, p. 45).

To develop the study, the concept of the searched term is initially presented, followed by the materials and procedures adopted for its realization, then the main results and final considerations, followed by references.

2 CORPORATE GOVERNANCE

In 1960, the expression "corporate governance" was used by Richard Eells (1960, our translation), to denote the structure and functioning of the form of corporate governance. In the management approach, in the survival of the organization, in the study by Jensen and Meckling (2008) applies the Agency Theory (conflict analysis due to the divergence of diverse interests)

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for modern organizations to formalize the cost model for foreign capital agency.

From then on, to minimize conflicts of interest, corporate management (CM) is defined, "as a set of institutional and market mechanisms that induce management into behaviors whose self-interest in maximizing value overrides the organization's interest" (KREUZBERG; VICENTE, 2019, p.47)

The term corporate governance for the Brazilian Institute of Corporate Governance - IBGC (2020) "is the system by which companies and other organizations are managed, monitored and encouraged, involving the relationship between partners, board of directors, executive officers [...] and other interested parties". The corporate governance structure, are created in accordance with Cunha, Moura, Santana (2012) to "ensure that new investors (minority shareholders) receive reliable information about the companies' value and that the administrators and controlling shareholders unduly take ownership, [...] ".

In this context, corporate governance converges with basic principles "[...] and its adequate adoption results in a climate of trust both internally and in relations with third parties. They are: transparency; equity, accountability and corporate responsibility" (IBGC, 2020). In view of the context, there is an extensive field for the management of knowledge regarding actions and disclosures of the precepts of Corporate Governance.

3 BIBLIOMETRY

Bibliometrics is the scientific or technical activity "for the quantitative study of publications and its main objective is the development of indicators" (RAVELLI, et. Al, 2009, p. 4), in which, "to understand the theme it is necessary to map it by means of bibliometric analysis" (RIBEIRO, et. al, 2012, p.52). Thus, studies are carried out "to analyze the scientific production of a given area or theme, obtaining indicators for the evaluation of scientific production" (CUNHA; MOURA; SANTANA; 2013, p.108).

Metric studies "point out three main bibliometric laws: [...] Lotka's Law of 1926; [...] the Bradford Act of 1934; [...] Zipf Law of 1949" (RODRIGUES; VIEIRA, 2016, p. 169). Lotka's Law (1926) is the analysis of the authors' bibliographic production on productivity, which "is important because this model has become the central axis of contemporary bibliometric research" (URBIZAGASTEGUI, 2008, p.87).

The Zipf Law "allows estimating the frequency of occurrence of words in a given scientific and technological text, [...] the principle of least effort: there is an economy in the use of words" (RODRIGUES; VIEIRA, 2016, p. 169) , and the Bradford Law, for the same authors (2016, p. 169 - 170) "allows calculating the degree of relevance of journals in a given area of knowledge".

The focus of the study, Lotka's Law, can be applied with emphasis on forms of counting authorship: "a) direct, when credit is given only to the author named first; b) complete, in which credit was given to all authors; c) adjusted / fractioned, where the credit is divided between the authors "(BEUREN; SILVA, 2014, p. 40). Also known as the inverse square model or generalized inverse power, it is defined by the equations (1, 2 and 3) (ALVARADO, 2006, p. 66-69):

$$y_x = C \left(\frac{1}{x^n} \right) \tag{1}$$

For x= 1,2,3, ..., x_max, where:
yx = probability that an author makes x contributions on a subject;
C and n = are the two parameters to be estimated from the observed data.

$$n = \frac{N \sum XY - \sum X \sum Y}{N \sum X^2 - (\sum X)^2} \qquad (2)$$

Where,
N = number of xy data pairs observed;
X and Y = log x and log y (base10).

Calculated the fall "of Lotka's Law by linear least squares" (CÂNDIDO; et al, 2018, p. 8).

$$C = \frac{1}{\sum_{X=1}^{P-1} \frac{1}{x^n} + \frac{1}{(n-1)P^{n-1}} + \frac{1}{2 \, P^n} + \frac{n}{24 \, (P-1)}} \qquad (3)$$

where:
x = is the number of 1,2,3... contributions per author;
n = is the value of the parameter calculated by the equation (2);
P = is the number of pairs observed.

This represents, "the theoretical percentage of authors who contributed with only one article during the studied period" (C NDIDO; et al, 2018, p. 7). Thus, one can test the distribution of generalized inverse power, using the level of significance, for the critical values of the Kolmogorov-Smirnov test ("non-parametric method of testing whether there are significant differences between the observed frequencies and the theoretical or calculated frequencies of a distribution, [...] judge the degree of proximity" – ALVARADO, 2006, p.71).

In this context, the D-max and the critical value are presented, being possible only the interpretations: a) D-max> critical value "rejects the null hypothesis of homogeneity of the authors' frequency distribution" (ALVARADO, 2006, p. 71) and b) D-max <critical value "does not reject the hypothesis of homogeneity of the empirical frequency distribution in relation to the theoretical one" (C NDIDO; et al, 2018, p. 11) that is, it accepts the hypothesis.

In this context, for Ribeiro; Santos (2012) the amount of bibliometric works "on corporate governance is growing", (CUNHA; MOURA; SANTANA, 2013), (RIBEIRO; SANTOS, 2015), (CORREA; BORTOLUZZI, 2015); (SILVA, 2015); (LUCAS, 2016), (FERREIRA; et. Al, 2019), however there were no studies that specifically deal with investigating productivity and applying Lotka's law (inverse power model). Thus, the methodological foundations and procedures adopted in the development of the research are presented and detailed.

4 METHOD

The research is of quantitative approach, classified as exploratory and descriptive. The Scopus database (Elsevier) was defined as the source for the composition of the corpus of analysis. The choice of the database is based on the "largest database of abstracts and citations

in the literature with peer review [...]. Offering a comprehensive overview of the world's research production in the areas of science, [...] will ensure that important research from around the world" (ELSEVIER, 2020).

The following terms were inserted in the search text box: "corporate governance" OR "corporative governance", using the title of the article, abstract and keywords as a parameter for investigation. The database returned 23,167 items, in different types of documents - article (16,855), book chapter (1931), conference document (1,745), review (1,486), book (629), publisher (178), note (100), conference review (68), short survey (40), retracted (19), correction (12), business article (7), document data (6), letter (4), report summary (2), report (1), undefined (84).

Due to the characteristics of the study, only the articles (16,855) were object of study. The database presents five classifications for export (chart 1), opened in several items, which can be exported to the program and formats: Mendeley, WxLibris, Ris, CSV, BibTex and Plain Text.

Chart 1. Five types of classifications for export from the Scopus database (Elsevier)

Citation information	Bibliographic information	Summary and keywords	Financing details	Other information
Author(s)	Affiliations	abstract	Number	Trade names and manufacturers
Document title	Serial identifiers (for example ISSN)	**Author's Keywords**	Acronym	Adhesion number and chemicals
Year	ID PubMed	Index Keywords	Sponsor	Conference information
Source title	Editor		Financing text	**Include references**
Volume, edition, pages	Publisher(s)			
Citation count	**Original document language**			
Document source and type	Corresponding address			
DOI	Abbreviated font title			

Source: Elaborated by the authors (2020)

As the export, from the Scopus base, is limited to 2,000 items at a time, they were removed in 12 files, separated by year until the sum of the years does not exceed the respective value (charts 2 and 3).

Chart 2. File name and quantity of items exported in each file - scientific production on corporate governance

Year	Quant.	File name	Items in file
1971	1		
1973	1		
1978	5	1	911
1979	2		
1982	7		

Chart 3. File name and quantity of items exported in each file - scientific production on corporate governance

Year	Quant.	File name	Items in file
2001	204		
2002	220		
2003	268	2	1925
2004	308		
2005	400		

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1983	6			2006	525		
1984	4			2007	571	3	1347
1985	8			2008	776		
1986	8			2009	868	4	1702
1987	7			2010	834		
1988	9			2011	982	5	1962
1989	10			2012	980		
1990	12			2013	1049	6	1049
1991	11			2014	1057	7	1057
1992	18			2015	1263	8	1263
1993	66			2016	1234	9	1234
1994	53			2017	1246	10	1246
1995	61			2018	1416	11	1416
1996	82			2019	1706	12	1706
1997	105			**Total**	**16818**		**16818**
1998	127						
1999	129						
2000	179						

Source: Elaborated by the authors (2020)   Source: Elaborated by the authors (2020)

The fields author (s), document title, year, language of the original document, author's keywords, and references, were exported in.bib format (BibTeX) and inserted in the R program, and in an electronic spreadsheet, MS_Excel software. In the R program, the Bibliometrix (ARIA; CUCCURULLO, 2017) package was used with the aid of an electronic spreadsheet to carry out the quantity of publications in the 48 years analyzed.

A total of 16,818 items, distributed in the years of publication, generating information on temporal production, percentage of growth of the theme, predominance of the number of authors per item, in addition to the application of Lotka's law by direct and complete counting, and keywords of bigger frequency.

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5 RESULTS: PRESENTATION AND DISCUSSION

Of the 23,167 items, in different types of documents (article, book chapter, letter, summary of the report, report, among others), only the articles (16,855 items) will be the object of study, 37 items being excluded due to the publication having occurred in the year 2020 (16,818). In these data, the average publication was 392 items, with a standard deviation of practically 489 items, which was high due to the fact that there were few publications in the first years (1971 to 1992). As the articles studied cover the period from 1971 to 2019, there were intervals, according to Bruni (2010, p.13) "class intervals, [...] are consequences of the total breadth of data and the number of classes that must be created", defined every seven years (chart 4).

Chart 4. Scope of study (articles) scientific production on corporate governance in Scopus database (Elsevier)

| Ano	Publicações
1971 I - 1979	7
1979 I - 1987	35
1987 I - 1995	186
1995 I - 2003	1.107
2003 I - 2011	4.550
2011 I - I 2019	10.933
Total	**16.818**

Legenda
I limite inferior incluído na classe, limite superior não

I - I limite superior e inferior incluídos na classe

Elaborated by the authors (2020)

As can be seen, the number of articles on corporate governance has increased in recent years, particularly between 2003 and 2019. There is a growing trend, in the number of articles, observed in Table 1 and Graph 1 (trace of accumulated documents versus years). Exponential growth is shown, concave at the beginning until the year 25 (1995), and from then on to accelerate growth, still not yet reaching its saturation point, still in full growth (ALVARADO).

Graph 1. Temporality of scientific production on corporate governance in the Scopus database (Elsevier)
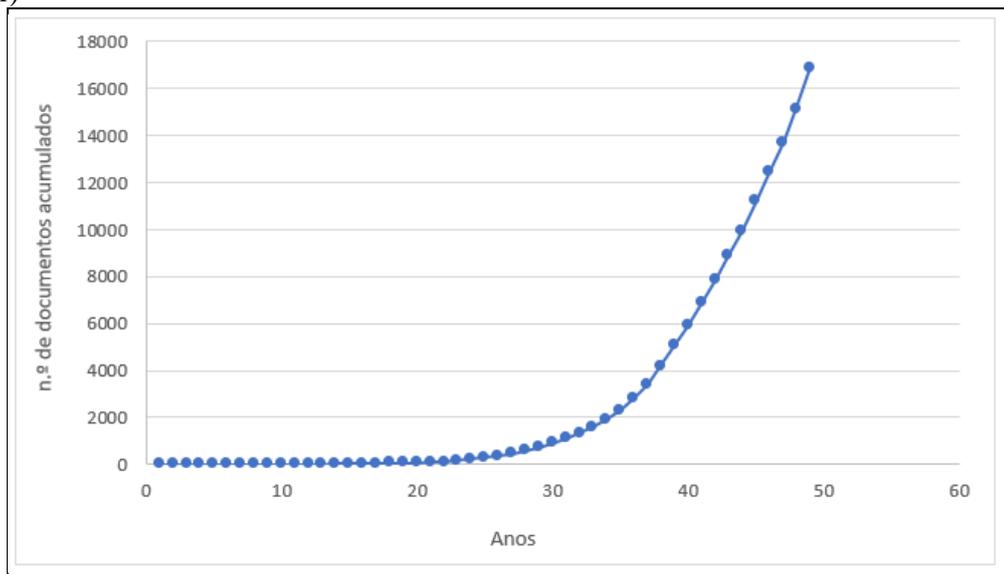
Source: Elaborated by the authors (2020)

There is a constant increase in the interest of the academic community on the topic, since there are no stagnation points between the years, only a drop compared to the previous one in the years 2010, 2012 and 2016. The average number of publications calculated considering the sum of the annual publications divided by the total number of years (between 2003 and 2019) is 910 documents per year, with 2019, 2018 and 2015 being the highest with 1,706, 1,416 and 1,263 items published respectively and in contrast 2003 the lowest number with only 268 documents.

The peak of publications happened in 2019 with 1,706 items, showing an increase of 20.48% in relation to the previous year (table 1). Based on the 48 years of advertising and the total number of items, the publication average was exceeded in all years, after 2005.

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Table 1. Percentage of growth in the 48 years of scientific production on corporate governance in the Scopus database (Elsevier)

Anos	Anos2	nº. Docs.	Docs Acumulados	Anos	Anos2	nº. Docs.	Docs Acumulados
1971	0	1	1	1996	25	82	371
1972	1	0	1	1997	26	105	476
1973	2	1	2	1998	27	127	603
1974	3	0	2	1999	28	129	732
1975	4	0	2	2000	29	179	911
1976	5	0	2	2001	30	204	1115
1977	6	0	2	2002	31	220	1335
1978	7	5	7	2003	32	268	1603
1979	8	2	9	2004	33	308	1911
1980	9	0	9	2005	34	400	2311
1981	10	0	9	2006	35	525	2836
1982	11	7	16	2007	36	571	3407
1983	12	6	22	2008	37	776	4183
1984	13	4	26	2009	38	868	5051
1985	14	8	34	2010	39	834	5885
1986	15	8	42	2011	40	982	6867
1987	16	7	49	2012	41	980	7847
1988	17	9	58	2013	42	1049	8896
1989	18	10	68	2014	43	1057	9953
1990	19	12	80	2015	44	1263	11216
1991	20	11	91	2016	45	1234	12450
1992	21	18	109	2017	46	1246	13696
1993	22	66	175	2018	47	1416	15112
1994	23	53	228	2019	48	1706	16818
1995	24	61	289				
Média						350	

Source: Elaborated by the authors (2020)

Regarding the authors, 80 articles did not have their respective author registered in the database, being shown in the program R, as "NA NA", so for the analyzes they were considered as single authorship, in their respective years of publication (1985 -1; 1991 – 1; 1993 – 11; 1994 – 7; 1995 – 8; 1996 – 3; 1997 – 2; 1998 – 1 ; 2000 – 1; 2001 – 1; 2003 – 4; 2004 – 4; 2005 – 1; 2006 – 7; 2007 – 3; 2008 – 3; 2009 – 2; 2010 – 2; 2011 – 2; 2012 – 5; 2013 – 2; 2014 – 2; 2015 – 5; 2016 – 2).

Involved in the production of 16,818 articles, 11,521 different authors were identified, so an average of 1.45 authors/article, however, considering authorship and co-authorship, we found 22,543 participations, producing an average of 1.34 authors article.

The number of authors per item varies from single publication to over 20 co-authors, with a predominance of joint publication with one more co-author (5,597 articles), considering the total number of publications – Chart 5.

Chart 5. Number of authors per item of scientific production on corporate governance in the Scopus database (Elsevier)

| Ano	Quantidade de autores por item													Total
	1	2	3	4	5	6	7	8	9	10	12	14	17	21	Total
1971 I - 1979	7														7
1979 I - 1987	21	11	3												35
1987 I - 1995	110	55	16	4	1										186
1995 I - 2003	556	363	145	31	5	3	1		3						1.107
2003 I - 2011	1.655	1.590	1.013	233	38	12	2	3	2		1			1	4.550
2011 I - I 2019	2.712	3.578	3.195	1.130	234	48	14	12	4	2	1	1	2		10.933
Total	5.061	5.597	4.372	1.398	278	63	17	15	9	2	2	1	2	1	16.818

Source: Elaborated by the authors (2020)

The comparison of the number of authors per item, according to Lawani's collaboration index (1980), shows a growth in production in collaboration, very light until 1995, when it starts to represent half and more than half from that year (chart 6 and graph 2). Collaboration grows steeply in the first decade to fade from the following decades, but continues to grow. In the last decade, collaboration is greater than the overall average of collaboration (75% versus 70%)

Chart 6. Collaboration index on corporate governance in the Scopus database (Elsevier)

Anos	Total de publicações	Total em colaboração	Índice de colaboração
1971 - 1979	7	0	0
1979 - 1987	35	14	40
1987 - 1995	186	76	41
1995 - 2003	1107	551	50
2003 - 2011	4550	2895	64
2011 - 2019	10933	8221	75
Total	**16818**	**11757**	**70**

Source: Elaborated by the authors (2020)

Graph 2. Collaboration index per year on corporate governance in the Scopus database (Elsevier)
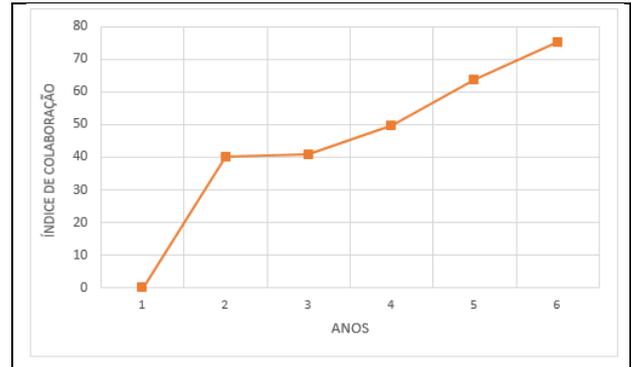
Source: Elaborated by the authors (2020)

To determine authorship, Urbizagastegui (2008) highlights three possibilities for counting: direct (credit to the main author only), complete (assigns equal credit to all authors), and fractional (fractional credit between authors).

By the direct count criterion, 11,521 different authors were identified, where 76.81% published only one article, a percentage of 16.81% higher than that presented by Lotka (1926) of approximately 60% (table 2).

Table 2. Observed frequency of contributions by author (by direct counting), least squares distribution and Kolmogorov-Smirnov adjustment test - of scientific production on corporate governance in the Scopus database (Elsevier)

Contribuições (x)	Autores (y)	Total de artigos (x . Y)	% y	Log x	Log y	Distribuição Teórica	Diferença	D max
1	8850	8850	76,8162	0,0000	3,9469	979,34	7870,66	0,68316
2	1562	3124	13,5579	0,3010	3,1937	580,75	2543,25	0,76833
3	562	1686	4,8780	0,4771	2,7497	427,79	1258,21	0,77998
4	268	1072	2,3262	0,6021	2,4281	344,38	727,62	0,77335
5	89	445	0,7725	0,6990	1,9494	291,06	153,94	0,75581
6	68	408	0,5902	0,7782	1,8325	253,68	154,32	0,73969
7	43	301	0,3732	0,8451	1,6335	225,85	75,15	0,72382
8	20	160	0,1736	0,9031	1,3010	204,22	-44,22	0,70783
9	13	117	0,1128	0,9542	1,1139	186,87	-69,87	0,69274
10	10	100	0,0868	1,0000	1,0000	172,60	-72,60	0,67863
11	11	121	0,0955	1,0414	1,0414	160,63	-39,63	0,66564
12	4	48	0,0347	1,0792	0,6021	150,43	-102,43	0,65293
13	5	65	0,0434	1,1139	0,6990	141,62	-76,62	0,64107
14	4	56	0,0347	1,1461	0,6021	133,93	-77,93	0,62979
15	4	60	0,0347	1,1761	0,6021	127,14	-67,14	0,61911
16	3	48	0,0260	1,2041	0,4771	121,10	-73,10	0,60886
17	1	17	0,0087	1,2304	0,0000	115,69	-98,69	0,59890
18	1	18	0,0087	1,2553	0,0000	110,81	-92,81	0,58937
21	2	42	0,0174	1,3222	0,3010	98,65	-56,65	0,58098
80	1	80	0,0087	1,9031	0,0000	35,99	44,01	0,57794
Total	**11521**	**16818**	**100,00%**	**19,0317**	**25,4735**	**4862,52**	**11955,48**	**13,47**
			r	**-94,65%**				

Source: Elaborated by the authors (2020)

To calculate Pearson's coefficient of determination, which describes the direction of the correlation (positive or negative), Log x and Log y were calculated, in which -94.65% means

a perfect negative correlation, that is, as the authors variable decreases, the number of contributions increases.

For Alvarado (2006, p. 69), the R^2 "allows to establish the amount of variation" of the slope of the regression line, which calculated according to the same author (2006), was n = 0.75, representing low productivity of the authors compared to the study by Lotka (1926) where "parameter of n = -2". The value of n, applied for the calculation of parameter c, results in -0.085, which made it possible to generate the theoretical Lotka distribution (chart 2).

The difference column shows the comparison between the total article variables minus the theoretical distribution. The biggest differences are observed for frequencies one and two, in addition, the distribution shows 13 authors more than expected.

When applying the Kolmogorov-Smirnov Test, for the distribution of n = 16,818 and significance level α = 0.01 obtained by the formula (1.63/root n), when compared to D max (0.7798> 0.0152), the rejection of the "null hypothesis of homogeneity of the frequency distribution of the producing authors" (Alvarado, 2016, p. 72) of the corporate governance literature, that is, when using direct counting "and when calculated by the model of generalized inverse power" (Cândido, 2018, p.11), indicates that the authors' productivity is lower than that found by Lotka (1926).

By the criterion of complete counting, 22,543 different authors were identified, who contributed 16,818 articles, which would produce an average of 1.34 articles. Of the total number of authors, 73.19% published only one article, 13.19% higher than Lotka's study (1926) (table 3).

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Table 3. Observed frequency of contributions by author (by complete count), least squares distribution and Kolmogorov-Smirnov adjustment test - of scientific production on corporate governance in Scopus' database (Elsevier)

Contribuições (x)	Autores (y)	Total de artigos	% y	Log x	Log y	Distribuição Teórica	Diferença	D max
1	16501	7288	73,1979	0,0000	4,2175	5075,64	2212,36	0,50673
2	3189	2959	14,1463	0,3010	3,5037	2319,76	639,24	0,54527
3	1217	1722	5,3986	0,4771	3,0853	1467,33	254,67	0,53417
4	599	1158	2,6571	0,6021	2,7774	1060,21	97,79	0,51371
5	329	730	1,4594	0,6990	2,5172	823,99	-93,99	0,49175
6	232	629	1,0291	0,7782	2,3655	670,62	-41,62	0,47230
7	133	398	0,5900	0,8451	2,1239	563,45	-165,45	0,45321
8	86	296	0,3815	0,9031	1,9345	484,56	-188,56	0,43553
9	60	257	0,2662	0,9542	1,7782	424,19	-167,19	0,41938
10	35	175	0,1553	1,0000	1,5441	376,59	-201,59	0,40423
11	37	173	0,1641	1,0414	1,5682	338,15	-165,15	0,39087
12	23	114	0,1020	1,0792	1,3617	306,50	-192,50	0,37829
13	13	74	0,0577	1,1139	1,1139	280,00	-206,00	0,36645
14	14	86	0,0621	1,1461	1,1461	257,52	-171,52	0,35565
15	13	90	0,0577	1,1761	1,1139	238,21	-148,21	0,34566
16	10	86	0,0444	1,2041	1,0000	221,46	-135,46	0,33646
17	9	76	0,0399	1,2304	0,9542	206,80	-130,80	0,32769
18	3	35	0,0133	1,2553	0,4771	193,87	-158,87	0,31922
19	4	37	0,0177	1,2788	0,6021	182,38	-145,38	0,31131
20	5	59	0,0222	1,3010	0,6990	172,12	-113,12	0,30390
21	5	49	0,0222	1,3222	0,6990	162,89	-113,89	0,29689
22	5	30	0,0222	1,3424	0,6990	154,55	-124,55	0,29026
23	3	18	0,0133	1,3617	0,4771	146,98	-128,98	0,28387
25	3	28	0,0133	1,3979	0,4771	133,77	-105,77	0,27807
26	1	6	0,0044	1,4150	0,0000	127,97	-121,97	0,27244
28	2	30	0,0089	1,4472	0,3010	117,69	-87,69	0,26731
29	1	13	0,0044	1,4624	0,0000	113,12	-100,12	0,26234
30	5	45	0,0222	1,4771	0,6990	108,87	-63,87	0,25773
37	1	21	0,0044	1,5682	0,0000	85,91	-64,91	0,25397
40	2	37	0,0089	1,6021	0,3010	78,66	-41,66	0,25056
44	1	15	0,0044	1,6435	0,0000	70,63	-55,63	0,24748
45	1	4	0,0044	1,6532	0,0000	0,00	4,00	0,24447
80	1	80	0,0044	1,9031	0,0000	35,95	44,05	0,24292
Total	**22543**	**16818**	**100,00%**	**37,9821**	**39,5367**	**17000,36**	**-182,36**	**11,66**
			r		**-97,73%**			

Source: Elaborated by the authors (2020)

The negative correlation of -97.73% indicates that while the variable authors decreased, the level of contributions increases, resulting from the calculated values (Log x and Log y). The calculated parameter n = 1.12, shows an improvement in relation to the direct count, which, according to Cândido (2018, p. 11) "reflects, to a certain extent, the advances obtained through the exercise of research collaboration".

Language of scientific production on corporate governance in the Scopus database Using the parameter n, the parameter c = 0.22512 was calculated, to which the theoretical distribution is made (chart 3). The difference column presents mainly in classes one to three the biggest divergences, in addition to the distribution presenting 11 authors more than predicted by the theoretical distribution.

Using the Kolmogorov-Smirnov test, for the distribution of n = 16,818 and significance level α = 0.01, it was D_crit = 0.0109, which compared to D_max 0.54527, refers to the rejection of the homogeneity of the distribution, ie , by complete counting of the authors and calculating the generalized inverse power, that is, it does not adjust Lotka's law.

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RDBCI: Rev. Dig. Bibliotec e Ci. Info. / RDBCI: Dig. J. of Lib. and Info. Sci. | Campinas, SP | v.18| e020019 | 2020

As for the predominance of the language, English is present in 16,302 articles, followed by Spanish, with 130 items, with "the plurality of languages in the field of scientific production decreased, taking into account the prominence of English" (ROSA; ALVES, 2010, p.3). The predominance of the language is justified when "the research activity is international... most of the most prestigious journals are written in English" (MEADOWS, 1999, p. 168). The hegemony of the English language, according to Price (1971, p. 257, our translation), "constitutes little more than half of the world's philosophical and scientific production". English represents 3.45% of the total languages (29), with a frequency of 96.93% of the items analyzed (Chart 7).

Chart 7. Language of scientific production on corporate governance in the Scopus database (Elsevier)

Idioma	Frequência	Frequência%
INGLÊS	16302	96,932%
ESPANHOL	130	0,773%
FRANCÊS	81	0,482%
PORTUGUÊS	65	0,386%
ALEMÃO	56	0,333%
RUSSA	56	0,333%
CHINESA	48	0,285%
OUTRAS (22)	80	0,476%
TOTAL	16818	100,000%

3,45% (bracket indicating INGLÊS and ESPANHOL)

Source: Elaborated by the authors (2020)

Regarding the keywords, the collection of records occurred on the basis of each item, captured by the R program and imported into the spreadsheet, which after being listed added in the frequency count. Of the 16,818 articles, only 2,485 items presented keywords. These words total 27,133, of which 6,963 are different, often ranging from one (4,435 items) to 763 repetitions (governance approach).

After the frequency of the keywords, with an interval parameter of 30 in the form of a circle, it is shown in the word cloud (figure 1) - Wordclouds software (available at wordclouds.com), with emphasis on the word "policy".

Figure 1. *Word cloud* formed by the keywords, with qrau 30, of scientific production on corporate governance in Scopus database (Elsevier)
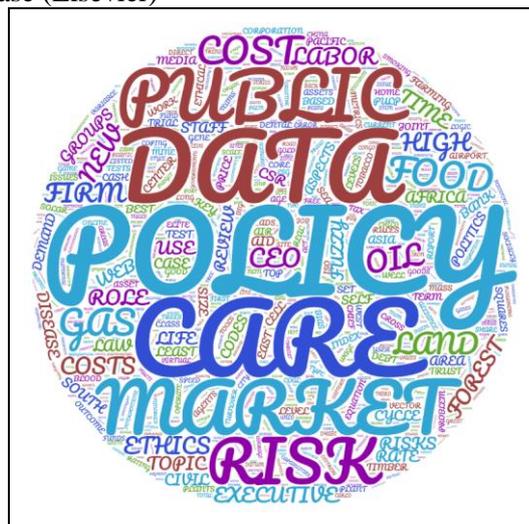
Source: Elaborated by the authors (2020)

In this sense, it is observed that the words present in the cloud have influence with the searched term, and that the words "governance approach" and "corporate strategy", of

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frequency 763 (2.81%) and 603 (2.22%) respectively, "advocates that a small number of words are used more frequently" (BEUREN; SILVA, 2014, p.40).

6 FINAL CONSIDERATIONS

The research investigates the mapping of the scientific production of "corporate governance", from the Scopus database (23,167 items), captured only the articles (16,818), in a coverage period that begins in 1971 and extends until the end of 2019. It appears that scientific production has exponential ascendancy and that it has not yet reached saturation point, since it is in full growth.

The co-authorship was formed, in its majority, by two, three and four researchers, and in the last decade (2011-2019) this type of authorship presents higher than the overall average of collaboration (75% versus 70%).

In the proposal of empirical frequency, both by the method of direct and complete counting, it refers to the rejection of the hypothesis of homogeneity of the distributions, and may state that the scientific production of corporate governance authors does not fit the application to Lotka's Law.

11,521 different authors were identified by direct count, and 22,543 by complete count. Between the years 1971 to 2003 (exclusive) there is a predominance of only one author in publications, and between 2003 (inclusive) to 2019 the predominance of more than two authors.

Both by direct and complete counting, there is a high number of researchers with only one publication, 76.81% and 73.19% respectively, a value higher than the study proposed by Lotka (1926).

There is a prevalence of publications in the English language, and with regard to keywords, there were 27,133 words, of which 6,963 were distinct, ranging from one to 763 repetitions, with the most repeated words being the search term "governance approach" and "corporate strategy" .

As limitations of the study, it can be pointed out: the choice of only one database; bibliometric analysis was restricted to temporality, number of authors per article, application of Lotka's Law using the inverse power model (direct and complete counting)

For new studies it is suggested: to increase the number of bases used; bibliometric analysis of references, formation of networks of authors and co-authors, which authors are the most productive and the journals, in addition to the realization of the laws of Bradford and Zipf.

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